

# 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 3

Calculator required

Time allowed: **50 minutes**

Maximum mark: **30 marks**

### Candidate information

Candidate name: .....

Session number: .....

Date: .....

**Topic emphasis:** properties of water, biomolecules, enzyme data analysis, metabolism and ATP, photosynthesis, membranes and transport, microscopy, differentiation, meiosis and chromosome abnormalities, DNA replication and transcription, biotechnology, genetics, evolution and classification, plant and animal transport, homeostasis, immunity, sampling techniques and climate change.

## 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]        |
| <hr/>                       |                   |
| <b>Total</b>                | <b>[30 marks]</b> |

*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. Why is sweating an effective way of cooling the human body? [1]

- A. Sweat is hypertonic, so water is drawn out of the skin cells.
- B. Water is a good solvent, so waste products are removed with the sweat.
- C. Water molecules are cohesive, so sweat spreads over the skin.
- D. A large amount of heat is absorbed when water evaporates from the skin.

2. Which row about polysaccharides is correct? [1]

|    | Polysaccharide | Monomer           | Function in plants        |
|----|----------------|-------------------|---------------------------|
| A. | cellulose      | $\beta$ -glucose  | strength of the cell wall |
| B. | starch         | $\beta$ -glucose  | energy storage            |
| C. | glycogen       | $\alpha$ -glucose | strength of the cell wall |
| D. | cellulose      | $\alpha$ -glucose | energy storage            |

3. Which describes the structure of a triglyceride? [1]

- A. Three glycerol molecules joined to one fatty acid by peptide bonds
- B. One glycerol molecule joined to three fatty acids by ester bonds
- C. One glycerol molecule joined to two fatty acids and a phosphate group
- D. Four fused hydrocarbon rings with a hydroxyl group

Turn over

4. What is meant by an essential amino acid?

[1]

- A. An amino acid that is present in every protein in the body
- B. An amino acid that has a charged R group
- C. An amino acid that cannot be synthesized by the body and must be obtained from the diet
- D. An amino acid that is found only in the active site of enzymes

5. The table shows the initial rate of an enzyme-catalysed reaction at different substrate concentrations. The temperature, pH and enzyme concentration were kept constant. [1]

| Substrate concentration /<br>$\text{mol dm}^{-3}$ | Initial rate / arbitrary units |
|---------------------------------------------------|--------------------------------|
| 0.10                                              | 10                             |
| 0.20                                              | 19                             |
| 0.40                                              | 30                             |
| 0.80                                              | 36                             |
| 1.60                                              | 37                             |

Which conclusion is supported by these data?

- A. The enzyme is denatured at high substrate concentrations.
- B. The substrate acts as an inhibitor above  $0.80 \text{ mol dm}^{-3}$ .
- C. The rate is directly proportional to substrate concentration over the whole range.
- D. At high substrate concentrations the active sites are saturated, so the rate no longer increases.

6. Which row correctly classifies two metabolic reactions?

[1]

|    | Anabolic reaction                     | Catabolic reaction                  |
|----|---------------------------------------|-------------------------------------|
| A. | digestion of starch                   | synthesis of glycogen               |
| B. | synthesis of protein from amino acids | hydrolysis of glycogen              |
| C. | hydrolysis of lipids                  | oxidation of glucose in respiration |
| D. | breakdown of glucose in respiration   | replication of DNA                  |

**Turn over**

7. Where do anaerobic and aerobic cell respiration take place in a human muscle cell? [1]

|    | Anaerobic respiration | Aerobic respiration |
|----|-----------------------|---------------------|
| A. | cytoplasm             | mitochondrion       |
| B. | mitochondrion         | cytoplasm           |
| C. | cytoplasm             | cytoplasm           |
| D. | mitochondrion         | mitochondrion       |

8. What is the role of ATP in a living cell? [1]

- A. It is the main long-term energy store of adipose tissue.
- B. It is used as a raw material by plants to synthesize glucose.
- C. Its hydrolysis to ADP and phosphate releases energy for cell processes.
- D. It is a hormone that controls the metabolic rate of the cell.

