



**MASSACHUSETTS**  
**DEPARTMENT of**  
**EDUCATION**

**Vocational Technical Education  
Framework**

**Agriculture and Natural Resources  
Cluster**

***Animal Science***

**August 2007**

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## **Strand 1: Safety and Health Knowledge and Skills**

### **1.A Define health and safety regulations.**

- 1.A.01a Identify and apply OSHA and other health and safety regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.02a Identify and apply EPA and other environmental protection regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.03a Identify and apply Right-To-Know (Hazard Communication Policy) and other communicative regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.04a Explain procedures for documenting and reporting hazards to appropriate authorities.
- 1.A.05a List penalties for non-compliance with appropriate health and safety regulations.
- 1.A.06a Identify contact information for appropriate health and safety agencies and resources.

### **1.B Demonstrate health and safety practices.**

- 1.B.01a Identify, describe and demonstrate the effective use of Material Safety Data Sheets (MSDS).
- 1.B.02a Read chemical, product, and equipment labels to determine appropriate health and safety considerations.
- 1.B.03a Identify, describe and demonstrate personal, shop and job site safety practices and procedures.
- 1.B.04a Demonstrate safe dress and use of relevant safety gear and personal protective equipment (PPE), including wrist rests, adjustable workspaces and equipment, gloves, boots, earplugs, eye protection, and breathing apparatus.
- 1.B.05a Illustrate appropriate safe body mechanics, including proper lifting techniques and ergonomics.
- 1.B.06a Locate emergency equipment in your lab, shop, and classroom, including (where appropriate) eyewash stations, shower facilities, sinks, fire extinguishers, fire blankets, telephone, master power switches, and emergency exits.
- 1.B.07a Demonstrate the safe use, storage, and maintenance of every piece of equipment in the lab, shop, and classroom.
- 1.B.08a Describe safety practices and procedures to be followed when working with and around electricity.
- 1.B.09a Properly handle, store, dispose of, and recycle hazardous, flammable, and combustible materials.
- 1.B.10a Demonstrate proper workspace cleaning procedures.
- 1.B.11a Demonstrate proper spacing distance from others when using tools.

#### **Performance Examples:**

1. Describe a safety plan, including factors related to protecting the environment, for employees under your supervision in the work place or at a job site.
2. Given a specific task, describe or demonstrate proper safety procedures/methods.

3. When presented with a hazardous situation that could develop in shop, the student will evaluate the situation and suggest procedures and/or practices that would resolve the hazardous situation.

**1.C Demonstrate responses to situations that threaten health and safety.**

- 1.C.01a Illustrate First Aid procedures for potential injuries and other health concerns in the occupational area.
- 1.C.02a Describe the importance of emergency preparedness and an emergency action plan.
- 1.C.03a Illustrate procedures used to handle emergency situations and accidents, including identification, reporting, response, evacuation plans, and follow-up procedures.
- 1.C.04a Identify practices used to avoid accidents.
- 1.C.05a Identify and describe fire protection, precautions and response procedures.
- 1.C.06a Discuss the role of the individual and the company/organization in ensuring workplace safety.
- 1.C.07a Discuss ways to identify and prevent workplace/school violence.
- 1.C.08 Demonstrate proper restraint of common rodent, reptile, amphibian, livestock, equine and avian species.
- 1.C.09 Identify and exhibit proper animal related hygiene in relation to zoonotic concerns.

## **Strand 2: Technical Knowledge and Skills**

### **2.A Select and use the appropriate tool to perform a given task.**

- 2.A.01c Select tools and equipment.
- 2.A.02c Identify standard tools, equipment, and safety procedures.
- 2.A.03c Follow operating instructions.
- 2.A.04c Set up/adjust tools and equipment.
- 2.A.05c Demonstrate proper maintenance of all tools.
- 2.A.06c Store tools properly.

### **2.B Demonstrate effective agribusiness and retail practices.**

- 2.B.01 Describe the scope and effect of agribusiness in the local economy.
- 2.B.02 Identify factors affecting prices and pricing strategies.
- 2.B.03 Compute and estimate fixed and variable expenses.
- 2.B.04 Compare and contrast methods of inventory control.
- 2.B.05 Create a plan to market goods and services (including promotional materials and displays).
- 2.B.06 Illustrate how different seasons affect products and services offered.
- 2.B.07 Identify markets, customers, and distribution channels.
- 2.B.08 Describe ways to inform customers of products and services, including supplying information, making recommendations, and demonstrating use.
- 2.B.09 Demonstrate the ability to process sales and taxes using a variety of tender.
- 2.B.10 Demonstrate procedures used to receive and handle merchandise.
- 2.B.11 Demonstrate procedures used to ship and deliver merchandise.

### **2.C Identify characteristics and breeds/species of large and small animals.**

- 2.C.01 Identify characteristics and breeds of dairy and beef cattle.
- 2.C.02 Identify characteristics and breeds of sheep.
- 2.C.03 Identify characteristics and breeds of swine.
- 2.C.04 Identify characteristics and breeds of dogs.
- 2.C.05 Identify characteristics and breeds of cats.
- 2.C.06 Identify characteristics and breeds of small mammals, including rodents and rabbits.
- 2.C.07 Identify characteristics and species of birds.
- 2.C.08 Identify characteristics and species of reptiles/amphibians.
- 2.C.09 Identify characteristics and breeds of horses.
- 2.C.10 Identify characteristics and breeds of primates.

### **2.D Identify requirements of and proper materials for animal housing, including pastures, cages, stalls, pens, and aquaria.**

- 2.D.01 State guidelines and legal requirements for the housing of large and small animals.
- 2.D.02 Identify housing appropriate for livestock.
- 2.D.03 Identify housing appropriate for horses.
- 2.D.04 Identify housing appropriate for rodents (research and domestic).
- 2.D.05 Identify housing appropriate for reptiles and amphibians.
- 2.D.06 Identify housing appropriate for birds (research and domestic).

