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BIOLOGY

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PRACTICE TESTS

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Next Generation Learning Standards

WITH ANSWERS AND EXPLANATIONS

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STUDENTS

This Biology practice book was put together with the purpose of providing you a way to measure what you have learned over the course of a year. Biological concepts will be presented in many forms: text, photos, data and graphs. You will be asked to analyze, and interpret this information, then give responses to questions on the presented information. Many of the questions present a new approach to information where you will have to apply your biology knowledge to that topic. By working diligently through these practice tests, you can assess your knowledge. It is not enough to just do the tests; you must be committed to seriously reviewing each answer and explanation until you feel confident on the concept. Preparing for a Regents should begin a month or two before the actual test. Work on one or two topic sets of questions daily and review your answers with the given explanations. Make note of questions that you do not feel confident in and revisit at a later time. As you become confident in the material and to this new test design, you should be successful on the Biology Regents.

The skills that you gain from analyzing and working through questions will provide you with tools to navigate other biology courses as well.

It is this author's wish that you do well on the Regents and develop a life-long appreciation for Biology.

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Test 1

Answer all questions in this part.

Directions **Use your knowledge of Life Science: Biology to answer all questions in this examination.**

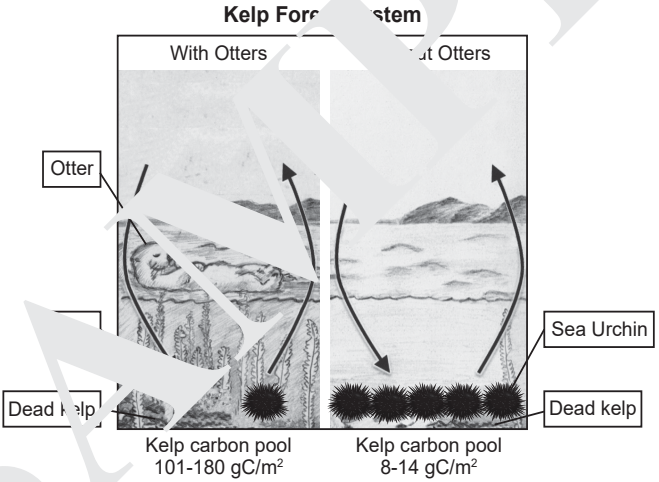
Base your answers to questions 1 through 5 on the information below.

Carbon! Where Does It Come From? Where Does It Go?

On Earth, carbon compounds are found in the oceans, atmosphere, and living organisms, as well as stored in rocks and sediments. Earth and its atmosphere can be considered a closed system. The amount of carbon in different locations within Earth's system is always changing.

Sea otters help maintain the carbon balance in their ecosystem. Otters eat sea urchins. Eating sea urchins is important, as sea urchins are herbivores that can destroy a kelp forest. Kelp are large autotrophic algae that grow much faster than most plants. When kelp die, they sink into the deep ocean. The low oxygen conditions of the sea floor cause decomposition to be slow or incomplete.

Scientists calculated the carbon pool (how much carbon kelp stores) with and without sea otters, as shown in the model.



1. Which claim about the kelp carbon pool is best supported by evidence from the information and the model above?

(1) The carbon storage is higher with the otters present because the sea otters eat the sea urchins.

(2) The carbon storage is higher with the sea urchins present because they control the kelp population.

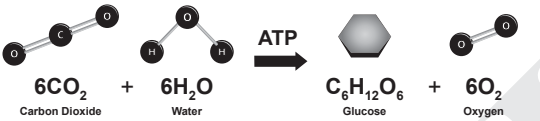
(3) The carbon storage is lower with the otters present because the sea otters eat the kelp.

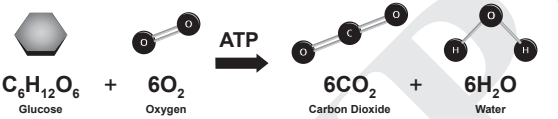
(4) The carbon storage is lower with the sea urchins present because they carry out autotrophic nutrition. 1 _____

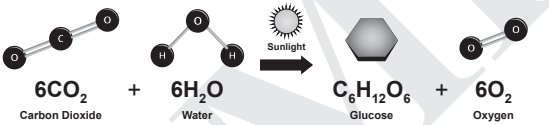
SAMPLE

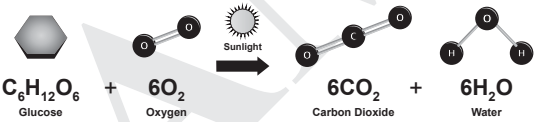
2. Which statement uses the model to describe how kelp contributes to a reduction of carbon entering the atmosphere?
(1) Kelp produces carbon as it grows within the hydrosphere.
(2) Some of the carbon stored in the dead kelp is trapped in the geosphere of the sea floor.
(3) Kelp produces carbon as it sinks into the hydrosphere.
(4) Some of the carbon stored in kelp is added to the geosphere through cell respiration. 2 _____

3. Which model identifies the process that converts light energy into chemical energy inside the kelp?

(1) 

(3) 

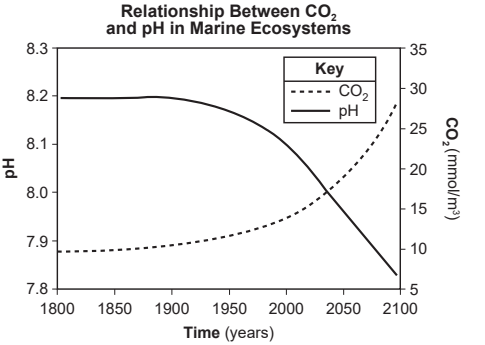
(4) 

(5) 

3 _____

Increased atmospheric carbon dioxide has been linked to changes within marine ecosystems. When CO_2 combines with water, it produces carbonic acid, lowering the water's pH. A pH of less than 7.8 can interfere with the ability of some marine organisms to make shells and skeletons. These organisms include corals, mussels, plankton, seastars, and sea urchins.

