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Biology

Higher level

Paper 1A

12 May 2025

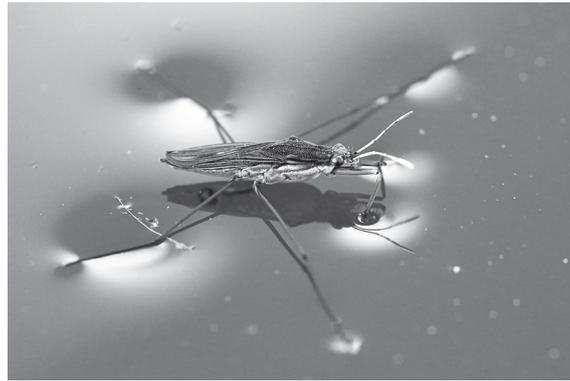
Zone A afternoon | Zone B afternoon | Zone C afternoon

2 hours [Paper 1A and Paper 1B]

Instructions to candidates

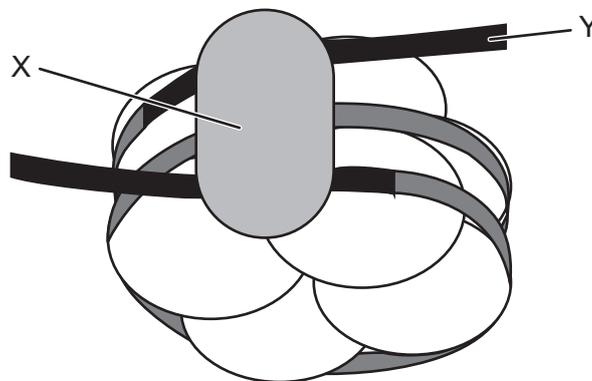
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- A calculator is required for this paper.
- The maximum mark for paper 1A is **[40 marks]**.
- The maximum mark for paper 1A and paper 1B is **[75 marks]**.

1. The photograph shows a pond skater.



Which property of water allows the insect to walk on water?

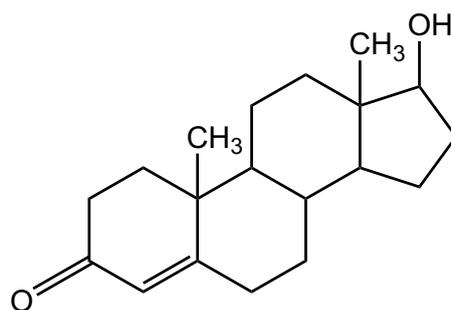
- A. Adhesion
 - B. Capillarity
 - C. Surface tension
 - D. Transparency
2. The diagram shows a structure found in a eukaryotic nucleus.



What is represented by X and Y?

	X	Y
A.	Ribosome	mRNA
B.	Histone	Linker DNA
C.	Nucleosome	mRNA
D.	RNA polymerase	Linker DNA

3. A simplified diagram of molecule X is shown.



What describes molecule X?

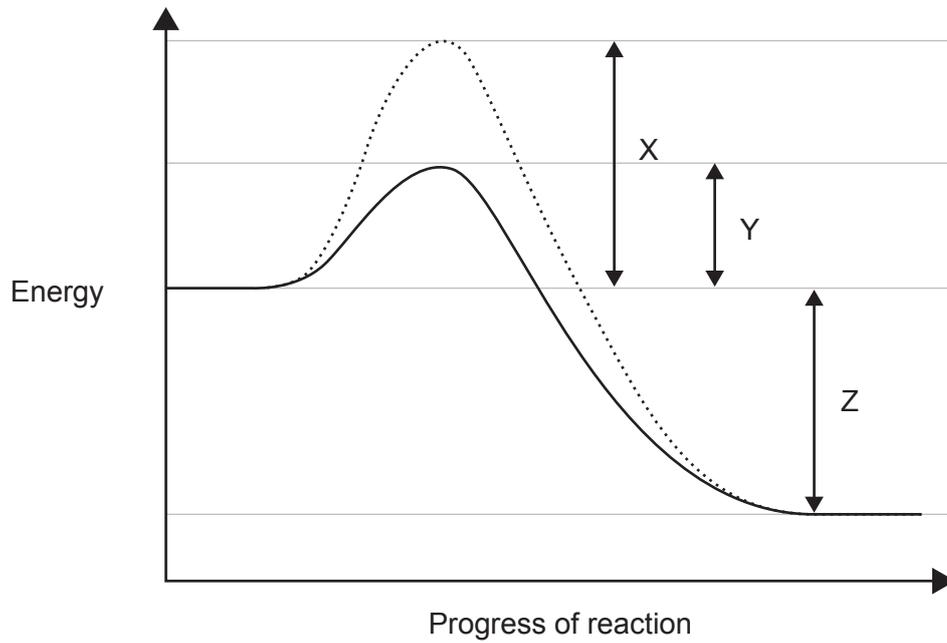
- A. Lipid able to pass through the bilayer of membranes
 - B. Lipid used for energy storage in mammals
 - C. Carbohydrate transported in the blood
 - D. Carbohydrate used for energy storage in plants
4. Diagrams of three different proteins, X, Y and Z, are shown.



