Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 1A

28 October 2025

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

1 hour 30 minutes [Paper 1A and Paper 1B]

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- A calculator is required for this paper.
- The maximum mark for paper 1A is **[30 marks]**.
- The maximum mark for paper 1A and paper 1B is **[55 marks]**.

19 pages

8825 – 6022
© International Baccalaureate Organization 2025

1. Which of the following is a consequence of the adhesive properties of water?

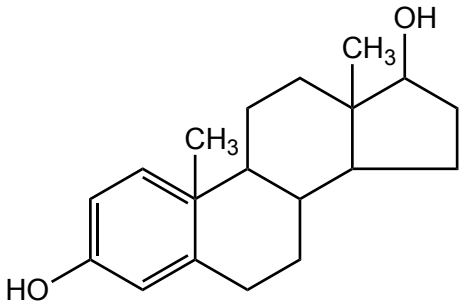
A. Stable temperatures of aquatic environments

B. Water movement by capillary action in soil

C. Transport of dissolved nutrients in blood plasma

D. Cooling effect of sweating

2. Oestradiol is a steroid hormone.



How does oestradiol cross plasma membranes?

A. It can move between phospholipids because it is non-polar.

B. It can pass either between phospholipids or through channel proteins because it is amphipathic.

C. It can only pass through hydrophilic pores as its polar ends can form H bonds.

D. It must pass through channel proteins due to its large size.

3. The table shows some essential and non-essential amino acids.

Essential amino acids	Non-essential amino acids
valine	alanine
lysine	glycine

What is a valid conclusion for an amino acid in the table?

A. Lysine is synthesized by the human body.

B. Alanine can only be obtained from food.

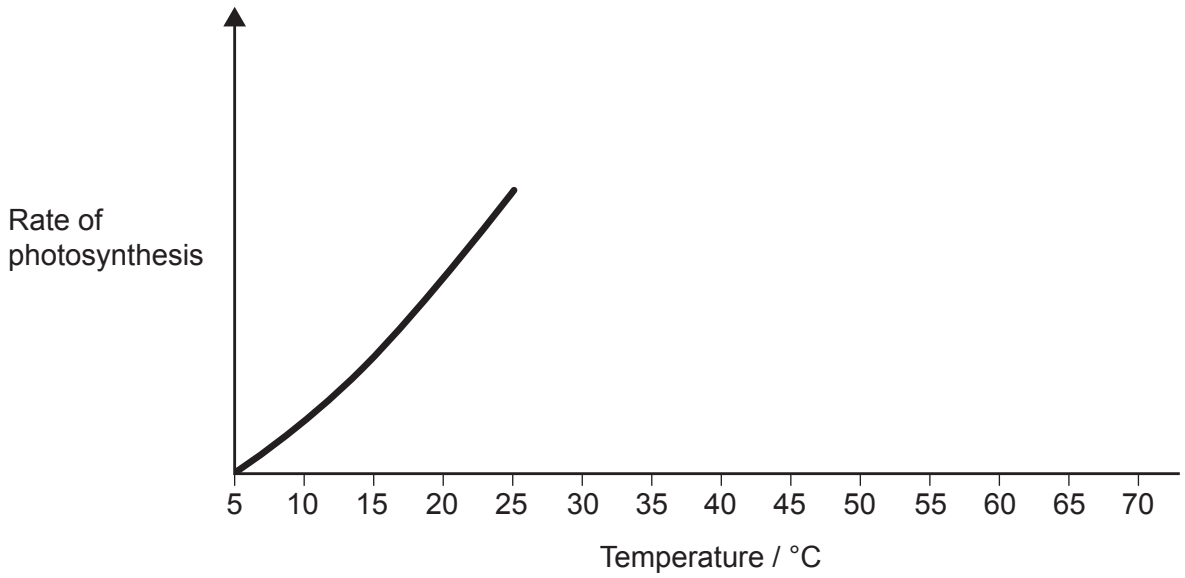
C. Glycine is not used in the human body.