The graph below shows the relationship between atmospheric CO_2 concentration and the pH of seawater.



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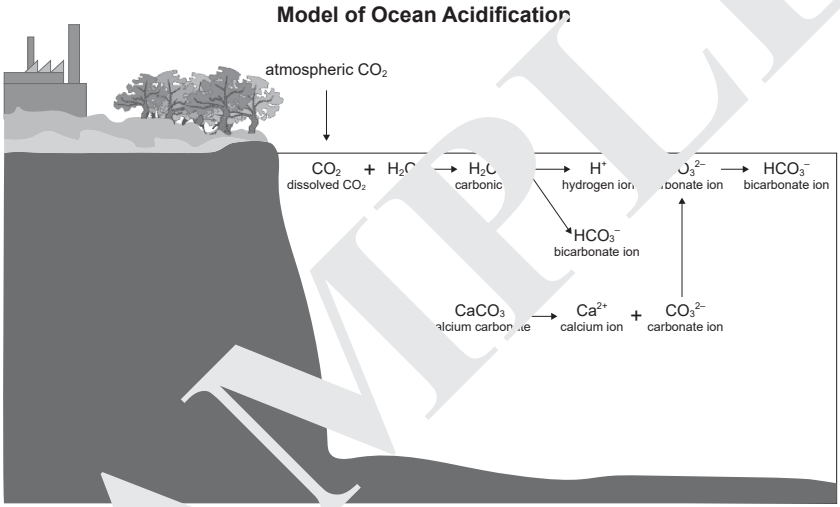
4. If the trend in atmospheric CO_2 levels continues, sea urchin populations may be impacted. Describe evidence from the graph that supports this claim.

The following diagram shows some information about the cycling of carbon.



The model below shows the equation for how sea urchins make their shells.

$$Ca^{2+} + CO_3^{2+} \rightarrow CaCO_3$$

Calcium ions and carbonate ions produce calcium carbonate.

5. As ocean acidification increases, the amount of available carbonate ions decreases. Use the model and information provided to describe how the cycling of carbon between the biosphere *and* at least one other sphere is affected as environmental conditions change.

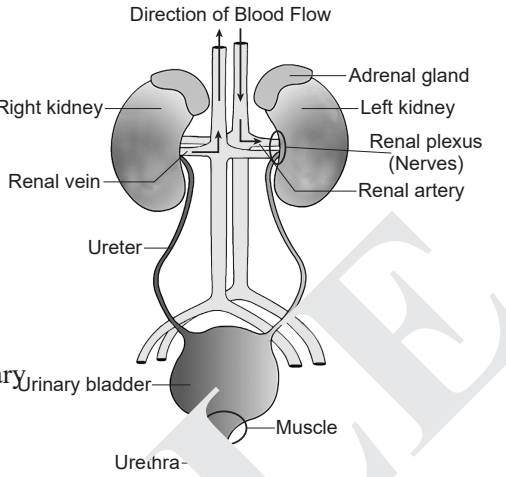
SAMPLE

Base your answers to questions 6 through 10 on the information below.

Drinking Water Is Just The Beginning!

The amount of water taken in must be in balance with the amount lost. The urinary system is involved in maintaining the salt and water balances within the body.

Human Urinary System

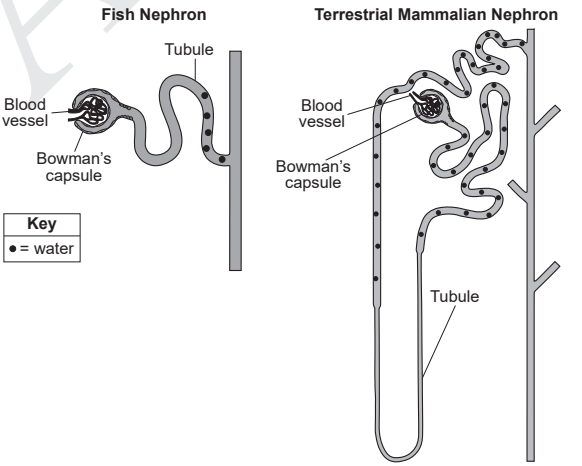


6. Which statement describes how the organization of the urinary system and one other system interact to maintain homeostasis in the human body?

(1) The adrenal gland, part of the endocrine system, delivers nutrients to the cells of the urinary system to remove carbon dioxide from the blood.
(2) The internal urethral sphincter muscle, part of the muscular system, contracts to signal the cells of the urinary system to regulate blood sugar.
(3) The brain, part of the nervous system, sends messages to the renal plexus (nerves) to signal the cells of the urinary system to deliver oxygen to the blood.
(4) The arteries, part of the circulatory system, deliver unfiltered blood to the cells of the urinary system to remove wastes. 6 _____

Each kidney is composed of about a million waste-filtering structures known as nephrons. Water is reabsorbed through some parts of the nephron, such as the tubule. The model below shows the structure of a nephron in two organisms.

