



Vocational Technical Education Framework



Agriculture and Natural Resources Occupational Cluster

Animal Science (VANIM)

CIP Code 010599

June 2014

Massachusetts Department of Elementary and Secondary Education

Office for Career/Vocational Technical Education

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Acknowledgements

The Massachusetts Department of Elementary and Secondary Education, Office for Career/ Vocational Technical Education, launched the Vocational Technical Education Framework Revision Project in April 2012. This Framework is the result of that effort and of the contributions of many educators across the state. The Department of Elementary and Secondary Education wishes to thank all of the Massachusetts groups that contributed to the development of these standards and all the individual teachers, administrators, and private sector advisory committee members who provided valuable employer validation of the standards for the Animal Science Framework of the Agriculture and Natural Resources Occupational Cluster.

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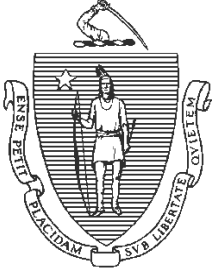
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Mitchell D. Chester, Ed.D.
Commissioner

July 2014

Dear Colleagues,

I am pleased to present to you the *Massachusetts Vocational Technical Education Frameworks*, adopted by the Department of Elementary and Secondary Education in June 2014. These frameworks, one for each of the 44 vocational technical programs, include standards in multiple strands representing all aspects of the industries that students in the vocational technical education program are preparing to enter.

The frameworks also include a crosswalk between the technical standards and relevant standards in Massachusetts Curriculum Frameworks to support effective integration of academic and technical content.

The comments and suggestions received during revision of the 2007 *Massachusetts Vocational Technical Education Frameworks* have strengthened these frameworks. We will continue to work with schools and districts to implement the 2014 *Massachusetts Vocational Technical Education Frameworks* over the next several years, and we encourage your comments.

I want to thank everyone who worked with us to create challenging learning standards for Massachusetts students. I am proud of the work that has been accomplished.

Sincerely,

Mitchell D. Chester, Ed.D.
Commissioner of Elementary and Secondary Education

Introduction

Overview & Organization and Key Changes

Overview

The Massachusetts Department of Elementary and Secondary Education understands the necessity of maintaining current Vocational Technical Education Frameworks which ensure career/vocational technical education students across the Commonwealth are taught the most rigorous standards aligned to the needs of business and industry.

With the advent of the Massachusetts Teaching & Learning System the Office for Career/Vocational Technical Education (CVTE) recognized the significance of including career/vocational technical education in the system and developed a comprehensive plan for including vocational technical education. The plan was designed in a Two Phase Process. Phase One included the revision of strands two, three, and six, of all of the Vocational Technical Education Frameworks. Phase Two consisted of three major components (projects) all equally crucial;

1. The revision of Strands One, Four, and Five to complete the revision of all six strands of the Vocational Technical Education Frameworks;
2. Statewide Professional Development on all revised strands, with training on strands two, three, and six delivered fall 2013, and training on strands one, four, and five delivered spring 2014;
3. The creation and development of additional Model Curriculum Unit (MCU) Teams.

The Office for Career/Vocational Technical Education Framework Team, with support from consultants, began Phase One in the 2012-2013 school year, to revise three of the six strands contained in all of the Vocational Technical Education (VTE) Frameworks. The state was organized into “Collaborative Partnerships” comprised of teams of project administrators, highly qualified subject matter educators, and business and industry partners, whose task was to revise Strand Two – Technical, Strand Three – Embedded Academics, and Strand Six – Technology Literacy. Each team met with a vocational advisory committee which included business and industry representatives and postsecondary education professionals, whose mission was to review and revise the team’s draft document during the revisionary process. Once strand two was revised, academic teachers (typically one English Language Arts teacher, one Mathematics teacher, and one Science teacher) worked with the technical subject matter teachers to develop a crosswalk between academic curricula standards and the technical standards, and provided examples of embedded academic content.

The Office for Career/Vocational Technical Education solicited statewide input from technical and academic teachers and administrators at the annual Massachusetts Association of Vocational Administrators (MAVA)/Massachusetts Vocational Association (MVA) - Connecting for Success Conference. Each framework team met with their content colleagues and reviewed the draft revisions and obtained

valuable feedback. Additionally, all drafts were reviewed and revised by the Massachusetts Vocational Technical Teacher Testing Program, to ensure appropriate measurable language.

Project consultants designed a new template to ensure all framework teams entered new standards and additional resources in a consistent manner. The framework teams created an “Appendix” listing potential industry recognized credentials attainable by secondary students; lists of professional, student, and relevant government organizations; and useful resources and websites. ** It is important to note that although most Framework Teams provided information for the “Appendix”, not all teams did. Therefore, sub-headings within the “Appendix” without information have been deleted. Disclaimer: Reference in the Appendices Section to any specific commercial products, processes, or services, or the use of any trade, firm or corporation name is for the information and convenience of the public, and does not constitute endorsement or recommendation by the Massachusetts Department of Elementary and Secondary Education.*

The Office for Career/Vocational Technical Education facilitated a comprehensive vetting process throughout the Commonwealth. During the fall of 2012 districts throughout Massachusetts solicited feedback from each Vocational Program’s Advisory Committee members at the Fall Board meetings. Additionally, the Office for Career/Vocational Technical Education met with various licensing boards at the Massachusetts Division of Professional Licensure and provided the applicable draft framework to each board for review. All framework drafts were posted on the CVTE website for public comment. Comments and suggested revisions received were shared with each framework team for response and edits, as appropriate.

The Phase I Process was completed on an accelerated timetable and resulted in all Vocational Technical Education Frameworks; Strand Two and Strand Six, revised with current, rigorous, relevant standards. Strand Three has been redesigned into a crosswalk which directly correlates academic and technical standards. An appendix of useful material for technical teachers recommended by their peers was added to each framework.

Phase II of the Framework Revision Process consisted of three major projects;

1. The Strands One, Four & Five Project, to complete the revision of all six strands of the Vocational Technical Education Frameworks;
2. Statewide Professional Development on all revised strands, with training on strands two, three, and six delivered fall 2013, and training on strands one, four, and five delivered spring 2014;
3. The creation and development of additional Model Curriculum Unit (MCU) Teams.

The Strands One, Four, & Five Project began in the fall of 2013 with the formation of a leadership team and three work groups. Co-Managers led the leadership team comprised of three Strand Coordinators who facilitated work teams and reviewed, researched, and revised these common strands. All skills specific to the vocational technical program have been included into Strand Two Technical.

The Strand One Team revised the safety knowledge and skills that all students need to acquire. The team included relevant issues (i.e., bullying, climate), laws, regulations, guidelines and policies pertaining to safety.

The Strand Four Team revised the Employability Knowledge and Skills that all students need to acquire. Teams considered current research on career readiness, including the work of the College Career Readiness Task Force convened by the Department, changes in workplace, technological changes that impact how people perform their work (i.e., communications methods), and included standards that emphasize the need for lifelong learning and adaptability given the multiple career changes over and an individual's working life. The team recommended this strand be renamed to: Career Readiness.

The Strand Five Team revised the Management & Entrepreneurship Knowledge and Skills that all students need to acquire. All business owners and employees must possess management and financial skills to be productive members of society. Skills included financial knowledge and basic business management skills.

All Strand One, Four and Five Project Teams worked collaboratively with staff from the Department of Elementary and Secondary Education and the Advisors of the Massachusetts Career and Technical Student Organizations to crosswalk standards to national Career & Technical Student Organizations Curricula, as applicable.

The Office for Career/Vocational Technical Education contracted the MAVA Consultant Team to work closely with the office to complete all of the work accomplished during Phase II of the Project.

A remarkable amount of work was accomplished through the efforts of hundreds of professionals who collaborated and diligently supported this work. The Office for Career/Vocational Technical Education is grateful for all the support received from the field, particularly all of the teachers (technical and academic), administrators, advisory committee members, business and industry representatives, the Division of Professional Licensure - boards, the Massachusetts Association of Vocational Administrators, the MAVA Consultants, and the Massachusetts Vocational Association, whose contributions were tremendous.

Special thanks to all staff in the Office for Career/Vocational Technical Education and the CVTE Framework Revision Team who provided guidance and numerous contributions during Phase One of the project.

Organization and Key Changes

This section contains the following:

- Highlights of changes to the Vocational Technical Education Frameworks; which includes a summary of changes made to each strand.
- Organization of the Frameworks – Strand Two illustrates structure of topic headings, standards and objectives, and performance examples.

Highlights of Changes to the Vocational Technical Education Frameworks:

Strand One:

Safety and Health Knowledge and Skills have been revised to contain the safety standards that are common to all programs. The Strand One Team worked collaboratively with staff from the Department of Elementary and Secondary Education and the Advisors of the Career and Technical Student Organizations (CTSO) to crosswalk standards to national CTSO Curricula, as applicable.

- No objectives were deleted, only modified.
- Language and wording was clarified.
- Additions included a focus on maintaining a safe school and workplace in terms of creating a positive climate/environment.
- Student safety credential program has been revised.
- Safety attire has been revised.
- Emergency equipment and fire safety has been revised.
- Many new Performance Examples have been included.
- Within each strand, standards and objectives were grouped under Topic Headings, which are displayed in bold. Each standard is followed by a performance example. See the section below titled: "Organization of the Frameworks – Strand Two". All strands were organized in that manner, with the exception of the former Strand Three.

Strand Two:

The Technical Standards Knowledge and Skills have been revised to reflect business and industry changes since the adoption of the 2007 Vocational Technical Education Frameworks (VTEF). There are additional changes to Strand Two below:

- The Technical Knowledge and Skills (Strand Two) section contains standards specific to the particular vocational program; suffix "a" (as common to all programs) and suffix "c" (as common within a cluster) have been removed.
- Each VTEF Strand Two begins with safety and health knowledge and skills specific to the particular vocational program.
- Within each strand, standards and objectives were grouped under Topic Headings, which are displayed in bold. Each standard is followed by a performance example. See the section below

titled: “Organization of the Frameworks – Strand Two”. All strands were organized in that manner, with the exception of the former Strand Three.

- Strand Two of the Frameworks for Animal Science, Environmental Science and Technology, and Horticulture, begin with core standards required for all participants in the programs, followed by a series of standards organized in concentrations. See the section below titled: “Organization of the Frameworks – Strand Two” for more information.
- An update to some of the vocational programs framework is the addition of advanced or supplemental standards which are noted in Strand Two by an asterisk (*). *These standards are not required, but are provided as suggestions that districts may choose to use to increase the depth of a particular topic, or add additional topics, particularly for advanced students or for those seniors who do not participate in cooperative education.* See the section below titled: “Organization of the Frameworks – Strand Two” for more information.

Strand Three:

Since the purpose of Strand Three was to correlate academic content that was *embedded* in the knowledge and skills necessary to perform certain technical skills, it was logical to highlight those connections through a crosswalk between the academic curriculum standards and the technical standards (Strand Two). The crosswalk directly correlates the English Language Arts (2011) and Mathematics (2011) Frameworks, incorporating the Common Core Standards and the Science and Technology/Engineering Frameworks. The crosswalk can be found in the appendix of each vocational framework. The crosswalk also includes performance examples which illustrate integrated academic and technical content.

- Embedded Academics has been replaced with a crosswalk between the academic curriculum standards and the technical knowledge and skills standards. The crosswalk is located in the Appendices.

Strand Four:

Employability (and Career Readiness) Knowledge and Skills focused on providing students with general knowledge and skills to be college and career ready. The Strand Four Team worked collaboratively with staff from the Department of Elementary and Secondary Education and the Advisors of the Career and Technical Student Organizations to crosswalk standards to national CTSO Curricula, as applicable.

- Language and wording were clarified.
- Additions included a focus on providing students with skills for employability/career readiness.
- Modifications included Career Exploration & Navigation, Communication in the Workplace, and Work Ethic & Professionalism.
- New Performance Examples have been included.
- Within each strand, standards and objectives were grouped under Topic Headings, which are displayed in bold. Each standard is followed by a performance example. See the section below titled: “Organization of the Frameworks – Strand Two”. All strands were organized in that manner, with the exception of the former Strand Three.

Strand Five:

Strand Five contains Management and Entrepreneurship Knowledge and Skills that are general for all students. The Strand Five Team worked collaboratively with staff from the Department of Elementary and Secondary Education and the Advisors of the Massachusetts Career and Technical Student Organizations to crosswalk standards to national Career & Technical Student Organizations Curricula, as applicable.

- Language and wording were clarified and organized into a logical format.
- The Strand Five Team felt that the 2007 curriculum remained valid.
- Additions included a focus on providing students with skills for management and entrepreneurship applicable to all vocational programs.
- Modifications included Starting and Managing a Business, Marketing, and Financial Concepts & Applications in Business, and Legal/Ethical/Social Responsibilities.
- New Performance Examples have been included.
- Within each strand, standards and objectives were grouped under Topic Headings, which are displayed in bold. Each standard is followed by a performance example. See the section below titled: "Organization of the Frameworks – Strand Two". All strands were organized in that manner, with the exception of the former Strand Three.

Strand Six

Strand Six Technology Literacy Knowledge and Skills has been replaced with the 2008 Massachusetts Technology Literacy Standards and Expectations Framework.

Appendix¹

Each framework contains an “Appendix” section which includes an Embedded Academic Crosswalk, Industry Recognized Credentials, Statewide Articulation Agreements, Professional, Governmental, and Student Organizations, Resources, and relevant websites.

The Appendix² contains:

- Embedded Academic crosswalks for English Language Arts, Mathematics, and Science & Technology/Engineering.
- Statewide Articulations: Current statewide Articulation Agreements and/or Apprenticeship Programs available to the specific vocational program are listed on this page. The development of new statewide articulations continues, and therefore these pages will be revised as new agreements are finalized.
- Industry-Recognized Credentials: Technical Teacher Teams generated lists of credentials for the vocational programs. Program Advisory Committees throughout the state reviewed and provided recommendations through the validation process. *The credential list has been provided as a resource only and districts are not obligated to provide all of the specified credentials for students.*
- Other: These pages provide lists of reference materials, government agencies, professional and student organizations, and useful websites created by each framework team. These are intended as helpful resources for technical teachers, identified by peers. These are not recommended or required by the Department of Elementary & Secondary Education.

¹ *Note: Although most Framework Teams provided information for the “Appendix”, not all teams did. Therefore, sub-headings within the “Appendix” without information have been deleted.*

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Organization of the Frameworks – Strand Two

The Vocational Technical Education Frameworks contain knowledge and skills covering all aspects of industry, reflected in six strands: Safety and Health, Technical, Embedded Academics, Employability, Management and Entrepreneurship, and Technological.

Within each strand, standards and objectives were grouped under topic headings, which are displayed in bold. Each standard is followed by a performance example. In the excerpt below, 2.A is the topic; 2.A.01 is the first standard and 2.A.01.01 and 2.A.01.02 are the objectives under that standard.

2.A Automotive Technology Specific Safety Practices

- 2.A.01 Identify and describe safety procedures when dealing with different types of automotive lifts according to current industry standards.
- 2.A.01.01 Demonstrate procedures for safe lift operations.
- 2.A.01.02 Demonstrate safe use, placement and storage of floor jacks and jack stands.

2.A.01 Performance Example:

- Student will set up lift using manufacturer’s suggested lift points.

- 2.A.02 Demonstrate and describe safety procedures when dealing with high pressure systems including necessary ventilation according to current industry standards.

2.A.02.01 Describe and demonstrate the importance of safety procedures to be used when servicing high pressurized systems (fuel systems, brakes, air conditioning, suspension, hydraulic systems, etc.).

2.A.02.02 Describe and demonstrate safe use of oxygen/acetylene torches and electric welding equipment.

2.A.02.03 Demonstrate ventilation procedures to be followed when working in the lab/shop area.

2.A.02 Performance Example:

- Student will relieve fuel system pressure to perform necessary repairs.

- 2.A.03 Identify and describe safety procedures when dealing with electrical circuits according to current industry standards.

2.A.03.01 Describe safety procedures to be followed when servicing supplemental restraint systems.

2.A.03.02 Demonstrate safety awareness of high voltage circuits of electric or hybrid electric vehicles and related safety precautions.

2.A.03 Performance Example:

- Safely disable Supplemental Restraint System (SRS) air bag for repair using manufacturer’s recommendations.

There are additional changes to some of the Frameworks Strand Two (Technical Knowledge and Skills). Specifically, Strand Two of the Frameworks for Animal Science, Environmental Science and Technology and Horticulture begin with core standards required for all participants in the programs, followed by a series of standards organized in concentrations. For example, Strand Two of the Horticulture Framework begins with the core standards required of all Horticulture students

(Topics 2.A through 2.I). These standards are followed by the three concentrations: Arboriculture (Topics 2.J through 2.L), Greenhouse Management and Floriculture (Topics 2.J. through 2.L) and Landscape and Turf Management (Topics 2.M through 2.Q).

Advanced / Supplemental Standards (Not Required)

Another variation that is new to the revised Strand Two Frameworks is the addition of advanced or supplemental standards which are noted with the use of an asterisk (*). *These standards are not required, but are provided as suggestions that districts may choose to use to increase the depth of a particular topic, or add additional topics, particularly for advanced students or for those seniors who do not participate in cooperative education.*

The following is an example from Automotive Technology, where entire topics were added:

Advanced Automotive Technology Technical Knowledge and Skills

Note: The following competencies are optional, supplementary competencies suitable for advanced students. These are not required.

2.CC Demonstrate appropriate engine repair techniques.

2.CC.01 Perform appropriate cylinder Head Repair.

2.CC.01.01* Diagnose, remove and replace cylinder head(s).

2.CC.01.02* Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition; determine necessary action.

The following is an example from the Strand Two Radio and Television Broadcasting Framework that shows the addition of an advanced objective, 2.B.04.08*:

2.B.04 Explain concepts fundamental to shooting in cinema and video.

- 2.B.04.01 Compare and contrast a single-camera and a multiple-camera production.
- 2.B.04.02 Explain the importance of shooting for the edit (i.e., match on action, sequencing, coverage).
- 2.B.04.03 Explain the importance of continuity.
- 2.B.04.04 Explain the 180° Rule line, and its application in various cinema scenarios.
- 2.B.04.05 Identify and establish a specific point-of-view when shooting from a script.
- 2.B.04.06 Analyze the methods in which specific shots can evoke emotion from an audience.
- 2.B.04.07 Define drop frame and non-drop frame code shooting and explain how to account for both when preparing for an edit.
- 2.B.04.08* Describe various cinematographic methods necessary when shooting scenes that incorporate post-production visual effect

2.B.04 Performance Examples:

- Students will list similarities and differences of single-camera and multiple-camera shoots.
- Students will describe multiple shooting considerations that are useful in streamlining the editing process.

Agriculture and Natural Resources Occupational Cluster

Animal Science Framework (VANIM)

Strand 1: Safety and Health Knowledge and Skills

1.A Fundamentals of Health and Safety

- 1.A.01 Describe and apply health and safety regulations.
- 1.A.01.01 Identify, describe and apply health and safety regulations that apply to specific tasks and jobs. Students must complete a safety credential program, e.g., Occupational Safety and Health Administration 10, CareerSafe and ServSafe.
 - 1.A.01.02 Identify, describe and apply Environmental Protection Agency (EPA) and other environmental protection regulations that apply to specific tasks and jobs in the specific occupational area.
 - 1.A.01.03 Identify, describe and apply Right-To-Know (Hazard Communication Policy) and other communicative regulations that apply to specific tasks and jobs in the specific occupational area.
 - 1.A.01.04 Explain procedures for documenting and reporting hazards to appropriate authorities.
 - 1.A.01.05 Identify and describe potential consequences for non-compliance with appropriate health and safety regulations.
 - 1.A.01.06 Identify and list contact information for appropriate health and safety agencies and resources.

1. A.01 Performance Examples:

- List and define OSHA Health and Safety Regulations, EPA and other environmental protection regulations to occupational area.
- List and define Right-to-Know regulations and reporting of hazards and contact information for appropriate health and safety agencies.
- List the laws and rules of regulatory agencies governing sanitation and safety.
- Utilize OSHA as well as health and safety websites for purposes of research.

- 1.A.02 Demonstrate appropriate health and safety practices based on the specific occupational area.
- 1.A.02.01 Identify, describe and demonstrate the effective use of Safety Data Sheets (SDS).
 - 1.A.02.02 Read and interpret chemical, product and equipment labels to determine appropriate health and safety considerations.
 - 1.A.02.03 Identify, describe and demonstrate personal, shop and job site safety practices and procedures.
 - 1.A.02.04 Demonstrate safe dress and use of relevant safety gear, personal protective equipment (PPE) and ergonomics, e.g., wrist rests, adjustable workspaces, equipment, gloves, proper footwear, earplugs, eye protection and breathing apparatus.

- 1.A.02.05 Demonstrate appropriate safe body mechanics, including appropriate lifting techniques and ergonomics.
- 1.A.02.06 Locate emergency equipment, first aid kit, SDS information directories and emergency action/response plan/escape routes in your lab, shop and classroom, including labels and signage that follow OSHA Hazard Communication Program (HAZCOM), eyewash stations, shower facilities, sinks, fire extinguishers, fire blankets, telephone, master power switches and emergency exits.
- 1.A.02.07 Demonstrate the safe use, storage, and maintenance of every piece of equipment in the lab, shop and classroom, e.g., the OSHA Lockout/Tagout Program (LOTO).
- 1.A.02.08 Describe safety practices and procedures to be followed when working with and around electricity, e.g., ground fault circuit interrupter (GFCI) and frayed wiring.
- 1.A.02.09 Handle, store, dispose of and recycle hazardous, flammable and combustible materials, according to EPA, OSHA and product specifications.
- 1.A.02.10 Demonstrate appropriate workspace cleaning, sanitation, disinfection and sterilization procedures required in specific occupational areas, e.g., Workplace Housekeeping OSHA Regulations.

1. A.02 Performance Examples:

- Identify, describe and demonstrate the use of SDS.
- List and demonstrate shop dress code, safety procedures and location of emergency equipment in labor classroom.
- Define and demonstrate safe storage and maintenance of equipment and proper disposal or recycling of hazardous, flammable and combustible materials.
- Identify, describe and demonstrate the Universal Precautions set of guidelines.

- 1.A.03 Demonstrate appropriate responses to situations that may threaten health and safety.
 - 1.A.03.01 Describe First Aid procedures for potential injuries and other health concerns in the specific occupational area.
 - 1.A.03.02 Describe the importance of emergency preparedness and an emergency action/response plan.
 - 1.A.03.03 Describe procedures used to handle emergency situations, defensive measures and accidents, including identification, reporting, response, evacuation plans and follow-up procedures.
 - 1.A.03.04 Identify, describe and demonstrate safety practices in specific occupational areas used to avoid accidents.
 - 1.A.03.05 Identify and describe fire protection, protection, precautions and response procedures.
 - 1.A.03.06 Discuss the role of the individual and the company/organization in ensuring workplace safety including transportation to and from school, school activities and the workplace.
 - 1.A.03.07 Discuss ways to identify, prevent and report school and workplace violence, discrimination, harassment and bullying.
 - 1.A.03.08 Demonstrate positive and appropriate behavior that contributes to a safe and healthy environment in school and the workplace.

1. A.03 Performance Example:

- Define first aid procedures and protocols used to handle emergency situations and practices used to avoid accidents.
- View safety videos and discuss the role of workplace safety.
- Attend or participate in a human rights alliance organization presentation.
- Observe and/or demonstrate the appropriate use of a fire extinguisher using the (PASS) technique: Pull, Aim, Squeeze, Sweep.
- Review and discuss specific policies, procedures and protocols regarding discrimination, harassment and bullying.
- Discuss and/or role-play proper and respectful behavior that contributes to a positive climate.
- Discuss and/or demonstrate behavior that contributes to a collaborative/teamwork environment.

Selected Websites

- Bullying Prevention and Intervention Resources : www.doe.mass.edu/bullying
- Centers for Disease Control and Prevention: www.cdc.gov
- Environmental Protection Agency : www.epa.gov
- “Lost Youth – Four Stories of Injured Young Workers” – WorkSafeBC:
<http://www2.worksafebc.com/Publications/Multimedia/Videos.asp?reportid=34291>
- Massachusetts Department of Elementary and Secondary Education. (2011). Career/Vocational Technical Education Safety Guide: www.doe.mass.edu/cte
- Massachusetts Department of Elementary and Secondary Education: www.doe.mass.edu
- Massachusetts Emergency Management Agency: www.mass.gov/eopss/agencies/mema
- Massachusetts General Law: www.malegislature.gov
- Massachusetts Health and Human Services: www.mass.gov/dph
- Massachusetts Right to Know Law Summary:
<http://www.mass.gov/lwd/docs/dos/mwshp/hib397.pdf>
- Safety Data Sheet: www.sdsonline.com
- National Fire Protection Association: www.nfpa.org
- Protection of Student Rights: Massachusetts General Law:
<https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXII/Chapter76/Section5>
- Occupational Safety and Health Administration: www.osha.gov
- Readiness and Emergency Management for Schools: www.rems.ed.gov
- Safe and Healthy Learning Environments: www.doe.mass.edu/ssce/safety.html

Strand 2: Technical Knowledge and Skills

2.A Animal Science Safety and Health Knowledge and Skills

- 2.A.01 Utilize appropriate Personal Protection Equipment (PPE) and animal safety protocols.
- 2.A.01.01 Select, demonstrate and use proper personal protection equipment for the given task.
 - 2.A.01.02 Demonstrate a quick release safety knot.
 - 2.A.01.03 Demonstrate a knowledge of safety procedures for a given animal or situation.

2.A.01 Performance Example:

- Describe and demonstrate the PPE and safety guidelines used in industry when placing an animal on a grooming table.
- Demonstrate ergonomically correct lifting techniques and the correct adjustment of the grooming noose around the dog's neck when placing the assigned canine on the grooming table.
- Examine the skin and coat condition before brushing out the dog prior to bathing and recommend appropriate shampoo.

- 2.A.02 Recognize and interpret animal behavioral changes.
- 2.A.02.01 Explain, compare and contrast: predator vs. prey response and fight vs. flight response.
 - 2.A.02.02 Interpret animal body language and communication.
 - 2.A.02.03 Describe the impact of an animal's body language, communication and appearance on potential animal behavior and how that influences animal handling strategies.

2.A.02 Performance Example:

- The student will record sounds/calls, eye contact, body language, posturing, movement and distance/comfort zones of an undisturbed flock of sheep..
- Describe the changes when a leashed dog is introduced to the flock, and hypothesize the rationale behind the flock's instinctual response.
- Discuss how the response might change if the shepherd were to utilize an animal (such as a llama or alpaca) for guarding purposes. Describe how that might change the flock dynamic, and affect the original predator vs. prey response.

- 2.A.03 Handle animals in a variety of management situations according to current industry and OSHA standards.
- 2.A.03.01 Transfer an animal from one form of housing to another.
 - 2.A.03.02 Approach, catch and restrain a loose animal.
 - 2.A.03.03 Approach a caged or housed animal.
 - 2.A.03.04 Identify common aides used in animal handling.

2.A.03 Performance Example:

- Demonstrate the safe handling procedures for a chinchilla when transferring it from its cage to a dust bowl, in order for the chinchilla to take a dust bath.
- Demonstrate how to catch the chinchilla in the confined space of the dust bath bowl, and transfer it back to its original cage.

- 2.A.04 Restrain an animal utilizing technique appropriate for the given situation and according to current industry and OSHA standards.

- 2.A.04.01 Identify guidelines and requirements for various animal restraint procedures utilized by industry.
- 2.A.04.02 Restrain an animal to undergo routine procedures.
- 2.A.04.03 Restrain an animal for grooming.
- 2.A.04.04 Restrain an animal to protect other animals, people, or itself from harm.
- 2.A.04.05 Identify common aides used in animal restraint.

- 2.A.04 Performance Example:
- Describe and demonstrate techniques used to brush a dog in preparation for grooming.
 - Repeat the process when lifting the dog from the floor into the tub for bathing.

2.B Fundamentals of Animal Science

- 2.B.01 Use terminology associated with the field of animal science and animal husbandry.
 - 2.B.01.01 Define, describe, and use terminology specific to each species with regard to gender, reproduction, groups, age and purpose/function.
 - 2.B.01.02 Use terminology used in common management practices associated with each species.

- 2.B.01 Performance Example:
- As part of an anticipatory set for a lesson on terminology specific to the species, write the terms to be discussed individually on cards without the benefit of definitions. Divide the students into teams and distribute an equal number of cards to each group.
 - Throughout the classroom, place posters with the names of the different species to be studied. Ask students to place their cards under the species that they feel the term refers to, and ask them to be prepared to defend their decision.
 - Conclude instruction by activating student's prior knowledge about the terms to be discussed, including information on root words and word origins as part of the discussion about the actual definitions.

- 2.B.02 Use animal science industry tools and equipment according to current industry and OSHA standards and manufacturers' specifications.
 - 2.B.02.01 Describe and follow safety protocols for various tools and equipment in accordance with industry standards.
 - 2.B.02.02 Select and use the appropriate tool to perform a given task.
 - 2.B.02.03 Apply safety procedures for various tools and equipment.
 - 2.B.02.04 Adjust tools and equipment according to manufacturer's specifications.
 - 2.B.02.05 Demonstrate maintenance of all tools.
 - 2.B.02.06 Store tools, in a manner consistent with industry practices.

- 2.B.02 Performance Example:
- As part of a lesson involving tattooing animals for identification and registration, review the safety guidelines, sanitation procedures and the required PPE needed when performing the task. Instruct students on how a veterinary health care professional would load the tattoo pliers with specific letters/numbers/symbols and perform the task.
 - Upon mastery of this content, ask students to review an animal's data and load the tattoo pliers with the appropriate letters/numbers/symbols to correctly tattoo an animal in accordance with acceptable industry practices and state identification requirements. Ask the student to "tattoo" a piece of paper to insure the tattoo reads correctly and adjust the setting for any errors.
 - Conclude instruction by providing students with an opportunity to read a live animal's tattoo, asking them to match it up to a corresponding set of registration papers or health documentation to insure an animal's identity.

