

Aquaculture

Exam Information	Description
Exam number 118 Items 38 National Career Cluster Agriculture, Food & Natural Resources Certification available Yes	The Aquaculture industry certification exam assesses learners' knowledge of the scientific method in the context of raising and breeding fish, including: fish ecology, anatomy and physiology, water quality, aquaponics, and commercial and recreational management operations. Learners are also tested on educational preparation and career opportunities in aquaculture.

Exam Blueprint and Performance Skills

Standard	Percentage of exam score
1. The Role Of Candidate Organizations (Optional)	0%
2. SAE In Agricultural Education	9%
3. Scientific Method	11%
4. History Of Aquaculture	11%
5. Living Organisms And Their Environment	12%
6. Nutrition And Growth Of Aquatic Animals	11%
7. Fish Anatomy And Physiology Concepts	24%
8. Health And Well-being Of Aquatic Animals	11%
9. Fish And Plants In Aquaponics	11%

*Includes performance skill evaluation

Standard 1 - The Role Of Candidate Organizations (Optional)

Candidates will explain the role of candidate organizations in agricultural education.

Objective 1 Discuss the history and organization of candidate organizations as they relate to the complete program of agricultural education.

1. Explain the interrelationship of classroom and laboratory instruction, supervised agricultural experience, and candidate organizations.
2. Describe how, when, and why candidate organizations were organized.
3. Identify key historical events within candidate organizations.
4. Identify the mission and strategies, colors, motto, emblem and parts of the emblem, and organizational structure of candidate organizations.
5. Recite and explain the meaning of candidate organizations' creed.
6. Discuss the meaning and purpose of a program of activities and its committee structure.
7. List candidate organizations' officers and discuss the role of each.

Objective 2 Identify opportunities in candidate organizations.

1. Describe candidate organizations' opportunities that develop leadership skills, personal growth, and career success.
2. Summarize major state and national activities available to candidate organizations' members.

Objective 3 Describe candidate organizations' degrees, awards, and career development events CDEs.

1. List and explain candidate organizations' degree areas.
2. Identify candidate organizations' proficiency awards.
3. List and discuss various team and individual CDEs.

Optional: Standard performance evaluations on the final page of this document

Standard 2 - SAE In Agricultural Education

Candidates will explain the role of supervised agricultural experience (SAE) programs in agricultural education.

Objective 1 Examine the responsibilities and benefits associated with an SAE.

1. Explain the meaning and benefits of an SAE.
2. Explain the characteristics of an effective SAE program and the responsibilities of those involved.

Objective 2 Determine the types of SAE programs.

1. Compare entrepreneurship SAEs and placement SAEs.
2. Describe research/experimentation SAEs.
3. Describe exploratory SAEs.

Objective 3 Plan an SAE program

1. Identify the steps in planning an SAE program.
2. Describe the function of a business/training plan and/or agreement in an SAE program.
3. Develop a short-range plan and a long-range plan for an SAE program.
4. Relate classroom and laboratory instruction to an SAE program.

Objective 4 Maintain and use SAE records.

1. Explain the importance of keeping records on an SAE program.
2. Explain how SAE records are organized.
3. Follow approved procedures to make entries in SAE records.

Optional: Standard performance evaluations on the final page of this document

Standard 3 - Scientific Method

Candidates will outline the steps of the scientific method.

Objective 1 Identify experimental design components.

1. Identify a problem.
2. Formulate a question and hypothesis.
3. Design and conduct a controlled experiment.
4. Collect/document and analyze data.
5. Draw conclusions based on the experimental data.

Objective 2 Explore various examples of scientific work.

1. Identify individual steps of the scientific method within real-world examples.
2. Summarize how scientific knowledge is gained.

Optional: Standard performance evaluations on the final page of this document

Standard 4 - History Of Aquaculture

Candidates will explain the history, importance, and scope of aquaculture.