- 2.D.07 Identify housing appropriate for fish and aquatic species.
- 2.D.08 Identify kennel systems for dogs and cats (research and domestic).
- 2.D.09 Identify housing appropriate for primates.
- 2.D.10 Identify laboratory cage washers, bottle fillers, ventilated cages and other laboratory tools.

**2.E Explain and demonstrate proper and safe handling and restraint of large and small animals in domestic, farm, and research settings.**

- 2.E.01 Identify guidelines and requirements for various animal restraint procedures.
- 2.E.02 Transfer an animal from one form of housing to another.
- 2.E.03 Restrain an animal to undergo routine procedures (e.g. examinations, tests, and treatments).
- 2.E.04 Restrain an animal for grooming.
- 2.E.05 Restrain an animal for protection to other animals, people, or itself.

**Performance Example:**

1. Explain the proper handling and restraint of cattle, horses, sheep, swine, goats, dogs, cats, small mammals, birds, reptiles, amphibians, and other large and small animals.

**2.F Identify the anatomy and physiology of large and small animals.**

- 2.F.01 Identify the organs and functions of the respiratory system in large and small animals.
- 2.F.02 Identify the organs and functions of the digestive system in large and small animals.
- 2.F.03 Identify the organs and functions of the circulatory system in large and small animals.
- 2.F.04 Identify the organs and functions of the reproductive system in large and small animals.
- 2.F.05 Identify the external anatomical features of large and small animals.
- 2.F.06 Identify the skeletal features of large and small animals.

**2.G Summarize proper animal nutrition and feeding.**

- 2.G.01 List the classes of nutrients and give examples of each.
- 2.G.02 Explain how vitamins and nutrients interact with and fuel various systems in large and small animals.
- 2.G.03 Describe the types of feed for various species of large and small animals (e.g. silage, hay, pelleted feed, and dry or moist pet feeds).
- 2.G.04 Describe methods of sterilizing feed and bedding, including irradiation and autoclaving.
- 2.G.05 Summarize common nutritional deficiencies found in a variety of large and small animals.
- 2.G.06 Explain the importance of proper animal nutrition for animal performance (e.g. showing, work, milk production, and breeding).
- 2.G.07 Describe the importance of proper animal nutrition for growth.
- 2.G.08 Properly store a variety of feed to protect from spoilage and hazards.

- 2.H Demonstrate the ability to identify healthy and unhealthy animals.**
- 2.H.01 Identify and describe the common causes of diseases including bacteria, viruses, fungi, parasites, genetic, and protozoan.
  - 2.H.02 Explain principles of maintaining proper environments to ensure animal health.
  - 2.H.03 Demonstrate the ability to identify possible conditions that are adverse to proper animal health.
  - 2.H.04 Describe the difference between and purposes of quarantine and isolation.
  - 2.H.05 Sanitize/disinfect animal environments and list common agents involved.
  - 2.H.06 Identify common zoonotic diseases.
- 2.I Analyze animal genetics, breeding and reproduction of domestic animals.**
- 2.I.01 Explain common breeding systems (ex. inbreeding).
  - 2.I.02 Describe the principles of artificial insemination.
  - 2.I.03 Describe the principles of in vitro fertilization.
  - 2.I.04 Describe the principles of embryo transfer.
  - 2.I.05 Describe the principles of cloning.
  - 2.I.06 Describe the principles of transgenics and knockouts.
- 2.J Explain animal rights/animal welfare and how to effectively communicate with the public as an employee in an animal related career path.**
- 2.J.01 Explain the difference between animal rights and animal welfare.
  - 2.J.02 Develop a position and debate various viewpoints on issues in animal science (ex. common management practices pros and cons, vegetarianism, uses of animals).
  - 2.J.03 Explain the historical significance of the animal rights/animal welfare debate and how it has impacted the management of animals today.

## **Strand 2: Companion Animals and Pet Shop Management Concentration**

### **2.K \* Explain practices of pet shop management.**

- 2.K.01\* Describe customer types and the importance of customer service.
- 2.K.02\* Demonstrate ways to greet and assist a customer in appropriate ways.
- 2.K.03\* Demonstrate ways to respond to customers and exceed their expectations.
- 2.K.04\* Demonstrate ways to resolve customer service complaints in a professional and appropriate manner.
- 2.K.05\* Identify the steps to manage dissatisfied customers.
- 2.K.06\* Explain ways to reduce customer service stress to both workers and the consumer.
- 2.K.07\* Define quality service from a consumer/customer perspective.
- 2.K.08\* Describe the selling process.
- 2.K.09\* List methods and tools used to determine the customer's needs.
- 2.K.10\* Prepare an advertising message incorporating multimedia, print and/or audio technologies.
- 2.K.11\* Research and analyze market information for trends.
- 2.K.12\* Discuss risk assessment for various pet species as pertaining to safety in the workplace.
- 2.K.13\* Discuss factors in choosing the right pet.
- 2.K.14\* Identify concerns regarding children and pets.
- 2.K.15\* Explain the benefits of pet therapy.
- 2.K.16\* Discuss the ethics of, and concerns regarding, euthanasia.
- 2.K.17\* Explain the problems of overpopulation.
- 2.K.18\* Identify pet products.
- 2.K.19\* Explain the training and benefits of companion/assistance animals.
- 2.K.20\* Identify resources and practices of obedience training techniques.
- 2.K.21\* Identify resources and practices of showing a pet.
- 2.K.22\* Identify the characteristics of pet breeds and classifications.

### **2.L \* Demonstrate proper pet grooming procedures.**

- 2.L.01\* Manage risks and liabilities inherent to pet grooming.
- 2.L.02\* Explain risks and liabilities involved when working with other people's animals.
- 2.L.03\* Discuss risk assessment for the grooming industry as it pertains to safe actions around animals and safety around grooming and other related equipment.
- 2.L.04\* Demonstrate emergency procedures for a dog or a cat.
- 2.L.05\* Identify licenses, permits and the process to start a grooming business in a locality.
- 2.L.06\* Design a grooming facility.
- 2.L.07\* Properly clean and sanitize a grooming facility.
- 2.L.08\* Identify and demonstrate proper use of the tools needed in the grooming industry.
- 2.L.09\* Demonstrate cleaning and oiling a clipper blade.

