

CTB/McGraw-Hill

BCS Science Benchmark 2 Grade 10

Test ID: 225014

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Test Directions

General Offline Instructions:

Today you will take the Acuity test. Read each question carefully and decide which answer is correct. Using your scan sheet, fill in the bubble that contains the letter for the answer you choose.

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1. You created the following chart in biology class regarding different chemicals and their functions in the human body.

Insulin	Glucagon	Amylase	Thyroxine
Found in the pancreas; a hormone	Found in the pancreas; a hormone	Found in the pancreas and saliva; an enzyme	Found in the thyroid gland; a hormone
Stimulates cells to store or use glucose for energy	Stimulates liver cells to release glucose into the bloodstream	Breaks down starches into sugar	Stimulates consumption of oxygen and increases metabolism

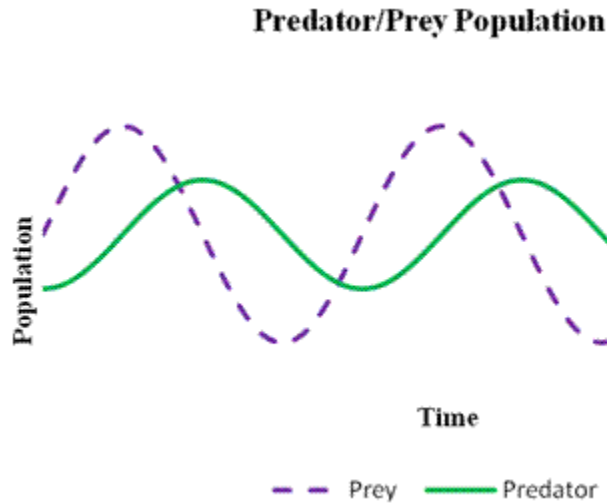
Your teacher presents you with the following scenario:

A student woke up late this morning and skipped breakfast. The student arrived at school 30 minutes later and felt tired and weak. These are symptoms of a low blood glucose level.

Which substance will **most likely** be released and begin to neutralize the low blood glucose level in the student?

- A** insulin
- B** glucagon
- C** amylase
- D** thyroxine

2. This graph illustrates the fluctuation in the population of a predator and its prey over a period of several years.



How would the addition of a second predator into the ecosystem that feeds on the same prey **most likely** affect this model in the next year?

- A The population of the prey would increase in order to keep up with the demand for food.
 - B The population of the current predator would remain the same and the new predator's population would increase.
 - C The population of the prey would increase and the population of both predators would increase.
 - D The population of the prey and the current predator would both decrease because there would be increased competition for the prey.
3. Listed below is a food chain found in the Pacific Northwest.

Algae --> herring fish --> Salmon --> Bear

The first order heterotroph receives 1000 kJ of energy from the autotroph. How much energy will be the third order heterotrophs receive if 90% of the energy is lost at each trophic level?

- A 10000 kJ
- B 1000 kJ
- C 100 kJ
- D 10 kJ

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4. Before a human skin cell undergoes the process of mitosis it contains 46 chromosomes in its nucleus. How many chromosomes will the nucleus of each of the new skin cells possess at the end of mitosis?

- A 23
- B 46
- C 92
- D 138

5. Human cells use the processes of cellular respiration and lactic acid fermentation to obtain the usable form of energy they need, ATP. The method used by cells depends on whether oxygen is present at the end of glycolysis.

Which statement correctly summarizes the energy changes based on the presence of oxygen?

- A If oxygen is not present at the end of glycolysis there will be more ATP produced than if oxygen is present.
- B If oxygen is present at the end of glycolysis there will be more ATP produced than if oxygen is not present.
- C There will be the same amount of ATP produced whether or not oxygen is present at the end of glycolysis.
- D If oxygen is present at the end of glycolysis there will be less ATP produced than if oxygen is not present.