2.C Species, Breeds and Characteristics of Animals

- 2.C.01 Identify the most common characteristics and breeds of large animals.
- 2.C.01.01 Identify characteristics and breeds of dairy and beef cattle (Dairy (e.g., Holstein, Jersey, Ayrshire, Brown Swiss, Guernsey, and Milking Shorthorn) Beef (e.g., Hereford, Angus, Charolais, Simmental and Belted Galloway).
 - 2.C.01.02 Identify characteristics and breeds of sheep. (e.g., Suffolk, Dorset, Hampshire, Merino, and Cheviot).
 - 2.C.01.03 Identify characteristics and breeds of swine. (e.g., Yorkshire, Landrace, Hampshire, Duroc and Poland China).
 - 2.C.01.04 Identify characteristics and breeds of goats (e.g., Angora, Boer, Alpine, Nubian, Toggenburg, and Saanen).
 - 2.C.01.05 Identify characteristics and breeds of horses and ponies (e.g., Belgian, Shetland Pony, Morgan, Quarter Horse, Appaloosa, Arabian, Thoroughbred, Miniature Horses, American Saddlebred and Holsteiner).

2.C.01 Performance Example:

- Ask students to create flashcards with a picture of the breed of animal on the front. On the back of the card, ask students to fill in the name of the breed, origin, color, and pertinent breed facts. Ask the students to form pairs to quiz each other on the information.
- Once completed, show students other pictures of the breed, and ask them to identify the breed out of the original context.

- 2.C.02 Identify the characteristics, species, and breeds of birds and specialty animals.
- 2.C.02.01 Identify characteristics and species of specialty animals. (e.g., Alpacas, Llamas, Bison, Ostrich, and Emus).
 - 2.C.02.02 Identify characteristics and breeds of poultry (e.g., Rhode Island Red, Plymouth Rock, and Leghorns).
 - 2.C.02.03 Identify characteristics and species of birds (e.g., Lovebirds, Cockatiels, Parakeets, Cockatoos, Amazons and Macaws).
 - 2.C.02.04 Identify characteristics and species of reptiles and amphibians (e.g., Iguana, Bearded Dragon, Corn Snake, Ball Python, Gecko, Newt, Firebelly Toad, White Tree Frog, Red Eared Slider, and Blue Tongued Skink).

2.C.02 Performance Example:

- Ask students to create flashcards with a picture of the breed of animal on the front. On the back of the card, ask students to fill in the name of the breed, origin, color, and pertinent breed facts. Ask the students to form pairs to quiz each other on the information.
- Once completed, show students other pictures of the breed, and ask them to identify the breed out of the original context.

- 2.C.03 Identify the characteristics and species and breeds of common companion animals
- 2.C.03.01 Identify characteristics and breeds of dogs according to the seven groups of the AKC (e.g., sporting, hound, working, terrier, toy, non-sporting, herding) and three most popular breeds from each group: Sporting - Labrador retrievers, Golden retrievers, and Cocker Spaniels. Hounds - Beagles, Dachshunds, and Basset Hounds. Working – Boxers, Rottweilers, and Doberman Pinschers. Terrier – Miniature Schnauzers, West Highland White Terriers, and Scottish terriers. Toy- Yorkshire Terriers, Shih Tzu, and Chihuahua. Non-Sporting – Poodles, Bulldogs, and Boston Terriers. Herding – German Shepherd, Shetland Sheepdogs, and Welsh Corgis.

- 2.C.03.02 Identify characteristics and breeds of cats (e.g., Long hair – Persian, Maine Coon, Ragdoll, and Domestic Long Hair. Short Hair - Exotic, Siamese, Abyssinian, and Domestic Short Hair).
- 2.C.03.03 Identify characteristics and species of small mammals (e.g., Rodents – Mice, Gerbils, Rats, Hamsters, Chinchillas, and Guinea Pigs -American, Abyssinian, Silky and Rabbits-Dutch, Holland Lop, Netherland Dwarf, New Zealand, and Rex.

2.C.03 Performance Example:

- Ask students to create flashcards with a picture of the breed of animal on the front. On the back of the card, ask students to fill in the name of the breed, origin, color, and pertinent breed facts. Ask the students to form pairs to quiz each other on the information.
- Once completed, show students other pictures of the breed, and ask them to identify the breed out of the original context.

2.D Animal Housing

- 2.D.01 Identify housing requirements for animals.
 - 2.D.01.01 Identify housing appropriate for livestock and poultry.
 - 2.D.01.02 Identify housing appropriate for horses.
 - 2.D.01.03 Identify housing appropriate for rodents (research and domestic).
 - 2.D.01.04 Identify housing appropriate for reptiles and amphibians.
 - 2.D.01.05 Identify housing appropriate for birds (research and domestic).
 - 2.D.01.06 Identify housing appropriate for fish and aquatic species.
 - 2.D.01.07 Describe kennel systems for dogs and cats (research and domestic).

2.D.01 Performance Example:

- Ask students to conduct a webquest researching the habitat requirements for a specific reptile. As part of this research, ask students to identify the environmental conditions, as well as the common behaviors that may influence habitat design.
- Once the research is complete, ask students to make a recommendation for a habitat for that specific reptile.

- 2.D.02 Apply industry practices for the management of animal housing.
 - 2.D.02.01 List the requirements and appropriate materials for animal housing, including pastures, cages, stalls, pens, and aquaria.
 - 2.D.02.02 Explain state and local guidelines and legal requirements for the housing of large and small animals.
 - 2.D.02.03 Identify adverse housing conditions: cold, wet, unsanitary, odor-ridden, unsatisfactory ventilation and dark.
 - 2.D.02.04 Describe favorable housing conditions: warm, dry, clean, odor free, proper ventilation, proper lighting.
 - 2.D.02.05 Recognize and describe the importance of environmental enrichment.
 - 2.D.02.06 Explain the problems and/or concerns associated with overpopulated housing conditions.
 - 2.D.02.07 Describe and demonstrate appropriate sanitation methods.
 - 2.D.02.08 Utilize manure management strategies that meet regulatory and industry standards.

- 2.D.02 Performance Example:
- Lead a classroom discussion on the requirements of animals for safe and healthy housing. Create a list of the needed elements that are required for satisfactory animal housing. Create a check list of “must haves” and “nice to have” conditions.
 - Using a visual presentation, ask students to observe pictures of actual animal housing units. Using their self-generated checklists, ask them to rate the housing using their established criteria.
 - As an extension of this lesson, ask students to assume the role of an animal health inspector. Ask them to decide if they would grant a permit to the owner based on the type of housing provided.

2.E Comparative Animal Anatomy and Physiology

- 2.E.01 Demonstrate knowledge of external anatomical features for large and small animals.
- 2.E.01.01 Identify and locate the external anatomical features of large and small animals.
- 2.E.01.02 Differentiate external anatomical features between species/breeds/sexes.

- 2.E.01 Performance Example:
- Start the class with an initial discussion about concept of sexual dimorphis, which is a phenotypic difference between males and females of the same species. Activate student’s prior knowledge of this concept by asking them to list differences they are aware of.
 - Lead a classroom discussion of sexual dimorphism which includes differences in morphology, size, ornamentation and animal behavior.
 - As an extension of this lesson, discuss with the students the management practice of blood typing birds to determine their sex in species where both sexes can be the same color.

- 2.E.02 Identify and describe the functions of the primary organs of the ten major systems of the animal’s body.
- 2.E.02.01 Diagram and label the skeletal features of large and small animals.
- 2.E.02.02 Locate and describe the functions of the primary organs of the respiratory system in large and small animals.
- 2.E.02.03 Locate and describe the functions of the primary organs of the circulatory system in large and small animals.
- 2.E.02.04 Locate and describe the functions of the primary organs of the digestive system in large and small animals.
- 2.E.02.05 Locate and describe the functions of the primary organs of the reproductive system in large and small animals.
- 2.E.02.06 Locate and describe the functions of the primary organs of the muscular system in large and small animals.
- 2.E.02.07 Locate and describe the functions of the primary organs of the urinary system in large and small animals.
- 2.E.02.08 Locate and describe the functions of the primary organs of the nervous system in large and small animals.
- 2.E.02.09 Locate and describe the functions of the primary organs of the endocrine system in large and small animals.
- 2.E.02.10 Locate and describe the functions of the primary organs of the integumentary system in large and small animals.

- 2.E.02 Performance Example:
- As part of a series of lessons about the urinary system, discuss the formation of bladder stones in animals, especially in dogs and cats. Discuss the three major factors that influence their formation, including infection, dietary influences, stress and genetics.
 - Discuss the common symptoms associated with this problem and the long term effects.

2.F Genetics, Breeding and Reproduction of Domestic Animals

- 2.F.01 Demonstrate an understanding of the basic terms and concepts associated with animal reproduction.
- 2.F.01.01 Identify parts of male and female reproductive anatomy.
 - 2.F.01.02 Define terminology associated with the reproductive system.
 - 2.F.01.03 Determine the gestation periods for dairy and beef cattle.
 - 2.F.01.04 Identify the gestation period for sheep.
 - 2.F.01.05 Identify the gestation period for swine.
 - 2.F.01.06 Identify the gestation period for dogs.
 - 2.F.01.07 Identify the gestation period for cats.
 - 2.F.01.08 Identify the gestation period for small mammals, including rodents and rabbits.
 - 2.F.01.09 Identify the gestation and incubation period for reptiles and amphibians.
 - 2.F.01.10 Identify the gestation period for horses.
 - 2.F.01.11 Identify the incubation period for birds.
 - 2.F.01.12 Compare and Contrast the lactation period of dairy cows with other mammals.

2.F.01 Performance Example:

- As an anticipatory set, launch the question, “What came first, the chicken or the egg?” – followed by a discussion of the requirements for incubation (heat, moisture/humidity, rotation). Discuss the varied incubation periods for different species of birds.
- Once this concept has been mastered, extend the lesson by asking students why eggs (laid one per day), all hatch on or about the same day, when clearly some were laid before others.

- 2.F.02 Identify key animal breeding practices and management strategies utilized by industry.
- 2.F.02.01 Discuss the key features of the stages of reproduction: mating, fertilization, mitosis/meiosis, gestation, parturition and lactation.
 - 2.F.02.02 Describe the specific management strategies used when caring for breeding animals.
 - 2.F.02.03 Compare and Contrast the advantages and disadvantages of artificial insemination versus natural breeding.
 - 2.F.02.04 Explain how criteria and data are used in selective breeding.
 - 2.F.02.05 Identify common breeding practices.
 - 2.F.02.06 Calculate the hereditary percentages for a simple dominant recessive trait using a Punnett Square.

2.F.02 Performance Example:

- Conduct a lesson involving the inheritance of the simple dominant white face gene (W) in cattle. Calculate the hereditary percentages of crossing a heterozygous white face cow with a heterozygous white face bull using a Punnett Square for the potential offspring.
- Once students have mastered this concept, propose another example using one homozygous solid faced cow with a heterozygous white face bull.

2.G Animal Health and Disease Prevention

- 2.G.01 Differentiate between the characteristics and behavior of healthy versus unhealthy animals.
- 2.G.01.01 Define the characteristics and behaviors of a healthy animal.
 - 2.G.01.02 Identify the characteristics and behaviors of an unhealthy animal.

2.G.01.03 Define temperature, pulse, and respiration (TPR) and explain how they relate to the health of the animal.

2.G.01 Performance Example:

- Review the safety procedures for catching a small ruminant, including haltering and performing a safety knot. Ask students to catch an animal and tie it up with a quick release knot.
- Once secured, ask students form teams of three and take the TPR on the animal. Ask students to rotate and complete the TPR on all animals in the group.
- Once completed, ask students to graph their results and hypothesize what could account for the different ranges in the results.

2.G.02 Evaluate how the environment impacts animal health.

2.G.02.01 Explain the principles of maintaining proper environmental conditions to ensure animal health.

2.G.02.02 List possible adverse conditions that could affect animal health.

2.G.02.03 Differentiate between sanitize, disinfect and sterilize and identify common agents utilized to achieve each level.

2.G.02.04 Outline the standards for and differentiate between quarantine and isolation.

2.G.02 Performance Example:

- As part of a classroom discussion about bringing a new animal into an existing group, brainstorm the potential dangers this introduction brings in the form of the health of the overall group. Select a species and discuss what precautions should be taken when bringing a new animal into the group.
- Create a checklist for an isolation protocol for the new animal being brought in. As an extension of the learning, switch species and ask students if and why the previous isolation protocol would need to change.

2.G.03 Identify the signs of disease in animals and describe approved disease prevention management strategies/protocols.

2.G.03.01 Identify and describe common causes of disease (Incl., bacteria, viruses, fungi, parasites, protozoan, prion and genetics).

2.G.03.02 Define the term zoonosis and identify common zoonotic diseases.

2.G.03.03 Describe alternative strategies to conventional animal health management (i.e., holistic, organic).

2.G.03.04 Compare and contrast preventative health practices and vaccination regimens.

2.G.03.05 Develop and perform preventative health practices and vaccination regimens in accordance with industry standards.

2.G.03 Performance Example:

- As part of a classroom discussion on public health and safety, discuss the zoonotic diseases that impact the New England region. List them on the board. Brainstorm with students the key information that the public should know about these diseases.
- Assign teams of students to research each disease, and present their findings to the class. Determine which disease has the highest rate of incidence, and how health officials monitor its impact.

2.H Animal Feeds and Feeding Practices

- 2.H.01 Outline fundamental animal nutritional and feeding concepts.
 - 2.H.01.01 Identify the six classes of nutrients and cite examples of each.
 - 2.H.01.02 Describe the functions of the six classes of nutrients.
 - 2.H.01.03 Identify various types of feeds for large and small animals (e.g., silage, hay, pelleted, extruded (dry), semi-moist, and moist).
 - 2.H.01.04 Identify and explain the different stages of nutrition (e.g., growth, maintenance, lactation, reproduction, and performance/work).
 - 2.H.01.05 Demonstrate the ways to store feed to prevent spoilage and contamination according to current industry and OSHA standards.

2.H.01 Performance Example:

- During a classroom discussion about the different stages of nutrition (growth, maintenance, lactation, reproduction, performance/work), ask students to identify the nutritional requirements for each of the following:
 - A two year old pregnant mare
 - A spent hen
 - A six week old puppy
 - A working six year old sheepdog

2.I Animal Welfare/Animal Rights

- 2.I.01 Differentiate between animal rights and animal welfare.
 - 2.I.01.01 Explain the difference between animal rights and animal welfare.
 - 2.I.01.02 Develop a position and debate various viewpoints on issues in animal science (ex. common management practices pros and cons, vegetarianism, uses of animals, etc.).
 - 2.I.01.03 Explain the historical significance of the animal rights and animal welfare debate including how it has impacted the management of animals today.
 - 2.I.01.04 Explain the difference between animal cruelty, abuse and neglect.
 - 2.I.01.05 Identify the three R's of research.
 - 2.I.01.06 Identify the five basic animal freedoms.
 - 2.I.01.07 Explain the importance of the Animal Welfare Act.

2.I.01 Performance Example:

- Divide the class into two groups, and assign each team either the topic of "animal rights" or "animal welfare". Ask them to conduct a webquest that identifies the basic differences between the two.
- Create a comparison chart on the board, and ask one group to list one item on the board that identifies one of the fundamental precepts of their movement. Ask the other group to offer a comparison to determine if the two faction agree or disagree. For the next round, allow the second group to go first. Alternate until the basic foundations of each group are identified and compared.

Animal Science Concentration: Companion Animals

2.J Companion Animal Agribusiness Service Skills

- 2.J.01 Demonstrate professional agribusiness skills associated with working in an office or business environment.
- 2.J.01.01 Display a professional appearance in the work place.
 - 2.J.01.02 Use appropriate language and tone of voice in the workplace.
 - 2.J.01.03 Demonstrate how to answer phones and direct customers.
 - 2.J.01.04 Utilize basic computer skills in order to file and retrieve information.
 - 2.J.01.05 Respond to customers, vendors and other industry professionals using electronic communications.
 - 2.J.01.06 Inventory, restock and rotate supplies, according to current industry and OSHA standards.
 - 2.J.01.07* Maintain client records.

2.J.01 Performance Example:

- As part of a lesson involving office procedures, instruct the class on how to answer phones and direct customers.
- Upon mastery of this skill, students will role play with each other, given a situation to resolve/handle.
- Finalize training on this topic by having students perform a customer call back and book appointment.

- 2.J.02 Demonstrate agribusiness retail skills associated with the companion animal service industry.
- 2.J.02.01 Describe the steps involved in making a primary and secondary sale.
 - 2.J.02.02 Prepare an advertising message incorporating multimedia, print and/or audio technologies.
 - 2.J.02.03 Research and analyze market information for trends.
 - 2.J.02.04 Identify entrepreneurial opportunities within in the pet industry such as Doggie Day Cares and Pet “Hotels”
 - 2.J.02.05* Develop a marketing plan for a companion animal agribusiness.
 - 2.J.02.06* Investigate the local, state and federal standards that regulate the companion animal industry.

2.J.02 Performance Example:

- Instruct the class on marketing concepts for promoting a grooming shop. Ask students to identify the key features they feel should be included and create a check list. When satisfactorily completed, ask students to design a pamphlet to market their shop, using this rubric as a guide.
- Summarize the lessons main concepts by asking students to view all of the pamphlets created by the class and fill out a rubric to determine the best design.

- 2.J.03 Demonstrate customer service skills associated with the companion animal service industry.
- 2.J.03.01 Describe customer types and the importance of customer service.
 - 2.J.03.02 Define quality service from a consumer/customer perspective.
 - 2.J.03.03 Greet and assist a customer using approved techniques developed by the employer.
 - 2.J.03.04 Respond positively to customer inquiries and requests.
 - 2.J.03.05 Resolve customer service complaints in a professional manner.
 - 2.J.03.06 Identify and list the steps followed when managing an unsatisfied customer.

2.J.03.07 Explain ways to reduce customer service stress for workers and the consumer/customer.

2.J.03.08* Develop a company policy for dealing with a dissatisfied customer.

2.J.03 Performance Example:

- Lead a classroom discussion on the origin of customer complaints. Through brainstorming, list the common causes on the board.
- Once the concept has been obtained, ask the students to develop scenarios that feature negative consumer experiences.
- Finalize the training of this topic by having students perform role plays demonstrating positive ways to solve the negative student based scenarios.

2.J.04 Assess the inherent risks associated with interacting with various types of animals.

2.J.04.01 Explain risk assessment for various pet species pertaining to safety in the workplace.

2.J.04.02 List key decision-making factors involved in choosing the right pet.

2.J.04.03 Identify and list safety concerns regarding the interaction between children and pets.

2.J.04.04* Develop a set of criteria matching potential owners with pets.

2.J.04.05* Conduct a mock interview for a potential placement for an animal.

2.J.04.06* Utilize web research tools to locate a reputable purebred breeder, animal rescue organization or breed club that may serve as a source of potential animals.

2.J.04 Performance Example:

- As a part of a series of lessons involving choosing the right pet, students will brainstorm questions that will help make a decision on the proper selection of a pet for a client.
- Once the concept has been obtained, ask students to refine the list and develop client interview questions to help employees decide on proper selection techniques.
- Conclude this lesson using a group share and student critique.

2.J.05 Describe the unique management issues associated with housing animals in a retail operation.

2.J.05.01 Demonstrate how to maintain health, performance and registration records on animals.

2.J.05.02 Explain the problems associated with overpopulation.

2.J.05.03 Describe the problems associated with overcrowding.

2.J.05.04 Discuss the ethics and concerns regarding euthanasia.

2.J.05.05* Develop a maintenance schedule for a companion animal facility (i.e. cleaning, painting, scheduling inspections).

2.J.05.06* Develop an enrichment program for animals kept in a group.

2.J.05 Performance Example:

- As part of a series of lessons concerning pet overpopulation students will view the movie "Kiss the Animals Good Bye" ([Pyramid Media, 1984](#))
- To determine if the class has mastered the concepts, students will write a reaction to the video.
- Conclude the lesson on this topic by having the students develop a public service announcement educating the public about overpopulation concerns.

2.K Competing with and Showing Companion Animals

- 2.K.01 Identify resources and strategies used when showing or competing with companion animals.
- 2.K.01.01 Identify resources and practices associated with showing a dog.
 - 2.K.01.02 Describe the characteristics of the American Kennel Club (AKC) dog breeds by their assigned group.
 - 2.K.01.03 Identify resources and practices associated with showing a cat.
 - 2.K.01.04 Describe the characteristics of Cat Fanciers Association (CFA) cat breeds.
 - 2.K.01.05 Identify the characteristics of popular pocket pets (i.e. hamsters, guinea pigs, gerbils, ferret, etc.).
 - 2.K.01.06* Research the history and common use of a select breed of companion animal.
 - 2.K.01.07* Select a breed of companion animal and identify the official characteristics associated with the breed standard.
 - 2.K.01.08* Select a breed of companion animal and identify faults or disqualifications within the breed standard.
 - 2.K.01.09* Design a brochure to provide information to customers about a companion animal breed selection.
 - 2.K.01.10* Compare and Contrast different types of breeding contracts for a companion animal.
 - 2.K.01.11* Compare and Contrast different types of purchasing contracts for a companion animal.
 - 2.K.01.12* Demonstrate advanced showmanship techniques for a specific dog according to AKC guidelines.
 - 2.K.01.13* Present a dog in a showmanship pattern (i.e. down-and-back, triangle, “L” and “T”).
 - 2.K.01.14* Conduct a webquest and outline the benefits of membership to professional canine handling organizations such as Professional Handlers Association (PHA) and American Kennel Club (AKC) Professional Handlers.

2.K.01 Performance Example:

- Start the class with an initial discussion on basic requirements/standards for showing companion animals.
- To determine if the class has mastered the concept, ask them to visit akc.org and perform a webquest for materials related to show patterns, requirements and standards.
- Finalize training on this topic but having students develop a pamphlet for showing standards and resources for a given group.

2.L Training Companion Animals

- 2.L.01 Demonstrate training techniques and strategies used by various professionals in the canine companion animal industry.
- 2.L.01.01 Identify resources and practices of obedience training techniques.
 - 2.L.01.02 Explain the benefits of pet therapy.
 - 2.L.01.03 Explain the training and benefits of companion, assistance and therapy animals.
 - 2.L.01.04 Distinguish between assistance animals, therapy animals and emotional support animals.
 - 2.L.01.05 Demonstrate the ability to train a dog in basic obedience (i.e. sit, heel, come, stay, down).

- 2.L.01.06 Differentiate between training with positive reinforcement techniques and punitive methods of training.
- 2.L.01.07 Identify the fundamental precepts involved in operant conditioning.
- 2.L.01.08* Describe the fundamental AKC guidelines for training dogs in tracking.
- 2.L.01.09* Describe the fundamental AKC guidelines for training dogs in agility.
- 2.L.01.10* Describe the fundamental AKC guidelines for training dogs in rally obedience.
- 2.L.01.11* Describe the fundamental AKC guidelines for training dogs in lure coursing.
- 2.L.01.12* Describe the fundamental AKC guidelines for training dogs in herding.
- 2.L.01.13* Describe the fundamental AKC guidelines for training dogs for earth dog competitions.
- 2.L.01.14* Describe the fundamental AKC guidelines for training dogs for hunt tests.
- 2.L.01.15* Describe the fundamental AKC guidelines for training dogs for various types of field trials.
- 2.L.01.16* Demonstrate advanced obedience skill training techniques (i.e. group exercises, long sits and downs, stand for examination).
- 2.L.01.17* Teach an animal to display a behavior using clicker training techniques.

2.L.01 Performance Example:

- Lead a classroom discussion on the differences between positive and negative reinforcement.
- Once the concept has been obtained, ask students to use a worksheet of examples to differentiate between positive and negative reinforcement.
- Summarize the lesson's main concept by asking students to write a compare and contrast paragraph between positive and negative reinforcement.

- 2.L.02* Demonstrate training techniques and strategies used by various professionals in the canine companion animal industry.
 - 2.L.02.01* Locate and identify a local therapy dog training program.
 - 2.L.02.02* Document the timeline followed for dogs enrolled in a canine assistance training program.

2.M Pet Grooming Industry

- 2.M.01 Describe the inherent risks and safety concerns in the pet grooming industry.
 - 2.M.01.01 Explain risk assessment for the grooming industry.
 - 2.M.01.02 Manage risks and liabilities inherent to pet grooming.
 - 2.M.01.03 Explain risks and liabilities involved when working with client-owned animals.
 - 2.M.01.04 Explain the importance of working safely around animals.
 - 2.M.01.05 Explain the importance of working safely around grooming equipment.
 - 2.M.01.06 Demonstrate basic first aid procedures for a dog or a cat.
 - 2.M.01.07 Demonstrate client record keeping as it pertains to a grooming operation.
 - 2.M.01.08 Identify design concepts associated with a professional grooming establishment.
 - 2.M.01.09* Identify licenses, permits and the process to start a grooming business in a locality.
 - 2.M.01.10* Develop a safety plan for a grooming shop.

2.M.01 Performance Example:

- Activate student's prior knowledge of the proper way to work around animals by creating a list (calm, quiet, etc.) through brainstorming.
- Upon completion of this task, ask the class to develop a list of areas/actions that may require extra safety practices in order to limit risk to human/animals (moving animals from cage to grooming area, lifting animals into wash areas, grooming animals with a heavy parasite load, mixing of species dogs/ cats, etc.).
- Conclude instruction on this concept by having students develop protocols for limiting the risk to the identified hazards (establish specific grooming days for high risk clients or clients with parasites, hydraulic tables for lifting larger clients, etc.).

2.M.02 Describe the safety features needed when designing a grooming facility.

2.M.02.01 Clean and sanitize a grooming facility according to current industry and OSHA standards.

2.M.02.02 Compare the pros and cons of the mobile grooming industry.

2.M.02.03* Design a grooming facility, including the following features: reception, kennel, grooming floor, exits, laundry, safety features, lighting, electricity, heat, storage, parking, dog walk area, signage, name, and location.

2.M.02.04* Locate a mobile grooming service in your area.

2.M.02 Performance Example:

- Lead a classroom discussion on ways to set up a grooming salon and things to consider when determining the overall layout of the shop (i.e. equipment to have, placement, electrical needs, etc.).
- Once the concept has been attained, ask students to use resources to make a list of item and equipment to consider when designing a salon and provide costs. Source the information through the internet or through catalogues.
- As part of a summative assessment, ask students to design their own grooming salon and label the essential elements.

2.M.03 Demonstrate animal brushing and bathing skills consistent with industry standards and practices.

2.M.03.01 Identify and use the tools needed in the grooming industry.

2.M.03.02 Demonstrate appropriate techniques to handle and/or restrain an animal for grooming.

2.M.03.03 Demonstrate brushing-out techniques for animals being groomed.

2.M.03.04 De-mat a dog.

2.M.03.05 De-mat a cat.

2.M.03.06 Select the appropriate shampoo and conditioner based on an animal's skin type and coat.

2.M.03.07 Bathe a dog, cat or rabbit.

2.M.03.08 Bathe an additional species of small animal (i.e. ferret, guinea pig, etc.).

2.M.03.09 Identify different types of shampoos and conditioners available for pet groomers.

2.M.03.10 Explain the use of water and shampoo systems (i.e. "HydroSurge").

2.M.03.11 Identify types of dryers used in a grooming shop (e.g., force dryers and hot air dryers).

2.M.03.12 Dry a dog and a cat.

2.M.03.13 Demonstrate nail trimming techniques.

2.M.03.14 Clean the ears of animals being groomed.

2.M.03.15 Dilute a gallon of shampoo from concentrate to a specified concentration (or solution).

- 2.M.03.16* Investigate and report the grooming pricing in your area.
- 2.M.03.17* Develop a price list for a grooming shop that is categorized by breed.
- 2.M.03.18* List the advantages and disadvantages of using a Hydrosurge for bathing an animal.

2.M.03 Performance Example:

- Activate student's prior knowledge of the different coat types across various dog breeds (hair breed, single coat, double coat, etc).
- Once the concept has been attained ask students to identify different tools that can be used on various coats, Students will then practice using tools on particular breeds.
- Ask students to apply their knowledge to a slightly different application by hypothesizing how different coat densities will affect the bathing process/ drying process.

- 2.M.04 Demonstrate advanced animal grooming skills consistent with industry standards and practices.
 - 2.M.04.01 Explain clipping techniques for a dog and a cat.
 - 2.M.04.02 Demonstrate clipping techniques for a dog and a cat.
 - 2.M.04.03 Clean and oil a clipper blade.
 - 2.M.04.04 Demonstrate grooming equipment maintenance.
 - 2.M.04.05 Perform at least one specialized dog cut.
 - 2.M.04.06 Identify the practices and roles of associated grooming organizations as they pertain to a grooming business (i.e., New England Pet Grooming Professionals – NEPGP, etc.).
 - 2.M.04.07 Identify the circumstances when a professional groomer may apply a muzzle to an animal.
 - 2.M.04.08 Compare the types of muzzles available, and list the pros and cons associated with each.
 - 2.M.04.09 Apply a muzzle to an animal.
 - 2.M.04.10* Given a fixed budget, catalog the items that would need to be included in a grooming kit capable of grooming all types of companion animals.
 - 2.M.04.11* Investigate the requirements for becoming a certified dog groomer through the National Dog Groomers Association of America.
 - 2.M.04.12* Identify and describe the appropriate specialty clips used for a specific breed (i.e., Poodle, English Springer Spaniel, Cairn Terrier, Soft Coated Wheaten Terrier, etc.)
 - 2.M.04.13* Design a creative clip for a Standard Poodle.
 - 2.M.04.14* Demonstrate and describe three clipping/trimming techniques for trimming a dog's foot (i.e., poodle foot, round and retriever foot).
 - 2.M.04.15* Demonstrate and describe how to clip a Standard Poodle face.
 - 2.M.04.16* Demonstrate and describe a body clip for a specific breed (i.e., lamb cut for the Standard Poodle, retriever clip for a Portuguese Waterdog, or a Cocker Spaniel for an American Cocker Spaniel, etc.)

2.M.04 Performance Example:

- Activate student's prior knowledge of basic grooming skills and restraints, leading into a lesson on specialized clips for certain groups/breeds of dogs.
- To determine if the student has mastered the skill, have students write out detailed grooming instructions for a particular breed from start to finish - including tools and equipment used on a 5X7 index card.
- As part of a summative assessment, students will apply knowledge in the lab and put a dog in a specialized clip for that breed and based on the client's preferences.

- 2.M.05 Describe common animal parasite issues related to the pet grooming industry.
- 2.M.05.01 Describe the different types of flea and tick control used in the grooming industry.
- 2.M.05.02 Describe parasite control in the grooming shop.
- 2.M.05.03* Develop a protocol for counseling clients about flea and tick control for their pet.
- 2.M.05.04* Write an action plan for keeping the grooming shop “flea free”.