- 2.L.10\* Explain and demonstrate use of water/shampoo systems (i.e. “HydroSurge”).
- 2.L.11\* Demonstrate proper grooming equipment maintenance.
- 2.L.12\* Demonstrate proper techniques to handle/restrain an animal for grooming.
- 2.L.13\* Demonstrate brushing-out techniques for animals being groomed.
- 2.L.14\* De-mat a dog and a cat.
- 2.L.15\* Bathe a dog and cat.
- 2.L.16\* Identify different types of shampoos available for different grooming situations.
- 2.L.17\* Dry a dog and cat.
- 2.L.18\* Clean the ears of animals being groomed.
- 2.L.19\* Explain and demonstrate clipping techniques for a dog and a cat.
- 2.L.20\* Perform at least one specialized dog cut.
- 2.L.21\* Cut the nails of a dog and cat.
- 2.L.22\* Explain grooming of non-dog or non-cat species.
- 2.L.23\* Demonstrate client record keeping as it pertains to a grooming operation.
- 2.L.24\* Identify the practices and roles of associated grooming organizations as they pertain to a grooming business (i.e. New England Pet Grooming Professionals – NEPGP).

**2.M \* Explain concepts and practices relating to pet health.**

- 2.M.01\* Discuss preparation and signs of whelping.
- 2.M.02\* Recognize a canine emergency situation.
- 2.M.03\* Demonstrate emergency procedures for a variety of pets.
- 2.M.04\* Discuss vaccination requirements for a variety of pets.
- 2.M.05\* Explain the dietary requirements of pets.
- 2.M.06\* Take temperature, pulse, and respiration on a dog, and state normal ranges.
- 2.M.07\* Recognize normal animal heart and lung sounds.
- 2.M.08\* Explain procedures relating to administering pet medication and vaccinations.
- 2.M.09\* Extensively identify methods of control, treatment, and prevention of diseases in pet species.
- 2.M.10\* Extensively identify methods of control, treatment, and prevention of internal/external parasites in pet species.

## **Strand 2: Equine Science Concentration**

- 2.N \*** **Demonstrate advanced procedures relating to equine science.**
- 2.N.01\* Handle, groom and perform general care on horses.
  - 2.N.02\* Demonstrate clipping techniques used on horses.
  - 2.N.03\* Develop procedures to properly feed and water horses.
  - 2.N.04\* Create a feed and watering schedule.
  - 2.N.05\* Explain typical eating patterns of horses.
  - 2.N.06\* Determine proper feeds based on the breed/use of a horse.
  - 2.N.07\* Examine foodstuff for quality.
  - 2.N.08\* Present a horse for observation in a professional manner.
  - 2.N.09\* Explain and demonstrate proper equitation and showing skills.
  - 2.N.10\* Halter a horse.
  - 2.N.11\* Bridle a horse.
  - 2.N.12\* Saddle or harness a horse.
  - 2.N.13\* Properly mount a horse.
  - 2.N.14\* Demonstrate basic riding or driving skills.
  - 2.N.15\* Lead a horse at halter.
  - 2.N.16\* Walk and trot a horse.
  - 2.N.17\* Plan and outline a health program for horses.
  - 2.N.18\* Describe normal behavior of common horse species.
  - 2.N.19\* Take temperature, pulse, and respiration on a horse, and state normal ranges.
  - 2.N.20\* Explain procedures relating to administering equine medication and vaccinations.
  - 2.N.21\* Extensively identify methods of control, treatment, and prevention of diseases in equine species.
  - 2.N.22\* Extensively identify methods of control, treatment, and prevention of internal/external parasites in equine species.
  - 2.N.23\* Explain care for feet and legs.
  - 2.N.24\* Lift, clean, and check a horse's foot.
  - 2.N.25\* Wrap a leg.
  - 2.N.26\* Determine height and weight of a horse.
  - 2.N.27\* Extensively identify external equine anatomy.
  - 2.N.28\* Maintain physical facilities for horses, horse health care, and equestrians.
  - 2.N.29\* Compare, contrast, and demonstrate the installation (and removal) of various types of bedding used with horses.
  - 2.N.30\* Identify and care for tack and equipment.

## **Strand 2: Livestock Management Concentration**

### **2.O \* Demonstrate advanced knowledge and procedures relating to keeping livestock.**

- 2.O.01\* Demonstrate advanced practices used to handle and restrain common livestock species safely.
- 2.O.02\* Perform animal care, sanitation, and facility maintenance.
- 2.O.03\* Maintain a system of livestock records.
- 2.O.04\* Explain selection of all classes of livestock on the basis of type, pedigree, and performance/progeny data.
- 2.O.05\* Use correct terminology for each species.
- 2.O.06\* Plan and outline a breeding program for a livestock operation.
- 2.O.07\* Explain practices and scientific principles relating to artificial insemination.
- 2.O.08\* Identify management methods that can enhance fertility and reproduction efficiency.
- 2.O.09\* Explain methods of pregnancy testing.
- 2.O.10\* Explain parturition through discussion of animal preparation and birth assistance protocols for normal and abnormal presentations.
- 2.O.11\* Plan and outline a health program for a livestock operation.
- 2.O.12\* Describe normal behavior of common livestock species.
- 2.O.13\* Take temperature, pulse, and respiration of various livestock species, and state normal ranges.
- 2.O.14\* Recognize normal heart, lung, and rumen contraction sounds.
- 2.O.15\* Explain procedures relating to administering medication and vaccinations.
- 2.O.16\* Extensively identify methods of control, treatment, and prevention of diseases in livestock.
- 2.O.17\* Extensively identify methods of control, treatment, and prevention of internal/external parasites in livestock.
- 2.O.18\* List types of nutrients, feed classes and feeding practices used in livestock rations.
- 2.O.19\* Formulate rations using computer programs or by the Pearson square method.
- 2.O.20\* Perform body scoring of livestock.
- 2.O.21\* Explain procedures relating to dehorning, docking, and castration.
- 2.O.22\* Demonstrate procedures of hoof trimming, shearing, and clipping.
- 2.O.23\* Demonstrate methods of livestock identification and its significance to production records, bred registries, and biosecurity.
- 2.O.24\* Demonstrate sample collection techniques of milk, blood, and urine
- 2.O.25\* Identify livestock products and markets.