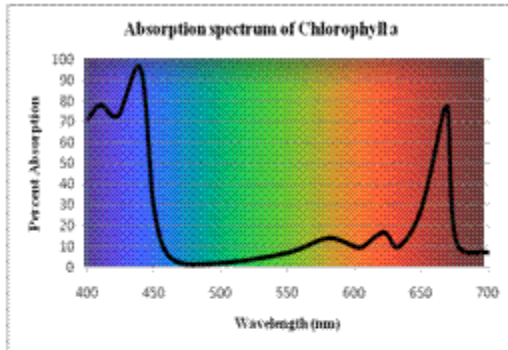
6. *Biomimicry* uses ideas and designs from nature to create materials that can be used in products that are environmentally friendly and beneficial to humans. Recently, scientists studied the surface of sharkskin and noticed a microscopic diamond-shaped pattern on the scales of sharks. Sharks do not have barnacles, bacteria, and algae on their skin. Other sea creatures such as whales have barnacles and bacteria on their skin. Based on this study, scientists have developed a thin adhesive film that has the same pattern as the sharkskin.

Which use of this film would **most** benefit humans?

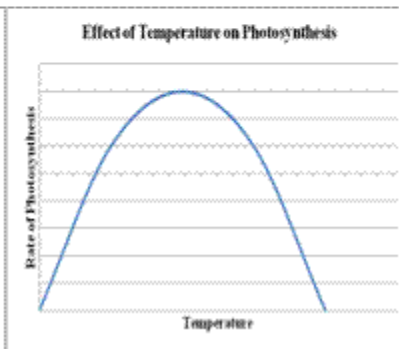
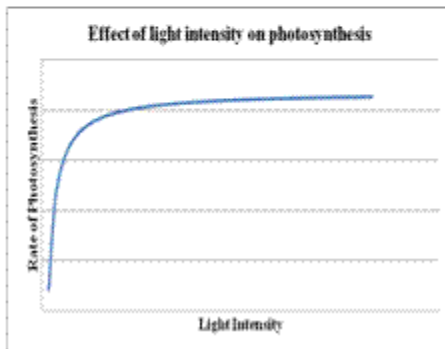
- A Cover doorknobs, chairs and tables in hospitals with this material so that bacteria will not grow and spread as quickly.
- B Cover the bottoms of shoes with this material to prevent dirt, water and bacteria from coming inside onto carpeted surfaces.
- C Cover fabrics with this material to create clothing that will be stain resistant.
- D Cover outdoor furniture and sidewalks with this material to make them waterproof.

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7. You are working with a scientist on a class project that involves growing corn and other grains in underground facilities in order to protect them from extreme weather conditions. The scientist sent you several graphs and charts she had collected from internet research. Your task is to design and conduct an experiment that will provide additional information for the scientist.



Type of Lighting	Heat produced per hour (kilojoules)
Incandescent	359 KJ
Fluorescent	105 KJ
Light emitting diodes (LED)	3.6 KJ



Which experimental design will **most likely** provide additional information that can help the scientist?

- A Design experiments using different colors of light. Compare plant growth from each trial to see which color of light works best.
- B Design experiments using lights of different intensity. Compare plant growth from each trial to see which type of lighting is the most energy efficient.
- C Design experiments measuring the heat generated by different light sources. Compare plant growth from each trial to determine which light bulb works best.
- D Design experiments measuring plant growth and temperature. Compare plant growth from each trial to determine if the underground facility has the temperature that best promotes plant growth.

8. As part of an investigation, sixteen bean seeds were planted. Eight bean seeds were grown in sunlight and eight bean seeds were grown in the absence of light. All of the other variables were identical for both investigations. The seeds grown in sunlight were healthy, green, and normal-looking in appearance. The seeds grown in the absence of light were white and thin when they sprouted and died very soon thereafter.

Which statement does the experimental evidence **best** support?

- A Sunlight is necessary for the germination of bean seeds.
- B Sunlight is necessary for normal bean seed growth.
- C The plants grown in the absence of sunlight were unhealthy since they were unable to perform the process of respiration.
- D The plants grown in sunlight were healthy since they could perform the process of respiration during the daylight hours.

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9. A research scientist working for an automobile tire company recently read two articles about making tires from renewable resources.

