

Student Name:



Benchmark  
Assessments

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**Biology**  
**(1<sup>st</sup> Semester)**

**1<sup>st</sup> Benchmark**

**Franklin County School District**  
**North Carolina**

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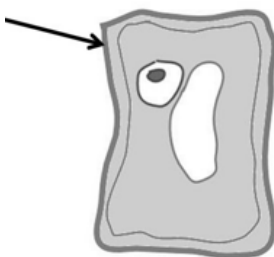
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**Directions: Read each question, and choose the correct answer.  
Then mark the space on your answer sheet for the  
answer you have chosen.**

1. The plant cell shown has an arrow pointing to a structure that is found in plant cells but not in animal cells.



Which statement *correctly* describes how this structure functions?

- A It provides protection for the cell's internal organelles and gives the cell its shape.
  - B It stores waste products generated by the plant during its metabolic reactions.
  - C It collects light that is converted to chemical bond energy during photosynthesis.
  - D It produces pollen that is transported to the flower to be used during sexual reproduction.
2. Scientists across the world follow the binomial classification of organisms developed by Carolus Linnaeus in the 18<sup>th</sup> century. Using this classification method, each organism is named using Latin words with the genus being the first name and the species being the last name.

What is an advantage of using the binomial classification system?

- A It avoids confusion because it gives each species a name that has historical significance.
  - B It avoids confusion because a species might have many common names.
  - C It correctly classifies the organism according to its genome size and genetic structure.
  - D It identifies the organism according to its phylogenetic and evolutionary relationships.
3. The term pseudopodia translates to false foot, and the structures are observed mostly in amoeba. Pseudopodia form as a response to food or predators, helping move the amoeba from one place to another.

How do pseudopodia form?

- A by retracting the cytoplasm toward the nucleus
- B by developing irregular cytoplasmic projections
- C by producing hair-like projections on the cell membrane
- D by developing a needle-thin and long, whip-like projection

4. The table lists the amounts of product that result when a substance undergoes a chemical reaction with and without the presence of a specific organic substance.

Amount of Product

Time (min)	Without Organic Substance ( $\mu\text{mol}$ )	With Organic Substance ( $\mu\text{mol}$ )
15	1	5
30	1	8
45	2	12
60	3	16

Based on the data, what can be inferred about the identity of the organic substance?

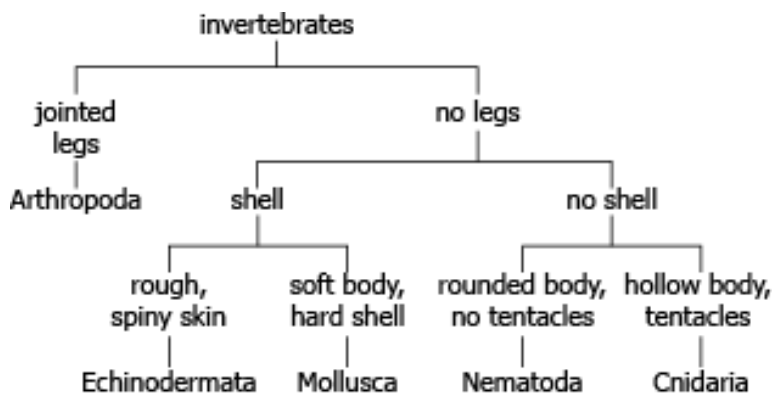
- A The substance must be a polysaccharide because it slows the rate of reaction, resulting in lower amounts of product.
- B The substance must be a neutral fat because it slows the rate of reaction, resulting in lower amounts of product.
- C The substance must be a nucleotide because it speeds up the rate of reaction, resulting in greater amounts of product.
- D The substance must be an enzyme because it speeds up the rate of reaction, resulting in greater amounts of product.

5. Cells use active transport to pump sodium and potassium in and out constantly. This transport is required to balance ions so that cells can conduct normal physiological functions.

What can be concluded based on this process?

- A Energy is vital for maintaining homeostasis.
- B Energy is produced in cells for sodium synthesis.
- C Active transport is involved in the movement of ions only.
- D Homeostasis in cells is maintained through the diffusion of ions.

6. Use the dichotomous key and the image of an invertebrate to answer the question.



Into which category should the invertebrate be classified?

- A Cnidaria
- B Echinodermata
- C Mollusca
- D Nematoda

7. If a capillary tube, filled with the amino acid serine, is introduced to a culture of *E. coli* bacteria, the bacteria gather near the opening of the capillary tube. What is the significance of this behavior of *E. coli*?