D. Valine must be supplied in the diet.

4. What are the waste products of aerobic and anaerobic respiration in humans?

	Aerobic respiration	Anaerobic respiration
A.	carbon dioxide only	lactate and carbon dioxide
B.	carbon dioxide and water	lactate and carbon dioxide
C.	carbon dioxide and water	lactate only
D.	carbon dioxide only	lactate only

5. An experiment investigated the effect of temperature on the rate of photosynthesis of a plant. Results are shown for temperatures between 5 °C and 25 °C.



How would further increases in temperature, up to 70 °C, affect the rate of photosynthesis?

A. It would decrease between 25 °C and 35 °C and then increase between 35 °C and 70 °C.

B. It would continue increasing as temperature increases.

C. It would increase to a maximum of between 30 °C and 40 °C and then decrease.

D. It would peak above 25 °C and then remain constant.

6. Which of the following is a consequence of the degeneracy of the genetic code?

A. Codons affected by mutagens always code for non-functional proteins.

B. There are variations in the amino acid sequences for the same protein.

C. Some base mutations cause no changes in protein structure.

D. A codon may code for more than one amino acid in response to environmental changes.

7. What bonds do the enzymes DNA polymerase and helicase form or break during DNA replication?

	DNA polymerase	Helicase
A.	forms sugar–phosphate bonds	breaks hydrogen bonds
B.	forms hydrogen bonds	breaks sugar–phosphate bonds
C.	forms hydrogen bonds	forms sugar–phosphate bonds
D.	forms sugar–phosphate bonds	forms hydrogen bonds

8. What is a reason that both phloem sieve tube elements and human red blood cells are considered atypical?

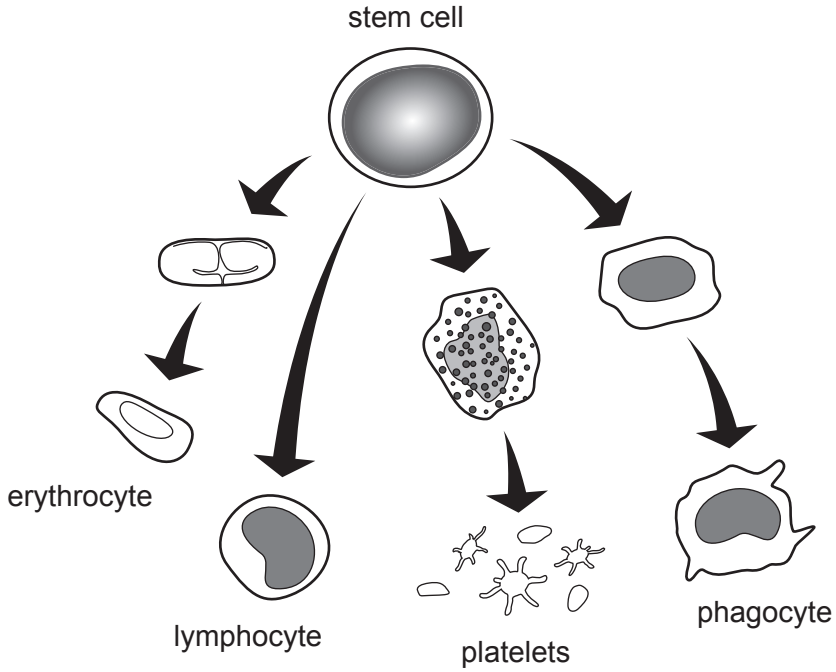
A. They have no cytoplasm

B. Their DNA is free in the cytoplasm

C. They do not have a nucleus

D. All membrane-bound organelles are missing

9. Stem cells can differentiate to produce a variety of cell types in the adult human body.



Which description corresponds to the stem cell in the diagram?