Which row describes the structure of each protein shown?

	X	Y	Z
A.	quaternary	globular	secondary
B.	conjugated	fibrous	globular
C.	tertiary	quaternary	primary
D.	globular	secondary	fibrous

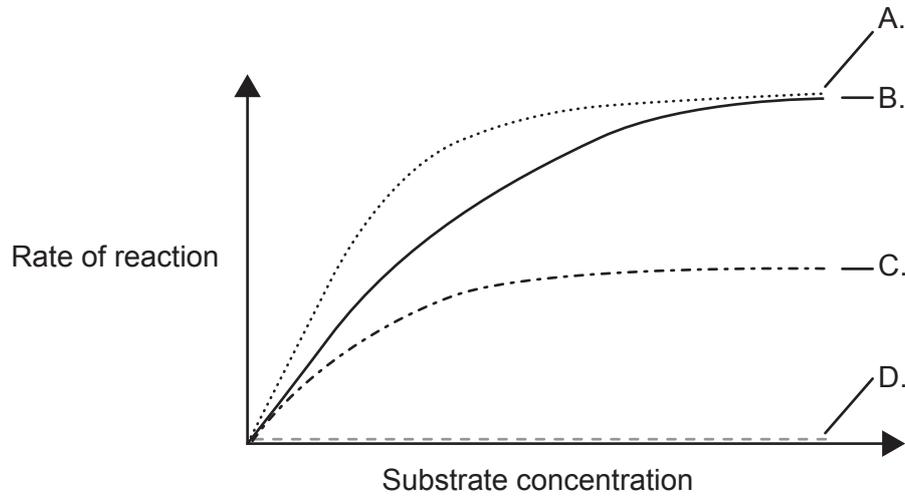
5. The graph shows energy changes during a reaction both with and without an enzyme present.



Which statement correctly identifies two of the regions labelled X, Y and Z in the graph?

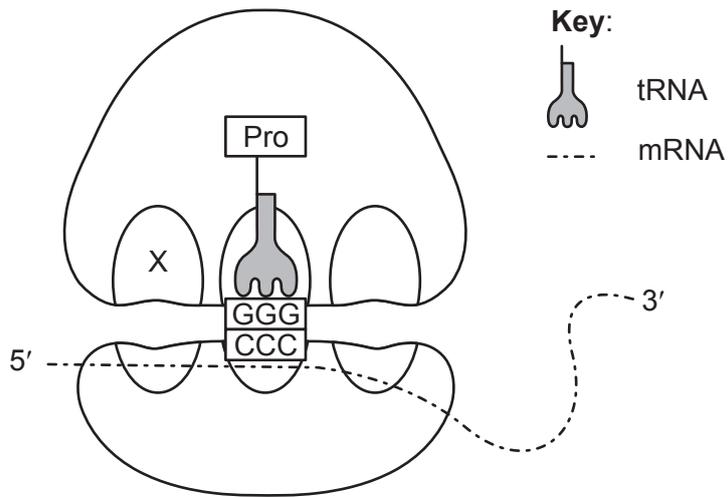
- A. X is the activation energy with an enzyme and Z is the net energy released from the reaction.
- B. X is the energy released from the reaction and Y is the activation energy with an enzyme.
- C. Y is the energy released with an enzyme and Z is the energy released when bonds are broken.
- D. Y is the activation energy with an enzyme and Z is the net energy released.

