Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 1A

12 May 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]**.

2225 – 6016

16 pages

1. What describes bonding within a water molecule?

A. Hydrogen bonding due to transfer of electrons

B. Double bonds due to equal sharing of electrons

C. Non-polar covalent bonding due to equal sharing of electrons

D. Polar covalent bonding due to unequal sharing of electrons

2. What is the function of cellulose in plant cells?

A. It increases the strength of cell walls.

B. It is a source of energy for plants.

C. It maintains the structure of the vacuole.

D. It increases the permeability of the cell membranes.

3. How are amino acids joined together to form a dipeptide?

A. Single bond between a carbon and a hydrogen

B. Hydrolysis reaction forming a hydrogen bond

C. Anabolism forming a double bond

D. Condensation reaction forming a peptide bond

4. Which process is an example of catabolism?

A. Protein synthesis

B. Photosynthesis

C. Oxidation of substrates in respiration

D. Glycogen formation

5. Bromothymol blue is an indicator that is initially blue and turns yellow when CO_2 is present. Tests were carried out varying the presence of a plant (*Elodea canadensis*) and a snail (*Marisa cornuarietis*) in an aquatic environment. What condition would produce a blue colour after sampling the water?

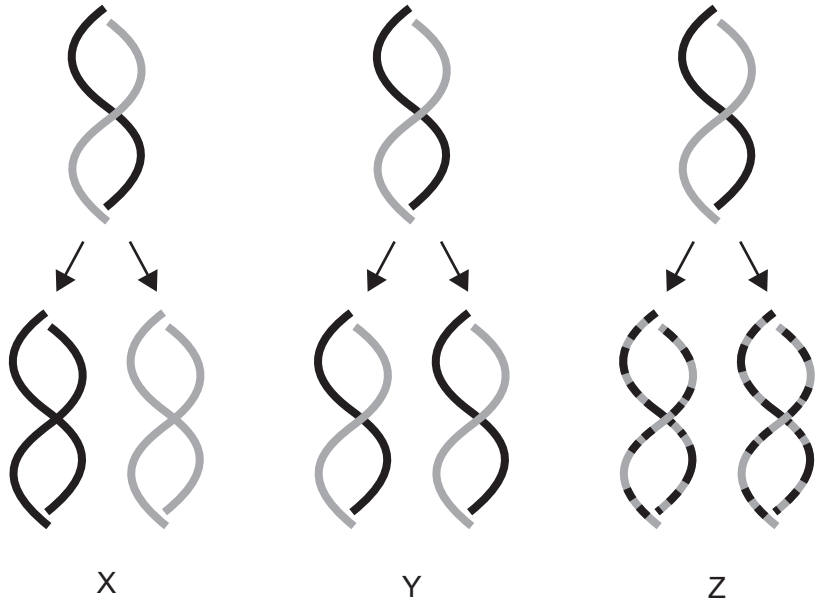
A. Plant kept in the dark without snail

B. Plant and snail kept in the dark

C. Plant kept in the light without snail

D. Snail with no plant

6. Which diagram(s) illustrate(s) semi-conservative replication of DNA?



A. X only

B. Y only

C. Z only

D. X and Y only

7. The table shows the genetic code.

1st base in codon	2nd base in codon: U	C	A	G	3rd base in codon
U	Phe	Ser	Tyr	Cys	**U**
	Phe	Ser	Tyr	Cys	**C**
	Leu	Ser	**STOP**	**STOP**	**A**
	Leu	Ser	**STOP**	Trp	**G**
C	Leu	Pro	His	Arg	**U**
	Leu	Pro	His	Arg	**C**
	Leu	Pro	Gln	Arg	**A**
	Leu	Pro	Gln	Arg	**G**
A	Ile	Thr	Asn	Ser	**U**
	Ile	Thr	Asn	Ser	**C**
	Ile	Thr	Lys	Arg	**A**
	Met	Thr	Lys	Arg	**G**
G	Val	Ala	Asp	Gly	**U**
	Val	Ala	Asp	Gly	**C**
	Val	Ala	Glu	Gly	**A**
	Val	Ala	Glu	Gly	**G**

Which mRNA could code for the sequence Ser-Leu-Arg-Phe?

A. UCA UCG UGG UUU

B. UCC ACC AGA UUC

C. UCU CCC AGA UUU

D. UCG CUG AGG UUC

8. In 2020, Peplow and co-workers obtained an image showing a $GABA_A$ cell membrane protein receptor. The technique they used allowed them to take the image at a particular moment in time by treating the sample so that the protein molecules were firmer and more stable. What technique did they use to obtain this image?