Nephrons of Various Organisms

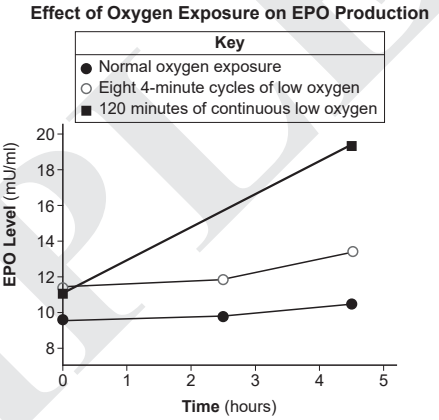


SAMPLE

7. Based on evidence in the model, which statement explains that natural selection led to the evolution of the nephron's structure and function in terrestrial mammals?
(1) The development of the Bowman's capsule in animal kidneys was more advantageous to mammals than fish.
(2) Nephrons with longer tubules were selected for in organisms that lived on land to conserve the water they drank.
(3) The longer nephron tubule was selected for in animals that lived in oceans, rivers and lakes to filter the excess water absorbed.
(4) The number of nephrons is more important in the evolution of mammals than it is to the evolution of fish. 7

Another function of the kidney is to aid in regulating the number of red blood cells. The kidneys produce a protein known as Erythropoietin (EPO) that stimulates the increased production of red blood cells.

The graph shows the results of a study. Participants were exposed to different conditions prior to time zero, then EPO levels were measured over a 4.5-hour time period.



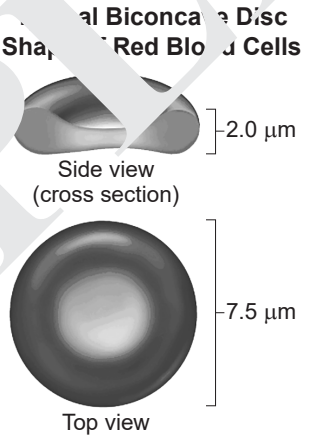
8. Using the information provided, describe the evidence to support the claim that exposure to low oxygen levels results in a feedback mechanism that allows the body to maintain homeostasis.

In addition to their other functions, red blood cells (RBCs) have the capacity to carry water. The surface of the cell contains structures called aquaporins, which transport water across cell membranes. Due to their unique cell structure, RBCs are able to expand up to 74% or shrink up to 40% compared to the original cell size.

SAMPLE

9. Which statement provides the best explanation for how red blood cells contribute to a feedback mechanism that maintains homeostasis?
(1) The aquaporins in the red blood cells facilitate the exchange of water in environments of different concentrations and help the kidneys more efficiently regulate salt and water balance.
(2) The aquaporins in the red blood cells prevent the exchange of water in environments of different concentrations and help the kidneys more efficiently regulate salt and water balance.
(3) The red blood cells change their shape to move through the kidney but have minimal effect on salt and water balance in the kidneys.
(4) The red blood cells change their shape to move through the kidney but do not regulate any feedback mechanisms. 9 _____

RBCs typically have a biconcave disk shape. A scientific study examined the effect of changing the RBC shape and membrane flexibility on its ability to transfer oxygen. For this study, when the RBC membrane was less flexible, the oxygen transfer capacity decreased by 18%. When the RBC was more flexible, the oxygen carrying capacity increased by 21%. When RBCs take on water their membrane initially becomes more flexible.



10. What evidence would support the claim that consuming water after exercise helps an athlete's body maintain homeostasis?

	Number of RBCs Taking on Water	RBC Flexibility	Rate of Oxygen Transfer
(1)	increases	decreases	decreases
(2)	increases	increases	increases
(3)	decreases	increases	increases
(4)	decreases	decreases	decreases

10 _____

Base your answers to questions 11 through 16 on the information below.

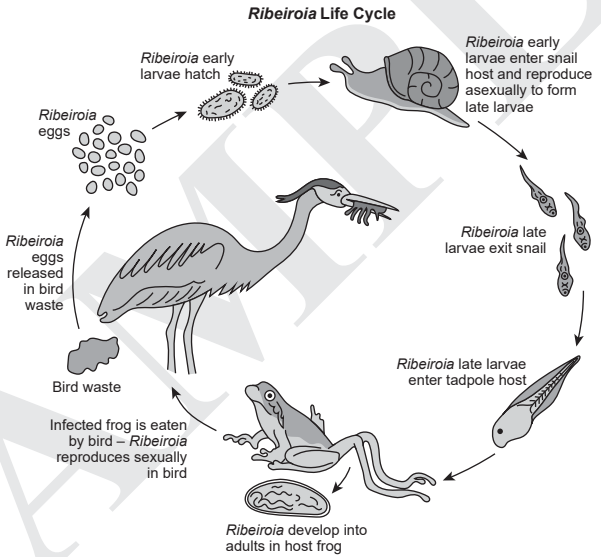
Heads or Tails?

In the mid 1990s, people across several states were finding large numbers of frogs and other amphibians with extra limbs. Possible explanations regarding the cause of these abnormalities ranged from UV radiation, chemical contaminants in the water, parasites, or even airborne substances.