Article 1 - Summary

Scientists have recently received a grant to develop an enzyme that would convert plant biomass into butadiene, a key component of synthetic rubber. Currently butadiene is produced from petroleum and generates 5 to 6 billion dollars in worldwide sales per year.

Article 2 - Summary

Scientists at a university are working with microcrystalline cellulose fibers as reinforcement materials for tires. Currently tire makers use carbon black and silica. Carbon black is made from petroleum feedstock; silica is expensive to produce. Microcrystalline cellulose is cheaper to produce and is made from wood. Microcrystalline cellulose requires less energy in the tire production process.

The research scientist must submit a 5-year plan for the company's research division. Which plan **best** demonstrates the effective use of the research department's resources?

- A Keep the current manufacturing process for tires. Have researchers look for ways to better use the current materials and continue reading articles about new materials.
 - B Keep the current manufacturing process for tires. Have researchers devote all of their resources to developing an enzyme for creating butadiene from biomass.
 - C Keep the current manufacturing process for tires. Have researchers look for ways to decrease the production cost using the current manufacturing process. Assign researchers to projects for developing the enzyme for producing butadiene from biomass and using microcrystalline cellulose as a reinforcement fiber.
 - D Keep the current manufacturing process for tires. Have researchers look for ways to decrease the production cost using the current manufacturing process as well as methods to change the process once new materials become available. Assign researchers to projects for developing the enzyme for producing butadiene from biomass and using microcrystalline cellulose as a reinforcement fiber.
10. Your biology class built a decorative fishpond in the front of the elementary school so the younger students could study ecosystems. Within a few months, the pond had a large amount of algae that caused problems with water quality and the filtering system. Your class began researching different methods to control the algae without killing the fish or other important organisms. The chemistry teacher stopped by and suggested you narrow your search to algaecides that contain copper compounds. Four properties of some copper compounds are listed below. Which property of some copper compounds **best** makes them an effective algaecide?
- A dissolves easily in water
 - B changes the color of the water to a blue-green shade when dissolved
 - C changes the pH of the water slightly
 - D reduces the amount of oxygen dissolved in the water

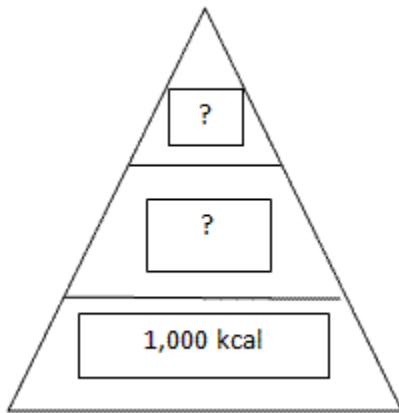
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11. While walking through a meadow, you find a completely white plant growing among green vegetation.

Which statement **best** describes the white plant?

- A The plant can absorb all wavelengths of light for maximum photosynthesis.
- B The plant contains high levels of leucoplasts and would have a high starch content.
- C The plant is commensal, utilizing visible light waves for maximum photosynthesis.
- D The plant is parasitic, obtaining food from the surrounding vegetation.

12. The transfer of energy from one trophic level to another generally has a value of approximately ten percent.



Approximately how much energy would be available to organisms at the third trophic level of an energy pyramid if there were 1,000 kcal available on the first trophic level?

- A 10 kcal
- B 100 kcal
- C 10,000 kcal
- D 100,000 kcal

13. During meiosis the number of chromosomes in an organism's daughter cells goes from diploid to haploid.

Which statement **best** describes why this process is important during meiosis?

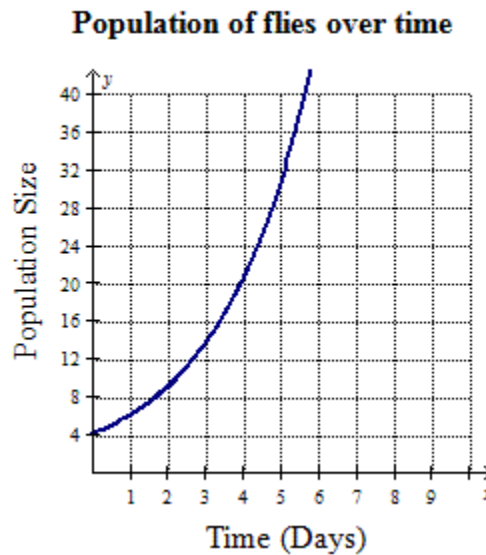
- A The amount of DNA in the parent cell is kept to a minimum.
- B The amount of DNA will double in the daughter cell so when the cell divides it will maintain the original number of chromosomes of the parent cell.
- C The number of chromosomes will be maintained after sexual reproduction to that of the parent cell.
- D It prevents the nucleus from becoming too large during sexual reproduction.