- 2.M.05 Performance Example:
- Instruct the class on regional parasites (found in New England) and the issues/diseases they may cause among companion animals.
 - Upon mastery of this content, ask students if they can identify where populations of parasites would be most common - then lead the class in a discussion about Integrated Pest Management (IPM).
 - Ask students to apply their knowledge to a slightly different application by having them describe how the use of IPM can help to limit the recurrence of infestations and cross species contamination.

2.N **Breeding Care and Maintenance of Companion Animals**

- 2.N.01 Explain concepts and practices relating to the selection of, breeding and management of companion animals.
- 2.N.01.01 Read a pedigree.
- 2.N.01.02 Discuss the selection of a brood bitch or queen.
- 2.N.01.03 List the criteria used for selection of a stud dog or tom cat.
- 2.N.01.04 Discuss the purpose and design of a whelping box.
- 2.N.01.05 Explain the different stages of labor.
- 2.N.01.06 Describe the grading and selection of puppies.
- 2.N.01.07 Explain temperament testing in puppies.
- 2.N.01.08 Describe the developmental stages of the dog.
- 2.N.01.09 Identify and describe canine and feline body language.
- 2.N.01.10 Explain how dominant and recessive genes relate to breeding and selection based on specific or desired certain traits.
- 2.N.01.11 Describe the function and purpose of the Orthopedic Foundation for Animals.
- 2.N.01.12* Design and build to scale a whelping box for a given breed of dog.
- 2.N.01.13* Describe the process used to select dogs for designated purposes (mobility impaired, nose work, search and rescue).
- 2.N.01.14* Complete a Punnet Square for a real or hypothetical companion animal mating based on a single trait.
- 2.N.01.15* Define the term “health clearances” as it pertains to companion animal breeding.
- 2.N.01.16* Describe what a CHIC (Canine Health Information Center) number indicates, and explain how an animal qualifies for one.

- 2.N.01 Performance Example:
- Activate student’s prior knowledge of reproductive anatomy and estrous cycle patterns.
 - To determine that the class has mastered the concept, ask them to participate in a student activity involving parts identification, form and function.
 - As part of a summative assessment, ask students to draw and label a reproductive diagram explaining the breeding and conception process.

2.0 Animal Health and Disease Prevention

- 2.0.01 Explain concepts and practices relating to pet health.
 - 2.0.01.01 List the protocols used in different canine and feline first aid situations.
 - 2.0.01.02 Demonstrate first aid procedures for a variety of pets.
 - 2.0.01.03 Discuss vaccination requirements for a variety of pets.
 - 2.0.01.04 Interpret rabies laws and protocols in Massachusetts.
 - 2.0.01.05 Explain the dietary requirements of pets.
 - 2.0.01.06 Identify and describe the different diet option available for specific animals (raw, barf, dry, etc.).
 - 2.0.01.07 Take temperature, pulse, and respiration on a companion animal, and state normal ranges.
 - 2.0.01.08 Demonstrate the technique used to listen to animal heart and lung sounds.
 - 2.0.01.09 Explain procedures relating to administering pet medication and vaccinations.
 - 2.0.01.10 Identify methods of control, treatment, and prevention of diseases in pet species.
 - 2.0.01.11 Identify methods of control, treatment, and prevention of internal/external parasites in pet species.
 - 2.0.01.12* Create an animal first aid kit.
 - 2.0.01.13* Research and present information about the nutritional analysis of various diets and feed stuffs.

2.0.01 Performance Example:

- Activate student's prior knowledge of regional (New England) animal health issues and have the student create a Know, Want to Know, Learned (KWL chart).
- Once the concept has been attained, ask the students to create a visual presentation based on one of the regional health concerns. Finalize the training on this topic by having the students present their visual presentations to the class.

NOTES:

* indicates supplemental/advanced learning standards and objectives.

Animal Science Concentration: Equine Science

2.P Equine Safety and Handling

- 2.P.01 Demonstrate handling procedures when working with horses according to standard industry practices and OSHA standards.
 - 2.P.01.01 Explain why horses are prone to “spooking” (example: fright vs. flight, prey response, limitations of monocular vision)
 - 2.P.01.02 Halter a horse.
 - 2.P.01.03 Lead a horse.
 - 2.P.01.04 Tie a horse with a quick release knot.
 - 2.P.01.05 Restrain a horse utilizing an alternative method of control.
 - 2.P.01.06 Demonstrate how to use a chain lead over a horse’s nose.
 - 2.P.01.07 Demonstrate or explain the use of a twitch.
 - 2.P.01.08 Move a horse in and out of housing safely.
 - 2.P.01.09 Move a horse in and out of turnouts safely.
 - 2.P.01.10 Lead a horse for inspection for show and veterinary exams.
 - 2.P.01.11* Demonstrate the use of a lip chain.
 - 2.P.01.12* Demonstrate the use of a chain or rope twitch.

2.P.01 Performance Example:

- After a review of safety, instruct the class on the procedure for putting a horse into their turnout area. To determine if the class has mastered the concept, have them turn a horse out into their turnout area.
- Finalize training on this topic by having them turnout a horse leading them out with a chain lead.

2.Q* Equine Transportation

- 2.Q.01* Identify the regulations and documents needed for inter and intrastate transport.
 - 2.Q.01.01* Differentiate between different trailering options listing the advantages and disadvantages of each.
 - 2.Q.01.02* List recommended safety equipment to use when transporting a horse (i.e. extra halter, rope, flares, etc).
 - 2.Q.01.03* Apply limb and head protection for the horse to be used during transport.
 - 2.Q.01.04* Map the travel route to be followed and make feeding and watering recommendations for the horse during transport.
 - 2.Q.01.05* Research and obtain information about truck and trailer specifications and driver licensing requirements.
 - 2.Q.01.06* Load a horse for transport.

2.R* Equine Daily Care and Management

- 2.R.01 Demonstrate the skills needed for the basic daily care of a horse.
 - 2.R.01.01 Apply safe working practices when in and around equine facilities.
 - 2.R.01.02 Diagram and label external equine anatomy.
 - 2.R.01.03 Identify equine conformation.
 - 2.R.01.04 Describe the relationship between a horse’s anatomy and its conformation.
 - 2.R.01.05 Groom a horse using such tools as a curry comb, bristle brush, shedding blade or mane and tail comb.
 - 2.R.01.06 Clean and care for hooves by lifting, cleaning/picking, and checking a horse’s hoof.
 - 2.R.01.07 Identify the symptoms associated with thrush.
 - 2.R.01.08 Pull a horse’s mane.
 - 2.R.01.09 Apply a standing stable wrap on a horse’s leg.
 - 2.R.01.10 Apply a poultice or a sweat to a horse’s leg

- 2.R.01.11 Maintain a pair of small animal clippers according to the manufacturer's recommendations and standard industry practice.
- 2.R.01.12 Maintain a pair of large animal clippers according to the manufacturer's recommendations and standard industry practice.
- 2.R.01.13 Demonstrate basic barn clipping techniques used on horses.
- 2.R.01.14 Measure a horse for a blanket, sheet or scrim.
- 2.R.01.15 Put on and remove a blanket, sheet or scrim on a horse.
- 2.R.01.16 Explain the pros and cons of keeping a horse barefoot.
- 2.R.01.17* Develop a schedule for a yearlong shoeing program for the farrier for a given horse.
- 2.R.01.18* Demonstrate a trace clip on a horse.
- 2.R.01.19* Demonstrate a body clip on a horse.
- 2.R.01.20* Shorten or thin a horse's mane using two alternative methods.
- 2.R.01.21* Demonstrate or explain how to clip a show horse for two specific disciplines.
- 2.R.01.22* Demonstrate how to put boots or wraps on a horse for a specific discipline.
- 2.R.01.23* Braid a horse's mane for a show.

2.R.01 Performance Example:

- Start the class with an initial discussion/demonstration on industry standards for safely putting on and taking off a turnout blanket.
- To determine if the student has mastered the skill, ask them to take a naked horse in a stall and put a blanket on them for turnout.
- Conclude the training by having the student perform the skill on different horses with different types/styles of turnout blankets.

2.S Equine Housing and Pasture Management

- 2.S.01 Demonstrate a working knowledge of equine housing.
 - 2.S.01.01 Clean a stall and barn according to standard industry practices.
 - 2.S.01.02 Perform a safety check on a facility to eliminate/minimize any hazardous conditions.
 - 2.S.01.03 Compare, contrast, and demonstrate the installation and removal of various types of bedding used in horse stalls.
 - 2.S.01.04 Compare and Contrast three types of equine fencing (e.g., board, electric, poly or vinyl).
 - 2.S.01.05 Discuss the five most common equine pasture considerations (e.g., footing, shelter, forage varieties, rotations and herd dynamics).
 - 2.S.01.06 Explain the pros and cons of automatic waterers.
 - 2.S.01.07* Identify five plants toxic to horses commonly found in New England.
 - 2.S.01.08* Research manure management options and develop strategies to eliminate or minimize the environmental impact of waste.
 - 2.S.01.09* Compare and Contrast five footing materials suitable for a riding ring.
 - 2.S.01.10* Develop a plan for the care and daily or annual maintenance of a riding ring.

2.S.01 Performance Example:

- Activate the students prior knowledge of various types of bedding used in the equine industry by having the students brainstorm in small groups the types of bedding they know of -- including the pros and cons of each.
- When satisfactorily completed, ask the students to compile a master chart on the board of all of the beddings with their pros and cons.
- Summarize this lesson by asking the students to write a paper on what bedding they would prefer to use (including justification) as to why that would be their choice -- and any potential negatives of their choice.

2.T Equine Feeds and Feeding Practice

- 2.T.01 Identify the unique nutritional feeds and feeding practices associated with horses.
- 2.T.01.01 Explain typical eating patterns of horses.
 - 2.T.01.02 Determine feeds recommended for specific breeds/uses of horses.
 - 2.T.01.03 Evaluate foodstuff (grain, hay and supplements) for quality.
 - 2.T.01.04 Develop a feed management system for horses demonstrating an understanding of accepted feeding protocols and equine behavior.
 - 2.T.01.05 Identify procedures to properly feed and water horses.
 - 2.T.01.06 Create a feeding and watering schedule for a stable.
 - 2.T.01.07 Determine the nutritional categories of horses based on the breed and use of a horse.
 - 2.T.01.08 Evaluate horses using a body condition scoring system.
 - 2.T.01.09 Determine the height and weight of a horse.
 - 2.T.01.10 Identify the parts of the horse digestive tract and explain how each part influences the health of the horse as it relates to feeding.
 - 2.T.01.11 Formulate a list of symptoms associated with colic.
 - 2.T.01.12 Describe the common treatments for colic.
 - 2.T.01.13 Identify the protocols for management of a suspected colic case prior to the arrival of the veterinarian.
 - 2.T.01.14* Discuss problems associated with the working horse related to feeding (ex. azoturia).
 - 2.T.01.15* Explain the potential causes of laminitis.
 - 2.T.01.16* Describe the negative impact of laminitis on the horse.
 - 2.T.01.17* Identify management treatment protocols for laminitis.

2.T.01 Performance Example:

- Instruct the class on how to determine a horse's height and weight using a weight tape and height stick.
- To determine if the student has mastered the skill, ask them to accurately determine the height and weight of several horses.
- Ask the students to apply their knowledge to a slightly different application by having them determine the height using a plain measuring tape and a measuring stick, and converting the height to hands.

2.U Equine Health, Fitness and Disease Prevention

- 2.U.01 Develop a comprehensive health management and prevention plan for a horse.
- 2.U.01.01 Plan and outline a health program for horse.
 - 2.U.01.02 Describe the normal behavior of the common horse species.
 - 2.U.01.03 Take the temperature, pulse, and respiration on a horse, and indicate the normal ranges.
 - 2.U.01.04 Explain the procedures related to administering equine medications according to veterinary protocols and industry standards.
 - 2.U.01.05 Explain the procedures related to administering vaccinations according to veterinary protocols and industry standards.
 - 2.U.01.06 Explain protocols of actions and information necessary when calling a vet in an emergency.
 - 2.U.01.07 Identify methods of control, treatment, and prevention of diseases in the equine species.
 - 2.U.01.08 Identify methods of control, treatment, and prevention of external parasites in the equine species.

- 2.U.01.09 Identify methods of control, treatment, and prevention of internal parasites in equine species.
- 2.U.01.10 Differentiate between an unsoundness and a blemish.
- 2.U.01.11 Identify five unsoundnesses on a horse.
- 2.U.01.12 Identify five blemishes on a horse.
- 2.U.01.13 Explain the need for floating teeth.
- 2.U.01.14 Identify common dental problems and defects.
- 2.U.01.15* Discuss the importance and significance of conditioning as it relates to the recovery time for a working horse participating in activities such as eventing, endurance activities and racing.
- 2.U.01.16* Compare and Contrast the potential health benefits of two alternative health therapies used in horses (i.e., chiropractor, Tellington-Jones Equine Touch Therapy, acupuncture, massage, ultrasound, and hydro-therapy).
- 2.U.01.17* Demonstrate first aide procedures for an equine medical emergency.
- 2.U.01.18* Describe the basics of vision in the horse and how it can affect behavior.
- 2.U.01.19* Discuss the basics of a lameness evaluation; include review of limb anatomy
- 2.U.01.20* Identify problems which require immediate veterinary attention.
- 2.U.01.21* Discuss signs of exercise fitness and design a plan which will safely develop an unfit horse into a fit horse.

2.U.01 Performance Example:

- Start the class with an initial discussion/demonstration on determining temperature, pulse and respiration on a horse.
- Once students have learned the concept, ask the class to demonstrate taking a horse's temperature, pulse and respiration and stating if the findings were within normal ranges.
- Finalize training on this topic by having the student determine baseline temperature, pulse and respiration on a given horse.

2.V Equine Breeding and Reproduction

- 2.V.01 Develop an understanding of the complexities of equine reproduction.
 - 2.V.01.01 Evaluate horses for potential breeding stock
 - 2.V.01.02 Explain the seasonality, estrous cycle, and signs of estrus of the mare.
 - 2.V.01.03 Explain the use of stocks for breeding and management purposes.
 - 2.V.01.04 Explain management methods that can enhance fertility and reproduction efficiency.
 - 2.V.01.05 Explain methods of pregnancy testing in horses.
 - 2.V.01.06 Identify the stages of gestation in a mare.
 - 2.V.01.07 Identify the stages of foaling in a mare.
 - 2.V.01.08 Explain equine parturition through discussion of animal preparation and birth assistance protocols for normal and abnormal presentation.
 - 2.V.01.09* Describe the variability of rules involving the approved use of artificial insemination in horses.
 - 2.V.01.10* Explain the importance of colostrum and the timeframe in which it should be obtained and utilized.
 - 2.V.01.11* Describe the importance of a retained placenta.
 - 2.V.01.12* Explain industry safety protocols involving stallion behavior.
 - 2.V.01.13* Explain stallion housing and handling.
 - 2.V.01.14* List the age at which a horse is sexually mature.
 - 2.V.01.15* Compare and contrast the advantages and disadvantages of pasture mating, live cover, fresh, cooled, and frozen semen breeding options.

- 2.V.01 Performance Example:
- Lead a classroom discussion on the variability of rules involving the approved use of artificial insemination in horses.
 - Once the concept has been attained, ask students to brainstorm why these variabilities exist. Hypothesize how this impacts the breeding industry.
 - Conclude instruction on this concept by having the students' research specific breeds and their rules for use of artificial insemination.

2.W Uses of Horses

- 2.W.01 Demonstrate a working knowledge of tack
- 2.W.01.01 List the basic functions and care of horse tack and equipment used for handling, riding, or driving horses.
 - 2.W.01.02 Identify five different types of bits.
 - 2.W.01.03 Identify five different types of saddles.
 - 2.W.01.04 Bridle a horse.
 - 2.W.01.05 Tack a horse for an appropriate discipline.
 - 2.W.01.06* Explain the importance of proper tack fitting.
 - 2.W.01.07* Fit a western saddle to a horse.
 - 2.W.01.08* Fit an English saddle to a horse.
 - 2.W.01.09* Fit a bridle to a horse.
 - 2.W.01.10* Differentiate between six different bit types or bit systems, detailing how they work.
 - 2.W.01.11* Evaluate five different training and riding aides or devices used with horses (ex. Draw reins).

- 2.W.01 Performance Example:
- Lead a classroom discussion/demonstration on fitting an English saddle to a horse.
 - To determine if the class has mastered the concept, ask when given three saddles to choose from, determine which one is the best fit for a given horse.
 - Ask the students to apply their knowledge in a slightly different application by determining how pads may impact or adjust the fit of a saddle to a horse.

- 2.W.02 Demonstrate skills in working with horses that align with current industry standards.
- 2.W.02.01 Explain or demonstrate equitation and showing skills according to current industry standards.
 - 2.W.02.02 Demonstrate mounting and dismounting a horse or boarding and exiting a cart.
 - 2.W.02.03 Describe the gaits of a horse.
 - 2.W.02.04 Demonstrate or discuss basic riding or driving skills.
 - 2.W.02.05 Walk and trot a horse.
 - 2.W.02.06 Present a horse in hand for observation in a professional manner.
 - 2.W.02.07 Order and describe the phases of an equine jumping an obstacle.
 - 2.W.02.08 Contrast related fences, closely related fences and no related fences.
 - 2.W.02.09 Explain striding and lines and their importance in setting a course.
 - 2.W.02.10 Set out trotting poles to a cross rail jump for an average size horse.
 - 2.W.02.11 Distinguish between five different types of fences found in stadium jumping.
 - 2.W.02.12* Describe safety considerations and protocols for disciplines outside of the ring setting using the US Polo Association Equine Welfare Standards.
 - 2.W.02.13* Compare and Contrast the five different types of jumps found in cross country and hunting, including how they are ridden.

2.W.02 Performance Example:

- As part of a series of lessons concerning horses and jumping, instruct the class on the phases involved in an equine jumping an obstacle.
- To determine if the class has mastered the concept, ask them to describe the phases of an equine jumping an obstacle.
- Finalize training on this topic by observing a horse jumping various obstacles and critiquing each phase. Discuss the impact on each phase on the next phase.

- 2.W.03 Demonstrate a working knowledge of disciplines and training involved in the equine industry
- 2.W.03.01 Demonstrate lunging and longeing a horse.
- 2.W.03.02 Describe equine behaviors and instincts and explain how this affects training methods.
- 2.W.03.03 Differentiate and detail five disciplines in the equine industry.
- 2.W.03.04 Describe disciplines that horses are ridden and/or compete in, including racing.
- 2.W.03.05 Describe disabled riding programs, including their benefits for the disabled.
- 2.W.03.06* Describe five different career pathways in the equine field including the skills and education needed to work in those segments of the industry.
- 2.W.03.07* Diagram the pyramid of training.
- 2.W.03.08* Identify, define and describe FEI, USEF, USDF, USEA , USHJA,PATH International and U.S. Polo Association.
- 2.W.03.09* Identify and describe licenses and or certifications available in the equine industry.
- 2.W.03.10* Compare and contrast three theories or methods of training.
- 2.W.03.11* Describe safety considerations and protocols for disciplines outside of the ring setting using the US Polo Association Equine Welfare Standards.
- 2.W.03.12* Describe the procedure or demonstrate longlining a horse.

2.W.03 Performance Example:

- As part of a series of lessons concerning training, present the pyramid of training to the class.
- Once the concept has been obtained ask the students to explain the pyramid of training by summarizing the concept as it relates to a discipline of their choice.

2.X Equine Business

- 2.X.01 Specify the agribusiness aspects of the equine industry.
- 2.X.01.01 Cite the need for record keeping in a stable business.
- 2.X.01.02 Discuss the importance of Massachusetts General Law 128D and its impact on liabilities in the equine industry.
- 2.X.01.03 Explain the importance of an emergency plan in a stable.
- 2.X.01.04 Discuss costs/expenses of ownership in the equine industry.
- 2.X.01.05* Describe the need for contracts in an equine business.
- 2.X.01.06* Write a sample leasing or boarding agreement.
- 2.X.01.07* Discuss the need for waivers in the equine industry
- 2.X.01.08* Explain the significance of a pre-purchase exam.
- 2.X.01.09* Develop a budget outlining the costs associated with keeping a horse for one year.
- 2.X.01.10* Obtain a copy of your town/city animal control laws and determine the steps involved in obtaining an animal permit or stable license to keep a horse.

- 2.X.01.11* Define the criteria and steps to follow when obtaining a Massachusetts Riding Instructor's license.
- 2.X.01.12* Identify three other industry certifications available, and discuss the advantages/disadvantages of each.
- 2.X.01.13* Discuss options for horses when they are done with their given jobs.

2.X.01 Performance Example:

- As part of a series of lessons concerning liabilities as they relate to the equine industry, ask students to conduct a webquest, researching data on horse-related injuries on a state and national level.
- Chart the results on the board, and compare/contrast results.

NOTES:

* indicates supplemental/advanced learning standards and objectives.

Animal Science Concentration: Livestock and Poultry Science

2.Y Livestock and Poultry Industries

- 2.Y.01 Demonstrate a working knowledge of the livestock and poultry industries.
- 2.Y.01.01 Explain the importance of raising livestock and poultry.
 - 2.Y.01.02 Use terminology for livestock and poultry species according to industry standards.
 - 2.Y.01.03 Identify products and markets of the livestock and poultry industries.
 - 2.Y.01.04* Identify a product successfully operating in a niche market in your local community
 - 2.Y.01.05* Discuss five value-added farm raised or grown products available in your community
 - 2.Y.01.06* Complete a GAP (Good Agricultural Practices) Certification course.
 - 2.Y.01.07* Determine the steps involved in obtaining an animal permit or license to keep livestock by obtaining a copy of your town/city animal control laws.

2.Y.01 Performance Example:

- Lead a classroom discussion about farmer’s markets. Discuss the variety of products available and marketing strategies utilized to enhance the sales of farm raised products.
- Obtain copies of the Massachusetts Department of Agriculture’s Agritourism map for students to utilize. Divide the farms listed on the map into regions. Assign student teams a region and ask them to conduct a webquest to identify products sold and marketing strategies used.
- Ask students to list the activities on a large piece of newsprint and report back to the whole class. Accept nominations from groups for the most creative marketing strategy, and ask teams to defend their choice.

2.Z Livestock and Poultry Safety Knowledge and Skills

- 2.Z.01 Apply safe working practices when in and around livestock and poultry operations.
- 2.Z.01.01 Identify common Personal Protective Equipment (PPE) requirements for working with livestock and poultry.
 - 2.Z.01.02 Describe basic agricultural equipment safety precautions in accordance with manufacturer’s specifications (when applicable), industry and OSHA standards and local licensing requirements.
 - 2.Z.01.03 Explain the relationship between good housekeeping and the prevention of health and safety hazards.
 - 2.Z.01.04 Identify signs and signals relating to agricultural safety practices.
 - 2.Z.01.05 Describe the safe work practices followed by industry relating to various weather conditions.
 - 2.Z.01.06 Explain the livestock safe handling concept of “flight zone” and “point of balance”.
 - 2.Z.01.07 Describe common bio-security methods used in livestock and poultry operations.
 - 2.Z.01.08 Summarize the importance of farm emergency and evacuation protocols.
 - 2.Z.01.09* Obtain a HOSTA Safe Tractor Driving Course certification.

2.Z.01 Performance Example:

- Obtain an OSHA 10 Hour Safety Certification.

2.AA Livestock and Poultry Handling and Restraint

- 2.AA.01 Demonstrate advanced practices used to handle and restrain common livestock and poultry species, according to current industry and OSHA standards.

- 2.AA.01.01 Tie a quick release knot.
- 2.AA.01.02 Identify safety protocols for handling and restraining livestock and poultry.
- 2.AA.01.03 Name and describe common handling and restraint devices used in the livestock industry.
- 2.AA.01.04 Catch and halter a dairy and/or beef cow
- 2.AA.01.05 Demonstrate or explain how to use a nose lead on a dairy and/or beef cow.
- 2.AA.01.06 Demonstrate or explain the use of a head gate on a dairy and/or beef cow.
- 2.AA.01.07 Demonstrate or explain casting a dairy and/or beef cow with a rope.
- 2.AA.01.08 Demonstrate a tail restraint/tail jack on a dairy and/or beef cow.
- 2.AA.01.09 Catch and halter a sheep or a goat.
- 2.AA.01.10 Hold and move a sheep and/or goat by the chin or jaw.
- 2.AA.01.11 Restrain a sheep or goat by rolling the animal on its rump.
- 2.AA.01.12 Demonstrate or explain use of a halter and lead line on a llama or alpaca.
- 2.AA.01.13 Demonstrate or explain the use of a neck hold on a llama or alpaca.
- 2.AA.01.14 Restrain a pig using a hog snare.
- 2.AA.01.15 Corner and/or move a pig using a hop panel or hurdle.
- 2.AA.01.16 Catch individual chickens from a large flock using a catching hook.
- 2.AA.01.17 Corner and catch poultry using a wire panel(s).
- 2.AA.01.18* Load a beef cow into a blocking chute or squeeze chute.

2.AA.01 Performance Example:

- Instruct the class on the cattle handling techniques developed by Dr. Temple Grandin at Colorado State University.
- Once the concepts have been attained, ask students to move a cow from a group to an individual pen utilizing her handling theories of pressure and positioning.
- Conclude instruction on this concept by having students move the separated animal through a series of obstacles (cones, pens, gates) – continuing to use Dr. Grandin’s techniques.

2.AA.02* Transporting Livestock and Poultry

- 2.AA.02.01* Identify the regulations and documents needed for inter and intrastate transport.
- 2.AA.02.02* Describe the different trailering options and identify the advantages and disadvantages of each.
- 2.AA.02.03* Create a list of recommended safety equipment to bring when transporting livestock (i.e. extra halter, rope, flares).
- 2.AA.02.04* Map the travel route to be followed and make feeding and watering recommendations for the animals/birds during transport.
- 2.AA.02.05* Research, obtain and report information about truck/trailer specifications and driver licensing requirements.
- 2.AA.02.06* Demonstrate the ability to hobble a cow.

2.BB Livestock and Poultry Housing and Facilities

2.BB.01 Identify and describe livestock and poultry housing and facilities.

- 2.BB.01.01 Perform light facility maintenance on a livestock housing facility.
- 2.BB.01.02 Research and relate the square footage and pasture requirements for livestock and poultry using Mass. Society for the Prevention of Cruelty to Animals (MSPCA), Mass. Department of Agricultural Resources (MDAR), local animal control laws and professional agricultural organization guidelines.
- 2.BB.01.03 Describe the key elements of animal housing sanitation.
- 2.BB.01.04 Identify types and functions of livestock housing.

- 2.BB.01.05 Identify types and functions of poultry housing
- 2.BB.01.06 Identify types and function of livestock facilities.
- 2.BB.01.07 Identify types and function of poultry facilities.
- 2.BB.01.08 Identify types and function of livestock equipment.
- 2.BB.01.09 Identify types and function of poultry equipment.
- 2.BB.01.10 Discuss advantages and disadvantages of natural and mechanical ventilation.
- 2.BB.01.11 Name and describe types of fencing used for protection, confinement and pasture management.
- 2.BB.01.12 Describe pasture management practices (e.g., continuous, rotational, and intensive).
- 2.BB.01.13 Detail manure management practices (e.g., storage, composting, and land application).
- 2.BB.01.14* Erect a section of electric fence for a species of livestock.
- 2.BB.01.15* Identify five plants toxic to livestock commonly found in New England.
- 2.BB.01.16* Determine manure management options and develop strategies to eliminate or minimize the environmental impact
- 2.BB.01.17* Obtain and report information about local and state manure management guidelines and practices.
- 2.BB.01.18* Select a species of livestock or poultry and design a housing facility for the animals.
- 2.BB.01.19* Select a species of livestock or poultry and design pasture system for the animals.

2.BB.01 Performance Example:

- Activate student’s prior knowledge of pasture management practices, including continuous, rotational and intensive grazing principles.
- When satisfactorily completed, ask students to create a list of materials needed to erect a 30’ high tensile fence, including a gate and a corner brace.
- Conclude instruction by asking students to erect the section of fence to meet industry standards.

2.CC Record Keeping and Selection

- 2.CC.01 Demonstrate the use of management tools for record keeping and animal selection in livestock and poultry operations.
 - 2.CC.01.01 Maintain a system of livestock and poultry records including breeding, health, pedigree, injuries, disposition and parturition.
 - 2.CC.01.02 Explain selection of all classes of livestock and poultry on the basis of type, pedigree, performance and progeny data.
 - 2.CC.01.03 Demonstrate methods of livestock and poultry identification and explain its significance to production records, breed registries and bio-security.
 - 2.CC.01.04* Research information about the National Animal Identification Program and the farm Premise ID Plan.

2.CC.01 Performance Example:

- As part of a series of lessons concerning livestock selection and evaluation, ask students to hypothesize the heaviest/lightest muscled, fattest/leanest and most REA (Rib Eye Area) when presented with four market lambs.
- Instruct students in the correct handling practices used by livestock judging professionals to estimate carcass traits in animals on the hoof.
- Finalize training on this topic by presenting students with a pen of six lambs, and asking the class to rank the lambs based on muscling, fat cover and REA. As an extension of the learning, ask the class if knowing the age of the animals would affect their ranking.

2.DD Feed and Nutrition for Livestock and Poultry

- 2.DD.01 Demonstrate an understanding of livestock and poultry feed and nutrition.
 - 2.DD.01.01 Demonstrate or explain feeding practices used in livestock operations.
 - 2.DD.01.02 Demonstrate or explain feeding practices used in poultry operations.
 - 2.DD.01.03 Compare and contrast the digestive systems of livestock and poultry species.
 - 2.DD.01.04 Name six classes of nutrients used in livestock and poultry nutrition.
 - 2.DD.01.05 Identify feed types used in livestock and poultry nutrition.
 - 2.DD.01.06 Evaluate feed for quality, nutritional value, and palatability.
 - 2.DD.01.07 Perform body condition scoring on various species of livestock.
 - 2.DD.01.08 Describe pasture management practices to maximize livestock nutrition.
 - 2.DD.01.09 Describe pasture management practices to maximize poultry nutrition.
 - 2.DD.01.10* Maintain pasture quality through proper rotation, fertilization, grazing, harvesting and weed control.
 - 2.DD.01.11* Formulate a ration for livestock and poultry species using computer software or by the Pearson Square method.
 - 2.DD.01.12* Compare and contrast hay produced from different farms for quality.

2.DD.01 Performance Example:

- Lead a classroom discussion about animal conditioning, weight gain/loss and its impact on animal productivity. Review the Body Condition Scoring Guide (BCS), and the characteristics associated with each score for sheep.
- Using a series of slides, assist students in evaluating the BCS of sheep using visual appraisal.
- As an extension of this lesson, ask students to BCS a group of live sheep by using a combination of visual observations and palpation of key bone structures for fat cover.