## **Strand 2: Veterinary Science Concentration**

### **2.P \* Perform appropriate health care, health management, and medical procedures on a variety of large and small animals.**

- 2.P.01\* Summarize the history of veterinary science and explain the numerous career pathways available in the field of veterinary medicine.
- 2.P.02\* Illustrate cellular structure, metabolism, and functions.
- 2.P.03\* Define tissue types and functions.
- 2.P.04\* Extensively identify structures and functions of the musculoskeletal system.
- 2.P.05\* Extensively identify structures and functions of the circulatory system.
- 2.P.06\* Extensively identify structures and functions of the respiratory system.
- 2.P.07\* Extensively identify structures and functions of the renal system.
- 2.P.08\* Extensively identify structures and functions of the digestive system.
- 2.P.09\* Extensively identify structures and functions of the reproductive system.
- 2.P.10\* Extensively identify structures and functions of the nervous system.
- 2.P.11\* Extensively identify structures and functions of the endocrine system.
- 2.P.12\* Extensively identify structures and functions of the immune system.
- 2.P.13\* Define the principles of infectious disease prevention.
- 2.P.14\* Classify diseases common in clinical practices.
- 2.P.15\* Identify zoonotic diseases common in clinical practices.
- 2.P.16\* Diagnose diseases found in clinical practices.
- 2.P.17\* Identify and treat common internal parasite and external parasites.
- 2.P.18\* Demonstrate a skin scraping for external parasites.
- 2.P.19\* Demonstrate a fecal flotation test for internal parasites.
- 2.P.20\* Summarize the principles of surgery, laceration, healing, and surgical considerations.
- 2.P.21\* Demonstrate the techniques appropriate to animal first aid and CPR.
- 2.P.22\* Explain methods used to safely take and read x-ray films.
- 2.P.23\* Explain the use of massage and alternative therapies.
- 2.P.24\* Use a stethoscope to hear normal equine heart and lung sounds.
- 2.P.25\* Explain how a veterinary clinic functions and the roles of people employed at a clinic.
- 2.P.26\* Explain the human/animal bond.
- 2.P.27\* Identify the process and ethics of euthanasia as a part of veterinary practice.
- 2.P.28\* Identify the signs and symptoms that indicate a variety of diseases and/or other health problems.
- 2.P.29\* Explain the differences between sanitation, disinfection, and sterilization and be able to relate which cleaning method should be used in any given situation.
- 2.P.30\* Describe the spaying/neutering and castration process and the effects to animals and animal owners.
- 2.P.31\* Demonstrate advanced restraint techniques for medical practices and procedures.
- 2.P.32\* Evaluate the ethical considerations inherent to the treatment and care of animals.

## **Strand 2: Research Animal Management Concentration**

- 2.Q \*** Explain the fundamentals of managing animals in a research facility.
- 2.Q.01\* Summarize the history of laboratory animal science and animal care programs.
  - 2.Q.02\* Identify and demonstrate proper protocols relating to the use of animals in a research facility.
  - 2.Q.03\* Describe the space, containment, research, and other facilities required of a research animal facility.
  - 2.Q.04\* Define medical terminology as it is appropriately used in the research animal facility.
  - 2.Q.05\* Summarize principles of feed and nutrition for laboratory animals.
  - 2.Q.06\* Illustrate cellular structure, metabolism, and functions.
  - 2.Q.07\* Define tissue types and functions.
  - 2.Q.08\* Extensively identify structures and functions of the musculoskeletal system.
  - 2.Q.09\* Extensively identify structures and functions of the circulatory system.
  - 2.Q.10\* Extensively identify structures and functions of the respiratory system.
  - 2.Q.11\* Extensively identify structures and functions of the renal system.
  - 2.Q.12\* Extensively identify structures and functions of the digestive system.
  - 2.Q.13\* Extensively identify structures and functions of the reproductive system.
  - 2.Q.14\* Extensively identify structures and functions of the nervous system.
  - 2.Q.15\* Extensively identify structures and functions of the endocrine system.
  - 2.Q.16\* Extensively identify structures and functions of the immune system.
  - 2.Q.17\* Explain how records are maintained in a laboratory animal facility.
  - 2.Q.18\* Demonstrate methods of laboratory animal identification.
  - 2.Q.19\* Explain animal procurement in the laboratory animal facility.
  - 2.Q.20\* Plan and outline a health program for a research animal facility.
  - 2.Q.21\* Take temperature, pulse, and respiration of various animal species, and state normal ranges.
  - 2.Q.22\* Explain procedures relating to administering medication and vaccinations.
  - 2.Q.23\* Extensively identify methods of control, treatment, and prevention of diseases in a research animal facility.
  - 2.Q.24\* Explain acceptable methods of euthanasia.
  - 2.Q.25\* Summarize the stages of experimental design and methodology, including IACUC and AWA.
  - 2.Q.26\* Demonstrate methods of handling, restraint, sexing, breeding, behavior, husbandry and physiological data for a variety of species used in laboratory research.
  - 2.Q.27\* Evaluate the ethical considerations inherent to the use of animals in research and laboratory experiments.

