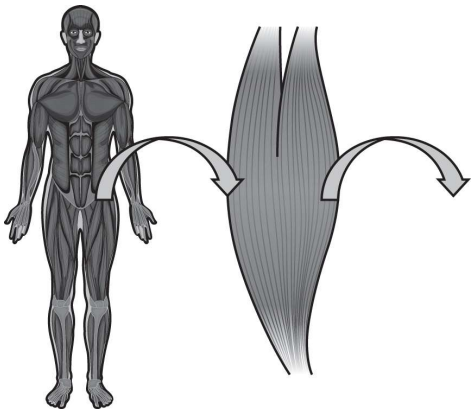
Unit Test: Living Systems

Read each question. Circle the letter of the correct answer.

1. The diagram shows a model of the hierarchical organization of the muscular system.



Which of these best explains the next level of organization in this model?

A. muscle cells, because they contain protein

B. mitochondria, because they produce energy for movement

C. muscle cells, because they are the smallest living unit in the body

D. mitochondria, because they are smaller than cells and have membranes

2. Scientists are developing a new class of vaccines, known as nanovaccines, that can be stored at room temperature for six to ten months. A study found evidence that nanovaccines boost the immune response in mice. The scientists reported their initial findings to other scientists. What is the most logical next step in the nanovaccine development process?

A. determine the best way to ship large quantities of the vaccine

B. replicate the nanovaccine results in further animal studies

C. collect data on the impact of vaccines in the developing world

D. produce larger quantities of vaccine for distribution by medical professionals

3. In the trachea there is a layer of epithelial cells called the respiratory mucosa, which contains specialized cells that produce mucus. These specialized cells are called goblet cells and the function of the mucus is to keep the trachea moist. What is this an example of?

A. Cells working together to maintain homeostasis.

B. Cells working together to produce energy for the body.

C. Organs working together to maintain homeostasis.

D. Organs working together to produce energy for the body.

4. Engineers are working to develop a new kind of artificial knee, which is used to replace damaged knees. Which of these would be considered a trade off of the artificial knee?

A. The artificial knee reduces pain in people who have the knee.

B. The artificial knee functions better than the knee that it replaces.

C. The new artificial knee is heavier than previous artificial knees to improve its lifespan.

D. The artificial knee is more resistant to wear and tear than other artificial knees.

5. Most starfish turn their cardiac stomach inside out to eat captured prey. The cardiac stomach digests the food outside of the body and, when complete, returns to the inside of the body. Which term applies to the cardiac stomach?

A. cell

B. organ

C. system

D. tissue

6. An engineer is developing a new prosthetic leg to help patients who have lost limbs to walk. The engineer is focused on making the best device possible to address this medical need. The current device design will cost $10,000 to manufacture, but the cost of the item cannot exceed $8,000. How should the engineer approach this problem using the engineering design process?

A. The engineer should change the cost constraint.

B. The engineer should move forward in the design process even though the design does not meet the constraints of the problem.

C. The engineer should trade off some of the safety and reliability of the design to reduce costs and meet the cost constraint for the project.

D. The engineer should reconsider the materials, location of manufacture, and any elements of the design that can be simplified to reduce cost.

7. A biologist discovers a new species of plant that grows in very wet climates. She hypothesizes that this species would not be able to regulate the size of its stoma (the pores in the leaf of the plant that allow gas exchange) when there are changes in water availability. Which experiment can she perform to best test this hypothesis?

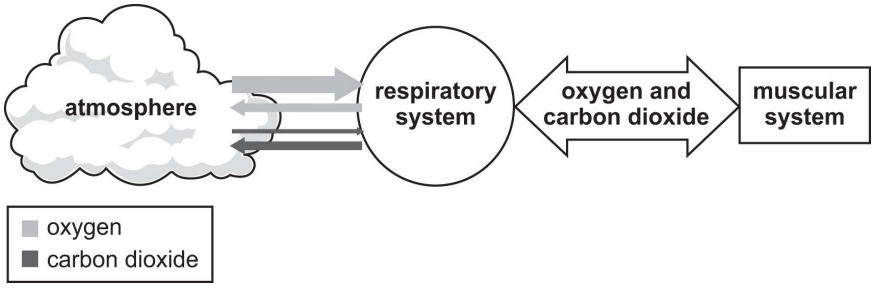
A. She waters different plants with different volumes of water and measures the diameter of stoma in each leaf.

B. She trims a different amount of roots from each plant and measures the amount of glucose produced by each plant.

C. She grows the plant in greenhouses with various levels of humidity and measures the amount of oxygen produced by each plant.