6. The graph illustrates how enzyme-catalysed reactions can be affected by inhibitors. Which curve shows the effect of statins on the rate of cholesterol synthesis in the body?



7. Which group(s) produce(s) oxygen as a by-product of photosynthesis?
- I. Algae
 - II. Cyanobacteria
 - III. Fungi
- A. I only
B. I and II only
C. II and III only
D. I, II and III
8. What is an advantage of free-air carbon dioxide enrichment experiments (FACE)?
- A. The carbon dioxide uptake by plants is controlled.
 - B. Temperature can be controlled.
 - C. Water can be controlled.
 - D. Data can more accurately represent future rates of photosynthesis.

11. A ribosome with three binding sites, an mRNA molecule and a tRNA molecule are shown.

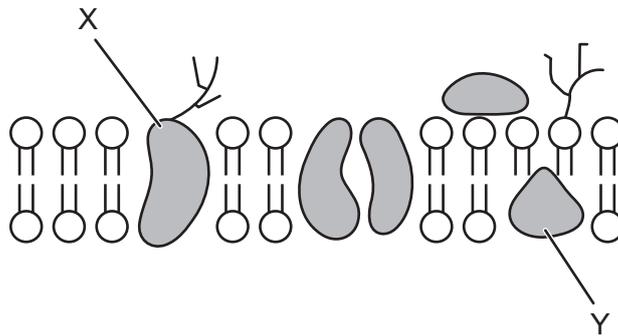


What would be the effect of blocking the left-hand binding site labelled X?

- A. The GGG tRNA would not be able to exit the ribosome.
 - B. A second tRNA would not be able to bind.
 - C. A second tRNA would enter the right-hand binding site.
 - D. The ribosome would move to the left.
12. What is a feature of immunofluorescence in light microscopy?
- A. Can only be used on dead cells
 - B. Enables higher resolution
 - C. Attaches a fluorescent stain to an antibody
 - D. Attaches a fluorescent stain to an antigen

13. What is a difference between the lytic and the lysogenic cycle of the bacteriophage lambda?
- A. Only in the lytic cycle is lambda DNA inserted into the host DNA.
 - B. Only in the lysogenic cycle is the host metabolism used to replicate.
 - C. Only in the lytic cycle is the host metabolism used to replicate.
 - D. Only in the lysogenic cycle is lambda DNA inserted into the host DNA.

14. The diagram shows a portion of fluid mosaic membrane.



What are the membrane structures X and Y?

	X	Y
A.	glycoprotein	integral protein
B.	integral protein	peripheral protein
C.	channel protein	integral protein
D.	glycoprotein	peripheral protein

15. Which features are found in both cardiac and striated muscle?

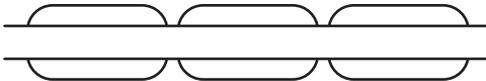
- A. Nuclei and branched myofibrils
- B. Sarcomeres and unbranched myofibrils
- C. Mitochondria and branched myofibrils
- D. Sarcomeres and mitochondria

16. Which is a description of stem cells?

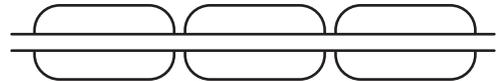
- A. Hair follicle stem cells are pluripotent.
- B. Stem cells in bone marrow are multipotent.
- C. Very early embryo stem cells are pluripotent.
- D. Late embryo stem cells are totipotent.

17. The diagrams represent sections through different axons. Which axon has the slowest speed of impulse?

A.



B.