A. Electrophoresis

B. Immunofluorescence

C. Cryogenic electron microscopy

D. Fluorescent dyes

9. The table shows concentrations of potassium ions and sodium ions maintained inside and outside human cells.

	Concentration of ions / 10^{-3} mol dm^{-3}	
Ions	**Intracellular**	**Extracellular**
Potassium	135	4
Sodium	10	145

What explains these concentrations?

A. Active transport using a protein pump

B. Facilitated diffusion using a vesicle

C. Simple diffusion using a protein channel

D. Osmosis using an aquaporin

10. What results from an unspecialized cell experiencing gradients of signalling chemicals?

A. Cell differentiation

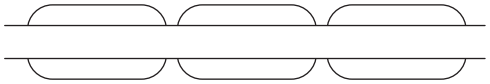
B. Meiosis

C. Saltatory conduction

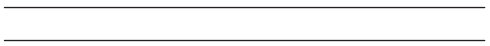
D. DNA replication

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

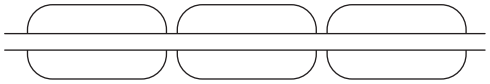
A.



B.



C.



D.

12. What occurs in cell division during both mitosis and meiosis?

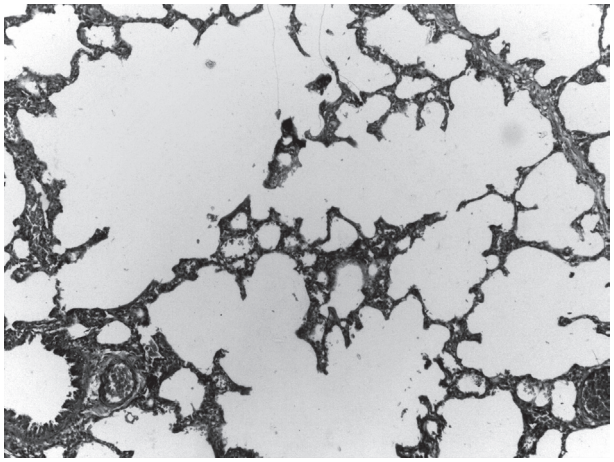
A. Condensation of DNA by supercoiling in telophase

B. Movement of microtubules to move chromatids in anaphase

C. Pairing of homologous chromosomes in prophase

D. Crossing over between chromosomes in metaphase

13. Emphysema is a condition where the alveoli of the lungs are destroyed, resulting in patients feeling out of breath. The micrograph shows air pockets resulting from emphysema.



What is a direct consequence of the destruction of alveoli?

A. Decrease in surface area for gas exchange

B. Increased blood flow to the lungs

C. Increase in pulmonary surfactant production

D. Decrease in ventilation rate

14. Which environmental condition(s) would increase the rate of transpiration in plants?

I. Increased carbon dioxide concentration in the atmosphere

II. Increased temperature of the atmosphere

III. Decreased humidity of the atmosphere relative to the inside of the leaf

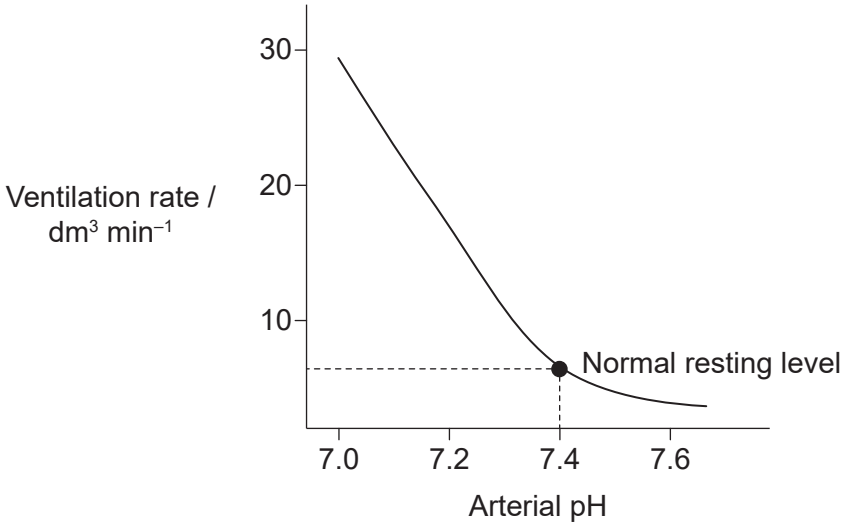
A. I and II only

B. III only

C. II and III only

D. I and III only

15. The graph shows ventilation rate as a result of change in arterial pH. Blood is normally maintained at approximately pH 7.4 in response to changes detected by receptors.