D. She places leaves from the plant in solutions containing different amounts of salt and measures the time it takes the leaves to dry out.

8. This model shows some of the inputs and outputs for the respiratory and circulatory systems.



Which statement explains why the arrows between the atmosphere and the respiratory system are different sizes?

A. The atmosphere contains more carbon dioxide than oxygen.

B. The respiratory system uses more carbon dioxide than oxygen.

C. The muscular system uses oxygen and produces carbon dioxide.

D. The respiratory system moves gases from the atmosphere to the muscular system.

Read each question. Follow the instructions to answer the questions.

9. Students in Ms. Choi's class are using models to represent aspects of bacterial cells. Write one letter in the correct box to classify each type of model.

Simulation	Physical Model	Conceptual Model	Mathematical Model
C	D	B	A

Write one letter in each box to correctly complete the diagram.

A. Tom wrote an equation to represent bacterial growth and reproduction.

B. Charlotte made a flow chart to illustrate the process of ATP production in bacteria.

C. Stella ran a computer program to predict the effects of a change in the shape of a bacterium.

D. Karen created a three-dimensional model of a bacteria cell showing its major structural features.

10. Different parts of the cell system are responsible for different functions in the maintenance of homeostasis. Write the letter of each part of the cell with its function.

nucleus	C
ribosomes	A
mitochondria	B
cell membrane	D

A. produces cellular proteins

B. produces energy for cellular functions

C. stores genetic information for the cell

D. controls movement of materials in and out of the cell

11. Three options of water filtration are solar disinfection using recycled glass bottles, ceramic filtration using locally produced pots, and slow sand filtration using sand and a biolayer. The Pugh chart compares the filtration options. A positive number represents an advantage and a negative number represents a disadvantage.

Pugh Chart of Water Filtration Systems

Criteria	Solar disinfection	Ceramic filtration	Slow sand filtration
Cost to manufacture and transport	0	−1	−2
Ease of production	0	−1	−2
Cost of maintenance	0	−1	−2
Elimination of bacteria and protozoa	1	2	2
Elimination of viruses	1	0	0
Elimination of turbidity (cloudiness)	0	1	1
Rate of purification	−3	−1	−1

Write one letter in each blank to correctly complete the sentence.

Ceramic filtration would be best for communities that have _____ or _____, while solar disinfection would be best for communities with _____ or _____.

A. viral outbreaks	**C.** issues with bacteria
B. highly turbid water	**D.** few financial resources

12. Write an X in the correct box to the appropriate cell in the table to show whether the action increases or decreases the rate of gas exchange.

Actions	Gas Exchange Increases	Gas Exchange Decreases
A. The carbon dioxide content in the blood increases.	X	
B. The leaf openings on the underside of a leaf increase in size.	X	
C. A plant is moved from a room with a lot of sun to a room with no light.		X
D. The brainstem sends a message to the diaphragm to contract less frequently.		X

13. Cochlear implants are devices that are often implanted in patients who have trouble hearing. Circle the letter of the sentences that describe a risk of cochlear implants.

A. Signaling from the device can cause dizziness.

B. Implantation of the device can cause infections.

C. Patients can hear other people speaking more accurately.

D. Patients can better determine the direction that sound comes from.

E. Cochlear implants have become more affordable in the last few years.

14. The geosphere, hydrosphere, biosphere, and atmosphere all work together to support life on Earth. Arturo is examining soil to determine its components. Write the letters of each component in the correct box to classify the source of the component.