2.EE Livestock and Poultry Reproduction

- 2.EE.01 Explain concepts of livestock and poultry reproduction
 - 2.EE.01.01 Plan and outline a breeding program for livestock and poultry operation
 - 2.EE.01.02 Compare and contrast the reproductive systems of livestock and poultry species.
 - 2.EE.01.03 Evaluate livestock and poultry for potential breeding stock.
 - 2.EE.01.04 Identify signs of estrus and estrous in livestock animals.
 - 2.EE.01.05 Explain practices and scientific principles relating to semen collection and artificial insemination
 - 2.EE.01.06 Identify livestock management methods that can enhance fertility and reproduction efficiency.
 - 2.EE.01.07 Review the safety procedures followed when working with liquid nitrogen.
 - 2.EE.01.08 Identify poultry management methods that can enhance fertility and reproduction efficiency.
 - 2.EE.01.09 Explain methods of pregnancy testing in livestock
 - 2.EE.01.10 Discuss livestock parturition including animal preparation and birth assistance protocols for normal and abnormal presentation.
 - 2.EE.01.11* Use progeny data, production information, performance information and pedigrees in the sire/ram/boar selection process.
 - 2.EE.01.12* Research and describe the procedures for flushing a cow and harvesting embryos for the embryo transfer process.
 - 2.EE.01.13* Create a toolkit designed to provide resources and tools needed to assist the producer working with livestock during parturition.

2.EE.01 Performance Example:

- As part of a series of lessons on animal reproduction and artificial insemination, review safety protocols and the SDS Data Sheet for liquid nitrogen. Outline the semen processor's recommendations for thawing.
- When satisfactorily completed, retrieve a unit of semen from an artificial insemination tank, thaw it and ask students to load it into a French gun. Ask the students to sheath the gun and secure it with the "O" ring. Have students eject the semen sample from the straw onto a microscope slide and review it under a microscope for variations in morphology and motility.

2.FF Livestock and Poultry Health

2.FF.01 Demonstrate a working knowledge of Livestock and Poultry Health

- 2.FF.01.01 Plan and outline a health program for livestock and poultry operations
- 2.FF.01.02 Apply "Rule of Comparison" to determine normal appearance and behavior of livestock and poultry species – (by comparing animals to what is termed normal or healthy, students are able to recognize signs of disease, hunger, fear, and poor management).
- 2.FF.01.03 Demonstrate taking temperature, pulse, respiration and state normal ranges.
- 2.FF.01.04 Identify methods of control, treatment and prevention of diseases in livestock and poultry.
- 2.FF.01.05 Identify methods of control, treatment and prevention of internal and external parasites in livestock and poultry
- 2.FF.01.06 Weigh livestock using a measurement formula or weight tape.
- 2.FF.01.07 Demonstrate or explain administering intramuscular medication or vaccination
- 2.FF.01.08 Demonstrate or explain administering subcutaneous medication or vaccinations.
- 2.FF.01.09 Demonstrate or explain administering intranasal vaccination
- 2.FF.01.10 Demonstrate or explain administering intravenous medication
- 2.FF.01.11 Demonstrate or explain administering intra-mammary medication.
- 2.FF.01.12 Demonstrate or explain the oral administration of a liquid with a dose syringe.
- 2.FF.01.13 Demonstrate or explain the oral administration of a bolus with a balling gun.
- 2.FF.01.14 Demonstrate or explain the oral administration of a paste wormer.
- 2.FF.01.15 Demonstrate or explain administering a topical medication.
- 2.FF.01.16 Demonstrate or explain collecting a blood sample by tail bleeding or the jugular vein.
- 2.FF.01.17 Demonstrate or explain collecting a fecal sample.
- 2.FF.01.18 Demonstrate or explain collecting a urine sample.
- 2.FF.01.19* Administer a magnet to a cow using a balling gun.
- 2.FF.01.20* Detail the procedures related to administering medications and vaccinations according to veterinary protocols and industry standards.
- 2.FF.01.21* List protocols and necessary information which a producer would need to have available when calling a veterinarian in an emergency.

2.FF.01 Performance Example:

- As part of a series of lessons on parasite control, instruct students to review options available through conventional worming treatments.
- Ask the class to develop a comprehensive, annual plan for parasite control, comparing and contrasting oral, injectable and topical anthelmintics.
- Conclude instruction on this concept by posing a problem whereby the reproductive status, age or projected processing date for the animal requires a change in the plan.

2.GG Management Procedures

- 2.GG.01 Demonstrate management procedures used in livestock and poultry production.*
- 2.GG.01.01 Demonstrate or explain dehorning a calf or other livestock.
 - 2.GG.01.02 Demonstrate or explain docking a lamb or other livestock.
 - 2.GG.01.03 Demonstrate or explain castrating a buckling or other livestock.
 - 2.GG.01.04 Demonstrate or explain clipping needle teeth of a piglet.
 - 2.GG.01.05 Demonstrate or explain ear tagging a goat or other livestock.
 - 2.GG.01.06 Demonstrate or explain ear notching a piglet.
 - 2.GG.01.07 Demonstrate or explain tattooing a calf or other livestock.
 - 2.GG.01.08 Demonstrate or explain debeaking chickens.
 - 2.GG.01.09 Demonstrate or explain hoof trimming of a goat or other livestock.
 - 2.GG.01.10 Demonstrate or explain maintenance and use of electric clippers.
 - 2.GG.01.11 Demonstrate or explain maintenance and use of electric shears.
 - 2.GG.01.12 Demonstrate or explain skirting a fleece with hand shears.
 - 2.GG.01.13 Demonstrate or explain collecting a milk sample by hand milking.
 - 2.GG.01.14* Target a particular marketing opportunity for livestock and outline the management procedures needed to reach that market.
 - 2.GG.01.15* Obtain information from a regional or national sale, and outline a health inspection and certification protocol that would meet the requirements of the sale.
 - 2.GG.01.16* Identify five professional organizations that could serve as a resource for the producer.

2.GG.01 Performance Example:

- As part of a lesson on goat management, review the safety procedures involved with catching and restraining a goat.
- Ask students to work in pairs to gather the tools needed to trim and/or treat a goat's hooves. Require teams to catch and safely restrain the goat, and trim its hooves.
- Conclude instruction on this subject by asking students to describe how to treat a goat's feet for hoof rot using a foot bath or topical application.

* Some of the procedures listed are done under the supervision or direction of a veterinarian.

NOTES:

* indicates supplemental/advanced learning standards and objectives.

Animal Science Concentration: Marine and Aquaculture

2.HH Oceanographic Concepts

- 2.HH.01 Detail oceanography and natural environmental conditions affecting animal life.
 - 2.HH.01.01 Locate and describe the major ocean basins of the world.
 - 2.HH.01.02 Identify five geological features of the ocean floor (e.g., Marianas Trench, Ring of Fire, Mid Atlantic Ridge, Puerto Rico Trench and Aleutian Trench).
 - 2.HH.01.03 Identify parts of a wave (i.e. crest, trough, wave height, wave length).
 - 2.HH.01.04 Diagram the supratidal, intertidal and subtidal zones. and describe their required environmental conditions
 - 2.HH.01.05 Define nekton, plankton and benthos.
 - 2.HH.01.06 Explain the importance of plankton.
 - 2.HH.01.07 Define SCUBA, and discuss the safety training required for certification.
 - 2.HH.01.08 Define and discuss the importance of ROVs.
 - 2.HH.01.09* Identify plankton based on physical characteristics.
 - 2.HH.01.10* Evaluate water based on temperature, salinity, pH, and dissolved oxygen content.
 - 2.HH.01.11* Describe the unique properties of water and the types of aquatic animals best suited for that environment.
 - 2.HH.01.12* Identify the different levels of the ocean (based on light, pressure/depth, and temperature)
 - 2.HH.01.13* Identify three ROVs that have been utilized by scientists in discovering new technical features of the ocean and ocean floor.

2.HH.01 Performance Example:

- As part of a classroom discussion about environmental conditions associated with the supratidal, intertidal and subtidal zones, ask students to identify animals commonly found in these areas.
- After brainstorming a list, ask teams of students to diagram/describe the environmental condition found in these areas and the adaptations that marine animals have devised to complement their ability to survive in these habitats.

2.II Invertebrates

- 2.II.01 Explain concepts fundamental to invertebrates.
 - 2.II.01.01 Identify six marine arthropods (i.e. American lobster, horseshoe crab, ghost crab, hermit crab, spider crab).
 - 2.II.01.02 Identify ten gastropods (e.g., Moon snail, Periwinkle, Olive snail, Top snail, Sundial snail, Turban snail, Auger snail, Cone snail, Atlantic Dogwinkle, and Murex).
 - 2.II.01.03 Identify five bivalves (e.g., Rock oyster, Turkey wing, Surf clam, Calico scallop, and Jingle shell).
 - 2.II.01.04 Identify and classify six echinoderms (e.g., brittle star, seastar, sea cucumber, branching seastar, and sea urchin).
 - 2.II.01.05 List the features that all mollusks have in common.
 - 2.II.01.06 Diagram and label the function of the water vascular system in echinoderms.
 - 2.II.01.07 Describe the characteristics of krill.
 - 2.II.01.08* Describe the management strategies employed when cultivating and breeding arthropods.
 - 2.II.01.09* Illustrate the management strategies employed when cultivating and breeding gastropods.

- 2.II.01.10* Discuss the management strategies employed when cultivating and breeding bi-valves.
- 2.II.01.11* Describe the management strategies employed when cultivating and breeding echinoderms.
- 2.II.01.12* Compare and Contrast the differences between invertebrate species.

2.II.01 Performance Example:

- Take a field trip and bring the class to a company that has live lobsters in tanks. Obtain an American Lobster for examination. Review the external anatomical features of the lobster. Observe the animal's method of locomotion in the tank.
- Discuss with the company representative what a "berried female" is, why they are protected, and the guidelines that govern the harvesting of these animals.

2.JJ Mammals

- 2.JJ.01 Demonstrate an understanding of marine mammal species.
 - 2.JJ.01.01 Diagram, list and describe the major groups of marine mammals.
 - 2.JJ.01.02 Describe oceanic animals and birds typically found on Massachusetts beaches.
 - 2.JJ.01.03 List six marine mammals from three different orders.
 - 2.JJ.01.04 Differentiate between mysticetes and odontocetes giving two examples of each.
 - 2.JJ.01.05 Differentiate between dolphins and porpoises.
 - 2.JJ.01.06 Differentiate between true seals and eared seals.
 - 2.JJ.01.07 Describe the general characteristics of walruses.
 - 2.JJ.01.08 List five baleen whales.
 - 2.JJ.01.09 Explain why Cape Cod has one of the highest instances of cetacean strandings.
 - 2.JJ.01.10 Identify the unique housing, nutritional and health requirements for marine mammals in captivity.
 - 2.JJ.01.11* Describe the physical characteristics of specific cetaceans, including internal anatomy, size, diet, reproduction and origin/habitat.
 - 2.JJ.01.12* Describe the physical characteristics of specific pinnipeds, including internal anatomy, size, diet, reproduction and origin/habitat.

2.JJ.01 Performance Example:

- Compare/Contrast the sizes of various marine mammals as part of a classroom discussion. Record the sizes of marine mammals, including their length and body depth.
- As part of this activity, bring students outside, preferably to a parking lot. Bring sidewalk chalk, and long tape measures. Divide students into teams, and assign them a variety of marine mammals. Ask them to draw the mammals on the parking lot as they are in real life.
- Compare/Contrast the sizes as observed at the end of the activity.

2.JJ.02* Marine Mammal Training

- 2.JJ.02.01* Describe the safety protocols involved with working with and training marine mammals.
- 2.JJ.02.02* Discuss how marine mammal behaviors and instincts affect training methods.
- 2.JJ.02.03* Describe the normal behavior of a marine mammal.
- 2.JJ.02.04* Present various training techniques and methods used when working with marine mammals.
- 2.JJ.02.05* Describe the phases of training involved in multi-step behavioral changes.

2.KK Aquariums

- 2.KK.01 Demonstrate practices related to maintaining aquariums, water quality and filtration systems.
 - 2.KK.01.01 Explain the fundamentals of filtration.
 - 2.KK.01.02 Perform and explain four major aquarium water tests (e.g., pH, ammonia, nitrate, and nitrite).
 - 2.KK.01.03 Demonstrate how to aquascape (design) a freshwater or marine aquarium.
 - 2.KK.01.04 List the benefits of utilizing live plants in an aquatic environment vs. plastic plants.
 - 2.KK.01.05 Discuss common criteria used when aquascaping a tank (e.g., creating a swimming area, visual security, slope of gravel and use of natural plants).
 - 2.KK.01.06 Explain the importance of habitat to a captive species.
 - 2.KK.01.07 Diagram, graph and label the nitrogen cycle.
 - 2.KK.01.08 Net and bag fish according to industry standards.
 - 2.KK.01.09 Perform routine aquarium maintenance and water changes.

2.KK.01 Performance Example:

- Conduct a lesson involving the process used to set up an undergravel filter in a species tank. Review the parts of the system, and installation procedures.
- Assign the students a species of fish for the tank. Ask the students to set up the tank, and create a habitat suitable for the fish.

- 2.KK.02* Demonstrate practices related to maintaining water quality and filtration systems for large tanks and habitats.
 - 2.KK.02.01* Describe the safety protocols and PPE utilized by industry when working with large volume tanks, holding tanks, and aquatic habitats.
 - 2.KK.02.02* Explain the fundamentals of filtration for large quantities of water.
 - 2.KK.02.03* Identify four major water quality tests (e.g., pH, ammonia, nitrate, and nitrite).
 - 2.KK.02.04* Design a large scale marine aquarium.
 - 2.KK.02.05* Explain the importance of habitat to a large scale captive species.

2.LL Fish

- 2.LL.01 Demonstrate an understanding of fish species found in both fresh, brackish and salt water.
 - 2.LL.01.01 Identify ten marine fish species (e.g., Yellow Tang, mandarin fish, Firefish, Flame Angel, Percula Clownfish, Pajama Cardinal Fish, Foxface Rabbitfish, Spanish Hogfish, Striped Squirrel Fish, and Rainbow Wrasse).
 - 2.LL.01.02 Identify ten freshwater fish species (e.g., Clown Loach, Guppy, Harlequin, Neon Tetra, Oscar, Platy, Red-Tailed Black shark, Silver Dollar, Tiger Barb, Zebra Danio).
 - 2.LL.01.03 Identify five brackish water fish species (e.g., Black Molly, Sailfin Molly, Green Spotted Puffer, Discus, Convict cichlid).
 - 2.LL.01.04 Diagram and label the external and internal parts of the fish and their functions.
 - 2.LL.01.05 Illustrate the internal and external anatomy of the shark.
 - 2.LL.01.06 Identify five species of sharks (e.g., Whale shark, Great White, Bonnet head, Nurse, Leopard shark).
 - 2.LL.01.07 Discuss three diseases common to fish and options for treatment where applicable (ex. Ichthyophthirius Multifilis, Gill Disease, Fin-rot, etc).
 - 2.LL.01.08* Identify the unique housing requirements for six common species of fish (three freshwater and three marine) maintained in captivity.

- 2.LL.01.09* Detail and contrast the the unique nutritional requirements for six common species of fish (three freshwater and three marine) maintained in captivity.
- 2.LL.01.10* Distinguish the unique diseases and health requirements for six common species of fish (three freshwater and three marine) maintained in captivity.
- 2.LL.01.11* Differentiate between aquatic species suitable for a community vs. a single species tank.

2.LL.01 Performance Example:

- Discuss the internal and external anatomy of the shark. Discuss the relationship between the shark's features and its choices of habitat and location.
- As an extension of this learning, review information from the current news about any recent sightings of sharks along coastal waters. Discuss why this phenomenon might be occurring, and what (if any) physical conditions could be influencing the appearance of these animals in these locations.

2.MM Aquaculture

- 2.MM.01 Describe the aquacultural practices and species commonly used in production.
 - 2.MM.01.01 Define six occupational areas in the aquaculture industry.
 - 2.MM.01.02 Describe the five basic structures used for raising aquatic species.
 - 2.MM.01.03 Identify methods and equipment used in feeding aquatic species.
 - 2.MM.01.04 Summarize the biological principles which make select species more suited for aquaculture production.
 - 2.MM.01.05 Give an example of polyculture.
 - 2.MM.01.06 Describe the effects of temperature, population density, oxygen, water quality and nutrition on growth rates.
 - 2.MM.01.07 Describe the five most common methods of commercial fishing.
 - 2.MM.01.08 Identify common predators that pose a threat to aquacultural operations.
 - 2.MM.01.09* Compare the pros and cons of utilizing aquaculture grown species for release.
 - 2.MM.01.10* Illustrate the history and development of aquaculture over time.
 - 2.MM.01.11* Project the impact of aquaculture in the future using a webquest or other research method.

2.MM.01 Performance Example:

- Describe the effects of temperature, population density, oxygen, water quality and nutrition on growth rates in an aquaculture operation.
- Once students have mastered these concepts, ask them how these conditions would be impacted based on the type of aquacultural operations being conducted. Ask students to compare these conditions in a pond culture vs. a raceway.

2.NN Birds and Reptiles

- 2.NN.01 Explain concepts fundamental to birds and reptiles.
 - 2.NN.01.01 Name the four groups of marine reptiles.
 - 2.NN.01.02 Identify six species of sea birds.
 - 2.NN.01.03 Describe four evolutionary changes seen in marine birds that make them different from birds that live on land.
 - 2.NN.01.04 Describe the unique housing, nutritional and health requirements for sea birds maintained in captivity.
 - 2.NN.01.05 Describe the unique housing, nutritional and health requirements for marine reptiles maintained in captivity.

2.NN.01 Performance Example:

- As part of a classroom discussion, ask students to list the ways in which birds on land differ from birds that live along the ocean shore. Ask them to site anatomical advantages/disadvantages, as well as diet, habitat and evolutionary differences.
- Refer the class to a skeleton of a land based avian vs. a shore bird. Viewing the two skeletons (or skeletal models), differentiate those internal features that are unique and also those that they share.

2.NN.02* Explain concepts fundamental to sea turtles.

- 2.NN.02.01* Categorize all sea turtle species.
- 2.NN.02.02* Explain the plight of sea turtle species, and which species are on the endangered or threatened species list.
- 2.NN.02.03* Describe environmental changes that have impacted sea turtle populations.
- 2.NN.02.04* Diagram the life cycle of a male vs. a female sea turtle.
- 2.NN.02.05* Identify the geographic distribution of sea turtle populations throughout the world.
- 2.NN.02.06* Compare and contrast the physical characteristics, habitat, internal anatomy, diet, behaviors and reproduction of sea turtles.

2.NN.03* Explain concepts fundamental to sea birds.

- 2.NN.03.01* Identify the following subcategories of sea birds: albatross, cormorant, gannet, gull, penguin and terns.
- 2.NN.03.02* Discuss the plight of sea bird species, and which species are on the endangered or threatened species list.
- 2.NN.03.03* Describe environmental changes that have impacted shore bird populations.
- 2.NN.03.04* Describe environmental changes that have impacted pelagic bird populations.
- 2.NN.03.05* Identify the unique locations and areas in which sea birds nest.
- 2.NN.03.06* Identify the geographic distribution of specific sea bird populations throughout the world.
- 2.NN.03.07* Compare and Contrast the physical characteristics, habitat, internal anatomy, diet, behaviors and reproduction of sea birds.

NOTES:

- * indicates supplemental/advanced learning standards and objectives.

Animal Science Concentration: Research Animal Technology

2.00 Laboratory Animal Science

- 2.00.01 Explain the field of animal science as it relates to lab animal medicine.
 - 2.00.01.01 Summarize the history of lab animal medicine.
 - 2.00.01.02 Define medical terminology as used in the research animal facility.
 - 2.00.01.03 Identify the different members and positions of a laboratory animal research team.
 - 2.00.01.04 List career opportunities in lab animal science.
 - 2.00.01.05* Define the term “bioethics” and explain how it applies to animal research.

2.00.01 Performance Example:

- As part of a series of lessons concerning the field of lab animal science, outline the various job opportunities available to students in the field.
- Have students complete a web quest on the MSMR website regarding different job opportunities available in the lab animal science field. The web quest should include topics such as job title, responsibilities, grade of pay, possible longevity of the position, educational requirements, etc.
- Finalize training on this topic by having students report their findings to the class.

2.PP Institutional Animal Care and Use Committees

- 2.PP.01 Describe the function and purpose behind an Institutional Animal Care and Use Committees (IACUC).
 - 2.PP.01.01 Identify and demonstrate protocols relating to the use of animals in a research facility.
 - 2.PP.01.02 Define IACUC and explain its functions.
 - 2.PP.01.03 List the responsibilities for each member of an IACUC.
 - 2.PP.01.04 Explain the importance of an animal use protocol.
 - 2.PP.01.05* Explain the animal research facility inspection process.

2.PP.01 Performance Example:

- As part of a series of lessons regarding members of an IACUC, have students research the roles and responsibilities of each member of the team.
- Once the concept has been attained, ask students to role play the different members of the team. Give each IACUC team a copy of an animal use protocol and ask the team to discuss the protocol as would a real IACUC.
- As part of a summative assessment, ask students to outline the role of each member of the IACUC and explain their importance.

2.QQ American Association for Laboratory Animal Science (AALAS)

- 2.QQ.01 Describe the function and purpose of the American Association for Laboratory Animal Science (AALAS).
 - 2.QQ.01.01 Define AALAS and explain its role in lab animal medicine.
 - 2.QQ.01.02 List levels of AALAS certification.
 - 2.QQ.01.03 Explain how levels of AALAS certification can enhance technical skills, promote career opportunities and contribute to employability.
 - 2.QQ.01.04* Review the timeline of the history of AALAS.
 - 2.QQ.01.05* Define and detail the daily job responsibilities of an ALAT.
 - 2.QQ.01.06* Define and detail the daily job responsibilities of a LAT.

2.QQ.01.07* Define and detail the daily job responsibilities of an LATG.

2.QQ.01 Performance Example:

- Start the class with an initial discussion on the different roles and responsibilities of an ALAT, LAT, LATG.
- Once the concept has been attained, ask students to perform some tasks in an animal lab (daily monitoring of animals, record keeping, daily sanitary procedures, etc) that mirror the job duties typically assigned to these three positions.
- Conclude instruction on this concept by planning a guest speaker (ALAT, LAT, LATG) to speak to the class regarding their daily roles and responsibilities.

2.RR Ethical Care of Animals

2.RR.01 Summarize the ethical considerations inherent to the use of animals in research and laboratory experiments.

2.RR.01.01 Demonstrate knowledge of animal activism and its role in animal research.

2.RR.01.02 Identify three animal rights groups.

2.RR.01.03* Describe how an animal rights group can influence the daily functions of an animal research facility.

2.RR.01.04* Outline safety protocols regarding visitors to animal research facilities.

2.RR.01 Performance Example:

- Lead a classroom discussion regarding animal rights organizations. Instruct students on the different types of organizations.
- Ask students to research three animal rights organizations and report their findings in a visual presentation. Some topics to include would be: purpose/mission of the organization, animals covered, mission statement.
- Summarize the lesson's main concepts by asking students to present their findings to the class.

2.SS Rules and Regulations Pertaining to Laboratory Animal Research.

2.SS.01 Describe the rules and regulations pertaining to lab animal research.

2.SS.01.01 Detail the fundamental principles behind the Animal Welfare Act and other federal regulations and local laws.

2.SS.01.02 List animals covered and not covered under the USDA.

2.SS.01.03 Identify and explain the 3 Rs of research.

2.SS.01.04 Explain the importance and use of "The Guide for Use and Care of Laboratory Animals".

2.SS.01.05* Explain the facility accreditation process.

2.SS.01.06* Describe rules and regulations for housing livestock animals.

2.SS.01 Performance Example:

- Lead a class discussion on federal regulations/guidelines regarding lab animals. Examples: AWA, AWR, PHS Policy, The Guide, GLP's, Farm Bill, etc.
- Once the students have grasped the topic, have the class research animals covered by the above regulations/guidelines.
- As part of a summative assessment, ask students to identify which federal laws/regulations would be involved when you are dealing with mice, rats, dogs and cattle.

2.TT Occupational Health and Safety Plans

2.TT.01 Explain an occupational health and safety plan and how it is used in a facility.

2.TT.01.01 Identify PPE that is used in the Animal Research Facility (ARF).

- 2.TT.01.02 Describe the facility security measures of an ARF.
- 2.TT.01.03 Identify the importance of health surveillance.
- 2.TT.01.04 Demonstrate handling and disposal of syringes, sharps and biohazards according to current industry and OSHA standards.
- 2.TT.01.05 Define zoonoses and list the common zoonotic diseases found in the research environment.
- 2.TT.01.06 List types of hazards in the lab animal research facility.
- 2.TT.01.07* Identify the importance of sentinel animals.
- 2.TT.01.08* Discuss risk assessment for various species pertaining to safety in the workplace.
- 2.TT.01.09* Discuss security breaches and how to prevent them.
- 2.TT.01.10* Outline a facility disaster plan.
- 2.TT.01.11* Identify common signage that is found in an animal research facility.
- 2.TT.01.12* Outline a security plan for an animal research facility.

2.TT.01 Performance Example:

- Start the class with an initial discussion on the importance of PPE in the animal research facility (ARF). Describe the different types of PPE that are found in the ARF.
- Once the concept has been attained, ask students to don basic PPE (gown, booties, gloves, mask, etc). Proper technique should be stressed.
- Conclude instruction on this concept by asking students to provide a PPE plan for specific lab animal rooms.

2.UU Facility Equipment and Caging Systems

- 2.UU.01 Identify lab animal facility equipment.
 - 2.UU.01.01 Describe common lab animal facility equipment.
 - 2.UU.01.02 Identify common caging systems found in an ARF.
 - 2.UU.01.03 Examine animal facility designs for positive and negative air flow requirements, materials, noise, lighting, temperature and humidity.
 - 2.UU.01.04 Describe the space, containment, research, and other facilities required of a research animal facility: quarantine, barrier, PIV, conventional, BL2.
 - 2.UU.01.05 Describe waste management systems.
 - 2.UU.01.06 Identify types of bedding used in an ARF.
 - 2.UU.01.07* Describe different methods for housing livestock animals.
 - 2.UU.01.08* Explain the importance of environmental monitoring systems.
 - 2.UU.01.09* Describe animal room design.
 - 2.UU.01.10* Outline a facility design plan.
 - 2.UU.01.11* Describe the methods used to store feed and bedding in an animal research facility.
 - 2.UU.01.12* Describe the types of equipment maintenance performed in an animal research facility.

2.UU.01 Performance Example:

- Lead a classroom discussion on different types of bedding used in an animal research facility.
- Once the concept has been attained ask students to set up multiple mouse cages that test each type of bedding. Students will record the following information daily: absorbency, ammonia level, dust, etc. After multiple days of research each student will report their findings.
- Conclude instruction on this concept by providing students with three bedding choices and have them choose appropriate bedding for a specific lab animal. Students should research the following on each type to make an educated decision: absorbency, ammonia level, dust control, cost, etc.

2.VV Lab Animal Environment

- 2.VV.01 Describe the laboratory animal environment.
- 2.VV.01.01 Distinguish between sanitation, disinfection and sterilization.
 - 2.VV.01.02 Demonstrate basic husbandry procedures of various lab animals.
 - 2.VV.01.03 Explain different record keeping strategies used in the laboratory animal field.
 - 2.VV.01.04 Define and describe environmental enrichment and provide examples appropriate to various lab animals.
 - 2.VV.01.05 Describe the methods used to procure animals.
 - 2.VV.01.06 Define quarantine, acclimation and conditioning.
 - 2.VV.01.07 Identify human health considerations in the animal research setting = allergens, zoonoses, biohazards and bites.
 - 2.VV.01.08* Outline the process for room and equipment cleaning.
 - 2.VV.01.09* Develop environmental enrichment plans for various common lab animal species.

2.VV.01 Performance Example:

- After review of safety procedures, instruct/demonstrate basic cage cleaning of mice and rats. Identify different environmental enrichment ideas that could be utilized during this process.
- Once the concept has been attained ask students to change multiple rodent cages. Students will provide animals with environmental enrichment when needed.
- Summarize the lesson's main concept by asking students to set up cages for incoming animals and to establish an environmental enrichment plan for each animal.

2.WW Animal Health

- 2.WW.01 Demonstrate knowledge of animal health skills.
- 2.WW.01.01 Describe the procedures for administering medication and vaccinations.
 - 2.WW.01.02 Describe methods of control, treatment, and prevention of diseases in a research animal facility.
 - 2.WW.01.03 Explain the use of euthanasia in a research animal facility.
 - 2.WW.01.04* Identify appropriate methods of euthanasia for various lab animals.
 - 2.WW.01.05* Cite the AVMA guidelines on euthanasia.
 - 2.WW.01.06* Describe the procedures of carcass disposal .
 - 2.WW.01.07* Explain how to confirm death after a euthanasia.
 - 2.WW.01.08* Explain procedures of animal transport.
 - 2.WW.01.09* Explain procedures of transporting and receiving animals.
 - 2.WW.01.10* Explain the importance of an incoming animal examination.
 - 2.WW.01.11* Categorize types of drugs used in the animal research facility.
 - 2.WW.01.12* Identify the 5 classes of controlled substances found in the animal laboratory environment
 - 2.WW.01.13* Describe the importance of drug expiration dates and storage.
 - 2.WW.01.14* Explain the importance of the use and maintenance of drug treatment records.

2.WW.01 Performance Example:

- As part of a series of lessons regarding administering medication and vaccinations, instruct students on proper vaccination protocols of a particular lab animal (ex: dog, livestock animal, etc).
- Once the concept has been attained ask students to outline a vaccination protocol/disease prevention plan for an animal with a lengthy stay in a research facility.
- After review of safety procedures, finalize training on this subject by having students

2.XX Feed and Nutrition of Lab Animals

- 2.XX.01 Explain feeding and nutrition of laboratory animals.
 - 2.XX.01.01 List important requirements in the feeding and nutrition of lab animals.
 - 2.XX.01.02 Explain types of diets used in an ARF.
 - 2.XX.01.03 Summarize principles of feed and nutrition for laboratory animals.
 - 2.XX.01.04* Discuss protocols related to reward, enrichment and behavior modification using feed.
 - 2.XX.01.05* Explain the importance of monitoring the shelf life of feed.