What is happening in the blood below pH 7.4?

A. Transmembrane receptors detect increased O_2 concentration.

B. Baroreceptors detect increased CO_2 concentration.

C. Thermoreceptors detect increased O_2 concentration.

D. Chemoreceptors detect increased CO_2 concentration.

16. What describes the control mechanisms for peristalsis that ensure coordinated passage of material through the digestive system?

A. Voluntary control by the central nervous system

B. Involuntary control by the enteric nervous system

C. Involuntary control by the central nervous system

D. Voluntary control by the enteric nervous system

17. Azithromycin is an antibiotic commonly used to treat pneumonia, an infection of the lungs caused by *Streptococcus pneumoniae*. A patient was diagnosed for the second time with pneumonia, but the same antibiotic was ineffective this time. What biological explanation might there be for this?

A. *S. pneumoniae* had mutated.

B. *S. pneumoniae* had developed antibodies for the antibiotic.

C. The patient was immune to the antibiotic.

D. The patient had antibiotic remaining from the first treatment.

18. What do rabies, tuberculosis and Japanese encephalitis have in common?

A. They are all infectious diseases caused by bacteria.

B. They are all infectious diseases caused by viruses.

C. They are all zoonoses.

D. They are all infecting red blood cells.

19. Cherry trees (*Prunus avium*) have two self-incompatibility alleles. What benefit do self-incompatibility alleles have?

A. They decrease genetic variation.

B. They prevent inbreeding.

C. They decrease the chances of mutations taking place within the gametes.

D. They prevent the plant from releasing pollen at certain times of the year.

20. Pink flowers arise from the incomplete dominance between red and white flowers in the four o'clock flower (*Mirabilis jalapa*). A pink-flowering variety is crossed with a white-flowering variety.

What could be the possible phenotypes of the offspring?