Objective 1 Discuss the history of aquaculture.

1. Discuss how the history of aquaculture helped develop civilization.
2. Identify major innovations and milestones in the advancement of aquaculture.

Objective 2 Discuss the importance of aquaculture with respect to economic development.

1. Correlate aquaculture with the characteristics of geography, temperature, oxygen levels, culture, and climate.
2. Identify various uses of aquaculture (e.g., food, medicine).
3. Identify and describe major areas or types of aquaculture, (e.g., marine, invertebrate and fresh water).
4. Identify and describe major types of aquaculture systems, (e.g., open, semiopen and closed systems).

Objective 3 Interpret trends in the aquaculture industry.

1. Identify trends in the aquaculture industry.
2. Determine the implications of trends on aquaculture production.

Objective 4 Determine career opportunities in the aquaculture industry.

1. Identify the nature of career opportunities in the aquaculture industry.
2. Develop a career plan to acquire needed education and skills for entering a career in the aquaculture industry.
3. Demonstrate personal and job skills for success in entering and advancing in a career in the aquaculture industry.

Optional: Standard performance evaluations on the final page of this document

Standard 5 - Living Organisms And Their Environment

Origins of Law-Candidates will analyze the relationship between ethics and the law and explain the origin of today's law.

Objective 1 Summarize how energy flows through an aquatic ecosystem.

1. Identify the trophic levels of an energy pyramid.
2. Arrange components of a food chain according to energy flow.
3. Compare the quantity of energy at each level of an energy pyramid.

Objective 2 Explain relationships between matter cycles and organisms.

1. Use diagrams to trace the movement of matter through a cycle (i.e., carbon, oxygen, nitrogen, water) in the context of aquatic ecosystems.
2. Evaluate the impact of personal choices (e.g., human impact on greenhouse gases, oil spills) in relation to the cycling of matter within an aquatic ecosystem.

Objective 3 Describe how interactions among organisms and their environment help shape ecosystems.

1. Categorize relationships among living things according to predator-prey, competition, and symbiosis.
2. Investigate an aquatic ecosystem using methods of science to gather quantitative and qualitative data that describe the ecosystem in detail.

Optional: Standard performance evaluations on the final page of this document

Standard 6 - Nutrition And Growth Of Aquatic Animals

Candidates will apply principles of nutrition to ensure the proper growth, development, reproduction, and economic production of aquatic animals.

Objective 1 Compare and contrast the digestive systems of aquatic animals.

1. Describe the structure and function of the herbivore digestive system.
2. Describe the structure and function of the carnivore digestive systems.
3. Describe the structure and function of invertebrate digestive systems.

Objective 2 Explain the role of nutrition in aquatic animal productivity.

1. List essential nutrients, (protein, vitamins, minerals, fiber, and fat) and describe the importance of each.
2. Compare and contrast common feedstuffs, including the source of the feed, in the diets of various aquatic animals. (i.e. clams, crustaceans, fish, amphibians)
3. Discuss the meaning and use of feed additives.

Objective 3 Provide appropriate nutrition for aquatic animals.

1. Using the Pearson Square, calculate balanced rations for aquatic animals.

Optional: Standard performance evaluations on the final page of this document.

Standard 7 - Fish Anatomy and Physiology Concepts

Candidates will describe fish anatomy and physiology concepts.

Objective 1 Explain fish classification.

1. Explain the classification scheme currently used in biology.
2. Discuss the concept of binomial nomenclature.
3. Compare and contrast the hierarchical classification of various fish species (trout, bass, catfish, and carp) to the “family” level.

Objective 2 Describe the anatomical features of various fish species and their functions.

1. Outline major fish body systems with their respective functions.
2. Identify major external and internal fish organs with their respective functions.
3. Compare and contrast various modes of fish reproduction.
4. Identify the four orientation planes on a fish: dorsal, ventral, anterior and posterior.

Objective 3 Describe the life cycle of a fish.