2.XX.01 Performance Example:

- Lead a class discussion on types of diets used in an animal research facility. Examples to use would be: ground, pelleted, extruded, semi-moist, canned, roughages, and live feed.
- As part of a formative assessment, have students compare and contrast the above feeds and identify which animals could be fed the diet.
- Conclude instruction on this concept by having students outline a feeding regimen for various lab animal species.

2.YY Heredity and Breeding

- 2.YY.01 Describe heredity and breeding of laboratory research animals.
 - 2.YY.01.01 Identify mating systems for various lab animals.
 - 2.YY.01.02 Describe maintenance of breeding stock.
 - 2.YY.01.03 List the benefits of using genetically modified animals in animal research.
 - 2.YY.01.04* Explain how to confirm pregnancy in rodents.
 - 2.YY.01.05* Explain the importance of breeding records.
 - 2.YY.01.06* Develop a breeding plan for rodents.

2.YY.01 Performance Example:

- As part of a series of lessons concerning genetically modified animals (GMO), discuss the advantages that GMO's have in the industry.
- Once students understand the concept, ask the class to research a specific GMO and how it has impacted the research community.
- Summarize the lesson's main concept by asking students to create a poster and present to the class about their findings.

2.ZZ Species

- 2.ZZ.01 Identify common animal species and breeds used in research.
 - 2.ZZ.01.01 List and describe common and uncommon species of animals used in laboratory animal facilities.
 - 2.ZZ.01.02 Classify strains and breeds of mice, rats, hamsters, gerbils, guinea pigs, rabbits, cats, and dogs commonly used in research.
 - 2.ZZ.01.03 Differentiate between common out-bred and in-bred strains and stocks of mice and rats.
 - 2.ZZ.01.04 Demonstrate proper sexing techniques for mice, rats, hamsters, gerbils, guinea pigs, rabbits, cats, and dogs.
 - 2.ZZ.01.05 Demonstrate handling and restraint methods for mice, rats, hamsters, gerbils, guinea pigs, rabbits, cats, and dogs.
 - 2.ZZ.01.06 Report biological data for mice, hamsters, gerbils, guinea pigs, rabbits, cats and dogs.
 - 2.ZZ.01.07* Classify taxonomy and breeds of swine used in the research facility.
 - 2.ZZ.01.08* Classify taxonomy and breeds of sheep used in the research facility.

- 2.ZZ.01.09* Demonstrate handling and restraint of livestock animals used in the research facility.
- 2.ZZ.01.10* List common nonhuman primates that are used in research.
- 2.ZZ.01.11* Distinguish between new world and old world monkeys.
- 2.ZZ.01.12* Describe handling and restraint of primates.
- 2.ZZ.01.13* Identify common amphibians used in research.
- 2.ZZ.01.14* Describe methods for handling and restraint of common amphibians.
- 2.ZZ.01.15* Name common fish species used in research.
- 2.ZZ.01.16* List common bird species used in research.
- 2.ZZ.01.17* Describe methods for handling and restraint of common birds used in research.

2.ZZ.01 Performance Example:

- Instruct class on how to handle and restrain various lab animals. Proper safety protocols should be stressed.
- After a review of the safety procedures, instruct students to individually handle and restrain the animals presented with instructor supervision.
- Ask students to apply their knowledge by sexing juvenile animals and sorting into sexed cages.

2.AAA Laboratory Animal Care and Management Skills

- 2.AAA.01 Perform the daily care and management of laboratory animals.
 - 2.AAA.01.01 Identify temporary and permanent methods of identification
 - 2.AAA.01.02 Identify signs of pain, distress, and abnormal behaviors or distress in laboratory animals
 - 2.AAA.01.03 Define the terms: SPF, axenic, gnotobiotic, and HPP free
 - 2.AAA.01.04 Discuss common lab animal issues including: barbering, head tilt, fight wounds, hydrocephalism, dehydration, diarrhea, conjunctivitis, rectal prolapsed, malocclusion, dystocia and emaciation
 - 2.AAA.01.05 Differentiate between the various routes of administration of substances.

2.AAA.01 Performance Example:

- Instruct class on the various types of identification used in an animal research facility. Discuss the concept of ear notching, and how it is utilized by researchers as a permanent form of identification.
- Follow the guidelines for ear notching, and provide students with cardboard “ears” to practice notching. Print a number on the cardboard, and ask the student to notch that

NOTES:

- * indicates supplemental/advanced learning standards and objectives.

Animal Science Concentration: Veterinary Science

2.BBB Comparative Animal Anatomy and Physiology

- 2.BBB.01 Describe the anatomy, physiology, and pathology of the major body systems in small and large animals (e.g., Skeletal, Digestive, Circulatory, Respiratory, Urinary, Reproductive, Nervous, Endocrine, and Integumentary).
- 2.BBB.01.01 Define the medical terminology used in the major body systems.
- 2.BBB.01.02 Illustrate various body planes and directional terminology.
- 2.BBB.01.03 Locate the various components of internal and external anatomy.
- 2.BBB.01.04 Diagram the various components of internal and external anatomy.
- 2.BBB.01.05 Identify organs/components that form each of the ten body systems. and describe their functions
- 2.BBB.01.06 Distinguish the differences in the body systems of various species.
- 2.BBB.01.07 Differentiate between normal and abnormal characteristics in the body system.
- 2.BBB.01.08 Identify common disorders associated with each system for various species.
- 2.BBB.01.09* Identify and define anatomy and physiology terms in a medical record.
- 2.BBB.01.10* Recognize the word parts of medical terms found in a medical record (e.g., root, prefix, and suffix).
- 2.BBB.01.11* Construct a diagram of one organ from each body system.
- 2.BBB.01.12* Present on a common disorder of each system.

2.BBB.01 Performance Example:

- Ask students to create a 3-D anatomical example out of any material they wish, and label each part of that example correctly. Students will also turn in a separate report on the function of that example, as well as a disease found in that example.
- Students will be assessed on their ability to locate and spell the parts correctly in addition to creating the example and the report.

2.CCC Office and Client Relations

- 2.CCC.01 Demonstrate the professional skills needed to work in a professional veterinary medical office environment.
- 2.CCC.01.01 Summarize front desk office duties.
- 2.CCC.01.02 Outline the key features of quality customer service.
- 2.CCC.01.03 Demonstrate professional and appropriate appearance and language in the work place
- 2.CCC.01.04 Respond to customers, vendors and other industry professionals using electronic communications.
- 2.CCC.01.05 Demonstrate how to answer phones and direct clients.
- 2.CCC.01.06 Demonstrate various ways to schedule appointments and respond to emergencies.
- 2.CCC.01.07 Relay and request information from other facilities to problem solve.
- 2.CCC.01.08 Use basic computer skills to file and retrieve medical records.
- 2.CCC.01.09 Discuss how to admit a patient.
- 2.CCC.01.10 Discuss how to discharge a patient.
- 2.CCC.01.11 Discuss the importance of prioritizing client concerns, facilitating the scheduling prompt appointments.
- 2.CCC.01.12 Inventory, restock and rotate supplies.

- 2.CCC.01.13 Describe the roles and responsibilities of each member of the veterinary health team.
- 2.CCC.01.14 Identify ethical considerations regarding confidentiality.
- 2.CCC.01.15 Utilize proper medical terminology and abbreviations used in a veterinary practice.
- 2.CCC.01.16 Record information and read charts for client data.
- 2.CCC.01.17 Describe the human animal bond.
- 2.CCC.01.18 Calculate tax on applicable products.
- 2.CCC.01.19 Describe how to handle cash, check, and charge transactions.
- 2.CCC.01.20 Explain the importance of communication in handling customers.

2.CCC.01 Performance Example:

- Each student will design a veterinary clinic front desk area on sketch paper. The student will then list and discuss the roles of the Veterinarian and Veterinary Assistant in the example.

- 2.CCC.02* Demonstrate the various supervisory front desk duties performed in a veterinary practice.
 - 2.CCC.02.01* Summarize front desk duties of a supervisor.
 - 2.CCC.02.02* Demonstrate professional and appropriate appearance and language as a manager at the front desk.
 - 2.CCC.02.03* Demonstrate how to answer multiple phone lines and direct multiple clients.
 - 2.CCC.02.04* Demonstrate how to cancel, confirm, and follow-up appointments.

2.DDD Pharmacy and Pharmacology

- 2.DDD.01 Describe common pharmaceutical materials used in a veterinary practice
 - 2.DDD.01.01 Indicate legal issues surrounding prescription and over the counter (OTC) medications.
 - 2.DDD.01.02 Explain how controlled substances are handled and logged.
 - 2.DDD.01.03 Categorize groups of commonly used drugs by their use.
 - 2.DDD.01.04 Explain how to interpret, label, and package dispensed drugs correctly.
 - 2.DDD.01.05 Demonstrate or explain proper storage, handling, and disposal of biohazards, pesticides, and therapeutic agents.
 - 2.DDD.01.06 Prepare and perform inventory procedures such as restocking supplies and rotating stock by expiration date.
 - 2.DDD.01.07 Describe how to prepare vaccines.
 - 2.DDD.01.08 Identify appropriate vaccination locations on the animal.
 - 2.DDD.01.09 Describe the different routes and methods of drug administration.
 - 2.DDD.01.10 Calculate medical conversions such as pounds to kilograms, milliliters to ounces, etc.
 - 2.DDD.01.11 Solve medical math problems such as conversions, calculations and dosing.

2.DDD.01 Performance Example:

- Students will randomly choose one medication and research that medication. Students will be asked to find:
 - the generic and trade name
 - the routes the medication can be given (oral, injectable, etc.)
 - what the medication is used for
 - what the medication is contraindicated in
 - whether it is a prescription or non-prescription medication
- Students will then present their findings to the class in the form of a visual presentation. Students will take notes and create quiz questions to answer based on those presentations. A final assessment will be in the form of an exam based on those and additional questions.

- 2.DDD.02* Explain specialized pharmaceutical materials used in a veterinary practice.
 - 2.DDD.02.01* Discuss how to complete a drug inventory sheet.
 - 2.DDD.02.02* List the different types of vaccines available.
 - 2.DDD.02.03* Solve advanced medical math problems such as conversions and calculations.

2.EEE Animal Nursing and Restraining

- 2.EEE.01 Demonstrate basic animal nursing and restraining techniques.
 - 2.EEE.01.01 Compare and Contrast normal and abnormal animal behavior.
 - 2.EEE.01.02 Evaluate and explain how to utilize patient and personnel safety measures.
 - 2.EEE.01.03 Identify and explain zoonotic diseases common in clinical practices.
 - 2.EEE.01.04 Explain and describe the difference between Isolation and Quarantine procedures.
 - 2.EEE.01.05 Describe how and where hazardous waste can be disposed.
 - 2.EEE.01.06 Remove and place small animals into various caging systems.
 - 2.EEE.01.07 Demonstrate the ability to restrain small animals for procedures.
 - 2.EEE.01.08 Demonstrate the ability to use a variety of restraint devices (i.e., e-collar, snare , catch pole, muzzles, cat bag, etc.).
 - 2.EEE.01.09 Demonstrate the ability to perform several physical restraints (standing, sitting, sternal, lateral).
 - 2.EEE.01.10 Explain the differences between restraining small animals and large animals.
 - 2.EEE.01.11 Identify different methods of restraining large animals (twitch, nose tongs/leads, etc.).
 - 2.EEE.01.12 Demonstrate humane handling procedures and strategies for small and large animals.

2.EEE.01 Performance Example:

- Students will be presented with a canine and a feline patient for their small animal exercise. The student will be asked to perform three basic restraints on each patient and will be assessed with the shop's competency scoring sheet.

- 2.EEE.02* Demonstrate advanced animal nursing and restraining techniques.
 - 2.EEE.02.01* Develop a client survey sheet that inquires about normal vs. abnormal animal behavior.
 - 2.EEE.02.02* Research the zoonotic diseases endemic in the New England region using a webquest or other research method.
 - 2.EEE.02.03* Demonstrate the ability to remove and place fractious small and large animals into various caging systems.
 - 2.EEE.02.04* Demonstrate the ability to restrain exotic animals for procedures.
 - 2.EEE.02.05* Demonstrate the ability to use multiple restraint devices at the same time (i.e. muzzle and a cat bag).
 - 2.EEE.02.06* Demonstrate the ability to change physical restraint positions depending on the situation.
 - 2.EEE.02.07* Compare and contrast a similar restraint on a small versus a large animal.
 - 2.EEE.02.08* Discuss when to use the various methods of restraining large animals.
 - 2.EEE.02.09* Discuss how to handle animals that are paralyzed or unable to walk or stand on their own.

2.FFF Animal Care

- 2.FFF.01 Perform various clinical procedures on small and large animals.
 - 2.FFF.01.01 Determine small and large animal gender.

- 2.FFF.01.02 Explain the importance of a thorough patient history.
- 2.FFF.01.03 Perform a physical exam on an animal.
- 2.FFF.01.04 Obtain and record a temperature, pulse, and respiration of small animals.
- 2.FFF.01.05 Obtain and record a temperature, pulse, and respiration of large animals.
- 2.FFF.01.06 Obtain and record weight of small and large animals in both pounds and kilograms.
- 2.FFF.01.07 List common diseases and medical conditions found in animals.
- 2.FFF.01.08 Trim the nails of small animals.
- 2.FFF.01.09 Demonstrate how to trim the hoofs of large animals.
- 2.FFF.01.10 Demonstrate or describe how to express anal sacs externally.
- 2.FFF.01.11 Clean external ear canals.
- 2.FFF.01.12 Apply and remove bandages on small and large animals.
- 2.FFF.01.13 Prepare food and water based on the animal's nutritional needs.
- 2.FFF.01.14 Explain the disposal of animal remains according to current industry and OSHA standards.
- 2.FFF.01.15 Summarize the grieving process as it relates to veterinary medicine.
- 2.FFF.01.16 Follow sanitation protocols for cleaning animal cages, kennels, stalls, and bedding.
- 2.FFF.01.17 Demonstrate sanitation protocols for cleaning the various rooms of the facility.
- 2.FFF.01.18* Describe animal first aid techniques.
- 2.FFF.01.19* Demonstrate animal CPR using an animal model.

2.FFF.01 Performance Example:

- Students will be given a canine patient and asked to perform the following:
 - Temperature, pulse and respirations TPR
 - Clip nails
 - Weigh
- The student will have time to practice the skill prior to final assessment. The student will be assessed using the shop's competency scoring sheet.

- 2.FFF.02* Perform basic clinical procedures on small and large animals.
 - 2.FFF.02.01* Explain why gender has to be determined via DNA testing on certain exotic species.
 - 2.FFF.02.02* Choose a common disease or medical condition presented in a clinic situation, conduct research on the topic, and prepare a presentation.
 - 2.FFF.02.03* Train someone how to trim the nails of small animals.
 - 2.FFF.02.04* Train someone how to trim the hoofs of small ruminants.
 - 2.FFF.02.05* Identify and describe the types of prescription pet foods used by veterinarians for small and large animals.
 - 2.FFF.02.06* Design a policy for cleaning animal cages, kennels/stalls, and bedding.
 - 2.FFF.02.07* Manage personnel cleaning shifts for various rooms of the facility.

2.GGG Surgical Procedures

- 2.GGG.01 Summarize the principles of surgery.
 - 2.GGG.01.01 Identify common veterinary medical surgical instruments.
 - 2.GGG.01.02 Describe and demonstrate how to clean and wrap surgical tools and gowns.
 - 2.GGG.01.03 Demonstrate the ability to operate and maintain an autoclave.
 - 2.GGG.01.04 Assist with preparation for surgical procedures while maintaining asepsis.
 - 2.GGG.01.05 Describe operating room sanitation and care (i.e. post-surgical clean up).

- 2.GGG.01.06 Identify common suture materials types and sizes (i.e. absorbable, non-absorbable, natural, synthetic, braided or monofilament).
- 2.GGG.01.07 Describe how to properly dispose of hazardous medical waste.
- 2.GGG.01.08* Demonstrate how to position a patient for common surgical procedures such as spay, neuter, and limb surgery.
- 2.GGG.01.09* Debate controversial surgery procedures such as declawing, dehorning, tail docking, and ear cropping.
- 2.GGG.01.10* Describe how to prepare a small animal patient for a dental procedure.
- 2.GGG.01.11* Explain the different planes of anesthesia.
- 2.GGG.01.12* Compare injectable anesthesia vs. inhaled anesthesia.
- 2.GGG.01.13* Identify common suture closures (i.e. continuous, interrupted, Ford interlocking, purse-string).
- 2.GGG.01.14* Identify different types of monitoring devices used in veterinary practices.

2.GGG.01 Performance Example:

- Students will participate in a “scavenger hunt” looking for selected surgical tools used in a veterinary practice. Students will need to correctly identify the tool (as they will only be given the name of the tool).
- As a review, at the conclusion of the activity, students will review the use of the tool. A tool quiz will be administered later to assess their ability to identify the tool and its use.

2.HHH Laboratory Procedures

- 2.HHH.01 Perform various laboratory procedures on small and large animals.
 - 2.HHH.01.01 Identify common internal and external parasites found in clinical practice.
 - 2.HHH.01.02 Collect a fecal sample for analysis.
 - 2.HHH.01.03 Prepare a fecal sample for analysis.
 - 2.HHH.01.04 Collect and prepare a voided urine sample for analysis.
 - 2.HHH.01.05 Maintain a laboratory log.
 - 2.HHH.01.06 Describe the process for or prepare a Wright’s and Gram stain.
 - 2.HHH.01.07 Describe the process or prepare blood for various laboratory tests.
 - 2.HHH.01.08*Prepare an ear smear.
 - 2.HHH.01.09*Prepare a sample for a Packed Cell Volume/Total Solids (PCV/TS) test and a blood smear slide.
 - 2.HHH.01.10*Prepare a skin scraping.
 - 2.HHH.01.11*Compare and contrast a fecal floatation vs. direct smear.
 - 2.HHH.01.12*Describe how to do a gross inspection of a urine sample.
 - 2.HHH.01.13*Explain why a veterinarian would order a culture and sensitivity test.
 - 2.HHH.01.14*Describe how to prepare for a necropsy.
 - 2.HHH.01.15*Demonstrate how to prepare for a skin scraping.

2.HHH.01 Performance Example:

- Students will show how to collect a fresh fecal sample from a goat, and set-up a fecal floatation. Students will then be asked to show how to place the sample under the microscope for viewing under 4X and 10X power. The student will be assessed on their ability to complete the task.

2.III Radiology

- 2.III.01 Summarize the principles of radiology.
 - 2.III.01.01 Identify the PPE used when taking a radiograph.

- 2.III.01.02 Explain the practice of radiation safety used within the facility.
- 2.III.01.03 Maintain a radiology log.
- 2.III.01.04 Describe how to set up a machine to take a radiograph.
- 2.III.01.05 Use (or describe the use of) identification markers for radiographs.
- 2.III.01.06 Demonstrate how to position a patient for a radiograph.
- 2.III.01.07* Describe how to use a caliper to measure body thickness.
- 2.III.01.08* Explain the dangers of radiation exposure.
- 2.III.01.09* Identify ailments that could result from repeated radiation exposure.
- 2.III.01.10* Describe the purpose and function of a dosimetry badge.

2.III.01 Performance Example:

- Students will write a research paper about radiation safety for the patient and the veterinary staff. Students will identify the appropriate PPE to be used, the dangers of repeated radiation exposure, and what precautions should be taken to ensure full safety for the patient and the veterinary staff.

NOTES:

- * indicates supplemental/advanced learning standards and objectives.

Strand 3: Embedded Academics

Strand 3: Embedded Academics, a critical piece of a Vocational Technical Education Framework, are presented as Crosswalks between the Massachusetts Vocational Technical Education Frameworks and the Massachusetts Curriculum Frameworks. These Crosswalks are located in the Appendix of this Framework.

Academic Crosswalks

[Appendix A:](#) [English Language Arts](#)

[Appendix B:](#) [Mathematics](#)

[Appendix C:](#) [Science and Technology/Engineering](#)

Earth and Space Science

Life Science (Biology)

Physical Science (Chemistry and Physics)

Technology/Engineering

Strand 4: Employability and Career Readiness

4.A Career Exploration and Navigation

- 4.A.01 Develop a career plan and portfolio.
 - 4.A.01.01 Develop and revise career plan annually based on workplace awareness and skill attainment.
 - 4.A.01.02 Assess personal strengths and interest areas to determine potential careers, career pathways and career ladders.
 - 4.A.01.03 Examine potential career field(s)/discipline(s) and identify criteria to select, secure and keep employment in chosen field(s).
 - 4.A.01.04 Research and evaluate a variety of careers utilizing multiple sources of information and resources to determine potential career(s) and alternatives.
 - 4.A.01.05 Identify training and education requirements that lead to employment in chosen field(s) and demonstrate skills related to evaluating employment opportunities.
 - 4.A.01.06 Explore and evaluate postsecondary educational opportunities including degrees and certifications available, traditional and nontraditional postsecondary pathways, technical school and apprenticeships, cost of education, financing methods including scholarships and loans and the cost of loan repayment.
 - 4.A.01.07 Create a portfolio showcasing academic and career growth including a career plan, safety credential, resume and a competency profile demonstrating the acquisition of the knowledge and skills associated with at least two years of full-time study in the Chapter 74 program.

- 4.A.02 Demonstrate job search skills.
 - 4.A.02.01 Conduct a job search and complete written and electronic job applications, resumes, cover letters and related correspondence for a chosen career path.
 - 4.A.02.02 Explore and evaluate postsecondary job opportunities and career pathways specific to career technical areas.
 - 4.A.02.03 Identify role and use of social media and networking for staying current with career and employment trends as well as networking, job seeking and career development opportunities.
 - 4.A.02.04 Demonstrate ability to use social media and networking to develop useful occupational contacts, job seeking and career development opportunities.

- 4.A.03 Demonstrate all phases of the job interview process.
 - 4.A.03.01 Gather relevant information about potential employer(s) from multiple print and digital sources, assessing the credibility and accuracy of each source.

- 4.A.03.02 Identify employment eligibility criteria, such as drug/alcohol free status, clean driving record, etc.
- 4.A.03.03 Practice effective interviewing skills: appearance, inquiry and dialogue with interviewer, positive attitude and evidence of work ethic and skills.
- 4.A.03.04 Explore and evaluate employment benefit packages including wages, vacation, health care, union dues, cafeteria plans, tuition reimbursement, retirement and 401K.

4. A Performance Examples:
- Conduct research to analyze and present on specific careers within a cluster.
 - Conduct web-based job search using sites such as Monster.com, CareerBuilder.com, Indeed.com, Snagajob.com, Simplyhired.com and others.
 - Create profile on social media/networking site such as LinkedIn and/or LinkedIn University for postsecondary research and employment opportunities.
 - Complete online job application.
 - Conduct and videotape practice interviews for instructor and student analysis.
 - Provide students with sample employment and benefit packages for evaluation.

4.B Communication in the Workplace

- 4.B.01 Demonstrate appropriate oral and written communication skills in the workplace.
 - 4.B.01.01 Communicate effectively using the language and vocabulary appropriate to a variety of audiences within the workplace including coworkers, supervisors and customers.
 - 4.B.01.02 Read technical and work-related documents and demonstrate understanding in oral discussion and written exercise.
 - 4.B.01.03 Demonstrate professional writing skills in work-related materials and communications (e.g., letters, memoranda, instructions and directions, reports, summaries, notes and/or outlines).
 - 4.B.01.04 Use a variety of writing/publishing/presentation applications to create and present information in the workplace.
 - 4.B.01.05 Identify, locate, evaluate and use print and electronic resources to resolve issues or problems in the workplace.
 - 4.B.01.06 Use a variety of financial and data analysis tools to analyze and interpret information in the workplace.
 - 4.B.01.07 Orally present technical and work-related information to a variety of audiences.
 - 4.B.01.08 Identify and demonstrate professional non-verbal communication.
- 4.B.02 Demonstrate active listening skills.
 - 4.B.02.01 Listen attentively and respectfully to others.
 - 4.B.02.02 Focus attentively, make eye contact or other affirming gestures, confirm understanding and follow directions.
 - 4.B.02.03 Show initiative in improving communication skills by asking follow-up questions of speaker in order to confirm understanding.

4. B Performance Examples:
- Read and analyze technical instructions to learn what makes them effective.
 - Read and analyze technical instructions to follow directions and/or solve a problem.
 - Examine a technical document and use it to write a set of instructions for another student to follow and evaluate.
 - Analyze websites for effective technical writing and design.
 - Create brochures and presentations using software and/or Web 2.0 tools to convey technical information.
 - Conduct research using the Internet, print documents, observations and interviews to create a technical guide.

4.C Work Ethic and Professionalism

- 4.C.01 Demonstrate attendance and punctuality.
- 4.C.01.01 Identify and practice professional time-management and attendance behaviors including punctuality, reliability, planning and flexibility.
- 4.C.02 Demonstrate proper workplace appearance.
- 4.C.02.01 Identify and practice professional appearance specific to the workplace.
- 4.C.02.02 Identify and practice personal hygiene appropriate for duties specific to the workplace.
- 4.C.02.03 Identify and wear required safety gear specific to the workplace.
- 4.C.03 Accepts direction and constructive criticism.
- 4.C.03.01 Demonstrate ability (both verbally and non-verbally) to accept direction and constructive criticism and to implement solutions to change behaviors.
- 4.C.03.02 Ask appropriate questions to clarify understanding of feedback.
- 4.C.03.03 Analyze own learning style and seek instructions in a preferred format that works best for their understanding (such as oral, written or visual instruction).
- 4.C.04 Demonstrate motivation and initiative.
- 4.C.04.01 Evaluate assigned tasks for time to completion and prioritization.
- 4.C.04.02 Demonstrate motivation through enthusiasm, engagement, accurate completion of tasks and activities.
- 4.C.04.03 Demonstrate initiative by requesting new assignments and challenges.
- 4.C.04.04 Explain proposed solutions to challenges observed in the workplace.
- 4.C.04.05 Demonstrate the ability to evaluate multiple solutions to problems and challenges using critical reasoning and workplace/industry knowledge and select the best solution to the problem.
- 4.C.04.06 Implement solution(s) to challenges and/or problem(s) observed in the workplace.
- 4.C.04.07 See projects through completion and check work for quality and accuracy.

- 4.C.05 Demonstrate awareness of workplace culture and policy.
 - 4.C.05.01 Display ethical behavior in use of time, resources, computers and information.
 - 4.C.05.02 Identify the mission of the organization and/or department.
 - 4.C.05.03 Explain the benefits of a diverse workplace.
 - 4.C.05.04 Demonstrate a respect for diversity and its benefit to the workplace.

- 4.C.06 Interact appropriately with coworkers.
 - 4.C.06.01 Work productively with individuals and in teams.
 - 4.C.06.02 Develop positive mentoring and collaborative relationships within work environment.
 - 4.C.06.03 Show respect and collegiality, both formally and informally.
 - 4.C.06.04 Explain and follow workplace policy on the use of cell phones and other forms of social media.
 - 4.C.06.05 Maintain focus on tasks and avoid negative topics or excessive personal conversations in the workplace.
 - 4.C.06.06 Negotiate solutions to interpersonal and workplace conflicts.

4. C Performance Examples:
- Complete a learning style analysis tool.
 - Develop a rubric to assess work ethic and professionalism as detailed in the standards above.

Student Organizations

Business Professionals of America

www.bpa.org

Selected Websites

- 5 Ways to Ace a Job Interview: http://kidshealth.org/teen/school_jobs/jobs/tips_interview.html
- America’s Career Resource Network: <http://acrn.ovae.org/teachers/careerexpclassrm.htm>
- Career Cruiser – Florida Department of Education:
<http://www.fldoe.org/workforce/pdf/cruiser.pdf>
- Career Development Guide and Glossary: <http://www.doe.mass.edu/connect/cde.html>
- Career One Stop: <http://www.careeronestop.org/>
- Career Plan: <http://www.doe.mass.edu/cd/plan/intro.html>
- Career Plan Model: http://www.doe.mass.edu/ccr/epp/samples/cpmodel_11x17.pdf
- Checklist: <http://www.doe.mass.edu/cd/plan/checklist.pdf>
- Career Tech: http://www.okcareertech.org/cac/Pages/resources_products/ethics_web_sites.htm
- Ethics Resource Center: <http://www.ethics.org/>

- Interaction in the Workplace: <http://hrweb.berkeley.edu/guides/managing-hr/interaction/communication>
- Individual Learning Plans: How-to Guide: “Promoting Quality Individualized Learning Plans: A How to Guide on the High School Years” <http://www.ncwd-youth.info/ilp/how-to-guide>
- ILP Fact Sheet: <http://www.ncwd-youth.info/fact-sheet/individualized-learning-plan>
- ILP Policy Brief: <http://www.ncwd-youth.info/ilp/produce-college-and-career-ready-high-school-graduates>
- ILP Resources Home Page: <http://www.ncwd-youth.info/ilp>
- Interview Skills Lesson Plans:
<http://www.amphi.com/media/1220281/interview%20skills%20lesson%20plan.doc>
- Labor and Workforce Development: <http://www.mass.gov/lwd/employment-services/preparing-for-your-job-search/>
- Maine Community College System – Center for Career Development:
http://www.ccd.me.edu/careerprep/CareerPrepCurriculum_LP-6.pdf
- Massachusetts Work-Based Learning: <http://skillspages.com/masswbl>
- North Dakota Association of Agriculture Educators:
http://www.ndaae.org/attachments/File/Preparing_students_for_a_Job_Interview.pptx
- NY CTE Learning Standards—Career Development and Occupational Studies (CDOS) Resource Guide with Core Curriculum : <http://www.p12.nysed.gov/cte/cdlearn/cdosresourceguide.html>
- Occupational Outlook Handbook: <http://www.bls.gov/ooh/>
- Purdue OWL Job Search Resources (for writing resumes, applications, and letters):
<https://owl.english.purdue.edu/engagement/34/>
- Soft Skills to Pay the Bills — Mastering Soft Skills for Workplace Success:
<http://www.dol.gov/odep/topics/youth/softskills/>
- US Department of Labor: <http://www.dol.gov/dol/audience/aud-unemployed.htm>
- Workplace Communication:
<http://www.regionalskillstraining.com/sites/default/files/content/WC%20Book%201.pdf>
- Your Plan For the Future: <http://www.yourplanforthefuture.org>

Strand 5: Management and Entrepreneurship Knowledge and Skills

5.A Starting a Business

- 5.A.01 Demonstrate an understanding of the practices required to start a business.
 - 5.A.01.01 Define entrepreneurship and be able to recognize and describe the characteristics of an entrepreneur.
 - 5.A.01.02 Compare and contrast types of business ownership (i.e., sole proprietorships, franchises, partnerships, corporations).
 - 5.A.01.03 Identify and explain the purpose and contents of a business plan.
 - 5.A.01.04 Demonstrate an understanding of the principles and concepts of a business's supply chain (i.e., suppliers, producers and consumers).