## **Strand 2: Marine Science / Aquaculture Concentration**

- 2.R \*** **Demonstrate advanced knowledge and procedures relating to marine science and aquaculture.**
- 2.R.01\* Identify the major ocean basins.
  - 2.R.02\* Identify the unique properties of water.
  - 2.R.03\* Diagram/describe the environmental conditions associated with the supratidal, intertidal and subtidal zones.
  - 2.R.04\* Diagram the zonation of a rocky shore community.
  - 2.R.05\* Construct a food chain showing the path of energy from encrusting algae to a predatory lobster.
  - 2.R.06\* List the two most important factors that determine where coral reefs develop.
  - 2.R.07\* Identify the characteristics of an estuary and explain its importance.
  - 2.R.08\* Diagram and explain the hydrologic cycle.
  - 2.R.09\* Explain how climatic are affected by the world's oceans.
  - 2.R.10\* List six marine mammals from three different orders.
  - 2.R.11\* Differentiate between mysticetes and odontocetes and give two examples of each.
  - 2.R.12\* Differentiate between dolphins and porpoises.
  - 2.R.13\* Differentiate between seals and sea lions.
  - 2.R.14\* Name the three groups of marine reptiles.
  - 2.R.15\* Identify six species of sea birds.
  - 2.R.16\* Distinguish between populations, communities and ecosystems.
  - 2.R.17\* Explain why tropical waters are less productive than temperate waters.
  - 2.R.18\* Describe two unique features of the following ecosystems: estuarine, sandy beach, and rocky shore.
  - 2.R.19\* List the factors required for the growth of a coral reef and label their locations on a global map.
  - 2.R.20\* Discuss the role of science and technology in the development of aquaculture.
  - 2.R.21\* List the six occupational areas of aquaculture.
  - 2.R.22\* List and describe seven biological characteristics of species recommended for aquaculture.
  - 2.R.23\* Describe the process of marketing aquaculture products.
  - 2.R.24\* Perform all required water quality tests and explain the significance of the results.
  - 2.R.25\* Describe four basic aquatic structures used for raising fish.
  - 2.R.26\* Explain the fundamentals of filtration.
  - 2.R.27\* Identify methods and equipment used in feeding aquatic species.
  - 2.R.28\* Give an example of polyculture.
  - 2.R.29\* List the state locations of the five regional aquaculture centers.
  - 2.R.30\* Discuss the current status of the fisheries industry locally, nationally and globally.
  - 2.R.31\* List three government agencies involved in fisheries management.
  - 2.R.32\* Identify the health benefits of eating fish.
  - 2.R.33\* Outline a sound fish health management program.
  - 2.R.34\* Describe the five most common methods of commercial fishing..

- 2.R.35\* Identify three cuts of fish.
- 2.R.36\* Select, prepare and present a species of fish for evaluation.
- 2.R.37\* Diagram the major groups of marine animals.
- 2.R.38\* Diagram a coral polyp and a nematocyst.
- 2.R.39\* List and explain three types of symbiotic relationships.
- 2.R.40\* Explain the relationship between corals and zooxanthellae.
- 2.R.41\* Identify maritime plants, alga, and lichens.
- 2.R.42\* List the feature that all mollusks have in common.
- 2.R.43\* Identify six marine arthropods.
- 2.R.44\* Explain the economic importance of krill.
- 2.R.45\* Explain the function of the water vascular system.
- 2.R.46\* Label the external anatomy of the shark.
- 2.R.47\* Describe three research/medicinal uses of sharks.
- 2.R.48\* Properly set up an aquarium.
- 2.R.49\* Demonstrate the ability to clean and reassemble a filter.
- 2.R.50\* Identify and perform four major aquarium water tests.
- 2.R.51\* Demonstrate how to properly prepare a saltwater solution.
- 2.R.52\* Demonstrate how to aquascape/design a freshwater or marine aquarium.
- 2.R.53\* Explain/diagram/graph the nitrogen cycle.
- 2.R.54\* Select six compatible fish for a freshwater or marine community tank.
- 2.R.55\* Show how to net and bag fish properly.
- 2.R.56\* Perform routine maintenance and water changes.
- 2.R.57\* Identify three types of food and/or feeding preferences.

## **Strand 3: Embedded Academic Knowledge and Skills**

### **3.A English Language Arts**

<b>VTE #</b>	<b>Acad #</b>	<b>Standard</b>	<b>Grade</b>	<b>Topic</b>
3.A.01c	2.4	Integrate relevant information gathered from group discussions and interviews for reports.	Pre-9	Language
3.A.02c	13.19	Identify and use knowledge of common graphic features (charts, maps, diagrams).	Pre-9	Reading
3.A.03c	19.21	Write reports based on research that includes quotations, footnotes or endnotes, and a bibliography.	Pre-9	Composition
3.A.04c	24.4	Apply steps for obtaining information from a variety of sources, organizing information, documenting sources, and presenting research in individual projects.	Pre-9	Composition
3.A.05c	24.5	Formulate open-ended research questions and apply steps for obtaining and evaluating information from a variety of sources, organizing information, documenting sources in a consistent and standard format, and presenting research.	9/10	Composition
3.A.06c	3.17	Deliver formal presentations for particular audiences using clear enunciation and appropriate organization, gestures, tone, and vocabulary.	11/12	Language
3.A.07c	4.27	Use general dictionaries, specialized dictionaries, thesauruses, histories of language, books of quotations, and other related references as needed.	11/12	Language
3.A.08c	19.27	For informational/expository writing: Write well-organized research papers that prove a thesis statement using logical organization, effective supporting evidence, and variety in sentence structure.	11/12	Composition
3.A.09c	24.6	Formulate original, open-ended questions to explore a topic of interest, design and carry out research, and evaluate the quality of the research paper in terms of the adequacy of its questions, materials, approach, and documentation of sources.	11/12	Composition

3.A.10c		Read technical manuals, guides, resource books and technical literature to gain information and solve problems (Operator's manual, service manuals and databases etc.).		Voc
3.A.11c		Read, comprehend, and follow written technical directions for repairs, procedures and processes.		Voc

### 3.B Mathematics

VTE #	Acad #	Standard	Grade	Topic
3.B.01c	7.M.2	Given the formulas, convert from one system of measurement to another. Use technology as appropriate.	Pre-9	Measurement
3.B.02c	7.P.4	Solve linear equations using tables, graphs, models, and algebraic methods.	Pre-9	Patterns, relations, algebra
3.B.03c	7.P.6	Use linear equations to model and analyze problems involving proportional relationships. Use technology as appropriate.	Pre-9	Patterns, relations, algebra
3.B.04c	8.M.2	Given the formulas, convert from one system of measurement to another. Use technology as appropriate.	Pre-9	Measurement
3.B.05c	8.N.1	Compare, order, estimate, and translate among integers, fractions and mixed numbers (i.e., rational numbers), decimals, and percents.	Pre-9	Numbers
3.B.06c	10.D.1	Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table, stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.	9/10	Data Analysis, Probability and Statistics
3.B.07c	10.M.4	Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements.	9/10	Measurement