1. Determine the correct sequence of the life cycle of a fish.
2. Determine the physiological difference at each stage of the life cycle: egg, sac fry, fry, fingerling, juvenile, adult.

Optional: Standard performance evaluations on the final page of this document

Standard 8 - Health and Well-Being Of Aquatic Animals

Candidates will be able to recognize and manage the health and well-being of aquatic animals.

Objective 1 Summarize the role of animal well-being in the animal industry.

1. Explain the meaning and importance of animal well-being.
2. Utilize safe practices in working with animals.
3. Relate concepts of animal welfare and animal rights to animal well-being.

Objective 2 Apply animal anatomy and physiology to maintain aquatic animal health.

1. Discuss common diseases, parasites, and physiological disorders of aquatic animals. (e.g., Fungal – cotton wool, egg fungus; Bacterial – fin rot, dropsy; Viral – herpes, pox; Parasitic – Ick, Anchor worm.)
2. Design and implement an aquatic animal health plan to promote efficiency of production.

Objective 3 Provide for the health and well-being of agricultural animals.

1. Prescribe and implement prevention and treatment for animal diseases, parasites, and other disorders.
2. Perform simple health checks on animals.
3. Diagnose species-specific illnesses and disorders based on symptoms and problems caused by diseases, parasites, and physiological disorders.

Optional: Standard performance evaluations on the final page of this document

Standard 9 - Fish And Plants In Aquaponics

Candidates will explain the inter-relatedness of fish and plants in the context of aquaponics.

Objective 1 Describe aquaponic techniques.

1. Outline the ecological inter-relatedness of fish and plants.
2. Explore types of aquaponic systems (e.g., gravel bed/media based, nutrient film technique, deep water culture-DWC).
3. Hypothesize how altering the autotroph-to-heterotroph ratio would influence an aquatic ecosystem.
4. Explore economic factors regarding various aquaponic systems (i.e., scale-up, commercial, hydroponic types).
5. Investigate the rate at which photosynthesis occurs in an aquatic ecosystem by altering one factor, e.g. light, temperature, and nutrient levels.

Objective 2 Relate water monitoring to aquaculture

1. Understand the importance of the following water quality parameters: pH, ammonia, nitrates, dissolved oxygen, chlorine, and turbidity.
2. Determine and document pH, ammonia, nitrate, and nitrite levels in a fish tank over time.
3. Demonstrate basic methods used to adjust basic water parameters i.e. water change, pH adjustment, de-chlorination, and oxygenation.

Performance Skills Evaluation

Exam name: Aquaculture

Candidate Name: _____

Performance assessments may be completed and evaluated any time before the certification is issued. The following performance skills can be used in connection with the associated standards and exam. The evaluator will function as the subject matter expert to determine if the candidate meets the skills requirements with a Yes/No for passing.

Standard 1 – The Role of Candidate Organizations Candidates will be able to recite and explain the meaning of a candidate organization creed.	Pass:
Standard 2 – SAE in Agricultural Education Candidates will develop a plan for a successful SAE.	Pass:
Standard 3 – Scientific Method Candidates will be able to design and conduct a controlled experiment that investigates an aquatic ecosystem using methods of science to gather quantitative and qualitative data.	Pass:
Standard 6 – Nutrition and Growth of Aquatic Animals Candidates will be able to correctly use the Pearson Square to determine optimal feed rations for their animals bearing in mind such factors as species, age, and condition, and implement their findings in the feeding of their animals	Pass:
Standard 8 – Health and Well-being of Aquatic Animals Candidates will be able to optimize their animals' health by designing and implementing an animal health plan.	Pass:
Standard 9 – Fish and Plants in Aquaponics Candidates will be able to determine, document, and make appropriate corrective adjustments to various water parameters such as pH, and ammonia, nitrate, nitrite, and oxygen levels.	

Evaluator Name: _____

Date: _____