14. Your class is conducting an online investigation regarding the population growth of flies over a period of several days.

The data gathered by your class is found below.

Time (Days)	Number of Flies
0	4
1	6
2	8
3	12
4	16
5	24
6	32

Doubling time for the flies in the experiment: 2 days



Which statement is true about the rate of change in the fly population from day 1 to day 2 as compared to that of day 5 to day 6?

- A The rate of change from day 5 to day 6 is four times greater than that from day 1 to day 2.
- B The rate of change from day 5 to day 6 is two times greater than that from day 1 to day 2.
- C The rate of change from day 5 to day 6 is six times greater than that from day 1 to day 2.
- D The rate of change from day 5 to day 6 is the same as that from day 1 to day 2.

15. Your laboratory group was given three different jars of pond water from the school pond. Each jar contains only one type of free-moving, single-celled organism: amoeba, euglena or paramecium. The only information your teacher has given you is that the amoeba and paramecium are heterotrophic and the euglena can be either heterotrophic or autotrophic, depending on its needs.

What procedure should your team use to find the jar containing euglena?

- A** Expose the jars to sunlight. After two days, the jar with the lowest oxygen content will contain the euglena.
- B** Expose only a small circular area of each jar to sunlight. After one day, the jar with the euglena will have the main concentration of organisms on the dark side.
- C** Prepare a wet-mount slide for each jar's specimen. Observe with a compound microscope and determine the method of reproduction. Only the euglena will reproduce by binary fission.
- D** Prepare a wet-mount slide for each jar's specimen. Observe with a compound microscope. Only the euglena will have chloroplast.

16. Your teacher listed on the board in no particular order some of the major events that occur within a cell during mitosis.

1. Centromeres divide.
2. Chromosomes line up along the equator.
3. Nuclear envelope forms at each pole.
4. Chromosomes become visible.
5. Chromatids (now called chromosomes) move toward opposite poles.
6. Chromosomes uncoil.

Which of the following has these events in the correct order from beginning to end?

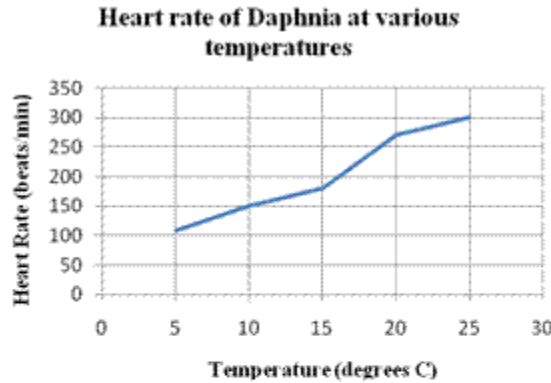
- A** 4 --> 2 --> 1 --> 5 --> 3 --> 6
- B** 6 --> 4 --> 2 --> 1 --> 5 --> 3
- C** 4 --> 1 --> 2 --> 6 --> 3 --> 5
- D** 6 --> 3 --> 5 --> 1 --> 2 --> 4

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17. Your biology teacher has asked you to perform laboratory investigations to determine if temperature has any effect on Daphnia, the water flea.