SAMPLE

11. Which question could be asked in order to determine if the abnormalities seen in the frog legs were caused by an inherited mutation?
(1) Do the offspring with an abnormality live in the same environment as the parents?
(2) Were the parents exposed to the same environmental factors as some of their offspring?
(3) Is a mutation that causes abnormal legs present in the DNA of the sex cells of the parents?
(4) Do the cells within the legs of the parents contain DNA with a mutation that causes abnormal limbs? 11 _____

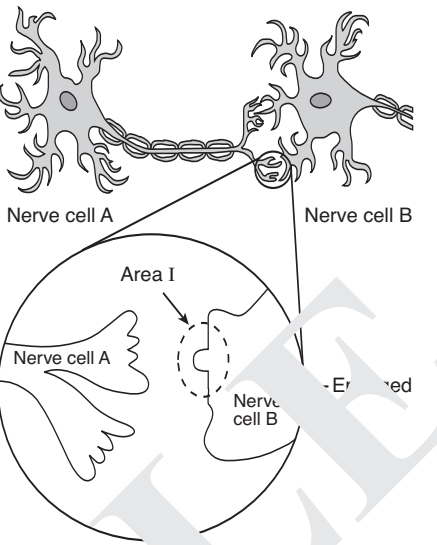
After further research, scientists discovered that these deformities in frogs were not caused by genetic mutations. The actual cause was a parasitic flatworm called *Ribeiroia*. *Ribeiroia* completes a complex life cycle by inhabiting several hosts. This life cycle is summarized in the diagram below.



12. A student claims that the *Ribeiroia* parasites that cause the most severe limb abnormalities in frogs have a greater chance of survival and reproduction than those that do not. Which explanation best supports this claim?
(1) The frogs with the most severe limb deformities will be more likely to be caught by birds, allowing the adult *Ribeiroia* to be more likely to survive and reproduce.
(2) The adult *Ribeiroia* will have a greater chance of remaining in the frog to complete all phases of its life cycle, allowing it a better chance to survive and reproduce.
(3) The *Ribeiroia* will have a greater chance of reproducing sexually because it stays in the snail, releasing larvae with this trait back into the water.
(4) The *Ribeiroia* larva will have a greater chance of reproducing asexually and completing its life cycle in the bird. 12 _____

SAMPLE

Base your answers to questions 15 and 16 on the diagram of nerve cells and on your knowledge of biology.



15. In the space below, sketch a chemical molecule that might be released from nerve cell *A* and be recognized and bind to area I of nerve cell *B*.

16. Describe what would happen if a drug molecule shaped like [redacted] were introduced into this nerve pathway.

_____

17. Identify *one* substance, other than the secretions from nerve cells, used in cell communication.

_____

18. In an organism, a muscle cell has the same DNA as a nerve cell, yet the cells perform different functions. This is possible because
(1) nerve cells communicate by producing ATP, while muscle cells react to stimuli.
(2) temperature variations within the body alter DNA
(3) proteins in each cell type change the structure of DNA
(4) different parts of the genetic instructions are used in each type of cell

18 _____

19. Acetylcholine is a chemical secreted at the ends of nerve cells. This chemical helps to send nerve signals across synapses. After the signal passes across a synapse, an enzyme breaks down the acetylcholine. LSD is a drug that blocks the action of this enzyme. Describe one possible effect of LSD on the action of acetylcholine.

_____

_____

SAMPLE

Base your answer to question 20 and 21 on the information below and on your knowledge of biology.

A Scorpion's Secret Weapon Ingredient

Getting stung by a scorpion is painful. The pain serves as a warning to its predators to stay away.

Scorpion venom contains toxins that are recognized by the pain receptors on nerve cells. These receptors are the same as those that cause a burning feeling when you touch something hot. But, being stung by a scorpion is much more painful than touching a hot object.

The venom itself doesn't cause all of the pain. It also contains an acid that changes the pH of the area surrounding the affected nerve cells. The change in pH increases the intensity of the pain message.

20. In a population of scorpions, a mutation occurred that resulted in the venom having no effect on its predators. Explain why the number of predators that feed exclusively on scorpions would decrease over time. Justify your answer.

_____

_____

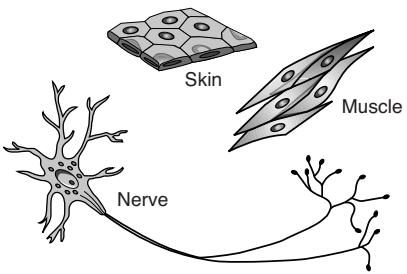
_____

21. The toxin affected the pain receptors on nerve cells, but it also makes enzymes in the surround area less effective. Explain how the toxin affects surrounding enzymes.

_____

_____

22. The cells in the diagram were present in the same individual.



These cells are most similar in the
(1) amount of energy they release
(2) type of proteins they synthesize
(3) rate of their metabolism
(4) information stored in their DNA

22 _____

SAMPLE

Base your answers to questions 23 through 27 on the information and data table below and on your knowledge of biology.

Dinosaurs: Some Live and Some Die

Avian (bird-like) and non-avian dinosaurs in the northern hemisphere lived in extreme heat. The average summer temperature could range from 8° to 104°F. Winters were mild and wet, averaging around 59°F. There was no polar ice at this time. Most non-avian dinosaurs had a mass of about 7700 pounds. Most avian dinosaurs weighed significantly less and most mammals that coexisted with the dinosaurs weighed less than a pound.

Diversity of Life Pre-asteroid Impact

A giant asteroid struck just off the coast of Mexico 66 million years ago. The asteroid impact event is referred to as the K-T extinction. Enormous amounts of dust, sulfur, and carbon dioxide entered the atmosphere. It caused Earth's average surface air temperatures to drop by as much as 47° F. Dust from the impact blocked the Sun's radiation for an extended amount of time, and photosynthesis was drastically reduced.

Many dinosaurs were immediately killed while others managed to survive for a period of time. All of the non-avian dinosaurs went extinct. The mammals that survived the impact increased in number. They continued to survive and evolve.

23. A possible explanation for why some organisms survived and others did not is that some were
(1) herbivores that had a large variety of plants to eat
(2) able to evolve quickly into better adapted non-avian species
(3) better able to compete successfully after the asteroid impact
(4) faster and stronger than others and were able to outrun the blast of the impact 23____

24. Explain how the evidence provided supports the claim that non-avian dinosaurs went extinct after the impact because of the traits present in their populations.