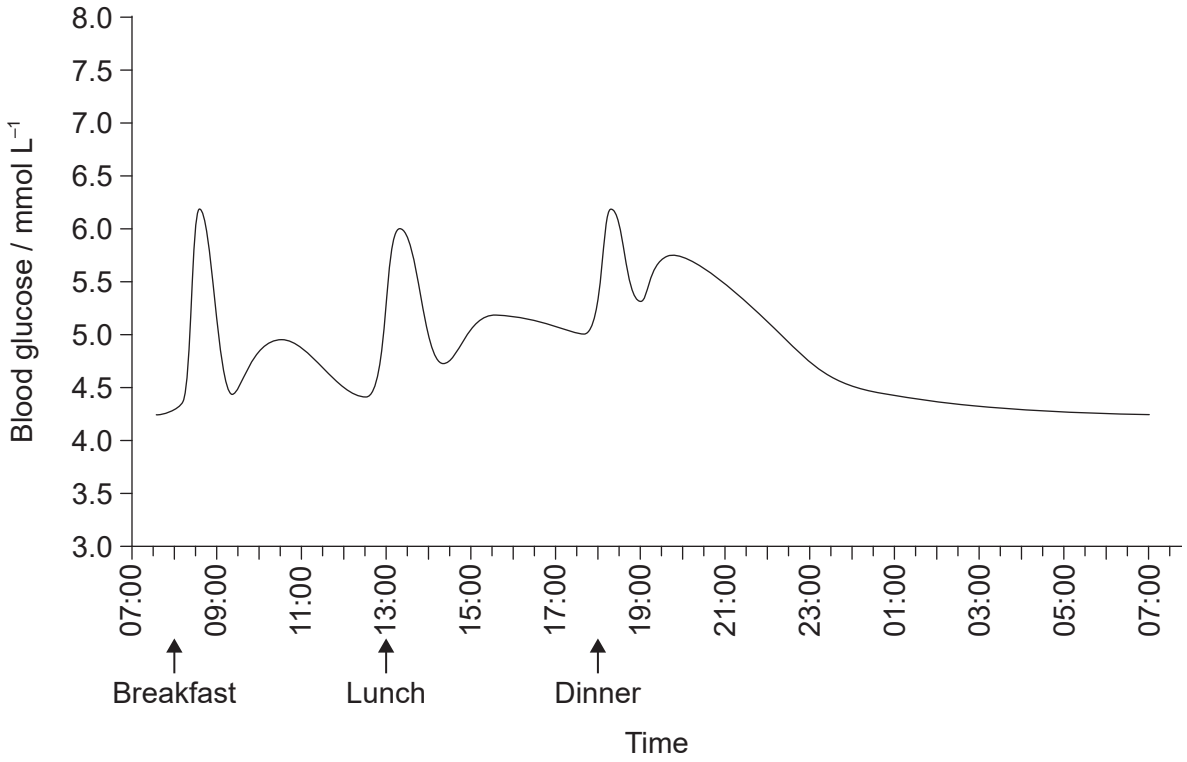
A. White flowers only

B. Pink and white flowers

C. Red and white flowers

D. Pink flowers only

21. The graph shows blood glucose levels over the course of a day.



What could explain the trend in glucose levels between 20:00 and 23:00?

A. Increasing insulin concentration forming glycogen from glucose

B. Decreasing insulin concentration forming glucose from glycogen

C. Increasing glucagon concentration forming glycogen from glucose

D. Decreasing glucagon concentration forming glucose from glycogen

22. What describes analogous structures?

A. They are formed from divergent evolution.

B. They share a common ancestor.

C. They came from different evolutionary origins.

D. They have the same structure but different functions.

23. What are causes for a global reduction in biodiversity?

I. Increase in size of towns and cities

II. Reclamation of degraded ecosystems

III. Clearance of land for agriculture

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

24. Dry rot fungus (*Serpula lacrymans*) secretes digestive enzymes to externally digest dead wood.

What type of nutrition is used by dry rot fungus?

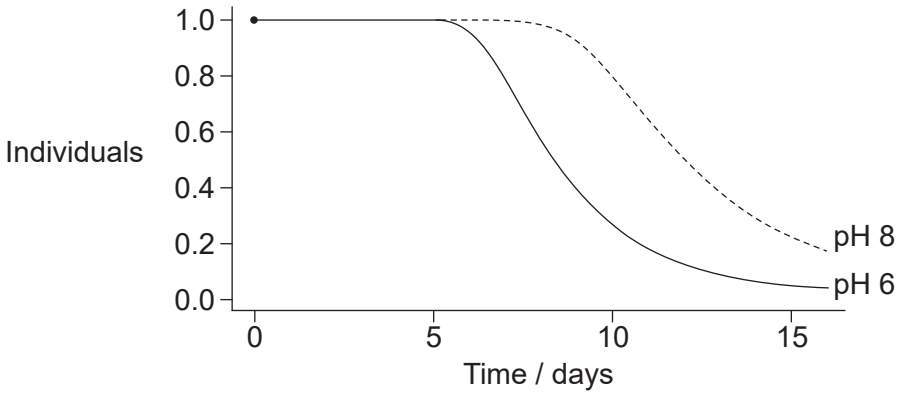
A. Holozoic

B. Saprotrophic

C. Mixotrophic

D. Autotrophic

25. The life cycle of the mosquito (*Aedes aegypti*) starts as a larva, then moves to the pupa stage, after which it moves to the adult stage. The influence of pH on mosquito larval development was measured. On the graph, 1.0 indicates that all individuals are at the larval stage and 0 indicates that all are pupae.



What can be concluded about the effect of pH on larval development from this graph?