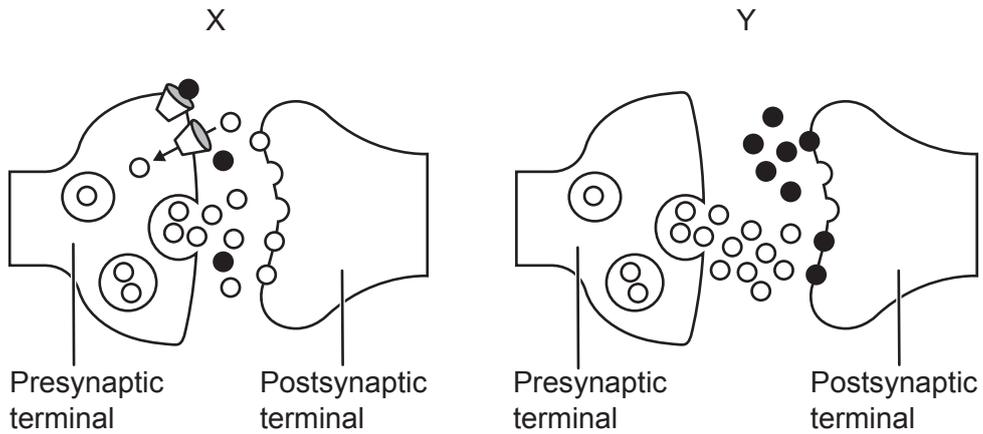
C.



D.



18. Diagrams X and Y show the possible action on synaptic transmission of two exogenous chemicals.



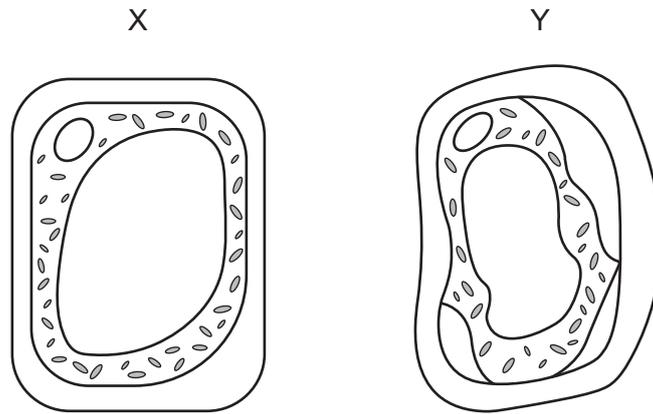
Key:

- neurotransmitter ● neonicotinoid or cocaine

Cocaine and neonicotinoids have different modes of action. Which statement identifies the correct mode of action of one of these chemicals?

- A. Y shows cocaine because it prevents binding of the neurotransmitter to the postsynaptic membrane.
 - B. X shows neonicotinoid because it is taken up by the presynaptic terminal.
 - C. Y shows neonicotinoid because it binds to the neurotransmitter.
 - D. X shows cocaine because the neurotransmitter cannot be taken up by the presynaptic terminal.
19. Which characteristic is shared by all tumours?
- A. Cells metastasize from the primary tumour
 - B. They result from mutations
 - C. Spherical in shape
 - D. Malignancy

20. Two plant cells are shown as they appear in different solutions X and Y.



What happens to water and pressure potential inside the cell if it is moved from solution X to solution Y?

	Water potential	Pressure potential
A.	does not change	decreases
B.	decreases	decreases
C.	does not change	increases
D.	increases	increases

21. The salamander genus *Ensatina* from California, USA, has evolved several different forms, depending on location. Two such forms are shown.