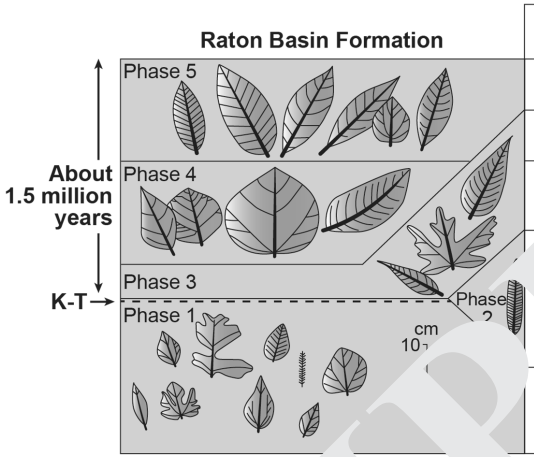
_____

_____

SAMPLE

When scientists analyzed leaf fossils formed after the asteroid impact, they discovered that the number and types of plants changed over time. They grouped the fossils found in the New Mexico and Colorado rock layers into "phases" of changing diversity. During this time, the environment was gradually warming.

Table 1: Leaf Fossils as Indicators of Diversity in New Mexico and Colorado Rock Layers



Phase	Number of Species
5	55
4	25
3	[illegible]
2	[illegible]
1	47

25. Which statement provides evidence that could be used to support the claim that the evolution of plants is the result of changes that occurred in the environment?

(1) The diversity of plants in Phase 1 remained constant after the K-T extinction event changed environmental conditions on Earth.

(2) The number of plant species decreased during the 1.5 million years before the K-T extinction event due to stable environmental conditions on Earth.

(3) The diversity of plant species increased during the 1.5 million years after the K-T extinction event changed environmental conditions on Earth.

(4) The number of plant species remained stable from Phase 3 to Phase 5 as the environment on Earth recovered from the K-T extinction event. 25____

SAMPLE

Table 2: Mammal Evolution

Mammal	When Appeared After K-T Extinction (years)	Body Mass (Kg)	Feeding Niche	Comparative Size
L	300,000	4-6	Ate only insects, and had small, sharp teeth	Raccoon size
M	450,000	50	Herbivore, with canine teeth	Chimpanzee size
N	680,000	44-77	Omnivore, with canine teeth and massive jaws	Wolf size
O	720,000	34-56	Herbivore, with 2-3 rows of molar teeth	Sheep size

26. Which statement provides evidence that changes in an environment may cause changes in mammal species?
(1)Mammals got larger in body size as plant diversity decreased.
(2) As the type of plants changed, the tooth and jaw structure of mammals changed.
(3) Where the animals lived changed as the number of plant species increased.
(4) The mammals listed in the chart were adapted to feeding on the same species of plants. 26____

27. Evaluate all the information given and complete the table by providing evidence that supports the claim that changes in environmental conditions may result in:

increased numbers of individuals of some species: _____

_____

_____

the emergence of new species: _____

_____

_____

the extinction of other species: _____

_____

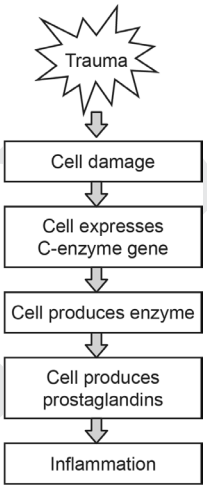
_____

SAMPLE

Base your answers to questions 28 through 32 on the information below and on your knowledge of biology.

Prostaglandins: One of the Most Important Molecules You Never Heard of

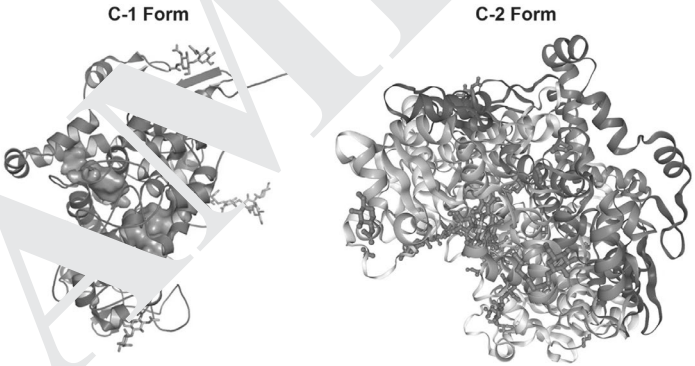
When cells experience trauma and are damaged, they quickly communicate this damage to nearby cells. One way this is accomplished is by the release of chemical messengers known as prostaglandins. Prostaglandins signal cells to respond with inflammation and pain (the inflammatory response). This, in turn, tells the organism that something is wrong.



Prostaglandins are produced by human cells present in multiple body systems. These include white blood cells, cells of blood vessels, and cells of the digestive tract. These cells produce C-enzymes. These enzymes signal the cells to produce prostaglandins. The model to the right illustrates this process.

C-enzymes are present in cells in different forms, including C-1 and C-2. Both forms are expressed in different tissues at different levels.

Ribbon models are often used to illustrate the physical structure of molecules. The ribbon models below represent the two different forms of the C-enzyme that produce prostaglandins.



28. Based on the models, which statement best supports the claim that the two enzymes function differently in tissues due to the amino acid sequence present in the C-1 and C-2 forms of the enzyme?

(1) The two forms of the C-enzyme result in different DNA sequences that have different shapes.

