



Biology

Higher Level

Paper 2 — Mock Examination

Mock Exam 2

Calculator required

Time allowed: **2 hours 30 minutes**

Maximum mark: **80 marks**

Candidate information

Candidate name:

Session number:

Date:

Topic emphasis: nucleic acids and the storage and expression of genetic information, transport and gas exchange in animals, energy transfer in photosynthesis and respiration, digestion and absorption, defence against disease, homeostasis, and energy flow in ecosystems.

Instructions to candidates

- Write your session number in the box on the cover.
- Do not open this examination paper until you are told to do so.
- **Section A:** answer **all** questions.
- **Section B:** answer **two** questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[80 marks]**.

The mark allocation is shown in square brackets at the end of each question or part question. Where a numerical answer is required, working should be shown and the answer given to an appropriate number of significant figures. In Section B, **one additional mark** is available for each question for the construction of your answer: this mark is awarded when the answer is clear enough to be understood without re-reading and when the question has been answered succinctly, with little or no repetition or irrelevant material.

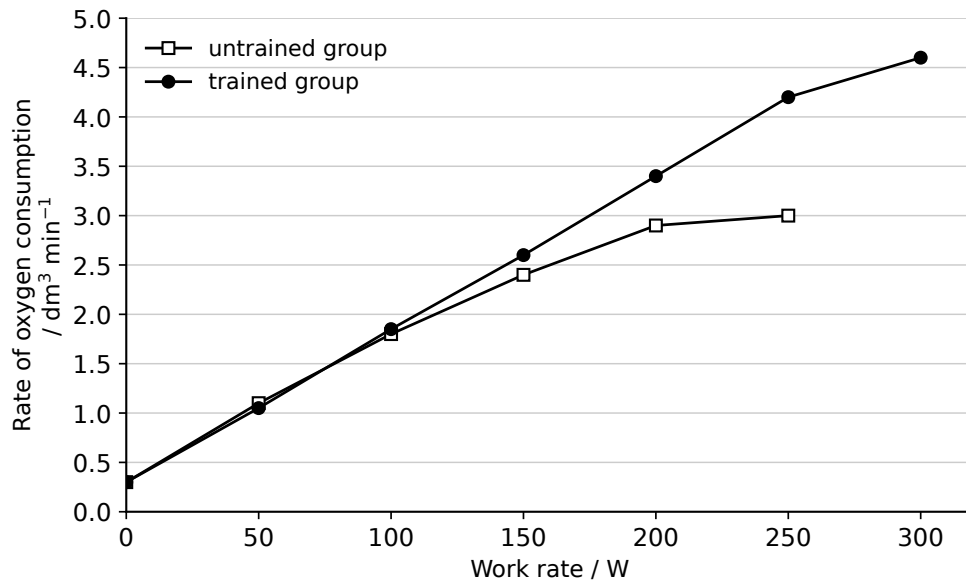
Mark allocation

Section A (questions 1–7)	[48 marks]
Section B (questions 8–10; answer two questions)	[32 marks]
Total	[80 marks]

Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

1. Scientists investigated the effects of endurance training on the response of the body to exercise. Ten trained cyclists and ten untrained volunteers of similar age and body mass exercised on a cycle ergometer. The work rate was increased every three minutes until the volunteer could no longer continue. The rate of oxygen consumption was measured at each work rate.



(This question continues on the following page)

(Question 1 continued)

- (a)** State the rate of oxygen consumption of the untrained group at a work rate of 150 W. **[1]**

- (b)** Compare and contrast the changes in the rate of oxygen consumption of the two groups as the work rate increases. **[3]**

- (c)** Calculate the difference in the rate of oxygen consumption between the two groups at a work rate of 250 W. **[1]**

- (d)** Suggest **two** reasons why the trained group can achieve a higher rate of oxygen consumption than the untrained group. **[2]**

(This question continues on the following page)

(Question 1 continued)

Further measurements were made on the same volunteers at rest and at their maximum work rate.

Measurement	Untrained at rest	Untrained at maximum	Trained at rest	Trained at maximum
Heart rate / beats min^{-1}	72	190	48	188
Stroke volume / cm^3	69	110	104	175
Cardiac output / $\text{dm}^3 \text{min}^{-1}$	5.0	20.9	5.0	32.9
Ventilation rate / $\text{dm}^3 \text{min}^{-1}$	7.5	105	7.0	155
Blood lactate / mmol dm^{-3}	1.0	8.4	0.9	3.1

- (e) State the measurement that has the same value in both groups at rest. [1]

.....