Atmosphere	Biosphere	Geosphere	Hydrosphere
D	A E	B	C

A. worm
B. minerals
C. moisture
D. air pockets
E. decaying wood

15. Which steps will reduce the amount of an input to photosynthesis? Circle the letters of all the correct answers.

A. cover half of the plant's stomata

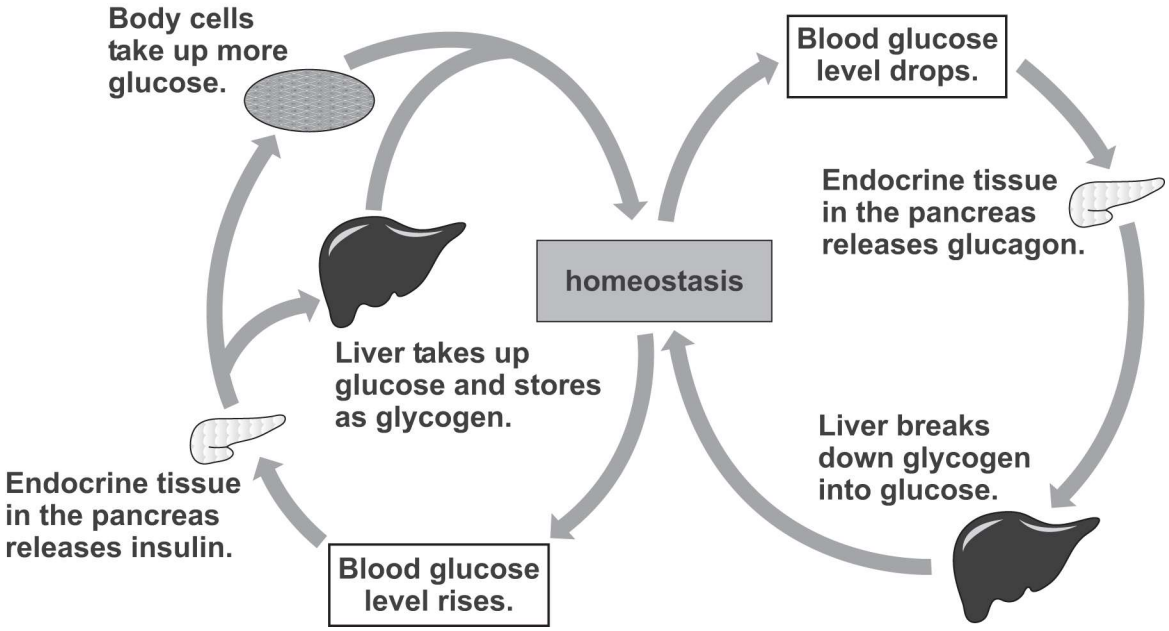
B. place the plant in a low-oxygen environment

C. increase the carbon dioxide levels of the plant

D. reduce the amount of sugar that the plant is receiving

E. reduce the amount of sunlight that is available to the plant

16. The amount of glucose in the bloodstream is regulated by the pathway shown in the diagram.



Write an X in the appropriate cell in the table to show whether each event would raise blood glucose, lower blood glucose, or would have no effect on blood glucose levels based on the diagram.

Event	Raises blood glucose	Lowers blood glucose	Neither raises nor lowers blood glucose
A. An individual eats a candy bar.	X		
B. Some body cells lose the ability to take up glucose.	X		
C. Tissue in the pancreas is unable to make glucagon.		X	
D. As a result of an injury, an individual loses 5% of his liver.			X

17. A student is making a model to show the levels of organization of life systems on Earth. Number the levels from smallest to largest with 1 as the smallest and 4 as the largest.

4 the regions of Earth populated by living organisms

3 the collection of populations living in a certain area

1 an individual animal, plant, or single-celled life form

2 organisms of the same species that live in the same area

a global distribution of organisms adapted to living in a particular environment

Read each statement. Write your answer on the lines.

18. Most individuals in need of a prosthetic limb in low income countries do not have access to one. Researchers studying these areas are looking at different options for prosthetic limbs. The information in the table shows some of the costs, benefits, and tradeoffs of prosthetic options available for patients in a developing country.

Prosthetic Options for Patients in Developing Country

Consideration	Type A	Type B	Type C
Cost	$$$	$	$$
Production	imported, but with local modifications needed	local, from recycled materials	local, using injection molding
Function	highest functionality	80–90% as functional as Type A	80–90% as functional as Type A
Lifespan	3–5 years	5–7 years	6–10 years

For each type of prosthetic limb, describe an advantage that using that type in the developing world has.

Describe a way in which one of the types of prosthetic limbs could be improved.

Describe a quality that is not in the table that could be a consideration when comparing types of prosthetic limbs, and explain why that should be considered.

19. The Ebola virus enters a human through the openings in the body or through the skin itself. Once inside, the virus attaches to a body cell and inserts genetic material into it. The genetic material of the virus then uses the machinery of the cell to make more virus particles. These are eventually released, killing the cell. The virus is not made of cells, but it has some components of cells such as proteins and genetic material.

Explain how the Ebola virus and human systems interact with each other in an individual who is sick with Ebola.

Generate an argument about whether or not viruses should be considered living or nonliving. Use at least two pieces of data to back up your claim.

20. A researcher is studying how pneumonia affects alveoli, small sacs in the lungs responsible for gas exchange.

Identify one level above and below alveoli, and list the levels of organization in humans.