(2) The DNA codes for the production of prostaglandin in molecules that control the production of both C-1 and C-2.

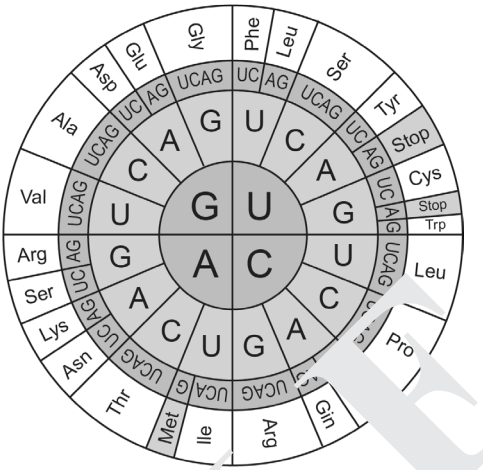
(3) The amino acid sequences of both molecules are the same because both are examples of C-enzymes.

(4) Each form of the C-enzyme gene produces a different amino acid sequence that results in proteins with different shapes and functions. 28 _____

SAMPLE

In order for a gene to be expressed, such as the gene that codes for the C-enzymes, the cell must follow specific steps. The codon chart can be used to simulate one step in the process used by the cell when producing the C-enzyme.

Codon Chart

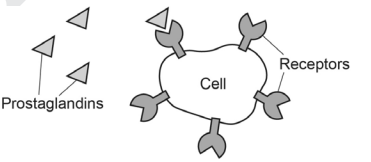


29. Use the highlighted portion of the table to construct an explanation that summarizes how the DNA sequence is expressed by cells to produce C-enzymes that control the production of prostaglandin molecules.

Expression of C-Enzyme Gene Segment

Gene DNA Sequence	**TCG**	**AAA**	**TGC**	**AAT**	**TAT**
mRNA Sequence	**AGC**	**UUU**	**ACG**	**UUA**	**AUA**
Amino Acid Sequence	**Ser**	**Phe**	**Thr**	**Leu**	**Ile**

Prostaglandins cause inflammation by attaching to protein receptors on the surface of some cells, as shown in the model.



30. Which claim could be used to describe a possible cause of the new variation in the gene that codes for the production of the prostaglandin receptor?
(1) The changed receptor will produce a new DNA sequence with different functions that change the inflammatory response.
(2) Events during reproduction or exposure to some environmental factors could result in a new inheritable variation in the DNA that codes for the production of prostaglandin receptors.
(3) The protein will no longer be able to produce the gene that codes for prostaglandins, resulting in a weaker inflammatory response.
(4) The changed DNA will be passed on through reproduction and result in a different order of simple sugar subunits that make up the C-enzyme protein.

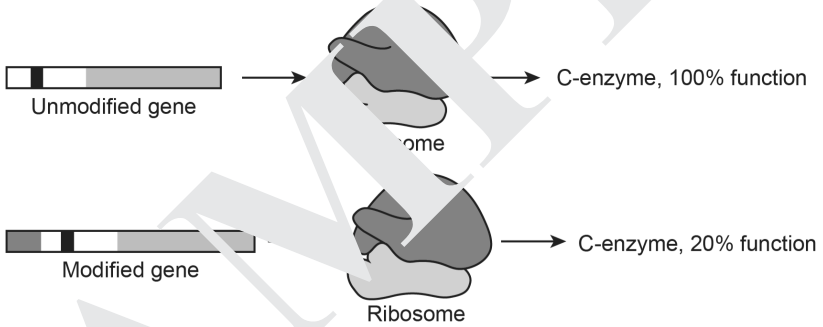
30 _____

SAMPLE

31. An individual inherited a new variation in the gene that codes for the production of the prostaglandin receptor. Which question could be asked to clarify how the variation was passed on to the individual?
(1) Were the father's white blood cells able to produce gametes with the variation?
(2) Did the receptor lose function due to a lack of prostaglandin molecules?
(3) Was the variation caused by a change in a gene sequence in the mother's gametes?
(4) Was the prostaglandin receptor with the variation the same size as the original receptor? 31 ____

Inflammation has been linked to an increased risk for some cancers. Researchers are examining the role of C-enzymes and their production of prostaglandins, which have been linked to the development of these cancers.

Experiments using animal models, such as mice, have tested the effect of a modified version of the C-enzyme gene on the occurrence of some cancers. The modified gene has an extra DNA segment added to one end. Animals with the modified gene had a decreased incidence of intestinal cancers. The diagram below represents the expression of the unmodified and the modified genes.



32. Construct an explanation, based on the evidence provided, that would account for the decrease in cancer that was observed in the animals with the modified gene.

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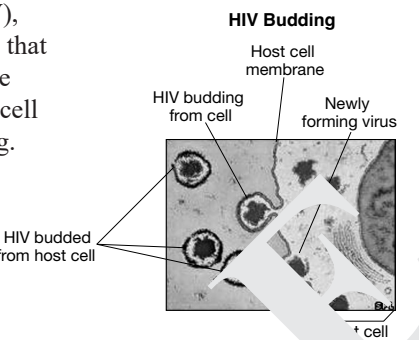
SAMPLE

Base your answers to questions 33 through 35 on the information and diagram below and on your knowledge of biology

human immunodeficiency virus (HIV), which can lead to AIDS, is a type of virus that adds its genetic material to the DNA of the host cell. HIV reproduces within the host cell and exits through a process called budding.

In the process of budding, the newly forming virus merges with the host cell membrane and pinches off, taking with it a section of the host-cell membrane. It then enters into circulation.