3.B.08c	10.P.8	Solve everyday problems that can be modeled using systems of linear equations or inequalities. Apply algebraic and graphical methods to the solution. Use technology when appropriate. Include mixture, rate, and work problems.	9/10	Patterns, relations, algebra
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### 3.C Science and Engineering/Technology

VTE #	Acad #	Standard	Grade	Topic
3.C.01c	2	Recognize that all organisms are composed of cells, and that many organisms are single-celled (unicellular), e.g., bacteria, yeast. In these single-celled organisms, one cell must carry out all of the basic functions of life.	Pre-9	Life Science
3.C.02c	3	Compare and contrast plant and animal cells, including major organelles (cell membrane, cell wall, nucleus, cytoplasm, chloroplasts, mitochondria, vacuoles).	Pre-9	Life Science
3.C.03c	4	Recognize that within cells, many of the basic functions of organisms (e.g., extracting energy from food and getting rid of waste) are carried out. The way in which cells function is similar in all living organisms.	Pre-9	Life Science
3.C.04c	10	Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.	Pre-9	Life Science
3.C.05c	2.3	Distinguish between plant and animal cells.		Biology
3.C.06c	2.4	Describe how cells function in a narrow range of physical conditions, such as temperature and pH, to perform life functions that help to maintain homeostasis.		Biology
3.C.07c	2.7	Provide evidence that the organic compounds produced by plants are the primary source of energy and nutrients for most living things.		Biology
3.C.08c	1.1	Identify the earth's principal sources of internal and external energy, e.g., radioactive decay, gravity, solar energy.		Earth Science
3.C.09c	1.1	Identify and explain the steps of the engineering design process, i.e., identify the problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.		Eng/Tech

3.C.10c	1.5	Interpret plans, diagrams, and working drawings in the construction of a prototype.		Eng/Tech
3.C.11c	3.1	Differentiate between open (e.g., irrigation, forced hot air system) and closed (e.g., forced hot water system, hydroponics) fluid systems and their components such as valves, controlling devices, and metering devices.		Eng/Tech
3.C.12c	3.3	Explain the relationship among temperature change in a substance for a given amount of heat transferred, the amount (mass) of the substance, and the specific heat of the substance.		Eng/Tech
3.C.13c	4.2	Give examples of how conduction, convection, and radiation are used in the selection of materials, e.g., home and vehicle thermostat designs, circuit breakers.		Eng/Tech
3.C.14c	4.3	Identify the differences between open and closed thermal systems, e.g., humidity control systems, heating systems, cooling systems.		Eng/Tech
3.C.15c	4.4	Explain how environmental conditions influence heating and cooling of buildings and automobiles.		Eng/Tech
3.C.16c	4.5	Identify and explain the tools, controls, and properties of materials used in a thermal system, e.g., thermostats, R Values, thermal conductivity, temperature sensors.		Eng/Tech
3.C.17c	5.3	Explain the relationship between resistance, voltage, and current (Ohm's Law).		Eng/Tech
3.C.18c	2.4	Describe the relationship among energy, work, and power both conceptually and quantitatively.		Physics
3.C.19c	2.6	Identify appropriate standard international units of measurement for energy, work, power, and momentum.		Physics
3.C.20c	5.4	Develop a qualitative and quantitative understanding of current, voltage, resistance, and the connection between them.		Physics
3.C.21c	5.5	Identify appropriate units of measurement for current, voltage, and resistance, and explain how they are measured.		Physics
3.C.22	1.1	Explain the significance of carbon in organic molecules.		Biology
3.C.23	1.2	Recognize the six most common elements in organic molecules (C, H, N, O, P, S).		Biology

3.C.24	1.3	Describe the composition and functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids).		Biology
3.C.25	1.5	Explain the role of enzymes in biochemical reactions.		Biology
3.C.26	1.5	Explain the role of enzymes in biochemical reactions.		Biology
3.C.27	2.1	Relate cell parts/organelles to their functions.		Biology
3.C.28	2.1	Describe and compare the processes of mitosis and meiosis, and their role in the cell cycle.		Biology
3.C.29	2.2	Differentiate between prokaryotic cells and eukaryotic cells, in terms of their general structures and degrees of complexity.		Biology
3.C.30	2.3	Distinguish between plant and animal cells.		Biology
3.C.31	2.4	Describe how cells function in a narrow range of physical conditions, such as temperature and pH, to perform life functions that help to maintain homeostasis.		Biology
3.C.32	3.1	Describe the structure and function of DNA, and distinguish among replication, transcription, and translation.		Biology
3.C.33	3.2	Describe the processes of replication, transcription, and translation and how they relate to each other in molecular biology.		Biology
3.C.34	3.5	Differentiate between dominant, recessive, co-dominant, polygenic, and sex-linked traits.		Biology
3.C.35	3.6	State Mendel's laws of segregation and independent assortment.		Biology
3.C.36	3.7	Use a Punnett Square to determine the genotype and phenotype of monohybrid crosses.		Biology
3.C.37	3.7	Use a Punnett Square to determine the genotype and phenotype of monohybrid crosses.		Biology
3.C.38	3.9	Recognize that while viruses lack cellular structure, they have the genetic material to invade living cells.		Biology
3.C.39	1.1	Identify and explain some of the physical properties that are used to classify matter, e.g., density, melting point, and boiling point.		Chemistry
3.C.40	1.2	Explain the difference between mixtures and pure substances.		Chemistry

3.C.41	1.3	Describe the four states of matter (solid, liquid, gas, plasma) in terms of energy, particle motion, and phase transitions.		Chemistry
3.C.42	1.4	Distinguish between chemical and physical changes.		Chemistry
3.C.43	2.3	Identify the major components of the nuclear atom (protons, neutrons, and electrons) and explain how they interact.		Chemistry

## **Strand 4: Employability Knowledge and Skills**

### **4.A Develop employability skills to secure and keep employment in chosen field.**

- 4.A.01a Evaluate industries, organizations, and careers based on multiple sources of research and information.
- 4.A.02a Assess interest areas to determine potential career pathways, including career ladders.
- 4.A.03a Develop a career plan with alternatives.
- 4.A.04a Complete job applications and related employment documents (e.g. W-4).
- 4.A.05a Create professional cover letters, resumes, and portfolios in a variety of formats (print and electronic).
- 4.A.06a Apply job search skills to seek, evaluate, apply for, and accept employment.
- 4.A.07a Demonstrate good interviewing skills.
- 4.A.08a Demonstrate employability skills needed to get and keep a job.
- 4.A.09a Assess alternative occupational choices (e.g. working conditions, benefits, and opportunities to change).