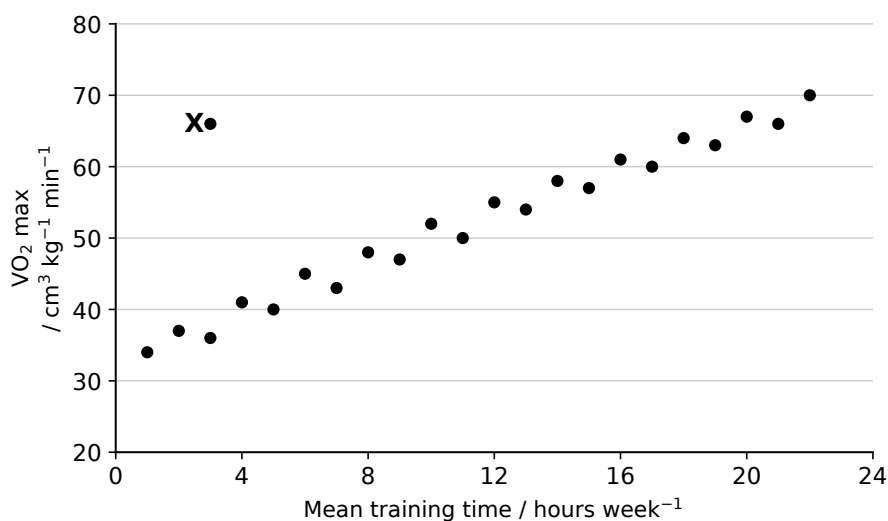
- (f) Suggest a reason why this measurement is the same in both groups at rest, even though their heart rates are different. [1]

.....

(This question continues on the following page)

(Question 1 continued)

The graph shows the mean training time per week and the maximum rate of oxygen consumption per unit body mass ($\text{VO}_2 \text{ max}$) for 22 further volunteers.



- (g) State the relationship between mean training time per week and $\text{VO}_2 \text{ max}$. [1]

.....

.....

- (h) A student suggested that the point labelled **X** is atypical. Outline a reason for this suggestion. [1]

.....

.....

- (i) Evaluate the hypothesis that the differences between the trained and untrained groups are caused only by training. [3]

.....

.....

.....

.....

.....

2. Before a cell divides, its DNA is replicated.

- (a)** Outline the roles of helicase and DNA polymerase III in DNA replication. **[2]**

.....
.....
.....
.....

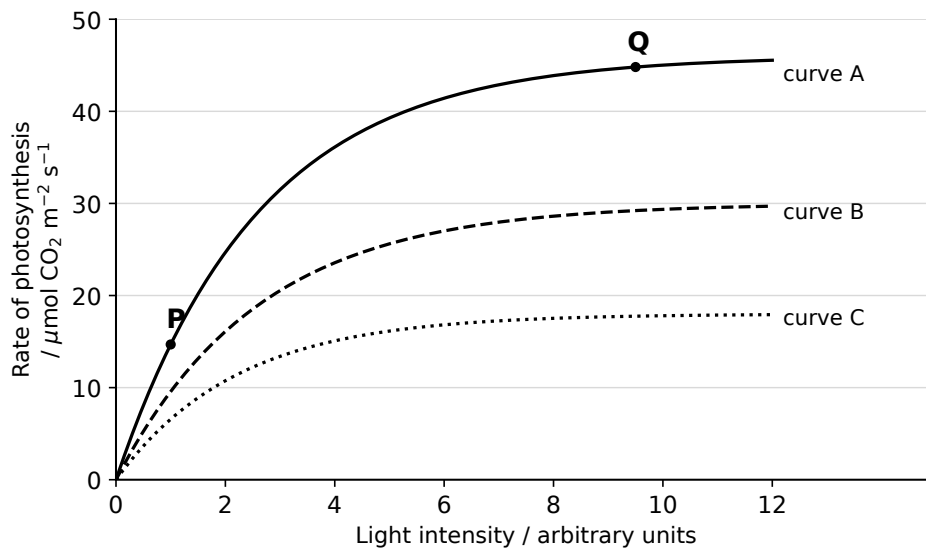
- (b)** Explain why DNA replication is described as semi-conservative. **[2]**

.....
.....
.....
.....

- (c)** Outline the roles of primase and DNA ligase in the replication of the lagging strand. **[2]**

.....
.....
.....
.....

3. The graph shows the rate of photosynthesis of a plant at different light intensities under three sets of conditions. Curve A was obtained at 25 °C with 0.40 % carbon dioxide, curve B at 15 °C with 0.40 % carbon dioxide and curve C at 25 °C with 0.04 % carbon dioxide.



(a) State the factor that is limiting the rate of photosynthesis at point **P**. **[1]**

.....

.....

(b) Explain the difference between curve A and curve C at point **Q** and above. **[2]**

.....

.....

.....

(c) Outline how the products of the light-dependent reactions are used in the light-independent reactions.