33. Explain how an outer covering composed of a section of a cell membrane from the host would protect HIV from attack by the host's immune system.

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34. Describe one specific way that HIV makes the body unable to deal with other pathogens and cancer.

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35. Cells of the immune system are able to respond to the presence of invading organisms because they recognize the
(1) antigens present on the invaders
(2) antibodies present in invading pathogens
(3) DNA pattern in the nuclei of viruses
(4) antibiotics released from microbes 35____

Base your answers to questions 36 through 38 on the information below and on your knowledge of biology.

In order to enroll in most schools, students must be vaccinated against certain viral diseases, such as mumps. Even with these vaccinations, many students still suffer from other diseases.

Discuss how a vaccination works and why some students still become infected with other diseases. In your answer, be sure to:

36. Identify what is present in a vaccine that stimulates an immune response.

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SAMPLE

ANSWER KEY WITH EXPLANATIONS
TEST 1

1. 1 With otters present, the kelp carbon pool measures 101-180 gC/m², without otters present the kelp carbon pool is 8-14 gC/m² . Otters feed on kelp-eating sea urchins allowing kelp forests to grow and store carbon.

2. 2 As kelp dies, it moves to the sea floor where it decomposes. The decomposed stored carbon is incorporated within the ocean floor (geosphere).

3. 3 This model reflects the photosynthetic process where carbon dioxide and water are taken in by autotrophs and transformed, using the energy of the Sun, into glucose. Oxygen is released as a byproduct.

4. Acceptable responses include, but are not limited to: As CO_2 increases, pH decreases. Less than 7.8 would prevent sea urchins from making skeletons, causing their population to decrease.
   or The graph projects that shortly after 2100 ocean pH may be under 7.8, the level at which organisms like sea urchins can't build shells/skeletons.

   Explanation: Many marine organisms are impacted by changes in pH. With increasing CO_2 levels, ocean waters are showing decreases in pH from 8.2 to 7.8. These lower pH levels disrupt the ability of sea urchins to form exoskeletons and their populations may decrease.

5. Acceptable responses include, but are not limited to: As atmospheric CO_2 increases, the carbonate ions in the hydrosphere are used up and the urchins will not have the resources needed to make their shells, reducing the number of urchins in the biosphere.
   or As carbonate ions are used to form bicarbonate in the hydrosphere, they are no longer available for sea urchin skeletons in the biosphere.
   or Increased CO_2 in the atmosphere causes the oceans in the hydrosphere to be more acidic from carbonic acid. The decrease in pH affects the organisms in the biosphere that need a certain pH range to survive.

   Explanation: As increasing CO_2 in the atmosphere enters the hydrosphere, carbonic acid is formed in the hydrosphere, leading to acidic conditions that do not favor sea urchin survival. Conditions also favor carbonate ions forming other compounds and not being available to combine with calcium ions to form calcium carbonate, the material that sea urchins use to make their exoskeleton.

6. 4 The function of the urinary system is to remove harmful wastes from blood. To deliver the blood to the urinary system, arteries of the circulatory system direct blood into the kidneys where it is filtered. Filtered blood leaves the kidneys through the renal vein, returning to the circulatory system to pick up metabolic wastes that are continuously produced.

7. 2 Longer nephron tubules allow for more surface area and opportunity for water to be reabsorbed and not removed from the body. Terrestrial or land mammals with favorable longer tubules adapted through natural selection to life on dry land where water regulation is a struggle.

8. Acceptable responses include, but are not limited to: When participants were exposed to 120 minutes of low oxygen, their EPO levels increased from about 11 m/u/ml to 19 m/u/ml over 4.5 hours. More red blood cells make it possible to transport more oxygen until the appropriate blood oxygen level (set point) is reached.
   or When there is a decrease in the amount of oxygen the blood is carrying to the kidney, the cells of the kidney release the EPO protein, which causes an increase in red blood cell production. This causes oxygen levels to increase back to normal.
   or The graph shows that the longer a person is exposed to low oxygen levels, the more EPO is released. Morered blood cells are produced to carry more oxygen until the normal oxygen level is reached

   Explanation: Individuals exposed to 120 minutes of lower oxygen levels demonstrated an increase in EPO levels from 11 m/u/ml to 19 m/u/ml. Individuals exposed to normal oxygen levels and intermittent low oxygen showed much lower increases, 10 m/u/ml to 10.8 m/u/ml and 11.5m/u/ml to 13m/u//ml respectively. Greater levels of EPO allow those with lower oxygen levels to increase their red blood cell numbers and deliver more oxygen.

9. 1 The presence of aquaporins on red blood cell membranes allow these cells to expand or deflate depending on concentrations of water and salt, and therefore aid in water regulation in kidneys.

10 2 As RBC's initially take on water, they become more flexible, increasing the rate of oxygen transfer. Drinking water after exercise would help an athlete's body return to a homeostatic state, by allowing RBCs to carry more oxygen.

11. 3 In order to be an inherited abnormality, the mutation in the DNA would have to be in the sex cells of the parent frogs. This mutation could then be passed on to offspring.

12. 1 Deformed frogs with leg abnormalities are less mobile and will have greater difficulty moving and escaping predator birds. When frogs are eaten by birds, it allows the Ribeiroia to reproduce and complete its life cycle.

13. 2 The introduction of parasites in the frog may have increased the amount of retinoic acid. Extra retinoic acid could promote increased activity of Hox genes which make proteins that attach to the DNA and activate leg producing genes. This increased activity may have promoted extra limb development.