	Type	Location
A.	totipotent	bone marrow
B.	multipotent	bone marrow
C.	totipotent	blood
D.	multipotent	blood

10. Which of the following is considered a cell organelle?

A. Cell wall

B. Lysosome

C. Cytoskeleton

D. Cytoplasm

11. The conduction velocity of electrical impulses was measured in different myelinated nerve fibres.

Type of nerve fibre	Conduction velocity / m s^{-1}
P	3–10
Q	30–70
R	80–110

Which hypothesis would explain the higher conduction velocity of nerve fibre R, compared to nerve fibres P and Q?

A. It is the longest.

B. It has the thinnest myelin sheath.

C. It has the largest diameter.

D. It has the greatest number of mitochondria.

12. Daughter cells usually receive equal amounts of cytoplasm as parent cells undergo cytokinesis. Which of the following is an exception?

A. Asexual reproduction by budding in yeast

B. Bacterial cell division

C. Cloning of lymphocytes during an immune response

D. Formation of a zygote during fertilization

13. According to the biological species concept, which of the following indicates that two organisms belong to the same species?

I. They occupy the same ecological niche.

II. They share morphological features.

III. They can crossbreed and produce fertile offspring.

A. I only

B. I and II

C. II and III

D. III only

14. The micrograph shows a transverse section of blood vessels in a human leg muscle.

Which is the main contributor to the movement of blood along vessel X?

A. The smooth surface of the inner lining

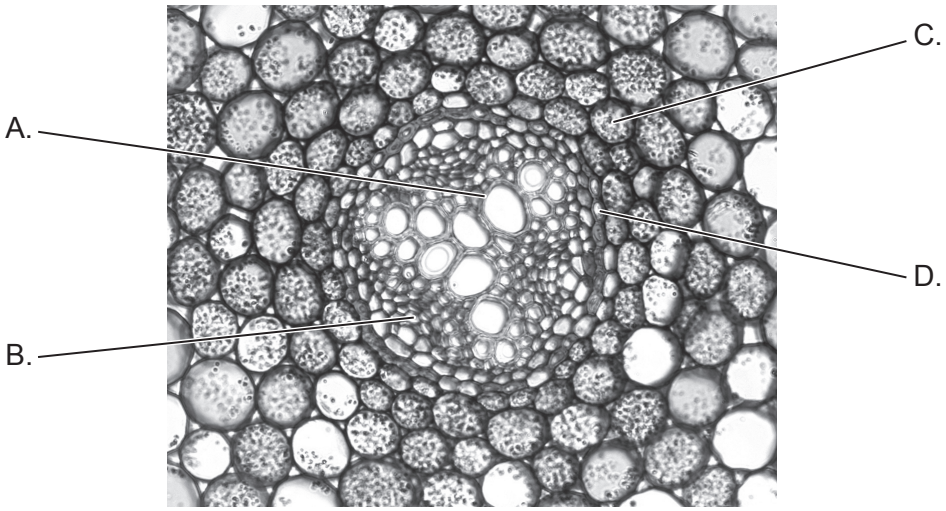
B. Stretching and recoiling of the vessel walls

C. Differences in plasma solute concentration

D. Contraction of muscles adjacent to the vessel

15. The micrograph of a transverse section of buttercup (*Ranunculus sp.*) root shows the stele (central part) and surrounding cortex cells.

Where is lignin found?



16. Which of the following will cause the production of antibodies during an infection?

A. Conversion of fibrinogen to fibrin by thrombin

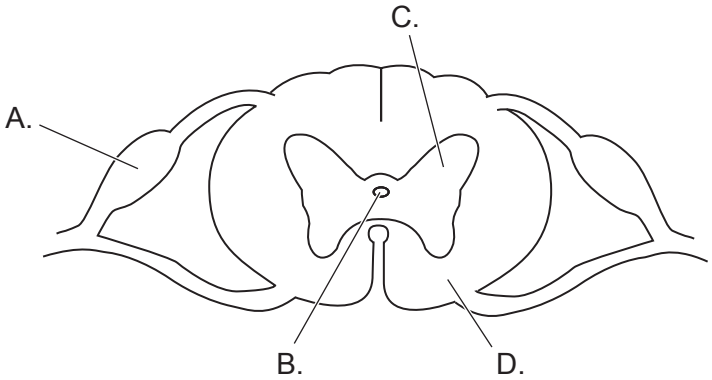
B. B-cell activation by helper T-cells and antigens