[3]

.....

.....

.....

.....

.....

4. Digested food is absorbed in the small intestine.

- (a)** Outline how the structure of a villus increases the rate of absorption of the products of digestion.

[3]

.....
.....
.....
.....
.....
.....

- (b)** State **two** enzymes secreted by the pancreas and the substrate of each.

[2]

.....
.....
.....
.....

- (c)** Explain why bile is needed for the efficient digestion of lipids, although it contains no enzymes.

[1]

.....
.....
.....

5. Vaccination stimulates the adaptive immune system without causing disease.

(a) Outline the role of helper T-cells in the response to a pathogen. **[2]**

.....
.....
.....
.....

(b) Explain how vaccination gives long-term protection against a disease. **[3]**

.....
.....
.....
.....
.....
.....

(c) State **one** reason why a vaccine against one strain of influenza may give little protection against a different strain.

[1]

.....
.....

6. The table shows the energy available at three trophic levels in a grassland ecosystem over one year.

Trophic level	Energy / $\text{kJ m}^{-2} \text{ year}^{-1}$
Producers	87 000
Primary consumers	14 000
Secondary consumers	1600

(a) Calculate the percentage of the energy of the primary consumers that is transferred to the secondary consumers.

[1]

.....
.....
.....

(b) Explain why the energy available decreases at each successive trophic level.

[3]

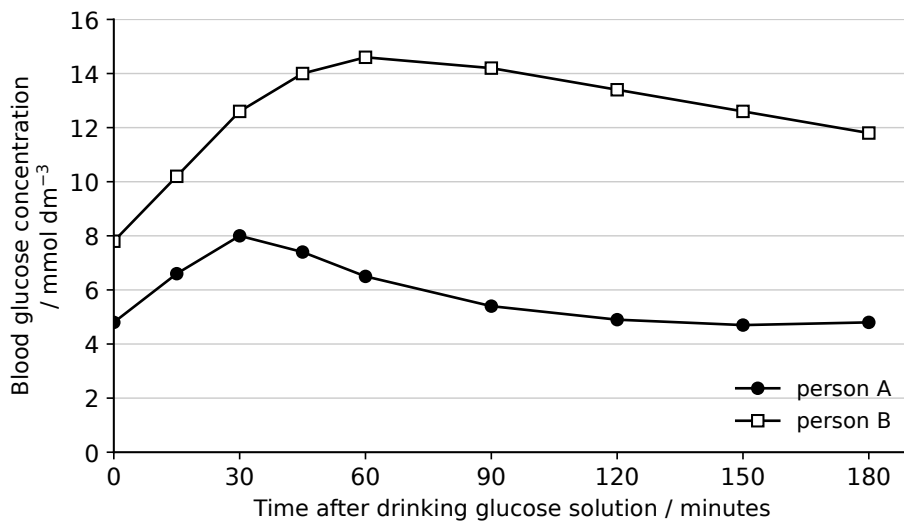
.....
.....
.....
.....
.....
.....

(c) Outline why food chains rarely contain more than four or five trophic levels.

[1]

.....
.....

7. Two people drank a solution containing 75 g of glucose after fasting overnight. The concentration of glucose in their blood was then measured for three hours. Person B had been diagnosed with type II diabetes.



(a) Using the graph, state the maximum blood glucose concentration reached by person A.

[1]

.....

.....

(b) Explain the changes in the blood glucose concentration of person A between 30 and 120 minutes.

[3]

.....

.....

.....

.....

.....

(c) Suggest a reason why the blood glucose concentration of person B remains high.

[1]

.....

.....

Section B

Answer **two** questions. **One additional mark** is available for the construction of your answer for each question. Answers must be written within the answer boxes provided.

8. All cells arise from pre-existing cells by division of a parent cell.

- (a) Explain the events of the cell cycle and the ways in which its control can be lost. [7]
- (b) Outline, with examples, the properties of stem cells and their use in medicine. [5]
- (c) Distinguish between the structure of prokaryotic cells and eukaryotic cells. [3]

9. The information carried in DNA is expressed through the synthesis of polypeptides.

- (a) Describe the roles of the three types of RNA in translation. [4]
- (b) Explain how the structure of DNA allows genetic information to be stored and copied accurately. [7]
- (c) Outline how the expression of genes can be regulated in eukaryotic cells. [4]

10. Internal conditions in mammals are kept within narrow limits.

- (a) Describe how the kidney produces urine that is more concentrated than the blood plasma. [5]
- (b) Outline the roles of the liver in the regulation of the composition of the blood. [3]
- (c) Explain how blood glucose concentration is controlled by negative feedback, and the consequences of the failure of this control. [7]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins or other markings on the paper.

End of examination.

Total: 80 marks