14. 1 Scientist would be interested in the effect of increased levels of retinoic acid on Hox gene inheritance as these genes produce the proteins that influence limb development. Non-coding areas of DNA would not impact limb development.

15. Acceptable responses include, but are not limited to: They came from a similar ancestry because they all have similar Hox genes resulting in similar segmentation.
   or The head (or thorax, or abdomen) in all organisms is coded for by the same Hox gene.
   or The Hox gene makes the body plan follow the head, thorax, abdomen pattern.

   Explanation: The body plans for all of these arthropods all exhibit similar patterns of development based on Hox gene activity. Each arthropod has a head, thorax and abdomen region suggesting common ancestry.

24. Acceptable responses include, but are not limited to: There was less food available because the Sun was blocked. Large, non-avian dinosaurs did not have enough food available to survive.
    or Most non-avian dinosaurs were very large, so they probably had a high energy requirement. The asteroid impact reduced the amount of sunlight reaching the Earth, photosynthesis declined, so the food web collapsed.
    or The non-avian dinosaurs had traits that were adapted to a warm environment and the temperature dropped 47°F. They were unable to maintain a suitable body temperature.

    Explanation: The impact of the meteor sent dust, sulfur and carbon dioxide into the atmosphere, blocking the Sun. As a result, much vegetation died off, leaving many non-avian dinosaurs without food sources. The lack of Sun also reduced the planet's temperature. Non-avian dinosaurs were not able to maintain their body temperature in this environment and perished.

25. 3 As a result of changing environments, plants species increased in the 1.5 million years after the K-T extinction. Species number increased from 2 to 35 different kinds in that time span.

26. 2 As a result of a changing environment, plants evolved and many new species developed. Organisms that inhabited those environments adapted to changing plant food sources as evidenced by changing types of feeding strategies and teeth/jaw structures. The changes in teeth and jaw structures occurred through the process of natural selection.

27. Acceptable responses include, but are not limited to:
    Increase in numbers: After the impact, the number of different animals/plants increased over time.
    or Following this dinosaur extinction, mammals and ferns increased in number.
    or The number of mammals that survived the asteroid impact increased in number

    New species: As present global surface temperatures are increasing, some mammal species are changing in size. If these trends continue these mammals may evolve into new species.
    or New species of mammals/plants appeared following the K-T extinction.
    or The two surviving plant species shown in the chart for question 3 evolved into more than 30 species.

    Extinction: The asteroid impact resulted in the extinction of the dinosaurs.
    or The dinosaur environment changed drastically resulting in the extinction of non-avian dinosaurs.
    or The dinosaurs went extinct after the asteroid impact totally changed the environment.

    Explanation:
    Increase in numbers: As a result of the asteroid impact and the changes that occurred to the environment, plant and animal species number increased. Plants became more diverse and mammals increased in size.

    New species: After the K-T extinction, new plant species appeared, many with larger leaves. New mammal species developed having larger body sizes and different jaw and tooth structure.

    Extinction: Dinosaurs became extinct after the asteroid strike due to changing environments that were unfavorable to both non-avian and avian dinosaurs. They did not have traits that allowed them to survive changing environments.

SAMPLE

28. 4 Genetic codes in DNA direct the sequencing of amino acids which are assembled to form proteins, like enzymes. C-1 and C-2 enzymes have different shapes indicating that their genetic codes are different.

29. Acceptable responses include, but are not limited to: Use the base-pairing rule to convert the DNA sequence (TCG) to an mRNA sequence (AGC). Then use the mRNA and the codon chart to locate the amino acid (Ser).
or Match the DNA bases to produce an mRNA sequence (A to U, G to C). Use the codon chart to identify the amino acid that is coded for by the mRNA.

Explanation: The DNA sequence (TCG) is transcribed into an mRNA strand (AGC) using complimentary base pairing. The mRNA strand is then translated into amino acid sequences. The Codon Chart is used to model this process. Working from the inside to the outer ring, the mRNA code AGC codes for the Amino Acid Ser.

30. 2 Genetic variation is a result of recombination and sorting during reproduction or a mutation caused by an environmental factor. This variation would produce prostaglandins with shapes that bind to cell receptors.

31. 3 Variations can occur when chromosomes are sorted into gametes during meiosis. A change in the mother's gamete could produce a change in the prostaglandin receptor.

32. Acceptable responses include, but are not limited to: The change in the gene changes the enzyme and it will not work as well. The production of prostaglandins that cause inflammation and the chance of cancer will be reduced.
or The amino acid sequence will be different. The enzyme may not function properly causing less inflammation and less cancer.
or The shape of the enzyme will be different, and it will not connect correctly with the molecule that causes inflammation. There will be reduced inflammation.
or The extra segment would interfere with the ability of the modified genetic code to attach to the ribosome. The production of enzymes will be reduced, reducing inflammation.

Explanation: Unmodified C enzymes are 100% functional and produce prostaglandins that are linked to increased rates of cancer. The modified *C* enzyme will have a different shape and is only 20% functional, producing lower amounts of prostaglandins, therefore reducing the rate of cancer.

33. Acceptable answers include, but are not limited to:
The host will not recognize the virus as an invader.
or The cell membrane has antigens that indicate that it is a normal part of the host, so it won't be attacked by the immune system.
or The virus is enclosed by a cell membrane that the host's immune system won't recognize as a pathogen.
or The immune system would recognize the virus as being part of the individual, since it will have receptors and other chemicals that identify it as not being a pathogen.

Explanation: The membrane enclosed virus is protected from an immune system attack because the membrane contains proteins that are recognized as self rather than foreign. The immune system would not trigger a response.

SAMPLE