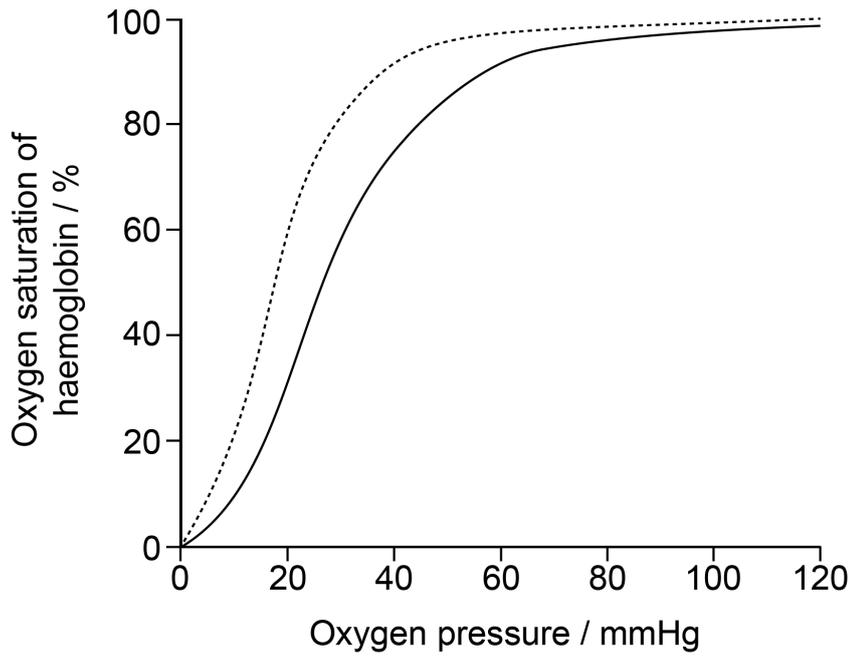


What determines if these forms are members of the same species?

- A. Have similar appearance
- B. Populations mix freely
- C. Produce fertile offspring
- D. Can interbreed

- 22.** What is one application of DNA barcoding?
- A. Selective breeding
 - B. Preserving an endangered species
 - C. Analysing environmental DNA
 - D. Sequencing a genome
- 23.** What is a role of one of the structures at a synovial joint such as the hip?
- A. Ligaments attach muscle to bone.
 - B. Tendons transmit force of contraction to bone.
 - C. Cartilage holds bones together at the joint.
 - D. Muscles stretch and contract to move bones.
- 24.** What is a reason that veins have relatively thin walls compared to arteries?
- A. Allows muscle contraction to assist in blood flow
 - B. Prevents a blood clot forming
 - C. Allows exchange of materials with tissue fluid
 - D. Easier attachment of semilunar valves

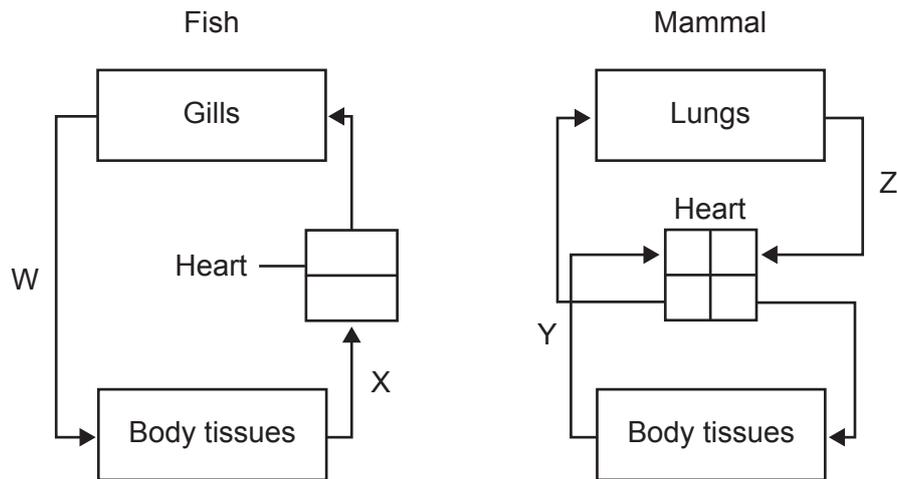
25. Two oxygen dissociation curves in an adult human are shown.



What is the explanation for the shift of the dissociation curve to the right-hand curve?

	Carbon dioxide	Affinity of haemoglobin for oxygen
A.	dissociates from haemoglobin	increases
B.	dissociates from haemoglobin	decreases
C.	associates with haemoglobin	increases
D.	associates with haemoglobin	decreases