C. Plasma cell activation by platelets

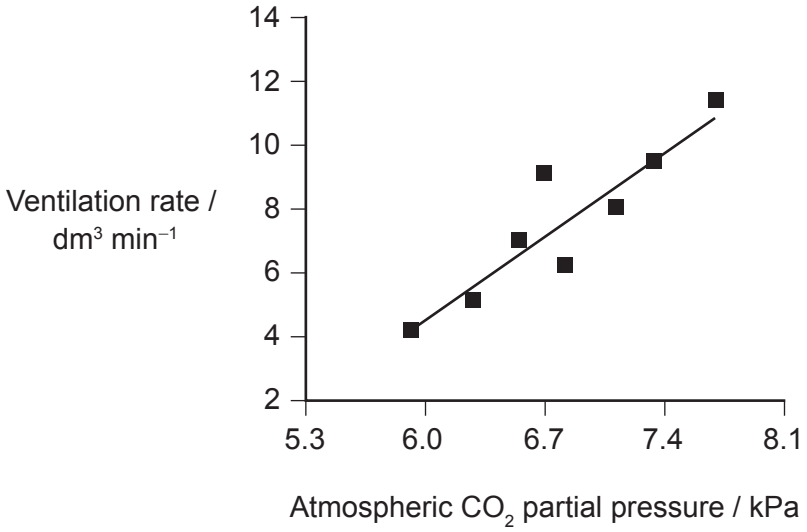
D. Activation of phagocytes by infected body cells

17. The spinal cord is involved in the coordination of involuntary actions such as the pain reflex.

Where are synapses between sensory neurons and interneurons found?



18. The graph shows the effect of atmospheric carbon dioxide (CO_2) concentration (measured as partial pressure) on the ventilation rate (measured as total volume of air breathed in and out from the lungs in one minute) of a mammal.



Which of the following explains the results obtained at high atmospheric CO_2 concentration?

A. The brainstem stimulates increased contraction of the diaphragm and intercostal muscles when chemoreceptors detect a drop in blood pH.

B. Stretch receptors in the brainstem send impulses to the lungs to increase ventilation rate.

C. Baroreceptors sense a build-up of CO_2 and send signals to the diaphragm and intercostal muscles.

D. The pituitary gland stimulates the brainstem when blood plasma becomes more acidic.

19. Flowering plants can use either self-pollination or cross-pollination when they carry out sexual reproduction. Which plants are most likely to cross-pollinate?

A. Plants that are hermaphrodites

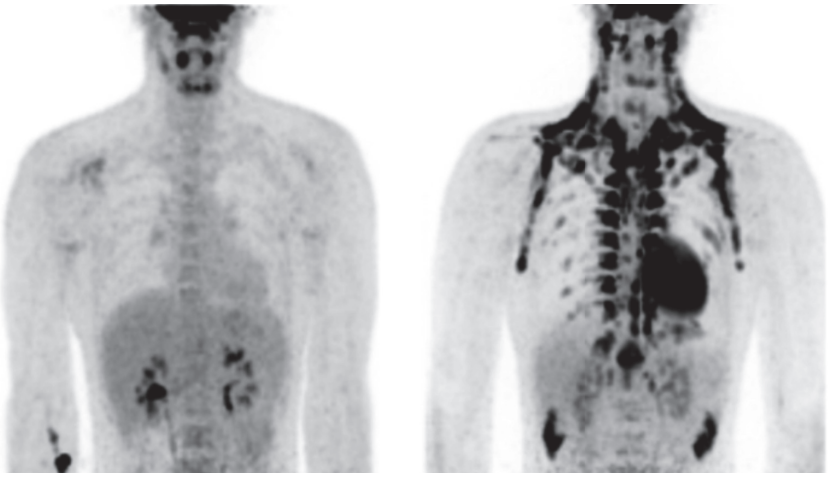
B. Plants whose anthers and stigmas mature at the same time

C. Plants with flowers that have much longer stamens than stigmas

D. Plants that are either male or female

20. The dark areas in the PET/CT scanning images show the activity of brown adipose tissue in an adult human at room temperature (20 °C) and 2 °C.

room temperature 2 °C



How does brown adipose tissue contribute to regulating body temperature at 2 °C?