- A The *E. coli* exhibit positive phototaxis, which allows them to absorb food sources efficiently.
- B The *E. coli* exhibit positive chemotaxis, which helps them identify prospective food sources.
- C The *E. coli* exhibit positive phototaxis, which helps them quantify the amounts of food sources available.
- D The *E. coli* exhibit positive chemotaxis, which allows them to kill microbial agents near potential food sources.

8. The table shows the functions of several biomolecules listed by three students.

Student	Biomolecule	Function
1	protein	regulates muscle contraction
2	lipid	acts as a raw material for production of vitamins
3	carbohydrate	protects vital organs of the body

Which student(s) *correctly* listed the function of a biomolecule?

- A Student 1 only
- B Student 2 only
- C Student 1 and Student 2
- D Student 2 and Student 3

9. Which characteristics are representative of a prokaryotic cell?

- A presence of cell wall and ribosomes
- B presence of cell membrane and DNA
- C absence of nucleus and presence of plasmids
- D absence of vacuole and presence of mitochondria

- 10. The modern phylogenetic system of classification considers the DNA relatedness among organisms during the process of placing organisms into groups. How is this system helpful?**
- A** It helps identify evolutionary relationships.
  - B** It helps give each organism a unique identity.
  - C** It helps distinguish plants and animals clearly.
  - D** It helps classify microorganisms by their modes of nutrition.
- 11. A researcher performed an experiment to study the effect of sugar concentration on the rate of fermentation. The researcher prepared four test tubes containing 40 mL of warm water and added 0.5 g, 1.0 g, and 1.5 g of sucrose to Test Tubes 2, 3, and 4, respectively. No sucrose was added to Test Tube 1. The researcher then added 1 g of yeast to all four test tubes. After five minutes, the researcher connected each test tube to a respirometer to record the volume of CO<sub>2</sub> being generated every two minutes. The table shows the volume of gas produced in each test tube.**

Volume of CO <sub>2</sub> Produced by Yeast (mL)				
Time (min)	Test Tube 1	Test Tube 2	Test Tube 3	Test Tube 4
0	0	0	0	0
2	0	0.2	0.5	1.0
4	0	0.6	0.9	1.5
6	0	1.0	1.4	2.4
8	0	1.8	2.4	4.5
10	0	3.0	4.1	7.3

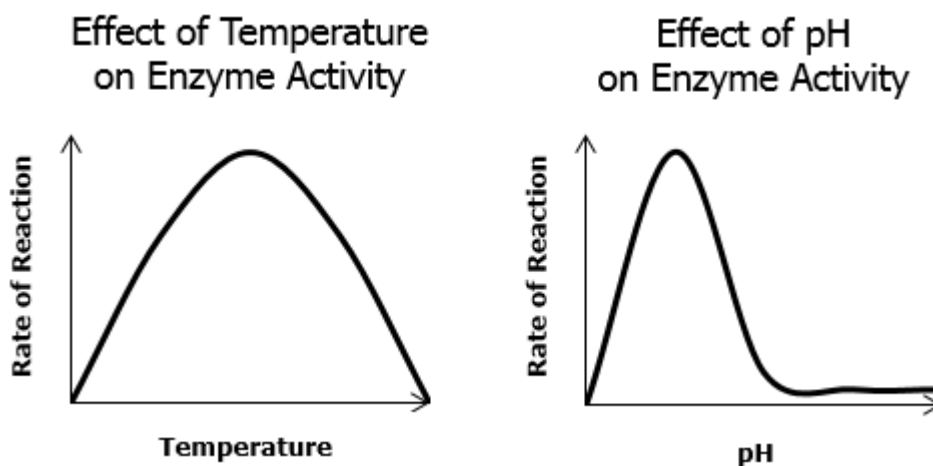
**What can be concluded from the experimental results?**

- A** The rate of fermentation was constant in all of the test tubes.
- B** The rate of fermentation does not depend on the concentration of sugar.
- C** The rate of fermentation increases with an increase in the concentration of sucrose.
- D** The rate of fermentation decreases with an increase in the concentration of sucrose.

**12. What molecule, located in the nucleus, is composed of two strands forming a double helix, and what is its function?**

- A** It is a protein, and it catalyzes cellular reactions.
- B** It is a carbohydrate, and it is a source of cellular energy.
- C** It is DNA, and it stores the genetic information of cells.
- D** It is RNA, and it is directly involved in the synthesis of proteins.