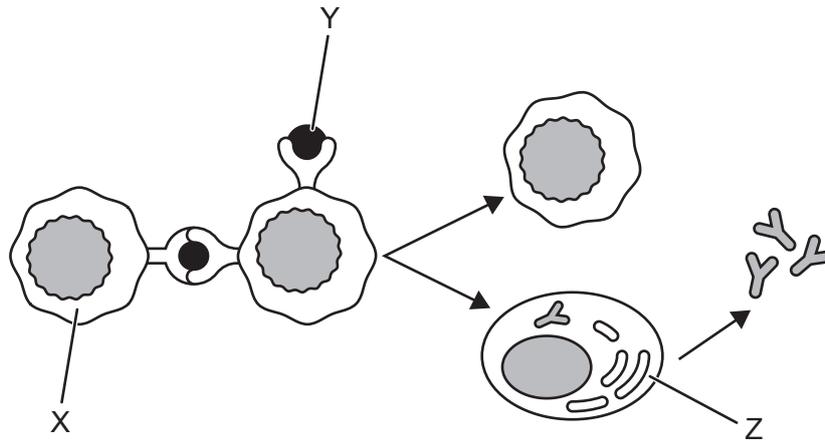
26. The diagrams show blood circulation in a fish and a mammal.



Which two labels represent deoxygenated blood with the lowest pressure in each animal?

- A. W and Z
- B. X and Y
- C. W and Y
- D. X and Z

27. The diagram shows stages in an immune response.



What is represented by labels X, Y and Z?

	X	Y	Z
A.	helper T-cell	antibody	plasma cell
B.	B-cell	antigen	memory B-cell
C.	helper T-cell	antigen	plasma cell
D.	B-cell	antibody	memory B-cell

28. What is a reason for the ineffectiveness of antibiotics against viruses?

- A. Viruses have genes for antibiotic resistance.
- B. Viruses do not have cell membranes.
- C. Antibiotics are only effective against archaea.
- D. Antibiotics target metabolic processes.

29. What correctly describes the action of auxin in phototropism?

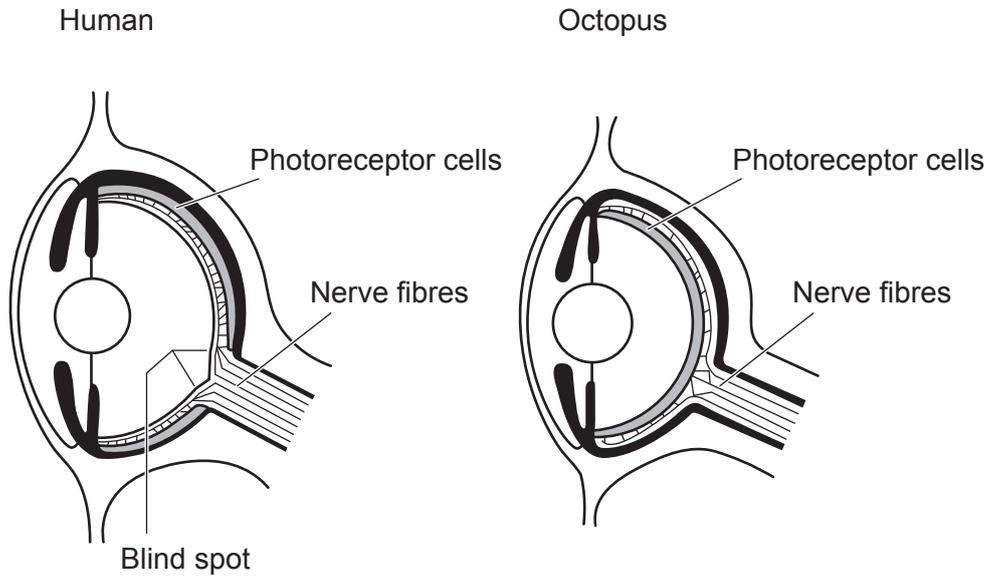
- A. Auxin efflux carriers actively transport auxin in and out of cells.
- B. Auxin promotes hydrogen ion secretion into the cytoplasm.
- C. Auxin efflux carriers are positioned in the plasma membrane on one side of the cell.
- D. Auxin breaks beta-glucose links in the cell wall.

30. What happens during fertilization in humans?
- A. The nuclear membranes of sperm and egg break down.
 - B. The sperm enters the egg.
 - C. The chromosomes undergo joint meiosis.
 - D. Mitochondria in the zygote come from sperm and egg.
31. When white flowers of the species *Mirabilis jalapa* are fertilized by pollen from red flowers, the resulting plants produce pink flowers. What is the pattern of inheritance and the reason for this?