A. It provides adenosine triphosphate (ATP) for muscle contraction when shivering.

B. It further insulates the body so that internal heat is not lost.

C. It turns into thick layers of white adipose tissue to prevent hypothermia.

D. It breaks down fat to generate heat but not ATP.

21. Scientists incubated larvae of the moth *Utetheisa ornatrix* at either 15 °C or 22 °C until they hatched. They found the hatched moths had different wing colour patterns due to phenotypic plasticity.

Moth from larvae incubated at 15 °C

Moth from larvae incubated at 22 °C

Which of the following explains the observed differences in wing colour?

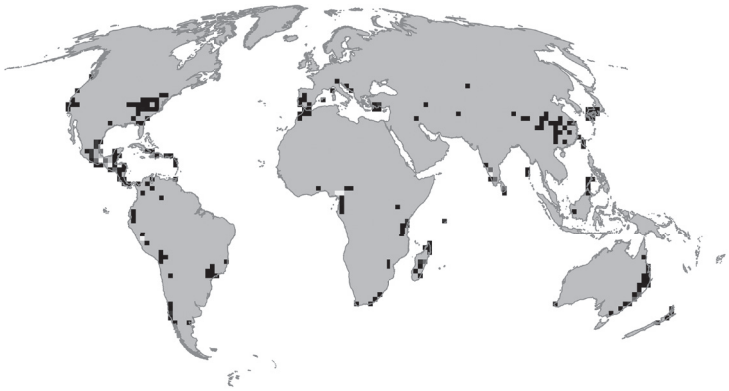
A. Colder temperatures induce mutations in genes for wing colour.

B. The expression of genes for wing colour is affected by temperature.

C. A mutation makes moths less visible to predators in cold climates.

D. Wing colour is the result of polygenic inheritance.

22. The dark areas of the map show the distribution of some species included in the EDGE of Existence programme.



What is the reason these species have been included in the EDGE of Existence programme?

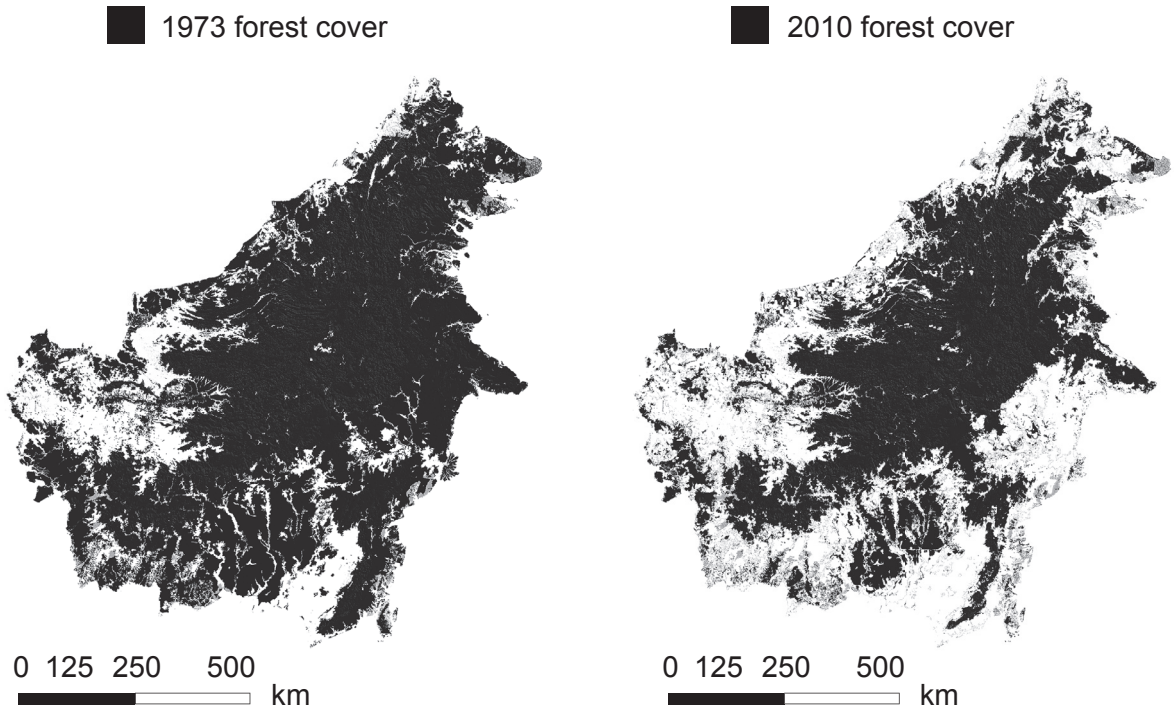
A. They occupy similar niches threatened by invasive species.