**13. The graphs show the rate of reaction vs. temperature and the rate of reaction vs. pH for an enzyme.**



**Which statement provides the correct interpretation of the graphs?**

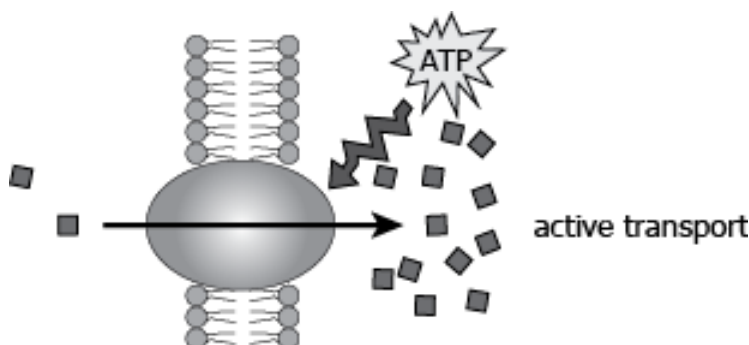
- A** The enzyme works at a high level no matter how the temperature or pH changes.
- B** The enzyme works best at a certain temperature and is not affected by changes in pH.
- C** The enzyme works best at a certain pH and is not affected by changes in temperature.
- D** The enzyme works at a high level within specific ranges of temperature and pH.

14. A gray whale has a hairpin loop arrangement of blood vessels near the surface of its skin. The part of the loop near the surface contains cooler blood because the skin is exposed to ocean water. As the blood returns to the interior, it becomes warm as the internal tissues are warmer.

What is the *likely* use of this blood flow mechanism for the whale?

- A It restricts the whale from swimming in warm ocean water.
- B It helps the whale consume food without taking in cold water.
- C It helps maintain a constant warm body temperature in cold water.
- D It ensures the body temperature matches the temperature of the ocean water.

15. The model shows the active transport of molecules that are necessary for the maintenance of the internal cell environment.



Based on the model, what can be concluded about active transport?

- A Energy is necessary to produce life-saving molecules.
- B Energy is necessary to maintain the internal cell environment.
- C Active transport moves molecules along the concentration gradient.
- D Active transport always moves molecules from the external to the internal cell environment.

- 16. The table lists the elements that compose the four major biomolecules and their functions.**

Biomolecule	Elements	Function
W	C,H,O	provides short-term energy
X	C,H,O,P	composes cell membranes
Y	C,H,O,N	catalyzes biological reactions
Z	C,H,O,N,P	stores genetic information

**Which biomolecule corresponds with protein?**

- A** W
- B** X
- C** Y
- D** Z

- 17. A paramecium has hair-like projections called cilia on its entire outer surface that beat in a synchronous manner. A researcher conducts an experiment using two Petri dishes containing equal amounts of paramecia and prey placed on opposite sides of the Petri dishes. The viscosity of the liquid in the first dish is five times greater than the liquid in the second dish. The researcher counts the number of paramecia after eight hours and finds that the second plate contains more.**

**What can be concluded about the role of the cilia in the survival of the organisms?**

- A** Cilia help the organisms reproduce.
- B** Cilia help the organisms digest food.
- C** Cilia help the organisms kill pathogens.
- D** Cilia help the organisms reach their food sources.

- 18. Examine the table that compares two classification systems of living organisms proposed by two scientists.**

Scientist	Kingdoms	Year
Linnaeus	Plantae Animalia	1735
Haeckel	Plantae Animalia Protista	1866

**The third kingdom in Haeckel's system included all single-celled organisms. Those organisms were classified under either the kingdom Plantae or Animalia in the Linnaeus system.**

**Why was a new kingdom for single-celled organisms needed?**

- A** The morphology of single-celled species was difficult to understand.
- B** Fossils of single-celled species were discovered during the 19<sup>th</sup> century.
- C** The number of single-celled species was greater than the number of plant and animal species.
- D** Features of several single-celled species were very different from plant and animal species.

- 19. A student lists facts about several cell organelles in a chart, as shown.**

- |   |
|---|
| <ol style="list-style-type: none"><li>1. It is made of protein and RNA.</li><li>2. It releases energy for the cell.</li><li>3. It is made in the cell membrane.</li><li>4. It lacks an outer membrane.</li><li>5. It makes proteins for the cell.</li><li>6. It stores water.</li></ol> |
|---|

**Which facts are true for a ribosome?**

- A** 1, 2, 3
- B** 1, 3, 5
- C** 1, 4, 5
- D** 1, 4, 6

Use the information to answer questions 20-21.

An experiment tests ATP production in various cell extracts with and without oxygen. A sample of rabbit leg muscle tissue, known to be rich in mitochondria, is ground, liquefied, and separated into cellular components using an ultracentrifuge. The data table shows the amount of ATP each extract produces when glucose is added.