#### **Performance Examples:**

1. Research positions open within a variety of companies and compare/contrast their descriptions, duties, and expectations.
2. Prepare responses to standard interview questions.
3. Participate in a mock-interview with industry professionals.

### **4.B Communicate in multiple modes to address needs within the career and technical field.**

- 4.B.01a Apply strategies to enhance effectiveness of all types of communications in the workplace.
- 4.B.02a Apply reading skills and strategies to work-related documents.
- 4.B.03a Locate information from books, journals, magazines, and the Internet.
- 4.B.04a Apply basic writing skills to work-related communication.
- 4.B.05a Write work-related materials.
- 4.B.06a Explain information presented graphically.
- 4.B.07a Use writing/publishing/presentation applications.
- 4.B.08a Apply basic skills for work-related oral communication.
- 4.B.09a Explain proper telephone etiquette and skills.
- 4.B.10a Lead formal and informal group discussions.
- 4.B.11a Demonstrate effective negotiation and conflict management.
- 4.B.12a Apply active listening skills to obtain and clarify information.
- 4.B.13a Communicate with others in a diverse workforce.

#### **Performance Examples:**

1. Review a professional journal; choose one article to summarize.
2. Call the publisher for free products in journal.
3. Develop an oral presentation regarding an article in a journal.
4. Summarize trends presented in a graph.

**4.C Solve problems using critical thinking.**

- 4.C.01a Demonstrate skills used to define and analyze a given problem.
- 4.C.02a Explain the importance and dynamics of individual and teamwork approaches of problem solving.
- 4.C.03a Describe methods of researching and validating reliable information relevant to the problem.
- 4.C.04a Explain strategies used to formulate ideas, proposals and solutions to problems.
- 4.C.05a Select potential solutions based on reasoned criteria.
- 4.C.06a Implement and evaluate solution(s).

**4.D Demonstrate positive work behaviors.**

- 4.D.01a Identify time management and task prioritization skills.
- 4.D.02a Explain the importance of following workplace etiquette/protocol.
- 4.D.03a Demonstrate willingness to learn and further develop skills.
- 4.D.04a Demonstrate self-management skills.
- 4.D.05a List causes of stress and effective stress management techniques.
- 4.D.06a Describe the importance of having a positive attitude and techniques that boost morale.
- 4.D.07a Show initiative by coming up with unique solutions and taking on extra responsibilities.
- 4.D.08a Explain the importance of setting goals and demonstrate the ability to set, reach, and evaluate goals.
- 4.D.09a Explain the importance of taking pride in work accomplished and extrinsic and intrinsic motivators that can be used to increase pride.
- 4.D.10a Value the importance of professionalism, including reliability, honesty, responsibility, and ethics.
- 4.D.11a Demonstrate a respect for diversity and its benefit to the workplace.
- 4.D.12c Meet company attendance punctuality expectations.
- 4.D.13c Demonstrate effective negotiation skills.
- 4.D.14c Demonstrate conflict management with management/co-workers/others.
- 4.D.15c List the characteristics of a rational / responsible employee.

**4.E Identify the standards and qualifications that must be met to pursue careers in Agriculture and Natural Resources.**

- 4.E.01c Explain what types of skills or knowledge are necessary to work in a specific field of study.
- 4.E.02c Describe what type of degree or certification is required to enter a desired job/career.

**Performance Example:**

1. Student describes a career path progression including educational training, necessary work experience, and knowledge attainment to pursue careers within the Agriculture and Natural Resources Cluster, including the major career areas and examples of post-secondary opportunities.

## **Strand 5: Management and Entrepreneurship Knowledge and Skills**

### **5.A Analyze basic business practices required to start and run a company/organization.**

- 5.A.01a Define entrepreneurship .
- 5.A.02a Describe the relationship between suppliers, producers, and consumers.
- 5.A.03a Compare and contrast types of businesses, including sole proprietorships, small businesses, companies, corporations, governmental agencies, and non-profit organizations.
- 5.A.04a Describe practices that ensure quality customer service.
- 5.A.05a Explain the value of competition in business/field.

#### **Performance Examples:**

1. Prepare a business plan for a new company in your community.
2. Participate in a discussion with members of a local small-business incubator or chamber of commerce, identifying opportunities and summarizing best practices of new companies.
3. Create an equipment list, with costs, of equipment required for doing specific tasks.
4. Identify local zoning and environmental laws that apply to businesses in your industry.

### **5.B Manage all resources related to a business/organization.**

- 5.B.01a Identify a company's/organization's chain of command and organizational structure.
- 5.B.02a Define and demonstrate leadership and teamwork skills.
- 5.B.03a Explain ways a company or organization can market itself, including choosing a name, designing logos and promotional materials, advertising, and the importance of word-of-mouth.
- 5.B.04a Identify methods to track inventory, productivity, income, expenses, and personnel .
- 5.B.05a Explain the importance of written operating procedures and policies.
- 5.B.06a Identify professional organizations and their benefits.
- 5.B.07a Explain methods to effectively run a meeting.

#### **Performance Examples:**

1. Create a plan to keep track of tools and supplies in your classroom/shop.
2. Work as a team to complete a project, including running and participating in problem-solving meetings.
3. Contact a relevant professional organization and request information about its benefits, membership requirements, and costs.
4. Clip print advertisements from local companies, identifying common themes and contrasting different styles.