B. Their risk of extinction is higher as they live at the edge of ecosystems.

C. Their populations are decreasing and there are few or no closely related species.

D. They are keystone species in their ecosystems.

23. The satellite images show changes in the area covered by forest, much of which is mixed dipterocarp forest, on the island of Borneo in Southeast Asia.



Which human activities are most likely to have caused the changes shown in the map?

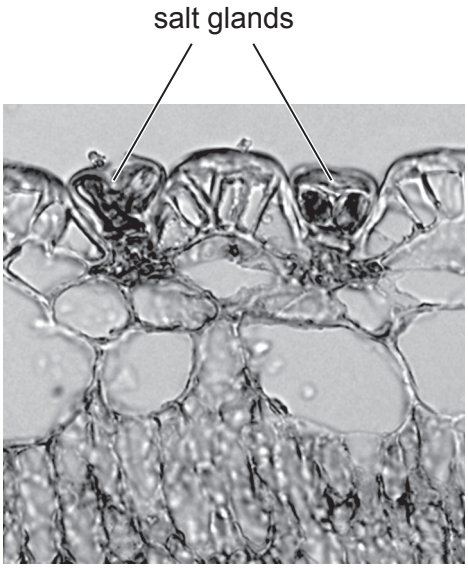
A. Logging and palm oil plantation

B. Logging and rewilding

C. Mining and afforestation

D. Afforestation and palm oil plantation

24. *Avicennia officinalis* is a tree species that is adapted to live in mangrove swamps. Salt glands can be seen in the micrograph of a transverse section of an *A. officinalis* leaf.



How does *A. officinalis* benefit from this adaptation?

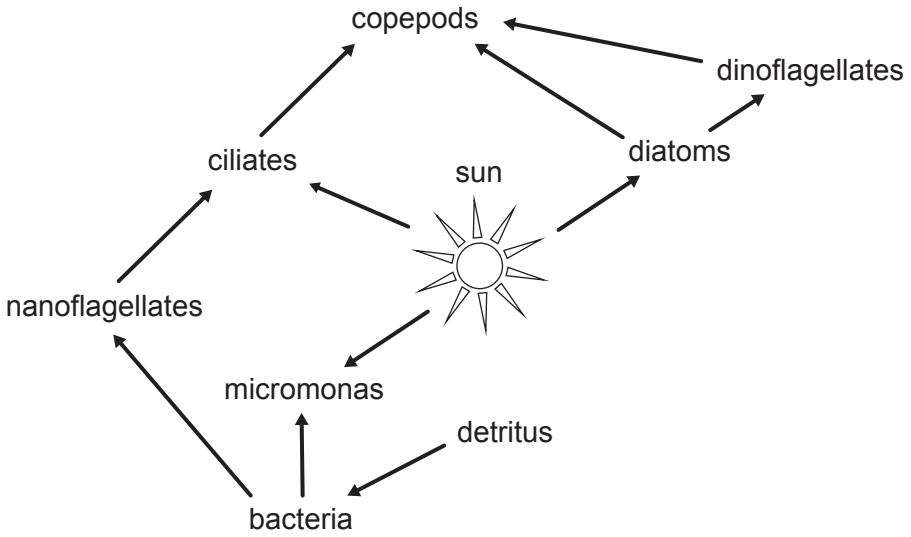
A. The glands provide nitrates for amino acid synthesis as mangrove soils are nitrogen-deficient.

