

Name: _____

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IB Biology — Practice Exam

Instructions: Answer all questions in the spaces provided. Pay attention to the command term in each question: "explain" needs reasons, not a description. A calculator is permitted.

Time Limit: 60 minutes

Multiple Choice (15 questions)

- [1 point] 1. Water is pulled up the xylem of a tall tree as a continuous column. Which property of water is most directly responsible for the column not breaking under tension?
- A. Adhesion of water molecules to the cellulose walls of the xylem
 - B. Cohesion between water molecules
 - C. The high specific heat capacity of water
 - D. The ability of water to dissolve ions
- [1 point] 2. In a sample of double-stranded DNA, 30% of the nucleotides contain adenine. What percentage of the nucleotides contain guanine?
- A. 20%
 - B. 30%
 - C. 40%
 - D. 70%
- [1 point] 3. In a photomicrograph, a cell measures 50 mm across. The actual diameter of the cell is 20 μm . What is the magnification of the image?
- A. $\times 25$
 - B. $\times 250$
 - C. $\times 2500$
 - D. $\times 25\,000$
- [1 point] 4. According to the biological species concept, two populations belong to different species if they:
- A. live in different habitats and never meet
 - B. show visible differences in body size or colour
 - C. cannot interbreed to produce fertile offspring
 - D. have different numbers of chromosomes in their body cells

- [1 point] 5. An enzyme-catalysed reaction is carried out at temperatures above the enzyme's optimum. Which statement best explains why the rate of reaction falls?
- A. The substrate molecules move too fast to bind to the enzyme
 - B. Bonds maintaining the tertiary structure break, changing the shape of the active site
 - C. The substrate molecules are denatured by the heat
 - D. The activation energy of the reaction increases
- [1 point] 6. Which statement correctly describes a difference between anaerobic and aerobic cell respiration in human muscle cells?
- A. Anaerobic respiration produces ethanol and carbon dioxide
 - B. Anaerobic respiration yields far less ATP per molecule of glucose
 - C. Aerobic respiration takes place only in the cytoplasm
 - D. Anaerobic respiration uses oxygen as the final electron acceptor
- [1 point] 7. A student measures the rate of photosynthesis of pondweed at a high, constant light intensity and a constant carbon dioxide concentration. When the temperature is raised from 15°C to 25°C, the rate doubles. Which factor was limiting the rate at 15°C?
- A. Light intensity
 - B. Carbon dioxide concentration
 - C. Temperature
 - D. Wavelength of the light
- [1 point] 8. Which feature of the alveoli in human lungs increases the rate of gas exchange by reducing the diffusion distance?
- A. A wall made of a single layer of flattened cells
 - B. A very large total surface area
 - C. A dense network of surrounding capillaries
 - D. A film of moisture lining the inner surface
- [1 point] 9. Shortly after a meal rich in carbohydrate, the blood glucose concentration rises. Which hormone is released in response, and by which cells?
- A. Insulin, released by alpha cells of the pancreas
 - B. Glucagon, released by alpha cells of the pancreas
 - C. Insulin, released by beta cells of the pancreas
 - D. Glucagon, released by beta cells of the pancreas
- [1 point] 10. Which event occurs during the depolarisation phase of an action potential in a neuron?
- A. Potassium ions diffuse into the axon through open channels
 - B. Sodium ions diffuse into the axon through voltage-gated channels
 - C. Sodium ions are pumped out of the axon by sodium-potassium pumps
 - D. Potassium ions diffuse out of the axon through voltage-gated channels

- [1 point] 11. Why does vaccination give long-term protection against a pathogen?
- A. The vaccine contains antibodies that remain in the blood for many years
 - B. Antigens in the vaccine stimulate the production of memory cells
 - C. The vaccine kills any pathogens already present in the body
 - D. The vaccine prevents the pathogen from entering the body
- [1 point] 12. Bacteria grown for many generations in a medium containing only heavy nitrogen (^{15}N) are transferred to a medium containing only light nitrogen (^{14}N) and allowed to divide twice. What proportion of the DNA molecules then consist of one heavy strand and one light strand?
- A. 0%
 - B. 25%
 - C. 50%
 - D. 100%
- [1 point] 13. The template strand of a gene has the base sequence 3'-TACGGA-5'. What is the sequence of the mRNA transcribed from it?
- A. 5'-AUGCCU-3'
 - B. 5'-UACGGA-3'
 - C. 5'-ATGCCT-3'
 - D. 5'-UCCGUA-3'
- [1 point] 14. In an industrial region, a moth population changed over a century from mostly pale to mostly dark forms as soot darkened the tree bark on which the moths rest and birds preyed on them. Which statement correctly describes what happened?
- A. The pollution caused mutations that turned pale moths dark
 - B. Individual moths became darker during their lives to match the bark
 - C. Dark moths, already present as a rare variant, were eaten less often and left more offspring, so the dark allele became more common
 - D. Pale moths migrated away from the polluted region
- [1 point] 15. Which of the following is an example of positive feedback in global warming?
- A. Faster plant growth at higher carbon dioxide concentrations removes more carbon dioxide from the atmosphere
 - B. Thawing permafrost releases methane, which causes further warming and further thawing
 - C. Increased evaporation produces more cloud, which reflects more sunlight back into space
 - D. Warmer oceans dissolve more carbon dioxide from the air

Short Answer (2 questions)

- [10 points] 16. A student investigated osmosis in potato tissue. Five cylinders were cut from the same potato, blotted dry and weighed, then each was placed for 30 minutes in a sucrose solution of a different concentration. Each cylinder was then blotted and reweighed. The percentage changes in mass were: 0.0 mol dm^{-3} , +8.0%; 0.2 mol dm^{-3} , +3.5%; 0.4 mol dm^{-3} , -1.0%; 0.6 mol dm^{-3} , -5.0%; 0.8 mol dm^{-3} , -8.5%.

[1 point] (a) The cylinder placed in the 0.6 mol dm^{-3} solution had an initial mass of 2.40 g and a final mass of 2.28 g. Show that the percentage change in mass is -5.0% .

[2 points] (b) Describe the relationship between the sucrose concentration and the percentage change in mass.

[2 points] (c) Estimate the sucrose concentration at which there would be no change in mass, and state what this concentration represents.

[3 points] (d) Explain the change in mass of the cylinder placed in the 0.8 mol dm^{-3} solution.

[2 points] (e) State two variables, other than sucrose concentration, that the student should have kept constant, and explain why one of them matters.

[10 points] 17. Red–green colour blindness in humans is caused by a recessive allele of a gene carried on the X chromosome. Use X^B for the allele giving normal colour vision and X^b for the colour-blindness allele. Maya has normal colour vision; her father is colour blind. Her partner Tom also has normal colour vision.

[2 points] (a) Explain why red–green colour blindness is more common in males than in females.

[2 points] (b) State the genotypes of Maya and Tom, giving a reason for Maya's genotype.

[2 points] (c) Determine the probability that their first child is a colour-blind boy. Show your working.

[2 points] (d) Outline two processes in meiosis that produce genetic variation among gametes.

[2 points] (e) Explain how natural selection can change the frequency of an allele in a population over many generations.