9. Which is the balanced equation for photosynthesis? [1]

- A.  $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
- B.  $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$
- C.  $6CO_2 + 6O_2 \rightarrow C_6H_{12}O_6 + 6H_2O$
- D.  $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

Turn over

- 10.** Which observation provides the strongest evidence for the fluid mosaic model of membrane structure? **[1]**
- A. Membranes appear as two dark lines about 7 nm apart in electron micrographs.
  - B. Membranes contain both lipids and proteins.
  - C. Membranes are impermeable to large polar molecules.
  - D. When a mouse cell and a human cell are fused, their membrane proteins mix within minutes.
- 11.** How is a large protein such as an antibody released from a plasma cell? **[1]**
- A. By exocytosis, as vesicles fuse with the plasma membrane
  - B. By simple diffusion through the phospholipid bilayer
  - C. By facilitated diffusion through channel proteins
  - D. By osmosis through aquaporins
- 12.** What is an advantage of an electron microscope compared with a light microscope? **[1]**
- A. Living specimens can be observed as they move.
  - B. Images are produced in natural colour.
  - C. The higher resolution allows smaller structures to be distinguished.
  - D. Specimens can be viewed without any preparation.

**Turn over**

- 13.** The cells of a multicellular organism contain the same genes, yet a nerve cell and a liver cell have very different structures.

What explains this difference?

**[1]**

- A. Different mutations occur in each type of cell.
- B. Different genes are expressed in different types of cell.
- C. Cells delete the genes that they do not need.
- D. Each type of cell contains a different number of chromosomes.

- 14.** Which row correctly compares mitosis and meiosis?

**[1]**

|    | <b>Mitosis</b>                         | <b>Meiosis</b>                       |
|----|----------------------------------------|--------------------------------------|
| A. | two nuclear divisions                  | one nuclear division                 |
| B. | genetically varied daughter cells      | genetically identical daughter cells |
| C. | produces gametes                       | produces body cells                  |
| D. | one division, identical daughter cells | two divisions, varied daughter cells |

- 15.** Down syndrome is caused by the presence of three copies of chromosome 21.

What is the usual cause of this condition?

**[1]**

- A. Non-disjunction during meiosis, producing a gamete with an extra chromosome 21
- B. A base substitution in a gene on chromosome 21
- C. Crossing over between chromosome 21 and another chromosome
- D. Failure of the zygote to divide by mitosis

**Turn over**

- 16.** DNA replication is described as semi-conservative.  
What does this mean? **[1]**
- A. Both strands of each new molecule are newly synthesized.
  - B. The original molecule is conserved intact and an entirely new molecule is built.
  - C. Each new molecule contains one original strand and one new strand.
  - D. Each new molecule contains fragments of both original strands in a random order.
- 17.** Which statement about transcription is correct? **[1]**
- A. It takes place on ribosomes in the cytoplasm.
  - B. tRNA molecules bind directly to the DNA template.
  - C. DNA polymerase joins the RNA nucleotides together.
  - D. RNA polymerase forms mRNA that is complementary to the template strand.
- 18.** What is the polymerase chain reaction (PCR) used for? **[1]**
- A. Separating DNA fragments according to their length
  - B. Amplifying a small sample of DNA to produce many copies
  - C. Cutting DNA at specific base sequences
  - D. Joining DNA fragments from two different species

**Turn over**

- 19.** In pea plants, tall (T) is dominant to short (t). A breeder has a tall plant and needs to find out whether it is homozygous or heterozygous.

Which procedure should be used?

**[1]**

- A. Cross the plant with a short plant and examine the offspring.
- B. Cross the plant with another tall plant of unknown genotype.
- C. Measure the height of the plant when it is fully grown.
- D. Count the number of seeds the plant produces.

- 20.** What determines the sex of a human embryo?

**[1]**

- A. The sex chromosome carried by the egg
- B. The number of autosomes in the zygote
- C. Whether the fertilizing sperm carries an X or a Y chromosome
- D. Hormones released by the mother during pregnancy

- 21.** The proportion of bacteria in a hospital that are resistant to an antibiotic has increased over the last 20 years.

Which explains this increase?

**[1]**

- A. Individual bacteria alter their DNA in response to the antibiotic in order to survive.
- B. The antibiotic causes mutations that make the bacteria resistant.
- C. All bacteria gradually become resistant after repeated exposure.
- D. Resistant individuals already present survive, reproduce and pass on the allele.