5. A Performance Examples:

- Develop a presentation pertaining to an entrepreneur and their business.
- Communicate with a business owner and discuss the pros and cons of starting and owning a business. Summarize the main points of the discussion.
- Choose a product or service and describe the process leading to distribution.
- Write a business plan for a business in your community.

5.B Managing a Business

- 5.B.01 Demonstrate an understanding of managing a business.
 - 5.B.01.01 Formulate short- and long-term business goals.
 - 5.B.01.02 Demonstrate effective verbal, written and visual communication skills.
 - 5.B.01.03 Utilize a decision-making process to make effective business decisions.
 - 5.B.01.04 Identify a business's chain of command and define its organizational structure.
 - 5.B.01.05 Identify and apply effective customer service skills and practices.
 - 5.B.01.06 Identify, interpret and develop written operating procedures and policies.
 - 5.B.01.07 Track inventory, productivity and labor cost.
 - 5.B.01.08 Demonstrate business meeting skills.
 - 5.B.01.09 Identify professional organizations and explore their benefits.

5. B Performance Examples:

- Working as a team, role-play situations that an entrepreneur might face in dealing with customers or employees.
- Contact a relevant professional organization and request information about its benefits, membership requirements and costs.
- Plan and conduct a business meeting.
- Identify companies that are known for customer service and list the practices that help differentiate themselves from all others in their industry.

5.C Marketing a Business

- 5.C.01 Demonstrate an understanding of marketing and promoting a business.
 - 5.C.01.01 Explain the role of business in the economy.
 - 5.C.01.02 Describe the relationship between business and community.
 - 5.C.01.03 Describe methods of market research and identifying target markets.

- 5.C.01.04 Describe and apply the concepts of a marketing mix (the 4Ps of marketing: product, price, place and promotion).
- 5.C.01.05 Compare and contrast the promotional tools and techniques used to sell products, services, images and ideas.
- 5.C.01.06 Describe the impact of supply and demand on a product or business.
- 5.C.01.07 Identify direct and indirect competition on a business.
- 5.C.01.08 Identify and use sales techniques to meet client needs and wants.
- 5.C.01.09 Discuss strategies to acquire and retain a customer base.

5. C Performance Examples:
- Research reliable sources to identify marketing and industry data related to a business.
 - Conduct market research by developing a survey and presenting the results.
 - Create a promotional campaign using a variety of media.
 - Write a marketing plan for a product.

5.D Financial Concepts and Applications in Business

- 5.D.01 Demonstrate an understanding of financial concepts and applications.
 - 5.D.01.01 Identify essential financial reports and understand their purpose (i.e., budget, balance sheet and income statement).
 - 5.D.01.02 Describe payroll practices (i.e., deductions – federal, FICA and state taxes and insurances).
 - 5.D.01.03 Identify the importance of maintaining accurate records.
 - 5.D.01.04 Apply practices related to pricing, purchasing and billing.
 - 5.D.01.05 Maintain and reconcile a checking account.
 - 5.D.01.06 Identify the options for funding a business.

5. D Performance Examples:
- Given an employee time card and rate of pay, calculate gross pay, taxes, deductions and net pay.
 - Develop a budget for a simulated business or project.
 - Analyze and discuss financial documents from a company.
 - Research various methods of funding a business.

5.E Legal/Ethical/Social Responsibilities

- 5.E.01 Demonstrate an understanding of legal, ethical and social responsibility for businesses.
 - 5.E.01.01 Identify state and federal laws and regulations related to managing a business.
 - 5.E.01.02 Describe and identify ethical business practices.
 - 5.E.01.03 Demonstrate an understanding of business contracts.
 - 5.E.01.04 Explain the role of diversity in the workplace.
 - 5.E.01.05 Explain the role of labor organizations.
 - 5.E.01.06 Identify practices that support clean energy technologies and encourage environmental sustainability.
 - 5.E.01.07 Demonstrate an understanding of how technology advancements impact business practices.

- 5.E Performance Example:
- Read and interpret a contract.
 - Complete an application for a license, permit or certificate.
 - Research federal, state and local regulations and laws required for a business.
 - Participate in and summarize a discussion with a member of a labor or civil rights organization.

Selected Websites

- CVTE Strand 1, 4, and 5 Resources: <https://sites.google.com/a/mccanntech.org/cvte-strands-1-4-and-5-resources/>
- Entrepreneur: <http://www.entrepreneur.com>
- Inc. Magazine: <http://www.inc.com/>
- Junior Achievement “Be Entrepreneurial Program”: <https://www.juniorachievement.org/web/ja-usa/home>
- Kahn Academy Interviews with Entrepreneurs: <https://www.khanacademy.org/economics-finance-domain/entrepreneurship2/interviews-entrepreneurs>
- Kauffman Founders School: <http://www.entrepreneurship.org/en/founders-school.aspx>
- National Federation of Independent Business: www.nfib.com
- National Foundation for Teaching Entrepreneurship (NFTE): www.nfte.com
- SBA Loans: <http://www.sba.gov>
- SkillsUSA Professional Development Program Competency List: <http://www.skillsusa.org/downloads/PDF/lessons/professional/PDPPreview.pdf>
- Small Business Administration: www.sba.gov

Glossary

Term	Definition
Balance sheet	A statement of the assets, liabilities and capital of a business at a particular point in time.
Budget	An estimate of income and expenditure for a set period of time.
Business Ownership	Types of business ownership refer to the legal structure of an organization. Legal structures include: Sole Proprietorship, Partnerships, Corporations and Limited Liability Companies.
Business Plan	A written document that describes in detail your business goals and how you are going to achieve them from a marketing, operational and financial point of view.

Term

Chain of Command and Organizational Structure

**Definition**

Refers to the management structure of an organization. It identifies lines of authority, lines of communication, and reporting relationships. Organizational structure determines how the roles, power and responsibilities are assigned and coordinated and how information flows between the different levels of management. (A visual representation of this structure is called an org chart).

FICA

Federal Insurance Contributions Act requires taxes deducted from pay for supporting Social Security.

Income Statement

A financial statement providing operating results for a specific time period showing a business's revenues, expenses and profit or loss.

Market Research

- Primary: Surveys, Focus Groups, Observation
- Secondary: Websites, Internet

Marketing Mix

A set of controlled variables that formulate the strategic position of a product or service in the marketplace. These variables are known as the 4 P's of marketing and include product, place, price and promotion.

Methods to Track Inventory, Productivity and Labor Cost

Refers to the processes a business uses to account for: 1) the inflows and outflows of inventory and materials related to inventory; 2) the efficiency of operations and 3) the cost of labor including salary and benefits.

Promotional Tools and Techniques

The six elements of a promotional mix are: advertising, visual merchandising, public relations, publicity, personal selling and sales promotion.

Supply Chain

The supply chain, or channel of distribution, describes how the product is handled and/or distributed from suppliers with materials, to the manufacturer, wholesaler or retailer and finally to the consumer.

Target Market

Those who are most likely to buy your product or service.

Strand 6: Technology Literacy Knowledge and Skills

6.A Technology Literacy Knowledge and Skills (Grades 9 through 12)

- 6.A.01 Demonstrate proficiency in the use of computers and applications, as well as an understanding of the concepts underlying hardware, software, and connectivity.
 - 6.A.01.01 Use online help and other support to learn about features of hardware and software, as well as to assess and resolve problems.
 - 6.A.01.02 Install and uninstall software; compress and expand files (if the district allows it).
 - 6.A.01.03 Explain effective backup and recovery strategies.
 - 6.A.01.04 Apply advanced formatting and page layout features when appropriate (e.g., columns, templates, and styles) to improve the appearance of documents and materials.
 - 6.A.01.05 Use editing features appropriately (e.g., track changes, insert comments).
 - 6.A.01.06 Identify the use of word processing and desktop publishing skills in various careers.
 - 6.A.01.07 Identify the use of database skills in various careers.
 - 6.A.01.08 Define and use functions of a spreadsheet application (e.g., sort, filter, find).
 - 6.A.01.09 Explain how various formatting options are used to convey information in charts or graphs.
 - 6.A.01.10 Identify the use of spreadsheet skills in various careers.
 - 6.A.01.11 Use search engines and online directories.
 - 6.A.01.12 Explain the differences among various search engines and how they rank results.
 - 6.A.01.13 Explain and demonstrate effective search strategies for locating and retrieving electronic information (e.g., using syntax and Boolean logic operators).
 - 6.A.01.14 Describe good practices for password protection and authentication.
- 6.A.02 Demonstrate the responsible use of technology and an understanding of ethics and safety issues in using electronic media at home, in school, and in society.
 - 6.A.02.01 Demonstrate compliance with the school's Acceptable Use Policy.
 - 6.A.02.02 Explain issues related to the responsible use of technology (e.g., privacy, security).
 - 6.A.02.03 Explain laws restricting the use of copyrighted materials.
 - 6.A.02.04 Identify examples of plagiarism, and discuss the possible consequences of plagiarizing the work of others.
- 6.A.03 Design and implement a personal learning plan that includes the use of technology to support lifelong learning goals.
 - 6.A.03.01 Evaluate the authenticity, accuracy, appropriateness, and bias of electronic resources, including Web sites.
 - 6.A.03.02 Analyze the values and points of view that are presented in media messages.
 - 6.A.03.03 Describe devices, applications, and operating system features that offer accessibility for people with disabilities.

- 6.A.03.04 Evaluate school and work environments in terms of ergonomic practices.
- 6.A.03.05 Describe and use safe and appropriate practices when participating in online communities (e.g., discussion groups, blogs, social networking sites).
- 6.A.03.06 Explain and use practices to protect one's personal safety online (e.g., not sharing personal information with strangers, being alert for online predators, reporting suspicious activities).
- 6.A.03.07 Explain ways individuals can protect their technology systems and information from unethical users.
- 6.A.04 Demonstrate the ability to use technology for research, critical thinking, problem solving, decision making, communication, collaboration, creativity, and innovation.
 - 6.A.04.01 Devise and demonstrate strategies for efficiently collecting and organizing information from electronic sources.
 - 6.A.04.02 Compare, evaluate, and select appropriate electronic resources to locate specific information.
 - 6.A.04.03 Select the most appropriate search engines and directories for specific research tasks.
 - 6.A.04.04 Use a variety of media to present information for specific purposes (e.g., reports, research papers, presentations, newsletters, Web sites, podcasts, blogs), citing sources.
 - 6.A.04.05 Demonstrate how the use of various techniques and effects (e.g., editing, music, color, rhetorical devices) can be used to convey meaning in media.
 - 6.A.04.06 Use online communication tools to collaborate with peers, community members, and field experts as appropriate (e.g., bulletin boards, discussion forums, listservs, Web conferencing).
 - 6.A.04.07 Plan and implement a collaborative project with students in other classrooms and schools using telecommunications tools (e.g., e-mail, discussion forums, groupware, interactive Web sites, video conferencing).

Appendices

The framework teams created an “Appendix” listing potential industry recognized credentials attainable by secondary students; lists of professional, student, and relevant government organizations; and useful resources and websites. **** It is important to note that although most Framework Teams provided information for the “Appendix”, not all teams did. Therefore, sub-headings within the “Appendix” without information have been deleted.***

Disclaimer: Reference in the Appendices Section to any specific commercial products, processes, or services, or the use of any trade, firm or corporation name is for the information and convenience of the public, and does not constitute endorsement or recommendation by the Massachusetts Department of Elementary and Secondary Education.

Embedded Academic Crosswalks

Embedded English Language Arts and Literacy

CVTE Learning Standard Number	Strand Coding Designation Grades ELAs Learning Standard Number	Text of English Language Arts Learning Standard
2.J.	SL.6-12.4-6	<p>4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.</p> <p>5. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.</p> <p>6. Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.</p>
	RST.6-12.7-8	<p>7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p> <p>8. Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p>
	WHST.6-12.4-9	<p>4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p> <p>5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.</p> <p>6. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.</p> <p>7. Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p> <p>8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.</p> <p>9. Draw evidence from informational texts to support analysis, reflection, and research.</p>
<p>Performance Examples:</p> <ul style="list-style-type: none"> • Conduct a lesson involving marketing concepts for a product in the companion animal field, discussing price, service rendered, target group, service area, contact info etc. To determine if the class has mastered the concept, ask them to watch 3-5 commercials and identify above criteria in a worksheet. Ask students to apply their knowledge to a slightly different application by creating an advertising message for as given product. • Activate prior knowledge with a think/pair/share based on the animals needs. To determine if the class has mastered the concept, ask students to role play with another student and identify if the needs of a prospective pet and owner are compatible. Finalize training on this topic by having students develop a questionnaire (that they will share) they could use to help someone decide which pet might be best for them. 		

<ul style="list-style-type: none"> Lead a classroom discussion on the concepts and the ethics surrounding euthanasia. Once the concept has been attained watch the video “Kiss the Animals Goodbye” and ask students to identify ethical dilemmas that are in the video. Ask Students to apply their knowledge to a slightly different application by creating an informational pamphlet that will educate the public. 		
2.K	RST.6-12.4-10	<ol style="list-style-type: none"> Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. Analyze the structure of the relationships among concepts in a text, including relationships among key terms. Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text.
	SL.6-12.4-6	<ol style="list-style-type: none"> Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.
<p>Performance Examples:</p> <ul style="list-style-type: none"> Start the class with an initial discussion on the different types of leads, collars, obedience exercises and terminology used. As a part of a formative assessment, students will complete a Webquest on AKC.org where they will read and complete questions and answers based on the requirements of obedience training. Conclude instruction on this concept by having the students attend an obedience trial with a scavenger hunt check list for tools and patterns. Students will then write a summary of the items most commonly used/not used and which they feel are the best tools for obedience. 		
2M	SL.6-12.4-6	<ol style="list-style-type: none"> Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.
	RST.6-12.1-7	<ol style="list-style-type: none"> Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

		<p>3. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.</p> <p>5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms.</p> <p>6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.</p> <p>7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p>
	WHST.6-12.7-9	<p>7. Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p> <p>8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.</p> <p>9. Draw evidence from informational texts to support analysis, reflection, and research.</p>
<p>Performance Examples:</p> <ul style="list-style-type: none"> • Lead classroom discussion on the license/permit/legal regulations on setting up and running your own business. Once the concept has been attained, students will contact their local municipalities and find the requirements for their city/town. As part of a summative assessment, ask students to list pro/cons of starting a business in their local city/town. • Start the class with an initial discussion on ergonomics and safety in the workplace and around workplace equipment. When satisfactorily completed, students will tour 2-3 different grooming facilities with a guided observation handout (looking at doors, spacing, draining, electrical, working heights, etc.). Conclude instruction on this concept by having students design a diorama or floor plan to scale and present facilities to the class. • Activate student's prior knowledge of dryers and then conduct a lesson on different types/uses of driers. Once the concept has been obtained ask the students to identify dryers and their uses. Conclude instruction on this concept by having students create a compare and contrast on dryer usage in given situations. • Start the class with an initial discussion on different grooming organizations and how they pertain to the grooming profession. Once the concept has been attained ask the students to read the mission statements and background information on several organizations. Finalize training on this topic by asking students to select an organization and explain the rationale for their choice (how this will benefit their future business). 		
2.0.	SL.6-12.4-6	<p>4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.</p> <p>5. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.</p> <p>6. Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.</p>
	RST.6-12.4-7	<p>4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or</p>

		<p>technical context relevant to grades 9–12 texts and topics.</p> <p>5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms.</p> <p>6. Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.</p> <p>7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p>
	WHST.6-8.9-10.4-9	<p>4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p> <p>5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.</p> <p>6. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.</p> <p>7. Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p> <p>8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.</p> <p>9. Draw evidence from informational texts to support analysis, reflection, and research.</p>
<p>Performance Example:</p> <ul style="list-style-type: none"> • Activate students’ prior knowledge of common pet vaccinations, and then discuss vaccination requirements for a variety of pets. As part of the formative assessment, have the students create an educational pamphlet to educate the public on different vaccine requirements. Conclude instruction on this concept by having students write a research paper on the protocols for an animal vaccine program and present their finding to the class 		

Embedded Mathematics

CVTE Learning Standard Number	Math Content Conceptual Category and Domain Code Learning Standard Number	Text of Mathematics Learning Standard
2.A.03	4.G.1	Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
	G-CO-1	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

Performance Example:		
<ul style="list-style-type: none"> Demonstrate the appropriate technique to approach an animal. Demonstrate an approach at 45° to the animal's shoulder. Students will practice the proper technique. 		
2.D.01	6.EE2	Write, read, and evaluate expressions in which letters stand for numbers.
	6.G.4	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface areas of these figures. Apply these techniques in the context of solving real-world and mathematical problems.
	6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
	6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems
	7.G.6	Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
	7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units
	7.RP.2	Recognize and represent proportional relationships between quantities
	7.RP.3	Use proportional relationships to solve multi-step ratio and percent problems
	8.F.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
	N-Q-1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
	N-Q-2	Define appropriate quantities for the purpose of descriptive modeling
	N-Q-3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	G-MG-1	Use geometric shapes, their measures, and their properties to describe objects
	G-MG-2	Apply concepts of density based on area and volume in modeling situations
	G-MG-3	Apply geometric methods to solve design problems
	G-MG-4	Use dimensional analysis for unit conversions to confirm that expressions and equations make sense
	F-BF-1	Write a function that describes a relationship between two quantities
	F-IF-4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship
	A-CED-1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions
Performance Example:		
<ul style="list-style-type: none"> Measure the length, width, and height of the fish tank using standard units. Discuss the variety of units – 		

inches, feet, centimeters, millimeters and their appropriateness. Calculate the volume and surface area of the tank using measured units. Determine the variety fish to be in the tank with their estimated weight and length. Using the calculated volume of the tank, determine the number of each type of fish that came be housed in the tank.		
2.D.02	6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
	6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems
	7.G.6	Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
	7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units
	7.RP.2	Recognize and represent proportional relationships between quantities
	7.RP.3	Use proportional relationships to solve multi-step ratio and percent problems
	8.F.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
	G-MG-1	Use geometric shapes, their measures, and their properties to describe objects
	G-MG-2	Apply concepts of density based on area and volume in modeling situations
	G-MG-3	Apply geometric methods to solve design problems
	G-MG-4	Use dimensional analysis for unit conversions to confirm that expressions and equations make sense
	F-BF-1	Write a function that describes a relationship between two quantities
	F-IF-4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship
	A-CED-1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions
Performance Example:		
<ul style="list-style-type: none"> Ask students to conduct a webquest to determine the number of cow calf units recommended for stocking in their region. Using this number as a reference, given a specific acreage of land, ask students to determine the number of animals that could potentially be supported by this acreage. 		
2.E.02	7.G.3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids
	G-MG-1	Use geometric shapes, their measures, and their properties to describe objects.
Performance Example:		
<ul style="list-style-type: none"> Ask students to create a clay model of an animal. Using a tongue depressor, ask students to demonstrate the planes of the body using the tongue depressor to represent the planes. 		
2.F.01	6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
	6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical

		problems
	7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units
	7.RP.2	Recognize and represent proportional relationships between quantities
	G-MG-1	Use geometric shapes, their measures, and their properties to describe objects.
	G-MG-4	Use dimensional analysis for unit conversions to confirm that expressions and equations make sense
	F-LE-1	Distinguish between situations that can be modeled with linear functions and with exponential functions. recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
<p>Performance Example: Gestation periods</p> <ul style="list-style-type: none"> Discuss the various gestation periods for a variety of animals. Demonstrate the conversion of gestation periods to days, weeks, and months. Students will perform conversion calculations for a variety of animals. Discuss the usefulness of different units. 		
2.F.02	6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems
	7.RP.2	Recognize and represent proportional relationships between quantities
	7.RP.3	Use proportional relationships to solve multi-step ratio and percent problems
<p>Performance Example: Punnett Square</p> <ul style="list-style-type: none"> Discuss the purpose of a Punnett Square. Demonstrate the development of the hereditary percentages based on a variety of dominant/recessive traits. Students will create Punnett Squares for a variety of examples. 		
2.G.01	6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
	6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems
	7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units
	7.RP.2	Recognize and represent proportional relationships between quantities
	N-Q-3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
<p>Performance Example: temperature, pulse, and respiration of an animal</p> <ul style="list-style-type: none"> Demonstrate the appropriate technique to obtain, temperature, pulse, and respiration. Show students how to convert temperature, pulse, and respiration to a variety of units. Students will capture temperature, pulse, and respiration measurements from a partner and convert measurements to a variety of units. 		
2.G.02	6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
	6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems
	7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units
	7.RP.2	Recognize and represent proportional relationships between quantities
	7.RP.3	Use proportional relationships to solve multi-step ratio and percent problems

	N-Q-1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
	N-Q-2	Define appropriate quantities for the purpose of descriptive modeling
	N-Q-3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	G-MG-4	Use dimensional analysis for unit conversions to confirm that expressions and equations make sense
	F-BF-1	Write a function that describes a relationship between two quantities
	F-IF-4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship
<p>Performance Example: Dilution</p> <ul style="list-style-type: none"> Discuss the concept of dilution as it is related to administration of medication to animals. Demonstrate the calculation of a dilution of several medications for a particular animal. Students will choose a particular animal and calculate its correct medication dosage. 		
2.G.03	6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
	6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems
	7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units
	7.RP.2	Recognize and represent proportional relationships between quantities
	7.RP.3	Use proportional relationships to solve multi-step ratio and percent problems
	N-Q-1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
	N-Q-2	Define appropriate quantities for the purpose of descriptive modeling
	N-Q-3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	G-MG-4	Use dimensional analysis for unit conversions to confirm that expressions and equations make sense
	F-BF-1	Write a function that describes a relationship between two quantities
	F-IF-4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship
<p>Performance Example: Administration of worming medication</p> <ul style="list-style-type: none"> Discuss the concept that medication is administered based on the weight of the animal. Using worming medication, calculate the amount of medication needed for a given pig weight. Students will calculate the medication for animals of varying weights and in varying units of measure, i.e. pounds, kilograms, ounces, grams, etc. 		
2.H.01	6.EE2	Write, read, and evaluate expressions in which letters stand for numbers.
	6.G.4	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface areas of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

	6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
	6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems
	7.G.6	Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
	7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units
	7.RP.2	Recognize and represent proportional relationships between quantities
	7.RP.3	Use proportional relationships to solve multi-step ratio and percent problems
	8.F.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
	N-Q-1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
	N-Q-2	Define appropriate quantities for the purpose of descriptive modeling
	N-Q-3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	G-MG-1	Use geometric shapes, their measures, and their properties to describe objects
	G-MG-2	Apply concepts of density based on area and volume in modeling situations
	G-MG-3	Apply geometric methods to solve design problems
	G-MG-4	Use dimensional analysis for unit conversions to confirm that expressions and equations make sense
	F-BF-1	Write a function that describes a relationship between two quantities
	F-IF-4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship
	A-CED-1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions
<p>Performance Example: Pricing example, buying by bag versus bulk</p> <ul style="list-style-type: none"> Discuss the various factors that must be considered in the purchase of feeds. Determine the annual feed needs of a particular animal then calculate the amount that should be purchased at one time considering the size of the storage containers, the self-life of the feed, and in particular, the most cost effective size to purchase. Students will choose an animal determine its feed requirements and calculate the optimal purchase size and schedule. 		

Embedded Science and Technology/Engineering

Earth and Space Science

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Earth and Space Science Learning Standard
2.D.02	1 Matter and Energy in the Earth System 1.2	Describe the characteristics of electromagnetic radiation and give examples of its impact on life and Earth's systems.

Performance Example:

- As part of a lesson concerning the proper living environment for amphibians and reptiles, the importance of sunlight and artificial ways to produce sunlight will be discussed.
- Once the concept has been explained students will be able to explain how proper lighting has a direct impact on animal health.
- Finalize training on this topic by having students describe what illnesses and symptoms can be caused by a lack of proper lighting and also by being exposed to too much lighting. When given a specific animal and size of environment, students should explain what size and type of bulb is to be used to maintain good health for the animal.

Life Science (Biology)

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Biology Learning Standard
2.D.02	15	Explain how dead plants and animals are broken down by other living organisms and how this process contributes to the system as a whole.
Performance Example: <ul style="list-style-type: none"> Students will observe and monitor the various stages of manure compost piles and be able to explain how the decomposing organisms present in the compost pile contribute to effective manure management. 		
2.VV.01	13	Give examples of ways in which organisms interact and have different functions within an ecosystem that enable the ecosystem to survive.
Performance Example: <ul style="list-style-type: none"> Topic: 01.04 Identify environmental enrichment and provide examples appropriate to various lab animals Instruct the class on the importance of environmental enrichment in a lab animal facility. Provide examples of different environmental enrichments activities that can be provided in a cage or facility. Upon mastery of this skill, ask the class to prepare a presentation regarding developing an environmental enrichment project for a particular lab animal species relating to how that organism naturally interacts within its' natural ecosystem. Ask students to apply their knowledge by examining an animal habitat and making recommendations to increase environmental enrichment activity. 		
2.JJ.01	17	Identify ways in which ecosystems have changed throughout geologic time in response to physical conditions, interactions among organisms, and the actions of humans. Describe how changes may be catastrophes such as volcanic eruptions or ice storms.
Performance Example: <ul style="list-style-type: none"> Activate student's prior knowledge of cetacean strandings from news and television. Discuss the relationship between sonar soundings and the frequency of beached animals. Ask students to collect data and create a map that indicates the most recent information about strandings in and around Massachusetts waters. Identify geographical similarities that could influence stranding incidences. Additionally, students can compare current stranding data to previous years and note any geographical changes that occurred in that area. Ask students to differentiate sonar from a technique known as pinging which is used to ward marine mammals away from dangerous potential stranding sites. Develop a hypothesis as to why the pinging technique is effective (and helpful), when sonar elicits the opposite response. 		
2.KK.01	13	Give examples of ways in which organisms interact and have different functions within an ecosystem that enable the ecosystem to survive.
Performance Example: <ul style="list-style-type: none"> Review with students the requirements (tank size, temperature, water type) for establishing a tank involving a marine mammal species. Discuss the various aspects of the environment and natural habitat where the species is most commonly found. Ask students to design a tank for the species that incorporates elements of the species preferred environment/ecosystem. Additionally, ask students to provide components that provide environmental enrichment for the animal and describe the method by which a marine mammal trainer could introduce the activity or element to the animal. 		
2.NN.01	10, 13	10. Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of

		organisms. 13. Give examples of ways in which organisms interact and have different functions within an ecosystem that enable the ecosystem to survive.
<p>Performance Example:</p> <ul style="list-style-type: none"> As part of a series of lessons on types of aquaculture operations, discuss polyculture and the integrated aquacultural methods used to raise diverse organisms within the same farming system, where each species utilizes a distinct niche and distinct resources within the farming complex. Upon mastery of this concept, ask the class if they could identify potential polyculture species. This may involve the rearing of several aquatic organisms together or it could involve raising aquatic organisms in conjunction with terrestrial plants and/or animals. Through a web quest, ask students to identify common industry polyculture practices, where the wastes from one organism are used as inputs to another, resulting in the optimal use of resources and less pollution overall. 		
2.NN.01	10	Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.
<p>Performance Example:</p> <ul style="list-style-type: none"> Lead a classroom discussion that activates student's prior knowledge of marine bird species, and the methods they use to obtain food from the ocean. Using an inflated beach ball in a tub or large container of water, discuss what happens when the ball is held under the water, and then released. Ask students why the ball pops to the surface and discuss the physical principles that govern its rapid rise to the surface. Conclude instruction by posing a question to students about how this concept could be applied to marine birds. Relate information about pneumatic bones, and discuss the advantages and disadvantages of this adaptation. 		
2.C.01- 2.C.03	Genetics 3.4, 3.6	<p>3.4 Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles).</p> <p>3.6 Use a Punnett Square to determine the probabilities for genotype and phenotype combinations in monohybrid crosses.</p>
<p>Performance Example:</p> <ul style="list-style-type: none"> Inheritance of an animal's coat color is an important trait relating to animal genetics in large, companion, and specialty animals. Students will be first able to explain the pattern of inheritance (i.e. dominant, recessive, codominant, sex-linked etc.) in a given breed/species of animal. Upon mastery of the skill students will then be able to predict the various genotype/phenotype probabilities of potential offspring using a Punnett Square when provided the parents. 		
2.E.02	Anatomy & Physiology 4.1, 4.2, 4.3 4.4, 4.5, 4.6	<p>4.1 Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy and for repair and growth.</p> <p>4.2 Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. Describe how the kidneys and the liver are closely associated with the circulatory system as they perform the excretory function of removing waste from the blood. Recognize that kidneys remove nitrogenous wastes, and the liver removes many toxic compounds from blood.</p> <p>4.3 Explain how the respiratory system (nose, pharynx, larynx, trachea, lungs, alveoli) provides exchange of oxygen and carbon dioxide.</p>

		<p>4.4 Explain how the nervous system (brain, spinal cord, sensory neurons, motor neurons) mediates communication among different parts of the body and mediates the body's interactions with the environment. Identify the basic unit of the nervous system, the neuron, and explain generally how it works.</p> <p>4.5 Explain how the muscular/skeletal system (skeletal, smooth and cardiac muscles, bones, cartilage, ligaments, tendons) works with other systems to support the body and allow for movement. Recognize that bones produce blood cells.</p> <p>4.6 Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father, and that sexually produced offspring resemble, but are not identical to, either of their parents.</p>
<p>Performance Example:</p> <ul style="list-style-type: none"> • Students will be instructed on locations and functions of the digestive organs of large and small animals. Students will then perform dissections on various (monogastric, ruminant, etc.) animal digestive tracts in order to identify the various anatomical structures and how their form relates to their function of digestion. • Students will be instructed on locations and functions of the circulatory system of large and small animals. Students will then perform a heart dissection in order to identify the anatomy of the heart and to explain how the heart's chambers and vessels allows for correct pumping of oxygenated and deoxygenated blood to and from the body. • Students will be instructed on locations and functions of the respiratory system of large and small animals. Students will create an artificial lung model from balloons, empty water bottles, and rubber bands in order to able to explain the parts of the body that are involved in the process of breathing and explain the structure and function of the lungs using their model. • Students will be instructed on the various skeletal features of large and small animals. Using various bone models or diagrams students will examine the bones to determine how specific anatomical features allow for muscle, ligament, and tendon attachment which contribute to particular movements of the animal. (I created this example, check for accuracy) • Students will be instructed on the various reproductive organs of large and small animals. Students will be asked to label models or dissect a male and female reproductive tract in order to identify the anatomical parts. Additionally students will observe that the different reproductive organs (e.g., ovaries, testes) create specialized sex cells that allow an organism to contribute half of the genetic information from the male parent and the other from the female. 		
2.F.01	Anatomy & Physiology 4.7	4.7 Recognize that communication among cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells.
<p>Performance Example:</p> <ul style="list-style-type: none"> • Students will be able to explain the relationship and interaction of various hormones necessary for milk letdown in a dairy cows. Students may be given an example where a cow is given an injection of a particular hormone and students need to explain the likely outcome that hormone would have on milk letdown. 		
2.F.02	Anatomy & Physiology 4.6	4.6 Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father, and that sexually produced offspring resemble, but are not identical to, either of their parents.
<p>Performance Example:</p>		

<ul style="list-style-type: none"> Students will be instructed on the various reproductive organs of large and small animals. Students will be asked to label models or dissect a male and female reproductive tract in order to identify the anatomical parts. Additionally students will observe that the different reproductive organs (e.g., ovaries, testes) create specialized sex cells that allow an organism to contribute half of the genetic information from the male parent and the other from the female. Students will be given various male/female breeding scenarios and students will need to explain the corrective action. 		
2.H.01	The Chemistry of Life 1.2	1.2 Describe the basic molecular structures and primary functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, nucleic acids).
<p>Performance Example:</p> <ul style="list-style-type: none"> Students will conduct a food nutrient lab to test for the presence of various organic compounds (carbohydrates, lipids, and proteins) in different animal feeds. Students will then explain the importance of these nutrients in the animal's diet related to the amount of the nutrient in the feed and the function of the nutrient. 		
CVTE Learning Standard Number	High School Biology, Topic Heading and Learning Standard Number	Text of Biology Learning Standard
2.E.01	Anatomy & Physiology 4.5	Explain how the muscular/skeletal system (skeletal, smooth and cardiac muscles, bones, cartilage, ligaments, tendons) works with other systems to support the body and allow for movement. Recognize that bones produce blood cells.
<p>Performance Example:</p> <ul style="list-style-type: none"> Lead a classroom discussion on how a horse's anatomy /structure relates to their conformation. As part of the discussion the students should discuss the relationship of how a horse's skeletal structure relates to their conformation and how that conformation effects their stride/gait. Once the concept has been attained ask students to compare two to three horses and explain what each horse's strengths and weaknesses are in their anatomy /conformation and how it may affect their gait/stride. Finalize training on this topic by taking the horses they compared out and actually measuring their gait/stride while watching them move. Further training may include discussion of unsoundness's related to the anatomy /conformation seen. 		
2.H.01	The Chemistry of Life 1.2 Anatomy & Physiology 4.1	1.2 Describe the basic molecular structures and primary functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, nucleic acids). 4.1 Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy and for repair and growth.
<p>Performance Example:</p> <p>Start the class with a discussion involving reading several feed tags from different equine feeds</p> <ul style="list-style-type: none"> (e.g., senior extruded feed vs sweet feed or pelleted feed) in order to examine the types of nutrients and organic molecules present (carbohydrates, lipids, proteins). Once the concept has been attained ask the student to justify which feed they would choose for a specific horse with a specific workload keeping in mind the function of the molecules in the feed. Ask students to apply their knowledge in a slightly different application by discussing the need for long fiber in a horse's diet. Students must explain the role of fiber and how it relates to the functional physiology of the horse's cecum and one way peristalsis. 		

