

BIOLOGY MOCK EXAMINATION SERIES

Written in the style of the IB Diploma Programme (first assessment 2025)

Biology

Standard Level

Paper 1A — Mock Examination

Mock Exam 1

Calculator required

Time allowed: **50 minutes**

Maximum mark: **30 marks**

Candidate information

Candidate name:

Session number:

Date:

Topic emphasis: water and biological molecules, enzymes and metabolism, cell structure and membrane transport, the cell cycle and meiosis, nucleic acids and protein synthesis, inheritance, gas exchange and transport, neural and hormonal control, defence against disease, ecology, evolution and sustainability.

Instructions to candidates

- Write your session number in the space on the cover.
- Do not open this examination paper until you are told 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 this examination paper is **[30 marks]**.

The mark allocation is shown in square brackets at the end of each question; every question in this paper is worth one mark **[1]**. There is no penalty for an incorrect answer, so you should attempt every question. Where a numerical answer is required, you may assume standard laboratory conditions unless stated otherwise in the question.

Mark allocation

Section A (questions 1–15)	[15 marks]
Section A (questions 16–30)	[15 marks]
Total	[30 marks]

All questions in this paper are original items written for revision purposes. They follow the style and topic coverage of the Diploma Programme biology guide but are not reproduced from any past examination paper.

Section A

Answer all questions. The maximum mark for each question is given in square brackets.

1. Which property of water is a direct consequence of hydrogen bonding between water molecules? [1]

- A. It is a poor solvent for ionic substances.
- B. It has a low boiling point for a molecule of its size.
- C. It has a high specific heat capacity.
- D. It is less dense as a liquid than as a solid.

2. Which biological molecule is correctly paired with its monomer or subunit? [1]

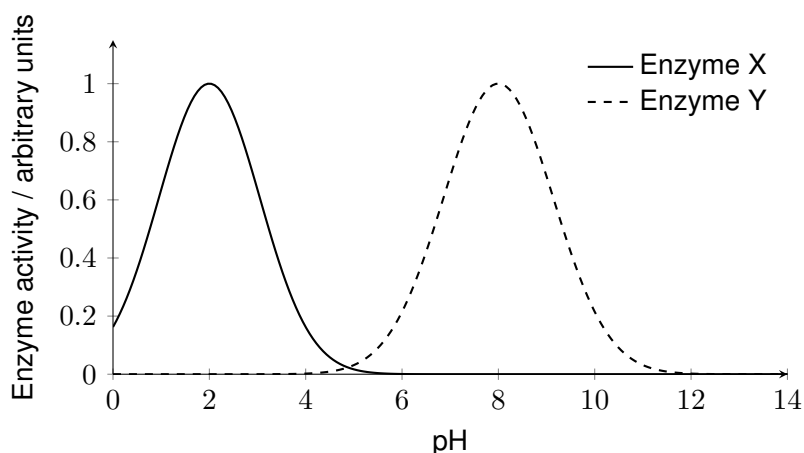
	Molecule	Monomer or subunit
A.	glycogen	glycerol
B.	cellulose	β -glucose
C.	protein	nucleotide
D.	DNA	amino acid

3. What is an advantage of using lipids rather than carbohydrates for long-term energy storage in animals? [1]

- A. Lipids can be respired without oxygen.
- B. Lipids are hydrolysed more rapidly than carbohydrates.
- C. Lipids are more soluble in the cytoplasm.
- D. Lipids release more energy per gram when oxidized.

Turn over

4. A solution of a globular enzyme is heated to 80 °C. What happens to the enzyme molecules? [1]
- A. Peptide bonds are hydrolysed and free amino acids are released.
 - B. The sequence of amino acids in the polypeptide is altered.
 - C. Interactions between R groups are disrupted and the active site changes shape.
 - D. The enzyme becomes more soluble because hydrophobic groups move to the surface.
5. Which observation provides evidence for the induced-fit model of enzyme action rather than the lock-and-key model? [1]
- A. Each enzyme catalyses only one type of reaction.
 - B. The active site alters its shape as the substrate binds to it.
 - C. Enzymes are not used up in the reactions they catalyse.
 - D. Enzyme activity falls sharply above the optimum temperature.
6. The graph shows the activity of two human digestive enzymes, X and Y, at different pH values. [1]



Which conclusion is supported by the data?

- A. Enzyme X is likely to act in the stomach and enzyme Y in the small intestine.
- B. Enzyme Y is denatured at pH 8.
- C. Both enzymes have the same optimum pH.
- D. Enzyme X has a higher activity than enzyme Y at every pH value.