A. All mosquito larvae developed into pupae by day 15 at both pH values.

B. pH has no effect on larval development of the mosquito.

C. On day 10, there are more pupae at pH 8 than at pH 6.

D. Mosquito larvae developed faster at pH 6.

26. What is the energy source of photoautotrophs and chemoautotrophs?

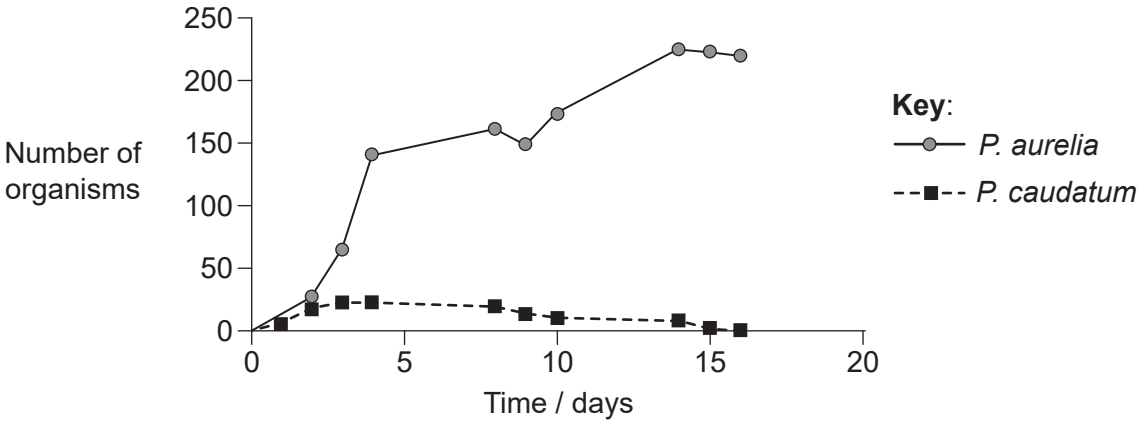
A. They both use light only.

B. They both use oxidation reactions only as an external energy source.

C. Photoautotrophs use oxidation reactions, while chemoautotrophs use light.

D. Photoautotrophs use light, while chemoautotrophs use oxidation reactions.

27. *Paramecium aurelia* and *Paramecium caudatum* are two species of paramecium that grow well individually. Scientists grew these two species of paramecium together, and the result is shown in the graph.



What could be deduced from this data?

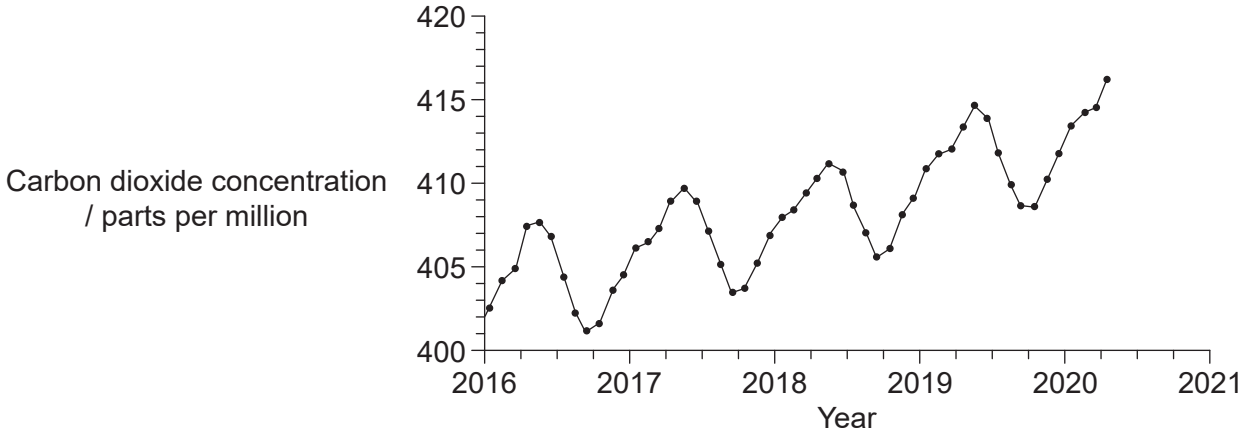
A. Predation results in *P. caudatum* consuming *P. aurelia*.

B. Allelopathy results in *P. caudatum* outcompeting *P. aurelia*.

C. Interspecific competition results in *P. aurelia* outcompeting *P. caudatum*.

D. Intraspecific competition results in *P. aurelia* eliminating *P. caudatum*.

28. The graph shows annual fluctuations of atmospheric carbon dioxide in the Northern Hemisphere. There is a relative increase in carbon dioxide concentration during winters.



Which reason might explain this increase during winters?

A. Increase in atmosphere–ocean diffusion

B. Decrease in photosynthesis of plants

C. Increase in respiration of all organisms

D. Decrease in combustion from wildfires

29. Mutations and sexual reproduction both play a role in generating variation, upon which natural selection acts. What describes how variation is generated?

I. Mutations generate new alleles.

II. Mutations generate new combinations of alleles.

III. Sexual reproduction generates new alleles.

A. I only

B. III only

C. II and III only

D. I and III only

30. What results from global warming?

A. An increase in absorption of solar radiation decreases poleward shift of temperate species.

B. Release of carbon dioxide from the deep ocean causes decreased rates of decomposition.

C. Release of methane from melting permafrost causes a decrease in absorption of solar radiation.

D. Loss of snow and ice causes an increase in absorption of solar radiation.

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