### **5.C Describe methods for managing, organizing, retrieving and reporting financial data.**

- 5.C.01a Explain the role of small businesses in the economy.

- 5.C.02a Extract and extrapolate data from financial documents, such as a pay-stub, budget, tax statement, and financial report.

**Performance Examples:**

1. Create and follow a budget for an in-class project.
2. Identify equipment in your shop/lab that are considered as capital.
3. From a pay-stub, determine gross salary, deductions, and net pay for a calendar year.
4. Create a rate card or other list of standardized costs for services provided, based on research of local rates and practices.

**5.D Apply labor and civil rights law and guidelines to business practice and decisions.**

- 5.D.01a List federal and state mandated employee rights.
- 5.D.02a Describe proper working conditions for your industry.
- 5.D.03a Explain the role of labor organizations.
- 5.D.04a Discuss the importance of diversity and list methods of encouraging diversity in the workplace.
- 5.D.05a Describe standard forms of employment contracts applicable to your industry.
- 5.D.06a State the current minimum wage, as well as wages for common jobs found within the field.
- 5.D.07a List opportunities for continual professional development.

**Performance Examples:**

1. Participate in and summarize a discussion with a member of a labor organization.
2. Participate in and summarize a discussion with a member of a civil rights organization.
3. While participating in a group project, write and follow job descriptions for each member of the team.
4. Evaluate a shop/lab in terms of safety, ergonomics, and workflow.

**5.E Evaluate the effects of community relations on companies and the industry.**

- 5.E.01a Describe the role that the industry/organization plays in different communities.
- 5.E.02a Describe the role that community interests play in a company's/organization's decision-making process.

**Performance Example:**

1. Participate in a service project or community-centered event.

**5.F Apply legal requirements and ethical considerations to business practice and decisions.**

- 5.F.01a Identify laws that regulate businesses/organizations in your field.
- 5.F.02a Define the requirements for and protections given by copyright and trademark law.
- 5.F.03a Define the impact of the Americans with Disabilities Act and other civil rights legislation on your business/organization, employees, and customers.

- 5.F.04a Define ethical business practices for your field.
- 5.F.05a Identify trade-specific practices that support clean energy technologies and encourage environmental sustainability.

**Performance Examples:**

1. Research the ethical guidelines set forth by a professional organization related to your industry and participate in a debate over how to apply these guidelines to a variety of situations.
2. Create a portfolio of a variety of completed contracts and their uses.
3. Participate in and summarize a discussion with a lawyer, consumer advocate, or other legal professional.
4. Create a quick reference outline listing legal topics and related resources.

**5.G Demonstrate knowledge of ethical and legal issues as they related to the stewardship of natural resources.**

- 5.G.01c Explain how personal responsibility and choices are related to natural resource sustainability.
- 5.G.02c Explain how personal workplace actions can affect the resource.
- 5.G.03c Identify sources for regulatory information.

**Performance Example:**

1. Describe examples of environmental impact by agricultural endeavors and the responsibility we have to minimize the impact. Include some of the methods we have at our disposal to sustain our resources.

## **Strand 6: Technological Knowledge and Skills**

### **6.A Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.**

- 6.A.01a Select and utilize the appropriate technology to solve a problem or complete a task.
- 6.A.02a Demonstrate file management skills (e.g., install new software, compress and expand files as needed, download files as appropriate).
- 6.A.03a Differentiate between different operating systems and demonstrate use of at least one to open and switch between programs and files.
- 6.A.04a Identify and demonstrate resolutions to simple hardware and software problems as they occur (e.g., frozen screen, disk error, printing problems).
- 6.A.05a Save, retrieve, load, format, and import data into, and export a variety of electronic documents (word processing, spreadsheet, database, AND desktop publishing).
- 6.A.06a Demonstrate the proper use of a variety of external peripherals and how they connect to a computer.
- 6.A.07a Illustrate methods of selecting and using search engines.
- 6.A.08a Send, receive, and manage electronic correspondence and files, in accordance with school policy.
- 6.A.09a Demonstrate proper use of electronic proofreading tools and explain reasons why these shouldn't be relied upon solely.
- 6.A.10c Perform efficient keyboarding techniques.
- 6.A.11c Demonstrate the use of formulas in a spreadsheet application.

#### **Performance Example:**

1. In the development of work-based projects, students demonstrate computer skills inherent in the word processing techniques used, the organization of data, use of photographic representation, research projects, and other relevant project based activities.

### **6.B Demonstrate responsible use of technology and an understanding of ethics and safety issues in using electronic media.**

- 6.B.01a Identify ways in which technology is used in the workplace and in society.
- 6.B.02a Summarize the rights and responsibilities of the school's Acceptable Use Policy.
- 6.B.03a Explain laws restricting use of copyrighted materials on the Internet.
- 6.B.04a Discuss the concerns about electronic communications, privacy and security, including protection from spyware and viruses.

#### **Performance Example:**

1. Describe how computers are used to increase efficiency, accuracy, and professionalism in the industry.

### **6.C Demonstrate ability to use technology for research, problem solving, and communication.**

- 6.C.01a Locate, evaluate, collect, and process information from a variety of electronic sources.

- 6.C.02a Demonstrate the use of telecommunications and other media to interact or collaborate with peers, experts, and other audiences.
- 6.C.03a Demonstrate the use of appropriate electronic sources to conduct research (e.g., Web sites, online periodical databases, and online catalogs).
- 6.C.04a Demonstrate proper style (with correct citations) when integrating electronic research results into a research project.
- 6.C.05a Collect, organize, analyze, and graphically present data using the most appropriate tools.
- 6.C.06a Present information, ideas, and results of work using any of a variety of communications technologies (e.g., multimedia presentations, Web pages, videotapes, desktop-published documents).
- 6.C.07a Identify capabilities of technology resources and describe how they can be used for lifelong learning.
- 6.C.08a Demonstrate the proper use of electronic tools and office communications equipment (telephone, fax, copier, etc.).

**Performance Example:**

1. Student is able to effectively use various technologies in the workplace.