If an individual has a pneumonia infection, explain how this would likely affect the functioning of the circulatory system.

The researcher is developing a model for the alveoli.

Describe a possible model that the researcher could use. Be sure to explain how the model could be used to represent both healthy alveoli and alveoli that have been infected with pneumonia.

21. A bioengineer has developed a new method to destroy cancers by reprogramming the T-cells of the immune system. Doctors harvest immune cells from the blood, grow them in the lab, reprogram them to attack cancer cells, and inject them back into the patient. The technique is expensive because it must be individually tailored to each patient. However, it can kill cancer cells that would otherwise escape treatment by conventional surgical, radiation, and chemotherapy techniques.

Besides cost and effectiveness of killing the cancer cells, identify one additional criterion that a scientist can use to evaluate this new technology.

_____

_____

Explain why the criterion is important.

_____

_____

Describe an experiment that scientists can use to test whether the technology meets this criterion.

_____

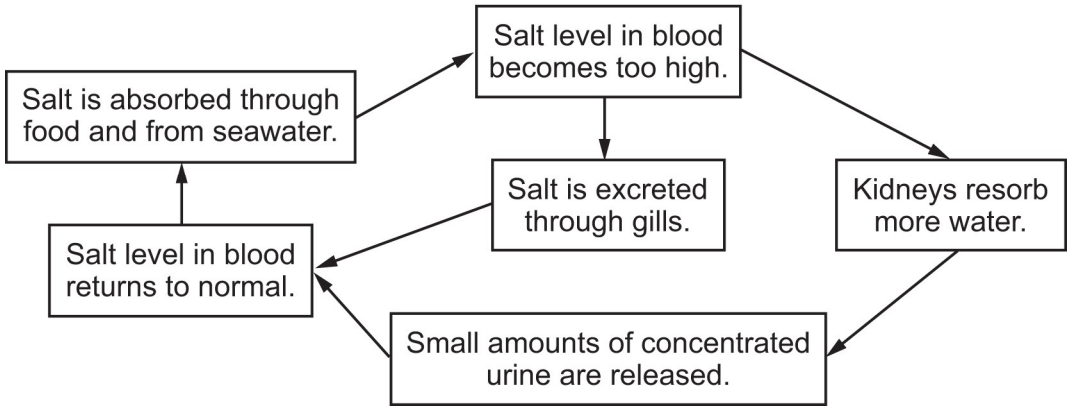
_____

Directions: Read the passage, then answer the questions that follow.

Homeostasis in Fish

A scientist is studying the ways in which fish maintain an appropriate level of salt in their blood. She made this diagram to represent how fish that live in salt water maintain a correct salt level.

Osmoregulation in Marine Fish



22. Some fish can live in both salt water and fresh water. Based on the information in the passage, which of these would be expected of a fish that moves from fresh water to salt water? Circle the letter of the correct answer.

A. It would produce larger amounts of more dilute urine.

B. It would produce smaller amounts of more dilute urine.

C. It would produce larger amounts of more concentrated urine.

D. It would produce smaller amounts of more concentrated urine.

23. If osmoregulation fails in a fish, the fish will have difficulty maintaining homeostasis. For each disruption in homeostasis, write one letter in the correct box to indicate whether it would be more likely to be the result of an osmoregulation failure in freshwater or saltwater fish.

Disruption	Freshwater fish	Saltwater fish
A. excess amounts of salt excreted by kidney		
B. excess amounts of water excreted by kidney		
C. excess amounts of salt retained by cells in the fish		
D. excess amounts of water retained by cells in the fish		

24. One type of fish that the scientist is studying is able to actively uptake salt through its gills. How would this ability aid a fish to maintain homeostasis? Circle the letter of the correct answer.

A. It would help prevent a fish in salt water from having too much salt in its blood.

B. It would help prevent a fish in salt water from having not enough salt in its blood.

C. It would help prevent a fish in fresh water from having too much salt in its blood.

D. It would help prevent a fish in fresh water from having not enough salt in its blood.

25. A scientist is trying to conduct an investigation into the ability of other aquatic organisms to determine their ability to maintain homeostasis under conditions of changing salinity. She is going to examine a jellyfish, which is normally found in the ocean.

Describe an experiment that the scientist could conduct to determine whether jellyfish can maintain constant salt levels in their cells under different external conditions. Include in your description the variables that the scientist should measure.

Explain how the scientist can tell whether the jellyfish can maintain homeostasis by looking at the data.

Explain how not being able to maintain homeostasis under changing salt conditions could be harmful to the jellyfish.