Turn over

7. In an investigation of catalase activity, the volume of oxygen collected increased from 4.0 cm^3 at 20 s to 16.0 cm^3 at 60 s.

What is the mean rate of oxygen production over this interval, in $\text{cm}^3 \text{ s}^{-1}$? [1]

- A. 0.20
- B. 0.27
- C. 0.30
- D. 0.40

8. What is the function of cholesterol in the plasma membrane of an animal cell? [1]

- A. It forms hydrophilic channels for the passive movement of ions.
- B. It acts as a receptor site for peptide hormones.
- C. It provides the energy required for active transport.
- D. It reduces the fluidity of the membrane at higher temperatures.

9. What occurs during one complete cycle of the sodium–potassium pump in a neuron? [1]

	Sodium ions	Potassium ions	ATP
A.	2 moved out	3 moved in	hydrolysed
B.	3 moved out	2 moved in	hydrolysed
C.	3 moved in	2 moved out	not required
D.	2 moved in	3 moved out	synthesized

10. Cells from an onion epidermis were placed in a concentrated sucrose solution. After 20 minutes the cytoplasm had shrunk away from the cell wall.

What can be concluded about the solution and the change in the cells? [1]

	Sucrose solution relative to the cell sap	Change in the cells
A.	hypertonic	plasmolysis
B.	hypotonic	plasmolysis
C.	hypertonic	cells become turgid
D.	isotonic	cells burst

Turn over

11. A mitochondrion measures 40 mm in length in an electron micrograph taken at a magnification of $\times 20\,000$.

What is the actual length of the mitochondrion? [1]

- A. $0.2\ \mu\text{m}$
- B. $2\ \mu\text{m}$
- C. $20\ \mu\text{m}$
- D. $200\ \mu\text{m}$

12. Which organelle modifies and packages proteins for secretion from the cell? [1]

- A. Rough endoplasmic reticulum
- B. Golgi apparatus
- C. Lysosome
- D. Nucleolus

13. What happens during anaphase of mitosis? [1]

- A. Chromosomes condense and become visible as two sister chromatids.
- B. Chromosomes line up along the equator of the cell.
- C. Nuclear membranes re-form around the two groups of chromosomes.
- D. Sister chromatids are separated and pulled towards opposite poles.

14. A mutation occurs in a proto-oncogene, a gene that stimulates cell division. What is a likely consequence of this mutation? [1]

- A. The cell stops dividing and becomes fully differentiated.
- B. The cell undergoes meiosis rather than mitosis.
- C. The cell cycle is no longer controlled and a tumour may form.
- D. DNA replication can no longer take place in the cell.

Turn over

15. Which processes increase genetic variation in the gametes produced by meiosis? **[1]**

- I. Crossing over between non-sister chromatids in prophase I
- II. Random orientation of bivalents at the equator in metaphase I
- III. Semi-conservative replication of DNA before meiosis begins

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

16. Which enzyme unwinds the double helix and breaks the hydrogen bonds between complementary bases during DNA replication? **[1]**

- A. DNA polymerase
- B. Helicase
- C. DNA ligase
- D. RNA polymerase

17. A section of the template strand of DNA has the base sequence TAC GGT. What is the base sequence of the mRNA transcribed from this section? **[1]**

- A. ATG CCA
- B. UAC GGU
- C. AUG GGU
- D. AUG CCA

18. A single base substitution occurs in the coding region of a gene, but the polypeptide produced is unchanged. What explains this observation? **[1]**

- A. More than one codon can code for the same amino acid.
- B. The mutation occurred in a somatic cell rather than a gamete.
- C. A tRNA molecule can bind to any codon on the mRNA.
- D. The mutation caused a frame shift further along the gene.

Turn over

- 19.** A man with blood group AB has children with a woman with blood group O.
Which blood groups are possible in their children? **[1]**
- A. A or B only
 - B. AB or O only
 - C. A, B, AB or O
 - D. O only
- 20.** Haemophilia is caused by a recessive allele carried on the X chromosome. A woman who is a carrier has children with a man who is not affected.
What is the probability that their next child will be a boy with haemophilia? **[1]**
- A. 0 %
 - B. 25 %
 - C. 50 %
 - D. 100 %
- 21.** Which feature of alveoli increases the rate of gas exchange in the lungs? **[1]**
- A. Thick walls that withstand changes in pressure
 - B. A wall one cell thick, giving a short diffusion distance
 - C. An impermeable lining that prevents the loss of water vapour
 - D. A limited blood supply, so that oxygen accumulates in the alveolus
- 22.** Why does the wall of the left ventricle contain more cardiac muscle than the wall of the right ventricle? **[1]**
- A. It receives blood at a higher pressure from the lungs.
 - B. It pumps a much larger volume of blood in each cardiac cycle.
 - C. Its valves require more force to be held closed.
 - D. It generates the higher pressure needed to supply the whole body.