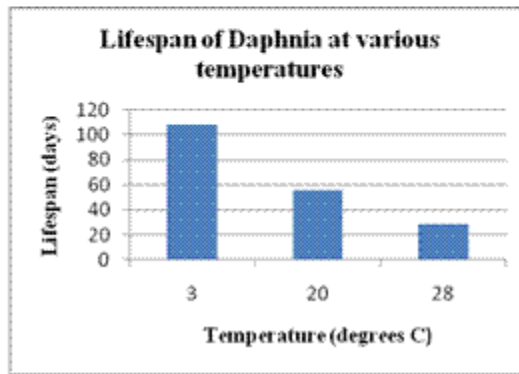
Heart rate of Daphnia

- 5°C – 108 beats/min
- 25°C – 300 beats/min
- 15°C – 180 beats/min
- 10°C – 150 beats/min
- 20°C – 270 beats/min



Average lifespan of Daphnia

- 3°C – 108 days
- 28°C – 29 days
- 20°C – 56 days



Which statement is **best** supported by the data shown?

- A The lifespan and heart rate of Daphnia both increase with an increase in temperature.
- B The lifespan and heart rate of Daphnia both decrease with an increase in temperature.
- C The highest rate of increase in heart rate occurs between 20 and 25 degrees Celsius.
- D The highest rate of increase in heart rate occurs between 15 and 20 degrees Celsius.

18. Filamentous algae are typically found in freshwater ponds. Under ideal conditions, the algae grows quickly and can alter the ecosystem of a pond in a short period of time. You conducted a series of experiments to determine the best growing conditions for filamentous algae. Since photosynthesis is a key component of plant growth, you decided to use different colors of light. Algae samples in a sodium bicarbonate (NaHCO_3) solution were placed in each flask and the flasks were stoppered. The experiments conducted are listed below.

Flask 1	Flask 2	Flask 3	Flask 4
0.10 % NaHCO_3 Solution	0.25 % NaHCO_3 Solution	0.50 % NaHCO_3 Solution	0.75 % NaHCO_3 Solution
150 ml water	150 ml water	150 ml water	150 ml water
10 g algae	10 g algae	10 g algae	10 g algae
4 hrs of light daily	4 hrs of light daily	4 hrs of light daily	4 hrs of light daily
Yellow light	Blue light	Red light	Green light

Flask 4 had the greatest growth of algae during the experiment.

These results were not what you expected. According to your research, one type of chlorophyll, **chlorophyll a** absorbs more energy in the blue and red range of light and very little in the yellow and green range of light.

Which statement is the **best** possible explanation for the results you obtained based on the setup of the experiment?

- A The algae and water mixture in each flask was slightly acidic and NaHCO_3 produces CO_2 when exposed to an acid.
- B Chlorophyll a is green and Flask 4 was exposed only to green light; therefore, flask 4 had the most growth.
- C The exposure to only 4 hours of light each day did not provide the algae with enough time to undergo photosynthesis.
- D Since the flasks were stoppered, the amount of oxygen increased and affected the photosynthesis rate.

19. While participating in a computer laboratory simulation on photosynthesis, your team collected data on how the rate of ATP production is affected by the wavelength and intensity of light.

Wavelength (nm)	% Maximum ATP	Number of ATP
400	65	3
450	15	1
500	7.5	1
550	15	1
600	20	1
650	85	4
700	5	1
750	3	1

Light Intensity (lux)	% Maximum ATP	Number of ATP
0	0	0
40	17	1
80	34	2
120	51	3
160	68	3
200	85	4

Which combinations of light intensity and wavelength would cause the highest possible rate of energy production?

- A 650 nm at 200 lux
- B 750 nm at 200 lux
- C 400 nm at 160 lux
- D 650 nm at 160 lux

20. Sarah picks up a beaker that was recently used for heating a liquid and is still hot. She immediately withdraws her hand from the beaker.

Which statement correctly identifies the body systems that are working together to protect Sarah from harm?

- A** The nervous and integumentary systems work together to protect against sudden temperature changes by sending signals that cause her to withdraw her hand from the beaker.
- B** The nervous and muscular systems work together to withdraw her hand from the beaker after realizing the beaker is still hot.
- C** The skeletal and muscular systems work together to withdraw her hand from the beaker after realizing the beaker is still hot.
- D** The skeletal and integumentary systems work together to protect against sudden temperature changes by sending signals that cause her to withdraw her hand from the beaker.

This is the end of the test.