B. The salt in the leaves attracts predators to eat the leaves.

C. A high concentration of salt in the glands allows absorption of water into the leaf cells.

D. The glands secrete salt to keep cytoplasmic concentration suitable for metabolic processes.

25. The diagram shows the flow of energy between some Arctic species.



Which organism is a mixotroph?

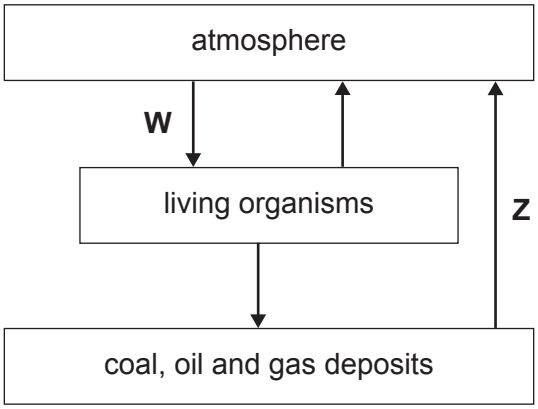
A. Bacteria

B. Nanoflagellates

C. Micromonas

D. Copepods

26. The diagram shows a simplified carbon cycle.



Which processes are taking place at W and Z?

	W	Z
A.	respiration	combustion
B.	photosynthesis	decomposition
C.	respiration	decomposition
D.	photosynthesis	combustion

27. Root nodules in a plant of the Fabaceae (legume) family is an example of a type of interspecific relationship that involves bacteria.

Which of the following explains the relationship between the species?

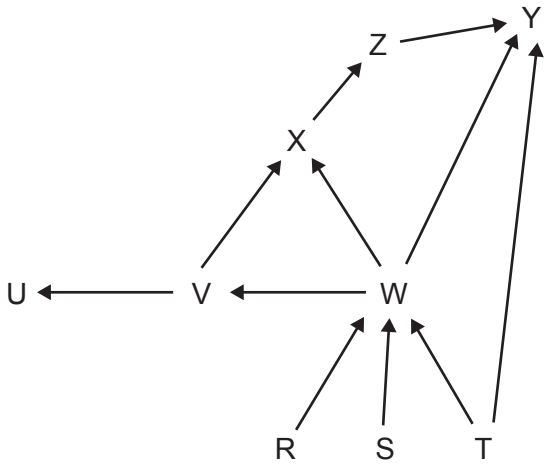
A. It is mutualistic, as bacteria obtain oxygen for respiration and provide carbon dioxide for plant photosynthesis.

B. It is mutualistic, as the plant supplies bacteria with sugars and obtains ammonium for protein synthesis.

C. It is parasitic, as bacteria take nutrients from the plant causing poor plant growth.

D. It is parasitic, as bacteria obtain water from roots, which reduces plant photosynthesis.

28. The diagram shows a food web for an aquatic ecosystem in which the letters R–Z represent individual species.



Which organism is both a secondary and tertiary consumer?

A. Organism T

B. Organism X

C. Organism Y

D. Organism Z

29. Which of the following may contribute to a positive feedback cycle in global warming?

A. The release of methane from thawing ice caps

B. The uptake of carbon dioxide by a reforested area

C. Higher temperatures increasing photosynthesis rates

D. The accumulation of peat in swamps

30. Increased leaching of nitrogen fertilizers disrupts the stability of aquatic ecosystems such as lakes. What change is expected if nitrogen leaches into a lake over time?