2.H.01	Anatomy & Physiology 4.1, 4.8	<p>4.1 Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy and for repair and growth.</p> <p>4.8 Recognize that the body's systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.</p>
<p>Performance Example:</p> <ul style="list-style-type: none"> As part of a series of lessons concerning TPR, conditioning, rest, homeostasis and recovery time the student will learn about the internal feedback and the importance of understanding fitness levels in a horse. To determine if the class has mastered the concept ask them to determine the TPR of two horses at rest, after moderate work and the time needed for recovery to determine which is the more fit horse. Ask students to apply their knowledge by setting up a fitness program for a horse including a system of tracking their work and fitness levels. Topic: 01.03 rest, light work, heavy work, recovery time 01.06 and 01.07 internal parasites Conduct a lesson on internal parasites in horses. As part of a formative assessment ask the students to explain the dangers of internal parasites to horses including their routes of entry/transmission. A discussion on the dangers of internal parasites to the horse's digestive system and their ability to digest macromolecules will be emphasized. Ask the students to apply their knowledge by setting up an internal parasite control system they think would be effective for the school. 		
2.F.01	Anatomy & Physiology 4.7 & 4.8	<p>4.7 Recognize that communication among cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells.</p> <p>4.8 Recognize that the body's systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.</p>
<p>Performance Example:</p> <ul style="list-style-type: none"> Conduct a lesson concerning the mares hormone cycles and the length of daylight influences the internal feedback loop that regulates those cycles. To determine if the class has mastered the concept, ask them to explain how time of year (e.g., light hours) influences the internal feedback occurring within the mare and correlating to their breeding cycle. Summarize the lessons main concepts by asking the students to explain the thoroughbreds official birthday and how understanding these concepts helps you to understand their breeding programs. 		
2.V.01	Cell Biology	Use cellular evidence (e.g., cell structure, cell number, cell reproduction) and modes of nutrition to describe the six kingdoms (Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia).
<p>Performance Example:</p> <ul style="list-style-type: none"> Activate student's prior knowledge of inspecting animals for signs of external parasite activity. After review of safety procedures have students handle and examine various mice for signs of mites and/or lice. Upon confirmation of mites or lice have students don appropriate PPE, calculate dosage of Ivermectin (or other treatment), and treat animals. Once the concept has been attained ask students to inspect the rest of the colony for external parasite. Lead the class in discussion of the importance of periodic health checks on an animal colony. 		

<p>After successful identification of external parasites (including the type of parasite: protistia, fungi, animalia) have students treat the infected animals if applicable based on the knowledge of the mode of nutrition/cellular structure/ cell reproduction of the parasite.</p> <ul style="list-style-type: none"> • Conclude instruction on this concept by asking students to research different treatments for external parasites in various lab animals. 		
2.F.02	Genetics 3.3	Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic change in an organism. Explain how mutations in gametes may result in phenotypic changes in offspring.
<p>Performance Example:</p> <ul style="list-style-type: none"> • Activate student’s prior knowledge of basic genetics principles and GMO’s. Provide students with a variety of examples of how GMO’s have benefited the research community. Discuss how GMO’s result in a lab created mutation of the organism’s DNA sequence to produce the desired phenotypic change in the organism. • • Once the concept has been attained ask students to research a particular GMO that is used in animal research. Projects can focus on GMO’s that model human disease to spark interest in students. Students should be encouraged to present their topic in a poster presentation. • • Conclude instruction on this concept by having students share their presentation and possibly extending the learning process by visiting an animal research facility so students can see a variety of GMO’s. 		
2.C.01	Evolution & Biodiversity 5.2	Describe species as reproductively distinct groups of organisms. Recognize that species are further classified into a hierarchical taxonomic system (kingdom, phylum, class, order, family, genus, species) based on morphological, behavioral, and molecular similarities. Describe the role that geographic isolation can play in speciation.
<p>Performance Example:</p> <ul style="list-style-type: none"> • As part of a series of lessons concerning identification of strains and breeds of lab animals introduce students to the subject of disease resistant species/breeds of animals. Instruct students on how a particular strain or breed of lab animal that is disease resistant (ex: cancer resistant mice) can help medical breakthroughs. • • Once the concept has been attained ask students to research a breed/ strain of lab animal that is disease resistant. Students will choose a particular disease resistant species/breed of animal and present their findings on a poster type presentation. • • Summarize the lesson’s main concepts by having student’s research particular medical breakthroughs that have been made due to using disease resistant animals in research. 		
2.UU.01	Anatomy & Physiology 4.8 Ecology 6.2	4.8. Recognize that the body’s systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop. 6.2 Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.

<p>Performance Example:</p> <ul style="list-style-type: none"> • Start the class with an initial discussion/demonstration on normal and abnormal behavior in mice. Provide visual pictures and/or video of abnormal mouse behavior. • As part of a formative assessment have students observe a variety of mouse cages (or pictures). At least one cage should house an abnormal mouse. Ask students to document the normal as well as abnormal behaviors. • Conclude instruction on this concept by introducing pictures of animals that suffer from the following problems: barbering, head tilt, hydrocephalism, dehydration, rectal prolapsed, malocclusion, dystocia and emaciation. Have students document what is observed. <p>Performance Example:</p> <ul style="list-style-type: none"> • Activate student’s prior knowledge of rodent caging requirements. Introduce students to cage overcrowding problems such as barbering or fight wounds. Explain the unique differences between the two. • As part of a formative assessment introduce students to cages of mice or pictures that depict the above problems. • Finalize training on this topic by having students solving overpopulation problem in a variety of lab animal species caused by human activity. 		
2.BB.01	Ecology 6.3 & 6.4	<p>6.3 Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels. Describe how relationships among organisms (predation, parasitism, competition, commensalism, mutualism) add to the complexity of biological communities.</p> <p>6.4 Explain how water, carbon, and nitrogen cycle between abiotic resources and organic matter in an ecosystem, and how oxygen cycles through photosynthesis and respiration.</p>
<p>Performance Example:</p> <p>Topic: -1.03 Manure management</p> <p>Performance Example: Manure Management Application- Composting</p> <ul style="list-style-type: none"> • Start the class with an initial discussion about the composting process consisting of three phases: 1) moderate-temperature phase, 2) the high-temperature phase, 3) and the maturation phase. Explain that during composting various microorganisms and invertebrates break down organic matter and produce carbon dioxide, water, heat, and humus. • As a formative assessment, ask students to identify the organisms that contribute to the decomposition process (Bacteria, fungi, protozoa, nematodes, mites, and other invertebrates). • Ask students to apply their knowledge to slightly different application by outlining a compost energy pyramid. Students using their organisms list will identify them as primary, secondary, and tertiary level consumers. Identify organic compost materials as the energy source in the pyramids base. 		
2.F.01	Genetics 3.4	Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles).
<p>Performance Example:</p> <p>Topic: 01.02 sex linked chickens</p> <ul style="list-style-type: none"> • As part of a series of lesson on poultry genetics, review concepts of genotype and phenotype by using punnett squares. Explain that when black sex-links chicks hatch both sexes have black down, but the males can be identified by the white dot on their heads. 		

<ul style="list-style-type: none"> • Ask students to consider how the black sex-links expressed phenotypes of male and female day old chicks could be used to reach the backyard market by poultry hatcheries. • Summarize the lessons main concepts by presenting Punnett Square examples of genotype and phenotype examples from livestock species. 		
2.EE.01	Anatomy & Physiology 4.7	Recognize that communication among cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells.
<p>Performance Example:</p> <p>Topic: 01.03 Synchro-Mate B and Lutalyse</p> <ul style="list-style-type: none"> • Lead a class discussion the pros and cons of the various methods of estrus synchronization available to current dairy and beef cattle operations. • To determine if the class has an understanding of estrus synchronization, ask students to research on line and outline a synchronization program for beef heifers using Synchro-Mate B or a double injection of Lutalyse. • Because studies that compare timed breeding and observed estrus report higher fertility in heifers displaying estrus, ask students to identify signs of estrus in cattle. 		
2.GG.01	Anatomy & Physiology 4.8	Recognize that the body's systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.
<p>Performance Example:</p> <ul style="list-style-type: none"> • Conduct a lesson on methods of livestock and poultry identification and explain its significance to production records, breed registries and bio-security. Identification methods may include: ear tagging, ear notching, tattoos, transponders, and bands (wing and leg). • Ask students to demonstrate ear tagging procedures for lambs based on industry standards. • Class will observe lamb for behaviors indicating stress from handling, restraint, and management procedure. Class will continue to observe lamb for behaviors after the completion of management procedure indicating a return to normal activities. Class will discuss and review management procedure and behavior observations. 		
2.HH.01	Ecology 6.2	Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.
<p>Performance Example:</p> <ul style="list-style-type: none"> • Start the class with an initial discussion about marine food webs, and the vital role that nekton, plankton and benthos play in the cycle. • As part of a formative assessment, ask students to identify the connection between nekton, plankton and benthos and zooplankton, and discuss the relationship that exists between them and higher forms of life further up the food chain. • As part of a summative assessment, review the USA Today article (Plankton, the Base of the Ocean's Food Web in Big Decline) published in July 2010 that first linked the effects of global warming with a decline in plankton populations. Ask students to define the mechanisms by which global warming affects plankton survivability. Ask students to go one step further and make a connection to the survivability of land based species and to mankind. 		
2.II.01	Cell Biology 2.3	Use cellular evidence (e.g., cell structure, cell number, cell

		reproduction) and modes of nutrition to describe the six kingdoms (Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia).
<p>Performance Example:</p> <p>Conduct a lesson involving a discussion of the phylum of Echinoderms and their water vascular or ambulacral system. Discuss the unique features of the system, and its purpose and function.</p> <p>Working in a lab setting with a variety of marine specimens at lab stations around the room, ask students to identify the network of fluid-filled canals that function in gas exchange, feeding, and secondarily in locomotion on specimens.</p> <p>Conclude instruction by asking students to examine other specimens for similar characteristics, and identify additional animals that share the same characteristics.</p>		
2.LL.01	Evolution & Biodiversity 5.1	Explain how evolution is demonstrated by evidence from the fossil record, comparative anatomy, genetics, molecular biology, and examples of natural selection.
<p>Performance Example:</p> <p>Conduct a lesson involving the anatomy and physiology of fish species using a lab station classroom model. As students circulate from station to station, activate student's prior knowledge by identifying common external parts and the function of major organs.</p> <p>Ask students to identify the variations in organs between the different species of fish examined, and hypothesize their influence on evolution and adaptation.</p> <p>As an extension of this lesson, ask students if they think that the adaptations of organisms may be a force that drives evolution? Why or why not? Explain. Also ask what effect habitat has on the diversity of organisms.</p>		
2.E.01	Anatomy & Physiology 4.1 & 4.3	<p>4.1 Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy and for repair and growth.</p> <p>4.3 Explain how the respiratory system (nose, pharynx, larynx, trachea, lungs, alveoli) provides exchange of oxygen and carbon dioxide.</p>
<p>Performance Example:</p> <p>Students will create a 3-D model and discuss the difference between a ruminant and a monogastric digestive system.</p> <p>Students will choose a disease of the respiratory system, and create a Powerpoint presentation that describes the disease relating to how it affects the physiology of the respiratory system.</p>		
2.DD.01	Cell Biology 2.8	Compare and contrast a virus and a cell in terms of genetic material and reproduction.
<p>Performance Example:</p> <p>Students will prepare an oral presentation on the different attenuated vaccinations used for dogs in veterinary medicine discussing how the vaccine will impact the viral structure/overall health of the</p>		

animal.		
2.GGG.01	Cell Biology 2.3 & 2.8	2.3 Use cellular evidence (e.g., cell structure, cell number, cell reproduction) and modes of nutrition to describe the six kingdoms (Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia). 2.8 Compare and contrast a virus and a cell in terms of genetic material and reproduction.
Performance Example: Students will create a Powerpoint presentation, comparing and contrasting gas autoclaves vs. steam autoclaves with an emphasis on how the autoclaves will affect the structure of bacteria and viruses.		
2.HHH.01	Cell Biology 2.3	Use cellular evidence (e.g., cell structure, cell number, cell reproduction) and modes of nutrition to describe the six kingdoms (Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia).
Performance Example Students will view unknown common external parasites under the microscope, and identify which ones they see by their common name. Students will choose an intestinal parasite and create a diagram of its lifecycle. Students will create a blood smear using dog blood, examine the cell structure under the microscope and identify the different WBCs found in the sample.		
2.III.01	Cell Biology 2.6	Describe the cell cycle and the process of mitosis. Explain the role of mitosis in the formation of new cells, and its importance in maintaining chromosome number during asexual reproduction.
Performance Example: Students will write a research paper on how radiation affects cells within the body. Radiation disrupts the cell cycle and the process of mitosis, students must explain how radiation interferes with this process and the affect on the body's cells.		
2.M.05	Cell Biology 2.8	Compare and contrast a virus and a cell in terms of genetic material and reproduction.
Performance Example: Start the class with an initial discussion/ demonstration on the proper techniques of cleaning a grooming facility, identifying cleaning agents/ dilution rates, and safety procedures When satisfactorily completed, ask students to demonstrate safely cleaning a portion of the grooming facility. Ask students to apply their knowledge to a slightly different application by posing a scenario that involves disease, animal bodily fluids or parasites. Student's answer must describe how the proper cleaning procedure will degrade a cell and virus by destroying necessary parts the cell/virus needs in order to reproduce.		
2.N.01	Genetics 3.6	Use a Punnett Square to determine the probabilities for genotype

		and phenotype combinations in monohybrid crosses.
Performance Example: Discuss the heritability estimates for congenital eye and hip dysplasia in dogs.		
2.0.01	Anatomy & Physiology 4.8	Recognize that the body's systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.
Performance Example: Conduct a lesson involving normal ranges for canine TPR and procedure on how to obtain these values. To determine if the class has mastered the concepts by asking students to develop baseline information on a partner and record the information. Conclude instruction on this concept by having students develop a baseline for an animal at home or on campus over one week's time. As part of a series of lessons concerning TPR students will recognize that depending upon different circumstances that the animal's TPR will vary as they try to maintain homeostasis in various conditions.		

Physical Science (Chemistry)

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Chemistry Learning Standard
2.D.02	7. Solutions, Rates of Reaction, and Equilibrium 7.2	Calculate concentration in terms of molarity. Use molarity to perform solution dilution and solution stoichiometry.
Performance Example: Start the class with an initial discussion on solutions and concentrations. This discussion will reflect heavily on safety for both humans and animals. Discuss why some products are sold and delivered in concentrated form. Demonstrate how to calculate the appropriate concentration of sanitizer and water to complete the task of sanitization while remaining safe. Upon mastery of this skill students will be asked to demonstrate their ability to calculate the appropriate concentration of sanitizer needed and use proper PPE's to mix the solution. Ask students to apply their knowledge to a slightly different application by giving them a task where they are told how much diluted sanitizer they need for a job. Students will then be asked how much concentrated sanitizer they need to order and how much water they will need to complete the task.		
2.M.02	7. Solutions, Rates of Reaction, and Equilibrium 7.2	Calculate concentration in terms of molarity. Use molarity to perform solution dilution and solution stoichiometry.

Performance Example:

Instruct the class on how to dilute concentrated disinfectants (remind students of proper PPE, safety glasses, gloves) using a given size container and dilution ratio.

Upon mastery of this skill, ask the class if they can determine the amount water that would be needed for a given amount of disinfectant to achieve given ratio of amount of concentrated disinfectant to liters of water.

Conclude instruction on this concept by using a variety different volume containers and having students dilute a solution (for safety purposes these dilutions should substitute food coloring and water instead of concentrated disinfectant) to the correct ratio based upon how much total solution the container can hold.

2.M.03

7. Solutions, Rates of Reaction, and Equilibrium
7.2

Calculate concentration in terms of molarity. Use molarity to perform solution dilution and solution stoichiometry.

Performance Example:

Instruct the class on how to dilute concentrated shampoos (remind students of proper PPE, safety glasses, gloves) using a given size container and dilution ratio of concentrated shampoo to water.

Upon mastery of this skill, ask the class if they can determine the amount water that would be needed for a given amount of shampoo to achieve the given ratio.

Conclude instruction on this concept by using a variety of different size containers and having students dilute a solution (food coloring added to water to be substituted for concentrated shampoo) to the same ratio.

2.O.01

7. Solutions, Rates of Reaction, and Equilibrium
7.5

Identify the factors that affect the rate of a chemical reaction (temperature, mixing, concentration, particle size, surface area, catalyst).

Performance Example:

Activate students' prior knowledge of medications used in industry, then lead a classroom discussion on medications and administrative routes for companion animals. For example why might a pill, which will be slower to take effect, be more effective in a situation instead of an injection, which deliver the medication faster.

When satisfactorily completed, ask students to demonstrate how and where they would deliver medications on a restrained animal.

Conclude instruction on this concept by posing a situation where the students must medicate an animal and identify the best way for the medication to be given by a professional and/or an owner.

2.T.01	1. Properties of Matter 1.2	Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures.
<p>Performance Example:</p> <p>As part of a series of lessons involving feeding horses discuss the pros and cons of putting iodized salt blocks in a horses stall or turn out area.</p> <p>To determine if the student has mastered the concept have them discuss the effect on the horses body of too much or too little salt intake.</p> <p>Finalize training on the topic by having students discuss equine feed supplements which contain different compounds and elements and the big industry it has become (ie; smart pak, platinum performance, etc...)</p>		
2.U.01	7. Solutions, Rates of Reaction, and Equilibrium 7.5	Identify the factors that affect the rate of a chemical reaction (temperature, mixing, concentration, particle size, surface area, catalyst).
<p>Performance Example:</p> <p>Conduct a lesson on preparing vaccines.</p> <p>As part of a formative assessment ask the students to describe the key concepts in preparing a vaccine.</p> <p>As part of a summative assessment, ask the students to create a step by step instruction sheet on mixing a vaccine that includes the quantities of each substance necessary in the mixture.</p>		
2.BB.01	7. Solutions, Rates of Reaction, and Equilibrium 7.5	Identify the factors that affect the rate of a chemical reaction (temperature, mixing, concentration, particle size, surface area, catalyst).
<p>Performance Example:</p> <p>Lead a discussion on the dairy management concept of the mastitis triangle (man/machine/environment).</p> <p>Ask students to explain the washing cycle combination of a industry standard milking system in the United States (pre-rinse, alkaline detergent wash, and acid rinse).</p> <p>Summarize the concept that sanitizing practices are a balanced application of temperature, chemical concentration, contact time, and mechanical processes, and lead a class discussion about what could happen to bacteria if one of the factors is not applied correctly.</p>		
2.BB.01	7. Solutions, Rates of	Identify the factors that affect the rate of a chemical reaction

	Reaction, and Equilibrium 7.5	(temperature, mixing, concentration, particle size, surface area, catalyst).
<p>Performance Example:</p> <p>Conduct a lesson involving manure management and how composting is a useful activity that involves a controlled chemical reaction help make manure a more useful product for agriculture. Once the concept has been attained ask students to discuss what happens when various factors are changed in the environment while composting. For example, what would happen to compost mixture of the temperature is higher than it should be, and what would happen to the compost if there was not enough moisture present?</p> <p>Summarize the main point of the lesson by asking students to complete a compost lab where they will be responsible for maintaining conditions of different compost piles. Once composting is complete students will analyze the results by comparing the final compost piles to observe how different environmental factors affect the rate of the compost reaction.</p> <p>Four elements for good composting: 1) Moisture Content (40-60%), 2) Carbon-Nitrogen Ratio (20-1 to 30-1), 3) Temperature (131F to 150F for 15 days), and 4)Oxygen Levels.</p>		
2.DD.01	1. Properties of Matter 1.2	Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures.
<p>Performance Example:</p> <p>As part of a series of lessons on livestock feed and nutrition, ask students to Identify the six classes of nutrients found in a sheep's ration (water, carbohydrates, fats, protein, minerals, and vitamins).</p> <p>When satisfactory completed, ask students to explain the physiological functions of each class of nutrients.</p> <p>Ask students to explain if copper is an essential micro mineral for sheep what problems could arise from a sheep consuming a copper supplemented cattle ration.</p>		
2.FF.01	6. States of Matter, Kinetic Molecular Theory, and Thermochemistry 6.3	Using the kinetic molecular theory, describe and contrast the properties of gases, liquids, and solids. Explain, at the molecular level, the behavior of matter as it undergoes phase transitions.
2.FF.01	7. Solutions, Rates of Reaction, and Equilibrium 7.3	Identify and explain the factors that affect the rate of dissolving (e.g., temperature, concentration, surface area, pressure, mixing).
<p>Performance Example:</p> <p>Activate student's prior knowledge by reviewing methods of control, treatment and prevention of milk fever in lactating livestock. In dairy cattle milk fever is a common metabolic disorder that generally</p>		

affects older, high producing cows. It may also be referred to as hypocalcaemia. Treatment generally involves calcium injection by intravenous route.

As part of a formative assessment, ask students to prepare an oral presentation contrasting the advantages and disadvantages of intravenous calcium versus oral supplements (gel or bolus) based on rate of absorption and animal safety.

Ask students to demonstrate preparing an intravenous set up with a 500ml bottle of calcium for the treatment of a cow down with severe milk fever.

2.KK.01	8. Acids and Bases and Oxidation-Reduction Reactions 8.2	Relate hydrogen ion concentrations to the pH scale and to acidic, basic, and neutral solutions. Compare and contrast the strengths of various common acids and bases (e.g., vinegar, baking soda, soap, citrus juice).
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Performance Example:

While conducting a lesson on water quality testing freshwater tanks, ask students to perform tests for nitrate, nitrite, pH and ammonia using the appropriate PPE and following the manufacturer’s specifications for the given test kit being used.

Upon mastery of this skill, ask students to compare these results between tanks, and observe differences between tanks based on the number of animals in the tank, volume of water and type of filtration system being used.

As part of a summative assessment, ask students to calculate the % water change required to bring a hypothetical volume of water in a tank from out of range to within acceptable limits.

2.KK.01	SIS3. Analyze and interpret results of scientific investigations.	<p>Present relationships between and among variables in appropriate forms.</p> <p>Represent data and relationships between and among variables in charts and graphs.</p> <p>Use appropriate technology (e.g., graphing software) and other tools.</p> <p>Use mathematical operations to analyze and interpret data results.</p> <p>Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.</p> <p>Use results of an experiment to develop a conclusion to an investigation that addresses the initial questions and supports or refutes the stated hypothesis.</p> <p>State questions raised by an experiment that may require further investigation.</p>
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Performance Example:

Activate student’s prior knowledge of water quality testing. Using this information as a basis for discussion, review the key features of the nitrogen cycle in a standard recirculating tank (also known as biological cycle, the nitrification process, new tank syndrome or the start-up cycle).

Ask students to graph the stages, and point out the three stages identified through testing – indicating when it would be safe to introduce fish to the tank.

2.LL.01	SIS2. Design and conduct scientific investigations.	<p>Articulate and explain the major concepts being investigated and the purpose of an investigation.</p> <p>Select required materials, equipment, and conditions for conducting an experiment.</p> <p>Identify independent and dependent variables.</p> <p>Write procedures that are clear and replicable.</p> <p>Employ appropriate methods for accurately and consistently making observations</p> <p>making and recording measurements at appropriate levels of precision</p> <p>collecting data or evidence in an organized way</p> <p>Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration (if required), technique, maintenance, and storage.</p> <p>Follow safety guidelines.</p>
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Performance Example:

Conduct a lesson involving the role of live plants in marine aquatic environments. In saltwater fish tanks, discuss how live rock and deep sand beds can have anaerobic areas where denitrifying bacteria can breakdown nitrates into harmless nitrogen gas that escapes through the water surface of the aquarium.

Discuss how the elimination of nitrates in the water can enhance the aquatic environment for fish and other marine animals.

Conduct an experiment with two identical new marine tanks - each being set up for the first time. Introduce aquatic plants to one, and not to the other. Monitor the ammonia, nitrate, nitrite and pH of the tanks as they cycle through the nitrogen cycle. Based on the data collected, hypothesize the influence live plants had on the new tank cycling process.

2.MM.01	7. Solutions, Rates of Reaction, and Equilibrium 7.3	Identify and explain the factors that affect the rate of dissolving (e.g., temperature, concentration, surface area, pressure, mixing).
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Performance Example:

As part of a lesson on pond aquaculture, discuss how the survival, production and feed-conversion ratios (FCRs) for most fish are influenced by the average minimum daily oxygen concentrations.

Ask students to conduct a webquest and gather information about the oxygen levels in a pond used for raising channel catfish, and graph the results.

Summarize the lesson's main concepts by asking students to recommend a management strategy that

could be used to raise the oxygen levels and improve the pond's overall productivity.		
2.NN.01	1. Properties of Matter 1.2	Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures.
<p>Performance Example:</p> <p>During a classroom discussion regarding the evolutionary changes seen in marine birds that make them different from birds that live on land, review the function of the salt gland.</p> <p>When satisfactorily completed, review the components found in nasal secretions of aquatic birds, including solutes containing sodium and chloride (in approximately equivalent amounts); as well as a small amount of potassium and bicarbonate.</p> <p>Discuss the important role of this gland in marine avian biology, and how it influences the health and nutrition of the bird.</p>		
2.VV.01	7. Solutions, Rates of Reaction, and Equilibrium 7.1	Describe the process by which solutes dissolve in solvents.
<p>Performance Example:</p> <p>Activate student's prior knowledge of the differences between sanitation, disinfection and sterilization. Provide students with examples of different types of disinfectants that are used in the Lab Animal Facility. Instruct students on how to dilute a disinfectant.</p> <p>Once the concept has been attained have students watch a solute dissolve in a solvent. Each student will need a sugar cube and a cup of water. Explain the importance of diluting at the proper rate.</p> <p>Ask students to apply their knowledge by diluting a particular disinfectant to be used in an animal room. After review of safety procedures have student don appropriate PPE and continue with the dilution paying close attention to the dilution rate.</p>		
2.AAA.01	7. Solutions, Rates of Reaction, and Equilibrium 7.3	Identify and explain the factors that affect the rate of dissolving (e.g., temperature, concentration, surface area, pressure, mixing).
<p>Performance Example:</p> <p>Conduct a lesson involving drug absorption routes and rates in research animals. Explain that there are various routes of administration that can be given to an animal. Depending on the route prescribed, the rate of administration varies. Explain the difference between absorption rates of a pill vs. an IV drug.</p> <p>Once the concept has been attained ask students to participate in a classroom lab. Provide students</p>		

<p>with a variety of absorbable materials. Have students time the absorption rate of these materials and report their findings.</p> <p>Conclude instruction on this concept by having students watch a demonstration on methods of administration.</p>		
2.BBB.01	8. Acids and Bases and Oxidation-Reduction Reactions 8.2	Relate hydrogen ion concentrations to the pH scale and to acidic, basic, and neutral solutions. Compare and contrast the strengths of various common acids and bases (e.g., vinegar, baking soda, soap, citrus juice).
<p>Performance Example:</p> <p>Lead a classroom discussion about pH and the different pH's of common substances and solutions.</p> <p>Students will create a chart showing the pH range from 0-14, and show where the pH of water, blood, and urine are located on that chart.</p> <p>Finalize training on this topic by having students research an animal and what the appropriate pH level should be for the animals blood and urine. The paper should also explain what common illnesses can be indicated by an unbalanced pH and what can be done to treat these illnesses.</p>		
2.DDD.01	7. Solutions, Rates of Reaction, and Equilibrium 7.2	Calculate concentration in terms of molarity. Use molarity to perform solution dilution and solution stoichiometry.
<p>Performance Example:</p> <p>Instruct the class on how to prepare a diluted vaccine. Lead a class discussion on situations where it may be appropriate to dilute a vaccine from its original concentration and why this may be beneficial when treating different size animals.</p> <p>Students will perform a lab demonstrating how dilutions affect the concentration of vaccines and how strong the vaccine will be. The more diluted a vaccine becomes; students will observe that there will be fewer particles of the vaccine present in a specified volume.</p> <p>Conclude instruction on this topic by giving the students a hypothetical situation where they need to treat an animal over a specified period of time. When given a concentrated vaccine ask students to calculate how diluted the vaccine should be to treat the animal for the full time period.</p>		
2.DDD.01	6. States of Matter, Kinetic Molecular Theory, and Thermochemistry 6.	Using the kinetic molecular theory, describe and contrast the properties of gases, liquids, and solids. Explain, at the molecular level, the behavior of matter as it undergoes phase transitions.
2.DDD.01	7. Solutions, Rates of Reaction, and Equilibrium 7.3	Identify and explain the factors that affect the rate of dissolving (e.g., temperature, concentration, surface area, pressure, mixing).