	Inheritance	Reason
A.	incomplete dominance	offspring show both parental phenotypes
B.	codominance	offspring show both parental phenotypes
C.	incomplete dominance	offspring show a blended phenotype of the parents'
D.	codominance	offspring show a blended phenotype of the parents'

32. What is a reason for the changes in blood flow during exercise?
- A. Increased blood flow to the kidneys removes waste products from exercise.
 - B. Blood flow to the brain decreases so that blood is diverted to the kidneys.
 - C. Increased blood flow to the skin removes heat.
 - D. Increased blood flow to the digestive system provides more glucose to muscles.

33. Human and octopus eyes have a similar structure and function but humans and octopuses have a different evolutionary origin.



What explains the similar structure of these eyes?

	Type of evolution	Relationship of structures
A.	convergent	analogous
B.	convergent	homologous
C.	divergent	homologous
D.	divergent	analogous

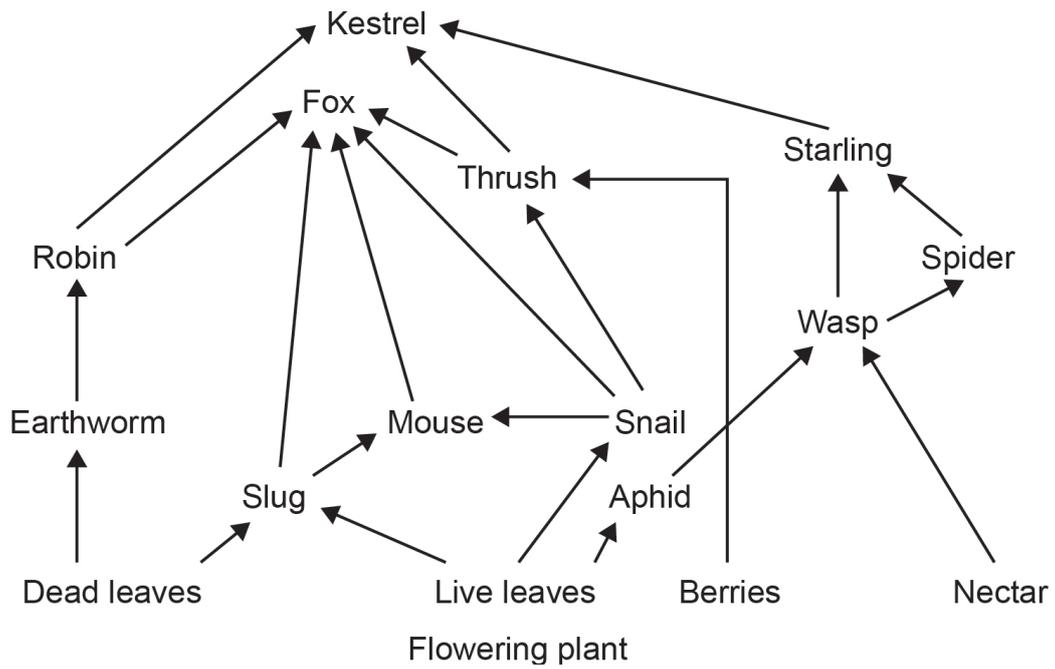
34. The image shows *Prorocentrum*, a coastal dinoflagellate that obtains energy from sunlight and from other organisms.



What best describes the mode of nutrition of *Prorocentrum*?