Rabbit Leg Muscle Tissue Study

Extract Contents	With Oxygen		Without Oxygen	
	ATP Production After 5 Minutes (µg/ml)	ATP Production After 25 Minutes (µg/ml)	ATP Production After 5 Minutes (µg/ml)	ATP Production After 25 Minutes (µg/ml)
water	0.00	0.00	0.00	0.00
cytoplasm	0.45	0.72	0.20	0.41
mitochondria	0.10	4.40	0.00	1.60
mitochondria and cytoplasm	0.55	5.12	0.20	2.01

20. Based on the data in the table, which conclusion can be made concerning cellular respiration?
- A Most ATP production takes place in the cytoplasm in the absence of oxygen.
  - B Most ATP production takes place in the cytoplasm in the presence of oxygen.
  - C Most ATP production takes place in the mitochondria in the absence of oxygen.
  - D Most ATP production takes place in the mitochondria in the presence of oxygen.
21. All extracts in this experiment are incubated at temperatures of 37°C, the internal body temperature of a rabbit. Which statement *correctly* predicts the individual results for the cytoplasm and the mitochondria if their incubation temperatures are changed to 50°C?
- A The cytoplasm and mitochondrial reaction rates will increase.
  - B The cytoplasm and mitochondrial reaction rates will decrease.
  - C Cytoplasm rates will increase, and mitochondrial rates will decrease.
  - D Cytoplasm rates will decrease, and mitochondrial rates will increase.

- 22. A student performs an experiment to understand how having high internal salt concentrations impacts marine plants' abilities to maintain homeostasis. The student adds 100 mL of distilled water to two different beakers, X and Y, then adds 3.5 mg of salt to beaker Y and a 5 g piece of seaweed to each beaker. The student observes the seaweed after it remains undisturbed for six hours.**

Beaker	Observation
X	Seaweed plant swells.
Y	Seaweed plant remains the same.

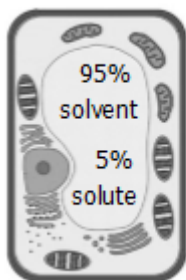
**What can be inferred from the observations of the experiment?**

- A** The high internal salt concentration prevents the plants from losing salts by osmosis.
  - B** The high internal salt concentration prevents the plants from losing water by osmosis.
  - C** The high internal salt concentration prevents the entry of water into the plants by facilitated diffusion.
  - D** The high internal salt concentration prevents the entry of salts into the plants by facilitated diffusion.
- 23. What compound is produced by aerobic respiration in all living organisms and by anaerobic respiration in yeast but not in human muscle cells?**
- A** carbon dioxide
  - B** fatty acids
  - C** lactic acid
  - D** sodium chloride
- 24. A student observes cells from eukaryotic and prokaryotic organisms using a light microscope. The student sees different features in eukaryotic cells at a magnification of 40x, but it is difficult to see distinct features even at 400x when viewing the prokaryotic organisms.**

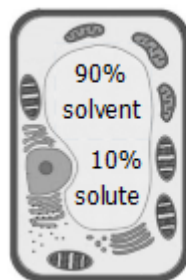
**What explains the difference in magnification required to observe prokaryotic cells?**

- A** Prokaryotic cells are compactly arranged.
- B** Prokaryotic cells have thick cytoplasm.
- C** Prokaryotic cells are smaller than eukaryotic cells.
- D** Prokaryotic cells have membrane-bound organelles.

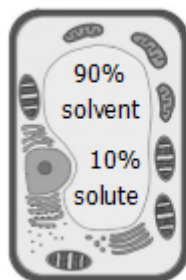
25. A researcher designs an experiment with the purpose of observing the transport of water out of a plant cell. Which experimental setup will provide the researcher with the conditions necessary for the transport of water out of the cell?

**A**

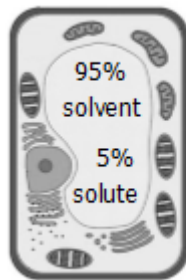
1% solute  
99% solvent

**C**

10% solute  
90% solvent

**B**

5% solute  
95% solvent

**D**

10% solute  
90% solvent

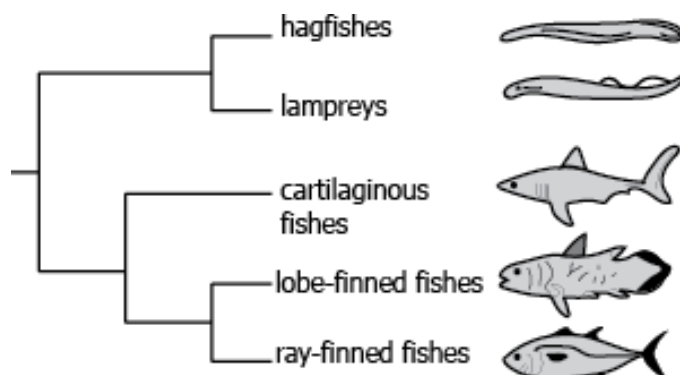
26. For which task would a biologist use a dichotomous key?