Performance Example:

Activate student's prior knowledge of the various routes of administration for delivering medicine to animals.

As a class, the students will discuss the pros and cons of the effects of a slower dissolving solid pill vs. a liquid IV injection of a drug on an aggressive patient.

Summarize the main concepts of the lesson by asking students to examine hypothetical situations where animals are sick and/or aggressive in to different degrees, and explain why they would treat the animal with an injection, pill or liquid medicine to be received orally.

2.FFF.01

7. Solutions, Rates of Reaction, and Equilibrium
7.2

Calculate concentration in terms of molarity. Use molarity to perform solution dilution and solution stoichiometry.

Performance Example:

Instruct the class on how to dilute concentrated detergent (remind students of proper PPE, safety glasses, gloves) using a given size container and dilution ratio. Lead a class discussion as to why manufacturers might sell concentrated detergents instead of pre-diluted mixtures.

Students will demonstrate how to dilute concentrated detergent with water so it is safe but still effective for cleaning laundry.

Conclude instruction on this concept by using a variety different volume containers and having students dilute a solution (for safety purposes these dilutions should substitute food coloring and water instead of concentrated detergent) to the correct ratio based upon how much total solution the container can hold.

2.FFF.01

7. Solutions, Rates of Reaction, and Equilibrium
7.2

Calculate concentration in terms of molarity. Use molarity to perform solution dilution and solution stoichiometry.

Performance Example:

Conduct a lesson about kennel cleanliness and safety. Introduce the topic of having sick patients in the kennel and how that might affect the proper way to clean a kennel.

Students will compare the dilution of cleaners used for disinfecting a kennel that housed a patient with a contagious disease vs. a kennel with a healthy patient.

Finalize training on this topic by telling the students that a certain number of kennels have housed contagious patients and a certain number have housed healthy patients. Based on this information ask students to prepare the appropriate amount of diluted cleaner that they would need to use for both situations.

2.HHH.01	1. Properties of Matter 1.1	Identify and explain physical properties (e.g., density, melting point, boiling point, conductivity, malleability) and chemical properties (e.g., the ability to form new substances). Distinguish between chemical and physical changes.
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Performance Example:

Lead a classroom discussion about tests that can help determine the presence of illness and/or parasites in patients.

When satisfactorily completed ask students to perform a fecal floatation test to see if parasites are present in a patient.

Students will research and present the reason why plain water is not the best medium to use for a fecal floatation. Students will conclude that the density of water is too close to the density of the parasites and the feces to see parasites sink.

Physical Science (Physics)

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Physics Learning Standard
2.D.01	3. Heat and Heat Transfer 3.4	Explain the relationships among temperature changes in a substance, the amount of heat transferred, the amount (mass) of the substance, and the specific heat of the substance.

Performance Example:

Lead a classroom discussion on the key factors of housing reptiles and amphibians. Topics should include heat, light, space and moisture necessary to keep different reptiles and amphibians healthy and comfortable.

Student will observe and explain what a temperature gradient is and how changes in temperature gradient will impact a given reptile or amphibian.

Conclude instruction on this topic by giving students a particular reptile and amphibian and ask them to research and design an enclosure that will suit the animal's needs. Included in this design should be consideration of where the enclosure should and can be placed.

2.D.01	3. Heat and Heat Transfer 3.4	Explain the relationships among temperature changes in a substance, the amount of heat transferred, the amount (mass) of the substance, and the specific heat of the substance.
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Performance Example:

Lead a classroom discussion on the appropriate size tank for different species of fish. Instruct the

<p>students that depending on the size of the tank the accessories including lights, pumps and heaters will also have to change in size.</p> <p>Students will learn to follow standards of heaters depending on the volume of water that is in the tank.</p> <p>Student will be able to calculate the appropriate heater size for different size fish tanks. Student will know that a larger volume of water will require a larger heater to maintain the appropriate temperature for the fish in the tank.</p>		
2.L.01	1. Motion and Forces 1.2	Distinguish between displacement, distance, velocity, speed, and acceleration. Solve problems involving displacement, distance, velocity, speed, and constant acceleration.
<p>Performance Example:</p> <p>Activate students' prior knowledge of what are the qualities of an assistance dog (what their build should be, temperament, trainability, and mobility)</p> <p>When satisfactorily completed, have a guest speaker come in (local service dog trainer) to discuss how they train their animals.</p> <p>Ask students to apply their knowledge to a slightly different application by developing a pro/con worksheet for given dogs and their ability to perform assistance work. (For example would a Great Dane or a Border Collie be a better someone who is mobile impaired.)</p>		
2.M.04	1. Motion and Forces 1.6	Distinguish qualitatively between static and kinetic friction, and describe their effects on the motion of objects.
<p>Performance Example:</p> <p>Start the class with an initial discussion on proper cleaning and oiling of a clipper and blades: what to look for on a worn tool, life span of tools, sounds of properly running tools.</p> <p>When satisfactorily complete, ask students to break down and service (older) clippers.</p> <p>Finalize training on this topic by having students properly breakdown clean, oil and return to running condition the clippers in the lab.</p>		
2.R.01	1. Motion and Forces 1.6	Distinguish qualitatively between static and kinetic friction, and describe their effects on the motion of objects.
<p>Performance Example:</p> <p>Start the class with an initial discussion/demonstration on care and handling of large clippers.</p> <p>To determine if the class has mastered the concept ask them to set up a pair of large clippers including oiling to reduce friction and attaching blades safely and correctly.</p>		

<p>Ask the students to apply their knowledge by clipping a horse, adjusting the tension of the blades to get a proper clip.</p>		
2.W.02	1. Motion and Forces 1.2	Distinguish between displacement, distance, velocity, speed, and acceleration. Solve problems involving displacement, distance, velocity, speed, and constant acceleration.
<p>Performance Example:</p> <p>As part of a series of lessons concerning striding and jumping discuss the relationship between the striding, cadence and speed approaching a fence to the distance of takeoff and landing for that jump.</p> <p>When satisfactorily completed ask the students to set up a series of trotting poles to a cross rail with the information of the distance of the gait for an average size horse.</p> <p>Ask the students to apply their knowledge in a slightly different application by setting up placing poles in an approach and landing to a canter vertical when given the information of the distance of the gait for an average size horse.</p>		
2.W.02	1. Motion and Forces 1.4	Interpret and apply Newton’s three laws of motion.
<p>Performance Example:</p> <p>Activate student’s prior knowledge by discussing toys like, building blocks, weebles and jenga. Ask students how these toys can be stacked on top of each other without falling over. Incorporate the relationship of this knowledge into a discussion on what keeps a rider on a horse (by balancing the force of weight evenly over the horse; not the rider’s grip....grip can push you up and off the horse).</p> <p>Once the concept has been obtained ask the students to demonstrate by riding a horse at a rising trot or sit down and get up out of a chair with their legs in front of them and lined up underneath them with their weight evenly balanced just like stacking building blocks.</p> <p>Summarize the lessons main concepts by having the students try riding with hands up over head and out to side while on a longe line at various gaits.</p>		
2.AA.01	1. Motion and Forces 1.4	Interpret and apply Newton’s three laws of motion.
<p>Performance Example:</p> <p>Instruct the class how to “throw or to tip” (hold stationary by setting on its rump) a sheep. A sheep resting comfortably with its weight on its rump (not its dock) should be off center and easier to work with.</p> <p>When satisfactorily completed, ask students to demonstrate setting a sheep on its rump in a secure and stable position.</p>		

Summarize the lesson’s main concepts by asking students to tip sheep to complete additional management applications of shearing and/or hoof trimming.		
2.HH.01	4.Waves 4.1	Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period) and explain the relationships among them. Recognize examples of simple harmonic motion.
<p>Performance Example:</p> <p>Conduct a lesson involving a discussion about the parts of the wave, including the crest, trough, wave height (amplitude) and wave length.</p> <p>Discuss how the energy transported by a wave is directly proportional to the square of the amplitude of the wave. This energy-amplitude relationship is sometimes expressed in the following manner.</p> <p>$E \propto A^2$</p> <p>This means that a doubling of the amplitude of a wave is indicative of a quadrupling of the energy transported by the wave. A tripling of the amplitude of a wave is indicative of a nine-fold increase in the amount of energy transported by the wave. And a quadrupling of the amplitude of a wave is indicative of a 16-fold increase in the amount of energy transported by the wave.</p> <p>Propose this problem to the class: An ocean wave has an amplitude of 2.5 m. Weather conditions suddenly change such that the wave has an amplitude of 5.0 m. Ask students to work together to determine the amount of energy transported by the wave under the new conditions.</p>		
2.JJ.01	4. Waves 4.4	Describe qualitatively the basic principles of reflection and refraction of waves.
2.JJ.01	4. Waves 4.6	Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect).
<p>Performance Example:</p> <p>Discuss with the class how scientists hypothesize that sonar may be responsible for some of the marine mammal strandings in and around Cape Cod.</p> <p>Scientists are using a technique called “pinging”, to warn mammals to stay away from dangerous areas. Compare/Contrast the sound waves released from pinging compared to those released by sonar and hypothesize why one has such disastrous results, and the other elicits a simple warning.</p>		
2.NN.01	1. Motion and Forces 1.2	Distinguish between displacement, distance, velocity, speed, and acceleration. Solve problems involving displacement, distance, velocity, speed, and constant acceleration.
Performance Example:		

Diving birds are equipped with a unique feature known as pneumatic bones. This adaptation creates hollow spaces in their bones which increase their buoyancy in the water. This adaptation can also slow them down in the water as they try to dive deeper to catch prey.

Discuss how this change in the bones of these birds makes it easier for them to reach the surface after a dive.

As an extension of this topic have students match what speed the birds should be moving at to reach varying depths.

2.VV.01

3. Heat and Heat Transfer 3.2

Explain how heat energy will move from a higher temperature to a lower temperature until equilibrium is reached.

Performance Example:

Lead a classroom discussion/demonstration on proper sterilization methods. Instruct students on the proper safety precautions when using an autoclave.

After review of safety protocols ask students to prepare caging and/or water bottles in preparation for autoclaving. Discuss the autoclave process, safety issues and confirmation of sterilization.

Finalize training on this topic by sterilizing cages through the autoclave process. Ask students to compare/contrast other methods of sterilization.

2.EEE.01

1. Motion and Forces 1.4

Interpret and apply Newton's three laws of motion.

Performance Example:

Students will demonstrate how to restrain a dog in a standing restraint, paying close attention to their center of gravity and using the appropriate amount of force.

They will discuss what to do in different scenarios, such as the dog being small, medium, or large; the dog being perfectly still or very wiggly; the dog being cooperative or uncooperative.

Students will then have to demonstrate the proper procedure of restraint with dogs of different sizes and weights.

2.GGG.01

3.Heat and Heat Transfer 3.2

Explain how heat energy will move from a higher temperature to a lower temperature until equilibrium is reached.

Performance Example:

Activate student's prior knowledge of autoclaves with a discussion of prior classes and lessons. Give students a blank diagram of an autoclave and go through the process of labeling the various parts of the machine and their functions.

Conclude instruction on this topic by having students create either a drawing or an interactive

<p>slideshow on how an autoclave that uses steam and pressure operates.</p>		
2.III.01	6.Electromagnetic Radiation 6.2	Describe the electromagnetic spectrum in terms of frequency and wavelength, and identify the locations of radio waves, microwaves, infrared radiation, visible light (red, orange, yellow, green, blue, indigo, and violet), ultraviolet rays, x-rays, and gamma rays on the spectrum.
<p>Performance Example:</p> <p>Lead a classroom discussion about different kinds of waves including light waves which help us see. Compare these waves to X-rays which are very similar but can be dangerous if they are being produced and you do not have the proper PPE.</p> <p>To determine if the class has mastered the concept ask them to fill out an assignment on when PPE's are necessary for both patients and workers.</p> <p>Conclude instruction of the topic by asking students to prepare a report that illustrates how x-ray radiation is used and how exposure can be hazardous to our patients.</p>		

Technology/Engineering

CVTE Learning Standard Number	Subject Area, Topic Heading and Learning Standard Number	Text of Technology/Engineering Learning Standard
2.B.02	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Lead a class discussion on animal stalls and pens and what kinds of debris can collect in these different types of enclosures.</p> <p>When satisfactorily completed ask students to create a list of tools that can be utilized to clean different kinds of animal enclosures.</p> <p>Conclude instruction on this topic by having students demonstrate what kind of tool they would select and use to clean a given enclosure.</p>		
2.A.01	3. Communication Technologies 3.4	Identify and explain how symbols and icons (e.g., international symbols and graphics) are used to communicate a message.

<p>Performance Example:</p> <p>Conduct a lesson involving safety and signs in everyday life and how signs can be used to convey important messages when dealing with animals.</p> <p>Students will be able to recognize and decipher signs near animal enclosures and in work and preparation areas to become aware of potential safety hazards.</p> <p>Students will also have to know how to properly notify others of the signs and how to behave in those areas.</p>		
2.D.02	1. Materials, Tools, and Machines 1.1	Given a design task, identify appropriate materials (e.g., wood, paper, plastic, aggregates, ceramics, metals, solvents, and adhesives) based on specific properties and characteristics (e.g., strength, hardness, and flexibility).
<p>Performance Example:</p> <p>Lead a classroom discussion about the requirements for different animals' enclosures.</p> <p>Once completed to satisfaction provide a situation where a group of students has an animal. Have the students list appropriate things that list what should be located in that enclosure and what materials those things should be made of.</p> <p>To conclude the lesson students should be able to set up appropriate housing depending on the animal the enclosure is being designed for. (e.g., gerbil, iguana, fish)</p>		
2.G.03	7. Bioengineering Technologies 7.2	Describe and explain adaptive and assistive bioengineered products, e.g., food, bio-fuels, irradiation, integrated pest management.
<p>Performance Example:</p> <p>Introduce students to the concept of integrated pest management with a lecture and discussion.</p> <p>Students will explain and observe how integrated pest management can be used to maintain health in a herd.</p> <p>To determine if students have mastered the concept give them a situation where a herd is in poor health with a specific illness or parasite. Have students write a report describing how integrated pest management could have prevented the parasite or could help improve the health of the herd.</p>		
2.L.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.

<p>Performance Example:</p> <p>Activate students' prior knowledge of the different types of collars, then move into a discussion on the use of these collars (identifying: safety concerns, techniques, situational use, etc).</p> <p>To determine if the class has mastered the concept, have the students apply given collars to a demonstration dog and perform a given task and record results.</p> <p>As part of a summative assessment, have students graph their results individually and as a class they will prepare a chart graphing success result across different breeds.</p>		
2.M.02	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Activate students' prior knowledge of the use of tools, then move into a discussion on the use of new tools (identifying: safety concerns, techniques, maintenance, situational use, etc).</p> <p>To determine if the class has mastered the concept, have the students identify given tools using a dip-sticking method and have student explain the proper technique to use tool.</p> <p>As part of a summative assessment, have students groom a dog using proper tools and techniques.</p>		
2.M.03	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Conduct a lesson involving different restraint including lateral recombency, muzzling, setting a grooming loop etc.</p> <p>To determine if the class has mastered the concept, they will demonstrate on training mannequins using a partner.</p> <p>Finalize training on this topic by having students demonstrate the restraints during a grooming lab.</p>		
2.M.04	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Start the class with an initial discussion on proper cleaning and oiling of a clipper and blades: what to</p>		

<p>look for on a worn tool, life span of tools, sounds of properly running tools.</p> <p>When satisfactorily complete, ask students to break down and service (older) clippers.</p> <p>Finalize training on this topic by having students properly breakdown clean, oil and return to running condition the clippers in the lab.</p>		
2.0.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Instruct the class on how safely restrain and obtain the vitals of a dog as well as what the values should be for small medium and large dog.</p> <p>When satisfactorily completed, ask students to demonstrate the proper way to obtain the vitals on a given dog.</p> <p>Conclude instruction on this topic by having students develop a baseline for a given animal over a period of a week. Students will graph out their work and average the results for their baseline.</p>		
2.R.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Lead a classroom discussion/demonstration on use of clippers and performing a barn clip (General neatening up) on a horse.</p> <p>Upon mastery of the skill ask the students to complete a barn clip on a horse.</p> <p>Ask the students apply their knowledge to a slightly different application by clipping a horse as for show.</p>		
2.S.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>As part of a series of lessons concerning building and maintaining equine fences discuss what tool and skills are necessary to build and or maintain a board fence.</p>		

<p>Once to concept has been attained ask the students to make a list of the tools and equipment necessary to build a board fence around a given area.</p> <p>Finalize training on this topic by going to the barn and working on the fence to fix and or maintain.</p>		
2.T.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Instruct the class on the use of a weight tape to determine height and weight of a horse.</p> <p>To determine if the class has mastered the concept have them measure a horses height in inches , convert to hands and check their accuracy using the height stick.</p> <p>Conclude instruction on this topic by having the students figure out their own height in hands.</p>		
2.Z.01	3. Communication Technologies 3.4	Identify and explain how symbols and icons (e.g., international symbols and graphics) are used to communicate a message.
<p>Performance Example:</p> <p>As a part of a series of lessons concerning farm safety, review uniformed hazards signs and their function to promote and improve personal safety.</p> <p>Once the concept has been attained, ask students to search the school farm to identify and document uniformed safety signs/labels on farm equipment and structures.</p> <p>Conclude instruction on this concept by reviewing student’s findings and incorporating those into the farm’s emergency protocol notebook that would enhance safety on our school farm.</p>		
2.AA.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Conduct a lesson involving swine handling and restraint applications. Students will identify required PPE and review safe working practices for the assigned management procedure.</p> <p>When satisfactorily completed, ask students will to demonstrate moving a pig with a pig panel/hurdle to another pen.</p> <p>Finalize training on this topic by asking students to demonstrate restraining a pig with a hog snare.</p>		

2.FF.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>As part of a series on camelid health care, lead with a demonstration on taking the temperature, pulse, respiration of an alpaca.</p> <p>Upon understanding this skill set, students will demonstrate taking temperature, pulse, and respiration of an alpaca. Student will need a partner (to safely restrain the alpaca), rectal thermometer, lube, cotton, stethoscope, watch, halter and lead rope.</p> <p>Conclude instruction on this concept by asking students to explain factors that may lead to variations from normal ranges of temperature, pulse, and respiration of camelids.</p>		
2.GG.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>As part of a lesson on sheep management, students will identify tools required for hoof trimming procedures of a sheep.</p> <p>As part of a formative assessment, ask students to explain proper maintenance care and use of the identified tools.</p> <p>Finalize training on this topic, have students in assigned teams, using correct PPE and safe practices, demonstrate hoof trimming procedures of a sheep.</p>		
2.TT.01	3. Communication Technologies 3.4	Identify and explain how symbols and icons (e.g., international symbols and graphics) are used to communicate a message.
<p>Performance Example:</p> <p>Start the class with an initial discussion on biohazards in the laboratory animal facility. Explain the various biohazard signs and symbols that are in the facility.</p> <p>When satisfactory completed, ask students to demonstrate their knowledge by doing a web quest to identify various signs and symbols that commonly seen in a lab animal facility.</p> <p>Finalize training on this topic by having students explain specific scenarios that will require biohazard signs to be used in an animal research facility.</p>		

2.WW.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>After review of safety procedures lead a classroom discussion/demonstration on administering medication via syringe. Instruct students on how to properly fill a syringe to a specific dosage.</p> <p>Once the concept has been attained ask students to demonstrate their knowledge by properly filling syringes to a specific dosage according to industry standards.</p> <p>Finalize training on this subject by asking students to properly calculate a dosage for a particular medication and draw it up correctly in a syringe.</p>		
2.AAA.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Conduct a lesson on temporary and permanent identification methods of lab animals. Ask students to brainstorm various methods of identification.</p> <p>Upon mastery of this skill, ask students to determine the most appropriate methods of temporary and permanent identification methods for various lab animals.</p> <p>Conclude instruction on this concept by providing students with a lab animal and having students apply either an ear tag or ear notch.</p>		
2.DDD.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Demonstrate to the class how to prepare vaccines using proper PPE.</p> <p>As a lab activity: Students will have to identify syringes based on size by selecting the proper syringe used for the given volume. Then students will practice using the different types of syringes to draw up mock vaccines.</p>		

2.EE.01	3. Communication Technologies 3.4	Identify and explain how symbols and icons (e.g., international symbols and graphics) are used to communicate a message.
<p>Performance Example:</p> <p>Lead a class discussion about important safety signs and symbols that are located around the school grounds. Once completed ask students to identify signs and symbols located around the class and lab and hypothesize their meaning.</p> <p>To conclude the lesson students will create a sign or symbol, then “quiz” each other on identifying the different signs and symbols used in the veterinary practice.</p>		
2.EEE.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Students will discuss different methods for handling aggressive dogs.</p> <p>Then students will identify the tools needed to handle aggressive dogs in a cage/kennel situation. Students will have to demonstrate how to use a catch pole appropriately—first on a stuffed animal and then on a real dog.</p>		
2.FFF.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p> <p>Students will be shown a diagram of a healthy, trimmed hoof on a goat.</p> <p>Students will then select a goat at random to determine if the hoof needs to be trimmed.</p> <p>Students will confirm with the instructor or farm manager, gather the appropriate tools, and then assist in trimming.</p>		
2.GGG.01	1. Materials, Tools, and Machines 1.2	Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
<p>Performance Example:</p>		

<p>Introduce the class to surgical tools and their uses.</p> <p>Give students a sheet with pictures of all surgical tools and have them look them up and label them.</p> <p>To conclude this lesson, students will have to assemble a laceration pack based on identification of random surgical tools. Students will also have to create a list with the correct name and spelling of each tool in the pack.</p>		
2.N.01	1. Engineering Design 1.1	Identify and explain the steps of the engineering design process: identify the problem, research the problem, develop possible solutions, select the best possible solution(s), construct prototypes and/or models, test and evaluate, communicate the solutions, and redesign.
<p>Performance Example:</p> <p>Instruct the class on the requirements for a small, medium, and large whelping box. As well as acceptable materials that can be safely used.</p> <p>To determine if the class has mastered the concept, students will determine the height of the whelping box based on the breed's height.</p> <p>Conclude instruction on this topic by having the student's layout and design a whelping box based on a given breed including: dimensions, materials, fasteners etc.</p>		
2.HH.01	6. Communication Technologies 6.1	Explain how information travels through the following media: electrical wire, optical fiber, air, and space.
<p>Performance Example:</p> <p>Discuss with the class how remotely operated underwater vehicles (ROVs), (unoccupied, highly maneuverable underwater robots operated by a person aboard a surface vessel) are utilized by scientists.</p> <p>Since they are linked to the ship by a group of cables that carry electrical signals back and forth between the operator and the vehicle, hypothesize and research the different tasks these vessels can complete when used by researchers.</p>		
2.JJ.01	1.Engineering Design 1.1	Identify and explain the steps of the engineering design process: identify the problem, research the problem, develop possible solutions, select the best possible solution(s), construct prototypes and/or models, test and evaluate, communicate the solutions, and redesign.

Performance Example:

Discuss the unique needs of marine mammals in captivity. Conduct a webquest that details engineering projects designed to enhance environmental enrichment for captive marine mammals in a captive environment.

Present findings to the rest of the class on the various projects that highlight creative approaches to engineering problems associated with a marine environment.

2.KK.01

3.Energy and Power
Technology-Fluid
Systems 3.1

Explain the basic differences between open fluid systems (e.g., irrigation, forced hot air system, air compressors) and closed fluid systems (e.g., forced hot water system, hydraulic brakes).

Performance Example:

Discuss how a simple recirculating system works for freshwater fish, reviewing the key components of the system.

Discuss how a single, larger system could be designed to service multiple tanks in a wall unit of recirculating systems.

Have students work in teams to determine the engineering issues that would present themselves when designing a system that serves multiple tanks and potentially hundreds of gallons of water.

2.MM.01

1.Engineering Design 1.2

Understand that the engineering design process is used in the solution of problems and the advancement of society. Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified.

Performance Example:

As part of a lesson on the types of commercial fishing methods used to catch fish such as pollock, cod, flounder and shrimp – discuss with students the principles of how a trawl operates.

Once students understand how trawls work, ask them to hypothesize how dredging a heavy frame with an attached mesh bag along the sea floor to catch animals living on or in the mud or sand can damage the sea floor.

2.UU.01

3. Energy and Power
Technologies-Fluid
Systems 3.1

Explain the basic differences between open fluid systems (e.g., irrigation, forced hot air system, air compressors) and closed fluid systems (e.g., forced hot water system, hydraulic brakes).

Performance Example:

Lead a class discussion on positive and negative air flow requirements in an animal research facility. Upon mastery of this concept have students identify which rooms need positive airflow and which rooms need negative airflow in a given facility.

Finalize training on this subject by having students lay out a facility design and indicating airflow throughout the facility design.

DESE Statewide Articulation Agreements

No Statewide Articulation Agreements at this time.

Industry Recognized Credentials (Licenses and Certifications/Specialty Programs)

Certificates and Credentials for Animal Science

Animal Science Potential Certifications/Credentials (over all)

1. 10-Hour OSHA General Industry Card/Credential*
[OSHA General Industry Training Guidelines](#)
2. 10-hour Construction Industry Card/Credential*
[OSHA Construction Industry Training Guidelines](#)
3. CPR & First Aid Training Card/Credential*
American Heart Association and American Red Cross
4. HOSTA - National Safe Tractor and Machinery Operation Certification (NSTMOC)*
NSTMOC Training Guidelines and Resources

Companion Animal Concentration Potential Certifications/Credentials

1. American Association for Laboratory Animal Science (AALAS) Certifications
[Technician Certification Handbook and exam registry](#)
 - a. Assistant Laboratory Animal Technician (ALAT)
 - b. Laboratory Animal Technician (LAT)
 - c. Laboratory Animal Technologist (LATG)Manager Certification handbook and exam registry
2. Pet Industry Joint Advisory Council (PIJAC)
Certified Avian Specialist (CAS) Certification*
3. National Dog Groomers Association of America
Guidelines and Instructions for Certification*

Equine Science Concentration Certifications/Credentials

1. Massachusetts Riding Instructor's License
[MA DAR Riding Instructor's License Information](#)
2. Humane Equine Management Certification*
Online Training Program and Information
3. Certified Horsemanship Association, Certification available, various levels and types
Certified Horsemanship Association - Certified Horseback Riding Instructors
4. Massachusetts Pesticide Applicators License
[Massachusetts Department of Agricultural Resources](#)

Livestock and Poultry Science Concentration Potential Certifications/Credentials

1. Massachusetts Pesticide Applicators License
Massachusetts Department of Agricultural Resources
2. Artificial Insemination Certification
Genex Cooperative, Inc., (Headquarters), 100 MBC Drive, P.O. Box 469, Shawano, WI 54166
3. Beef Quality Assurance and Beef Cattle Care Certificate (BQA)*
On-Line Program, guidelines and registry
4. Transportation – Beef Quality Assurance (BQA)*
On-Line Program, guidelines and registry
5. Dairy Quality Assurance Certificate (DQA)*
On-Line Program, guidelines and registry
6. Sheep Safety and Quality Assurance Certificate (SSQA)*
On-Line Program, guidelines and registry
7. Youth Pork Quality Assurance Plus Certificate (YPQAP)*
On-Line Program, guidelines and registry
8. Pork Transport Quality Assurance Certificate (PTQA)*
On-Line Program, guidelines and registry
9. Massachusetts Hoisters License
Massachusetts Executive Office of Public Safety and Security

Marine and Aquaculture Science Concentration Potential Certifications/Credentials

1. SCUBA (Open Water I) *
NAUI or PADI or SSI

Research Animal Technology Concentration Potential Certifications/Credentials

1. American Association for Laboratory Animal Science (AALAS) Certifications
Technician Certification Handbook and exam registry
 - a. Assistant Laboratory Animal Technician (ALAT)
 - b. Laboratory Animal Technician (LAT)
 - c. Laboratory Animal Technologist (LATG)Manager Certification Handbook and exam registry

Veterinary Science Concentration Potential Certifications/Credentials

1. American Veterinary Medical Association (AVMA) Veterinary Assistant Certification*
2. American Association for Laboratory Animal Science (AALAS) Certifications
Technician Certification Handbook and exam registry

- a. Assistant Laboratory Animal Technician (ALAT)
 - b. Laboratory Animal Technician (LAT)
 - c. Laboratory Animal Technologist (LATG)
- Manager Certification Handbook and exam registry

*Can be earned by student prior to graduation

Other

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Marine and Aquaculture Science Recommended Texts

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Related National, Regional, and State Professional Organizations

- American Society of Animal Science (ASAS) www.asas.org

Student Organizations

- Skills USA www.maskillsusa.org
- FFA www.ffa.org

Selected Websites

- U.S. Department of Agriculture www.usda.gov/
- U.S. Fish & Wildlife Service www.fws.gov/
- U.S. National Park Service www.nps.gov/