A. Wilting of surface plants

B. Increased biochemical oxygen demand (BOD)

C. Weakened mollusc shells

D. Bioaccumulation of pollutants at higher trophic levels

Disclaimer:

Content used in IB assessments is taken from authentic, third-party sources. The views expressed within them belong to their individual authors and/or publishers and do not necessarily reflect the views of the IB. Any trademarks™ or registered® trademarks included are used for illustrative purposes only, and use does not imply any affiliation with or endorsement by the International Baccalaureate.

References:

14. Calvo, J.L., 2018. *Muscular artery, vein and nerve bundles surrounded by adipose tissue, near a lymph node*. Available at: https://www.shutterstock.com/image-photo/muscular-artery-vein-nerve-bundles-surrounded-785176687?dd_referrer=. Source adapted.

15. olikim, 2006. *Microscopic image of a buttercup plant*. [image online] Available at: https://www.gettyimages.co.uk/detail/photo/microscopic-image-of-a-buttercup-plant-royalty-free-image/184098803 [Accessed 4 December 2024]. Source adapted.

18. Reproduced with permission of the © ERS 2025. Dempsey JA, Smith CA. Pathophysiology of human ventilatory control. *Eur Respir J* 2014; 44: 495–512 DOI:10.1183/09031936.00048514. [Accessed 17 October 2024]. Source adapted.

20. From *The New England Journal of Medicine* [online], Lichtenbelt, W.D. van M., Vanhommerig, J.W., Smulders, N.M., Drossaerts, J., Kemerink, G.J., Bouvy, N.D., Schrauwen, P. and Teule, G.J.J., Cold-Activated Brown Adipose Tissue in Healthy Men, Vol. 360., No. 15, Figure 1, © 2009 Massachusetts Medical Society. Reprinted with permission from Massachusetts Medical Society. Available at: https://www.nejm.org/doi/full/10.1056/nejmoa0808718 [Accessed 22 October 2024]. Source adapted.

21. Sourakov, A., 2015. Temperature-dependent phenotypic plasticity in wing pattern of *Utetheisa ornatrix bella* (*Erebidae*, *Arctiinae*). *Tropical Lepidoptera Research*, June 2015, Vol. 25, No. 1. Available at: https://journals.flvc.org/troplep/article/view/89750 [Accessed 14 November 2025]. Source adapted.

22. Safi K, Armour-Marshall K, Baillie JEM, Isaac NJB (2013) Global Patterns of Evolutionary Distinct and Globally Endangered Amphibians and Mammals. *PLoS ONE* 8(5): e63582. https://doi.org/10.1371/journal.pone.0063582.

23. Gaveau, D.L.A., Sloan, S., Molidena, E., Yaen, H., Sheil, D., Abram, N.K., Ancrenaz, M., Nasi, R., Quinones, M., Wielaard, N. and Meijaard, E., 2014. *Figure 3*. [image online] Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0101654#pone-0101654-g003 [Accessed 6 December 2024]. Reference redacted. Source adapted.

24. Tan W-K, Lim T-K, Loh C-S, Kumar P, Lin Q (2015) Proteomic Characterisation of the Salt Gland-Enriched Tissues of the Mangrove Tree Species *Avicennia officinalis*. *PLoS ONE* 10(7): e0133386. https://doi.org/10.1371/journal.pone.0133386. Licensed under the Creative Commons Attribution 4.0 International license: https://creativecommons.org/licenses/by/4.0/ [Accessed 17 October 2024]. Source adapted.

27. Tomasz Klejdysz, 2024. *Rhizobium root nodules on the roots of a soybeans for nitrogen fixation*. [image online] Available at: https://www.gettyimages.co.uk/detail/photo/rhizobium-root-nodules-on-the-roots-of-a-soybeans-royalty-free-image/2184787169?phrase=soybean%20root&searchscope=image%2Cfilm&adppopup=true. [Accessed 6 November 2024]. Source adapted.

All other texts, graphics and illustrations © International Baccalaureate Organization 2025