- A** to explain the principle of how an enzyme binds to its substrate
- B** to identify the effect the environment may have on the inheritance of a trait
- C** to identify two unknown organisms that have similar traits and appearances
- D** to explain how organisms slowly change over time in response to environmental conditions

27. Which relationship *most commonly* exists between enzymes and substrates?

- A** An enzyme has the ability to bind with all types of substrates because the active sites of the substrates change shape to fit the specific enzyme.
- B** An enzyme has the ability to bind with all types of substrates because the enzyme changes the shape of its active site to fit each different type of substrate.
- C** The active site of one type of substrate is specific for one type of enzyme and has the ability to change its shape to fit the enzyme.
- D** The active site of an enzyme is specific for one type of substrate and has the ability to change its shape slightly to fit the specific substrate.

28. The phylogenetic tree shows the evolutionary relationships among different categories of fishes.



The lobe-finned fish category includes many primitive fishes that existed even during the time of dinosaurs. Which category of fish is *most closely* related to the lobe-finned fishes?

- A cartilaginous fishes
  - B hagfishes
  - C lampreys
  - D ray-finned fishes
29. The kidneys in humans are responsible for eliminating wastes in the form of urine to maintain a suitable internal environment for the body to function. The blood carries metabolic wastes produced in the body to the kidneys. However, the blood passing through the kidneys has a lower concentration of metabolic wastes than the kidneys.

How do the kidneys absorb metabolic wastes from the blood?

- A by active transport using cellular energy in the form of ATP
- B by passive transport through the cell membrane
- C through diffusion by moving waste particles with the concentration gradient
- D through osmosis by establishing equilibrium on both sides of the cell membrane

30. A student reads about a plant cell structure that occupies much of the cell's volume. This cell structure fills with water, exerting pressure on the cell wall that helps maintain the shape of the cell.

Which cell structure is described?

- A chloroplast
- B mitochondrion
- C ribosome
- D vacuole

31. The table lists characteristics of two biomolecules, P and Q.

P	Q
1. It consists of a linear chain of several glucose molecules. 2. It forms the cell wall of plant cells.	1. It consists of a hydrophobic as well as a hydrophilic region. 2. It forms the plasma membrane of cells.

Which option *correctly* identifies the two biomolecules?

A

P	cellulose
Q	phospholipid

C

P	glucose
Q	steroid

B

P	starch
Q	steroid

D

P	glycogen
Q	phospholipid

32. Prokaryotic and eukaryotic cells have significant differences in their structures. Which statement is true regarding the genetic material of prokaryotes only?

- A It is composed of DNA only.
- B It is found in the cytoplasm only.
- C It is arranged into chromosomes.
- D It is responsible for the production of protein.

**33. Which table identifies the products formed during photosynthesis and how they are used?**

**A**

glucose	oxygen
stored in the form of starch	released into atmosphere

**C**

carbon dioxide	water
used to produce O <sub>2</sub> for respiration	stored in plant roots

**B**

glucose	oxygen
stored in the form of glycogen	used in cellular respiration

**D**

carbon dioxide	water
released into atmosphere	stored in the form of ATP

**34. A scientist treats a cell with a chemical that inhibits the functioning of contractile vacuoles. After an hour, the scientist observes the treated cell and an untreated cell under a microscope and notes that both cells are swollen. After 15 more minutes, the scientist observes the cells and notes that the treated cell has burst, while the untreated cell is its original size.**

**Based on the observations, what is the *primary* purpose of contractile vacuoles?**

- A** maintenance of water balance
- B** maintenance of cell shape
- C** maintenance of cell membrane
- D** maintenance of food availability

**35. Leigh syndrome is a rare genetic disorder that is triggered by an infant's first viral infection. Tests conducted on infants with the condition show they lack cellular energy in the form of ATP.**

**Which cellular organelle is *most likely* defective and responsible for Leigh syndrome?**

- A** chloroplast
- B** mitochondrion
- C** nucleus
- D** vacuole