Turn over

- 23.** Which combination allows a continuous column of water to be pulled up the xylem of a tall tree? [1]
- A. Cohesion between water molecules and tension generated by transpiration
 - B. Active transport of water by companion cells and root pressure alone
 - C. Osmosis of water from the leaves towards the roots
 - D. Hydrolysis of ATP within the lumen of the xylem vessels
- 24.** What causes the depolarization of an axon membrane during an action potential? [1]
- A. Potassium ions diffuse out through voltage-gated channels.
 - B. The sodium–potassium pump moves sodium ions into the axon.
 - C. Sodium ions diffuse in through voltage-gated channels.
 - D. Chloride ions are actively transported into the axon.
- 25.** Blood glucose concentration rises after a meal. Which response returns it to the set point? [1]

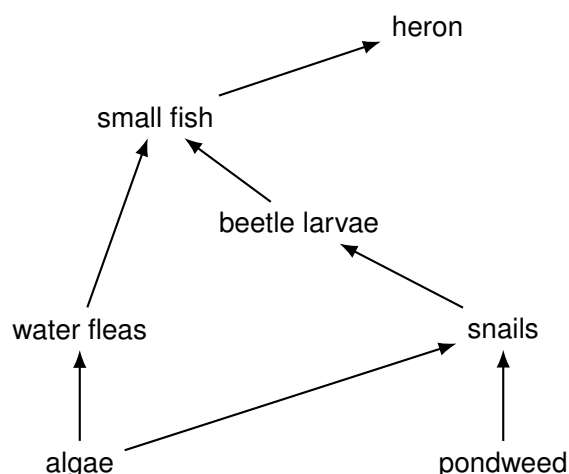
	Cells of the pancreas	Hormone	Effect in the liver
A.	α cells	glucagon	glucose converted to glycogen
B.	α cells	insulin	glycogen converted to glucose
C.	β cells	glucagon	glycogen converted to glucose
D.	β cells	insulin	glucose converted to glycogen

- 26.** Why does a person who has been vaccinated against a disease usually remain immune to it? [1]
- A. Memory cells allow antibodies to be produced faster and in larger amounts.
 - B. Antibodies contained in the vaccine remain in the blood for life.
 - C. Phagocytes destroy the pathogen before it can enter any body cell.
 - D. The vaccine permanently changes the DNA of all body cells.

Turn over

27. The diagram shows a food web in a freshwater pond.

[1]



Which organism is a secondary consumer in one food chain and a tertiary consumer in another?

- A. Water fleas
- B. Beetle larvae
- C. Small fish
- D. Heron

28. Two populations of a beetle species became separated when a river changed its course. After many generations the two populations could no longer produce fertile offspring together.

What does this describe?

[1]

- A. Sympatric speciation caused by polyploidy
- B. Convergent evolution producing analogous structures
- C. Allopatric speciation following geographical isolation
- D. Artificial selection by selective breeding

Turn over

- 29.** In a capture–mark–release–recapture study of a snail population, 40 snails were captured, marked and released. In a second sample of 50 snails, 10 were marked.

What is the estimated size of the snail population?

[1]

- A. 80
- B. 125
- C. 200
- D. 400

- 30.** Increasing concentrations of carbon dioxide in the atmosphere lead to more carbon dioxide dissolving in the oceans.

What is a consequence of this for marine organisms?

[1]

- A. The concentration of carbonate ions falls, making it harder to build calcium carbonate shells.
- B. The pH of sea water rises, dissolving the shells of molluscs.
- C. Photosynthesis by phytoplankton stops because carbon dioxide becomes toxic.
- D. Oxygen becomes more soluble, increasing the biochemical oxygen demand.

End of examination.

Total: 30 marks

Turn over

Answer sheet

Write the letter of your chosen answer in the box next to each question number.

Q	Ans	Q	Ans	Q	Ans
1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

Candidate name:

Session number:

Total mark: _____ / **30**