**Turn over**

- 22.** Which is an example of homologous structures, providing evidence of common ancestry? **[1]**
- A. Pentadactyl limbs with the same arrangement of bones but different functions
  - B. The streamlined body shapes of sharks and dolphins
  - C. The wings of butterflies and the wings of bats
  - D. The similar leaf shapes of unrelated desert plants
- 23.** Which sequence of taxa is arranged from the largest group to the smallest group? **[1]**
- A. Class, phylum, order, family
  - B. Phylum, class, order, family
  - C. Family, order, class, phylum
  - D. Order, class, family, phylum
- 24.** What is the purpose of a dichotomous key? **[1]**
- A. To show the evolutionary relationships between species
  - B. To estimate the size of a population from a sample
  - C. To identify an organism using a series of paired choices
  - D. To divide all living organisms into three domains

**Turn over**

**25.** How does a plant reduce water loss when the soil begins to dry out? **[1]**

- A. Guard cells lose water, become flaccid and close the stomata.
- B. Guard cells take up water, become turgid and close the stomata.
- C. The waxy cuticle opens to allow water vapour to escape more slowly.
- D. Xylem vessels close so that water no longer reaches the leaves.

**26.** Which row correctly matches a blood vessel with one of its features? **[1]**

|    | <b>Blood vessel</b> | <b>Feature</b>                           |
|----|---------------------|------------------------------------------|
| A. | artery              | valves along its length                  |
| B. | artery              | thick layer of muscle and elastic fibres |
| C. | vein                | narrow lumen and a thick wall            |
| D. | capillary           | wall several cells thick                 |

**27.** The core body temperature of a person falls below the set point.  
Which responses help to restore it? **[1]**

- A. Vasodilation of skin arterioles and sweating
- B. Increased sweating and hairs lying flat
- C. Vasodilation of skin arterioles and shivering
- D. Vasoconstriction of skin arterioles and shivering

**Turn over**

**28.** Untreated infection with human immunodeficiency virus (HIV) eventually leads to AIDS.

Why does this happen?

**[1]**

- A. HIV destroys red blood cells, so oxygen transport is reduced.
- B. HIV destroys helper T-cells, so antibody production falls and opportunistic infections develop.
- C. HIV is a bacterium that has become resistant to antibiotics.
- D. HIV prevents blood from clotting, so wounds become infected.

**29.** A student sampled dandelions in a field using quadrats of area  $0.25\text{ m}^2$ . The mean number of dandelions per quadrat was 6.

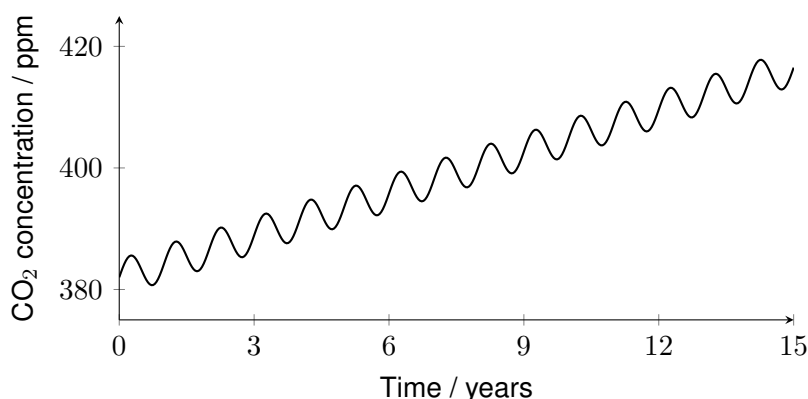
What is the estimated number of dandelions in a  $200\text{ m}^2$  area of the field?

**[1]**

- A. 1200
- B. 2400
- C. 4800
- D. 9600

**30.** The graph shows the concentration of carbon dioxide in the atmosphere measured at a monitoring station over a period of 15 years.

**[1]**



What explains the regular annual fluctuations shown by the data?

- A. Seasonal changes in the rate of photosynthesis by vegetation
- B. Annual variation in the amount of volcanic activity
- C. Seasonal changes in the rate of combustion of fossil fuels in power stations
- D. Yearly variation in the amount of sunlight reaching the Earth

**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**