- A. Mixotrophic
- B. Autotrophic
- C. Holozoic
- D. Heterotrophic

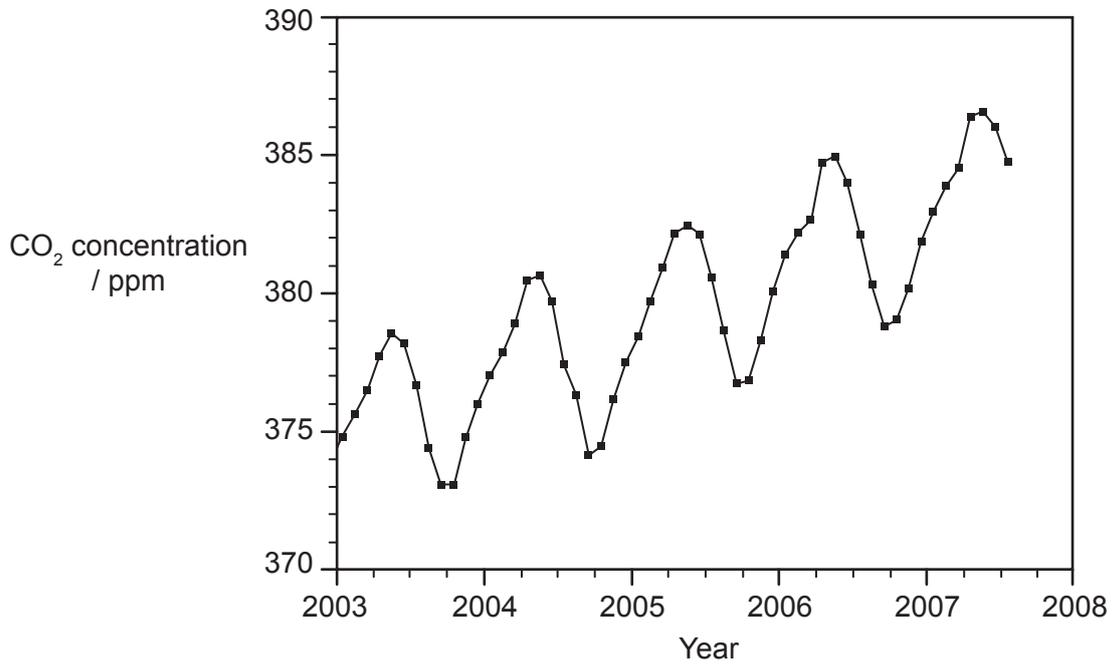
35. A terrestrial food web is shown.



How many species in the food web are **only** primary consumers?

- A. 3
- B. 4
- C. 5
- D. 6

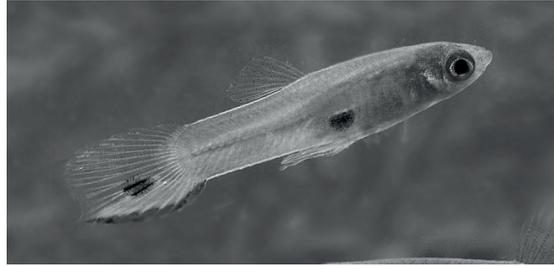
36. The graph shows data collected at Mauna Loa, USA, for monthly mean carbon dioxide concentration.



What causes the decreases in monthly mean carbon dioxide concentration each year?

- A. Combustion increases.
- B. Respiration increases.
- C. Decomposition increases.
- D. Photosynthesis increases.

37. John Endler experimented on populations of guppies (*Poecilia reticulata*) with different colouration. A male guppy fish is shown with large spots, which makes the fish more attractive to females, but more visible to predators.



The table shows the male colouration of guppy fish and number of predators in three different ponds.

	Predator X	Predator Y	Male guppy colouration
Pond 1	12	0	Large colourful spots
Pond 2	15	0	Medium colourful spots
Pond 3	5	17	None/very small drab spots

What can be concluded from the data?

- A. There is a positive correlation between numbers of predator X and size of spots.
 - B. Predator Y has least influence on colouration.
 - C. There is a negative correlation between number of predators and size of spots.
 - D. There is no sexual selection.
38. Which action is part of the rewilding of ecosystems?
- A. Applying fertilizer
 - B. Removal of apex predators
 - C. Reintroduction of keystone species
 - D. Restricting size for easier management

39. Which of these conditions is/are necessary for genotype frequencies to fit the Hardy–Weinberg equation?

- I. Homozygous recessive phenotypes have lower survival.
- II. Mating is random.
- III. The population is small.

- A. I only
- B. II only
- C. II and III only
- D. I, II and III

40. Which action will decrease carbon sequestration?

- A. Afforestation
 - B. Primary production
 - C. Deforestation
 - D. Rewetting peatlands
-

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