OCR
Oxford Cambridge and RSA

Thursday 22 May 2025 – Morning

AS Level Biology A

H020/02 Depth in biology

Time allowed: 1 hour 30 minutes

You can use:
- a scientific or graphical calculator
- a ruler (cm/mm)

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*****).
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

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1

(a) The table describes features of molecules.

Complete the table. Use ticks (✓) to identify if the feature describes starch or cellulose.

Description	Starch	Cellulose
Is made of amylose and amylopectin		
Is a long unbranched chain		
Is made from β glucose molecules		

[3]

(b) Students complete paper chromatography on carbohydrates.

The table shows the R_f values for known carbohydrates.

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The measurements recorded for an unknown carbohydrate were:

Distance travelled by solvent = 8.50 cm

Distance travelled by carbohydrate = 4.34 cm

Calculate the R_f value of the unknown carbohydrate and use the table to identify it.

Give your answer to **2** decimal places.

R_f value = ...

Name of carbohydrate = ...

[2]

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(c) Outline the role of the solvent in paper chromatography.

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..... **[2]**

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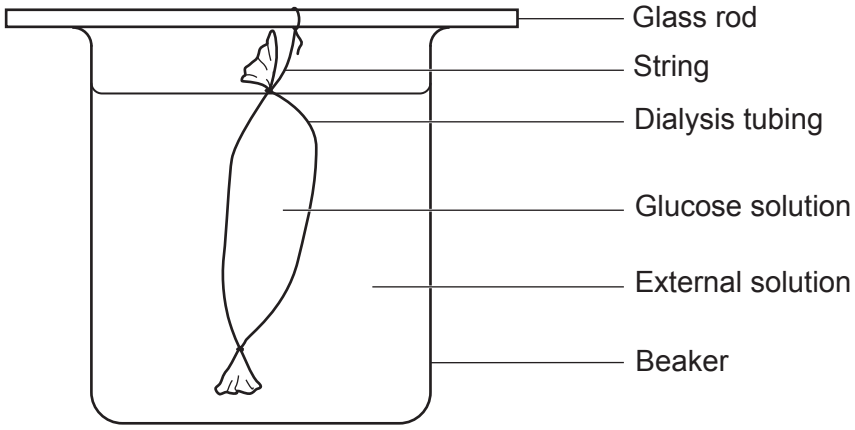
2

(a) Students use a model cell to investigate the effect of the thickness of the exchange surface membrane on the rate of diffusion across the membrane.

The students are provided with dialysis tubing of different thicknesses, grade 1, grade 3 and grade 5, where grade 5 is the thickest.

They set up the apparatus as shown.

The students remove a sample of the external solution at 30 second intervals and determine the concentration of glucose (mmol dm^{-3}) in the sample.



The table shows their results.

Grade of dialysis tubing	**Concentration of glucose found in the samples of external solution taken at 30 s intervals (mmol dm^{-3})**				
	0 s	**30 s**	**60 s**	**90 s**	**120 s**
1	0.00	1.31	2.52	3.59	4.80
3	0.00	0.82	2.24	2.39	3.31
5	0.00	0.31	0.64	0.96	1.22

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(i) Identify the independent variable **and** the dependent variable in this experiment.

Independent variable

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.....

Dependent variable

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[2]

(ii) Suggest **two** improvements to this experiment to increase the accuracy of the results.

Improvement 1 .....

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Improvement 2 .....

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[2]

(iii) Suggest a conclusion that can be drawn from the data in the table.

You should give evidence to support your conclusion.

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..... **[2]**

(b) State **one** similarity and **one** difference between simple diffusion and facilitated diffusion.

Similarity .....

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Difference .....

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[2]

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(c) Using your knowledge of the phospholipid bilayer in plasma membranes, explain how an increase in temperature affects the permeability of the membrane.

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..... **[3]**

(d) Exocytosis is an active process.

Explain why ATP is needed for exocytosis.

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..... **[2]**

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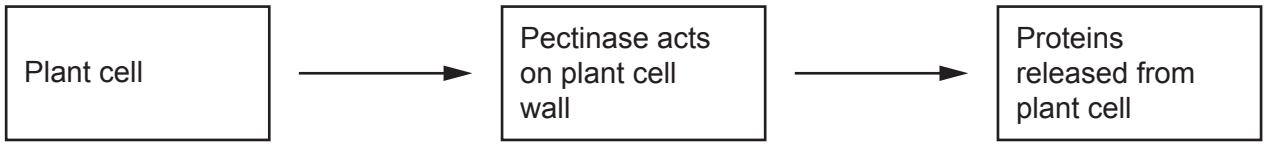
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3

(a)

(i) Enzymes can be used to extract proteins from plant cells. These proteins can be used for food products.

The diagram shows how the enzyme pectinase can be used to extract some plant proteins.



Complete the sentences using the most appropriate term(s).

Use the diagram and your knowledge of enzymes.

In living organisms, enzymes usually speed up reactions involved in the

..... of the cells.

From the location of the enzyme pectinase shown in the diagram, the action of pectinase can be described as ..... .

[2]

(ii)* The table shows some data on different methods that can be used to extract plant proteins.

Protein source	Extraction method	Percentage yield of protein extracted
Mung beans	chemical only	77.3
Potatoes	chemical and enzyme assisted	88.8
Soya beans	chemical only	48.7
Split peas	chemical and enzyme assisted	80.7

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A student concluded:

‘The data proves that the enzyme assisted extraction method always gives a greater yield of plant protein’.

Evaluate this conclusion.

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..... **[6]**

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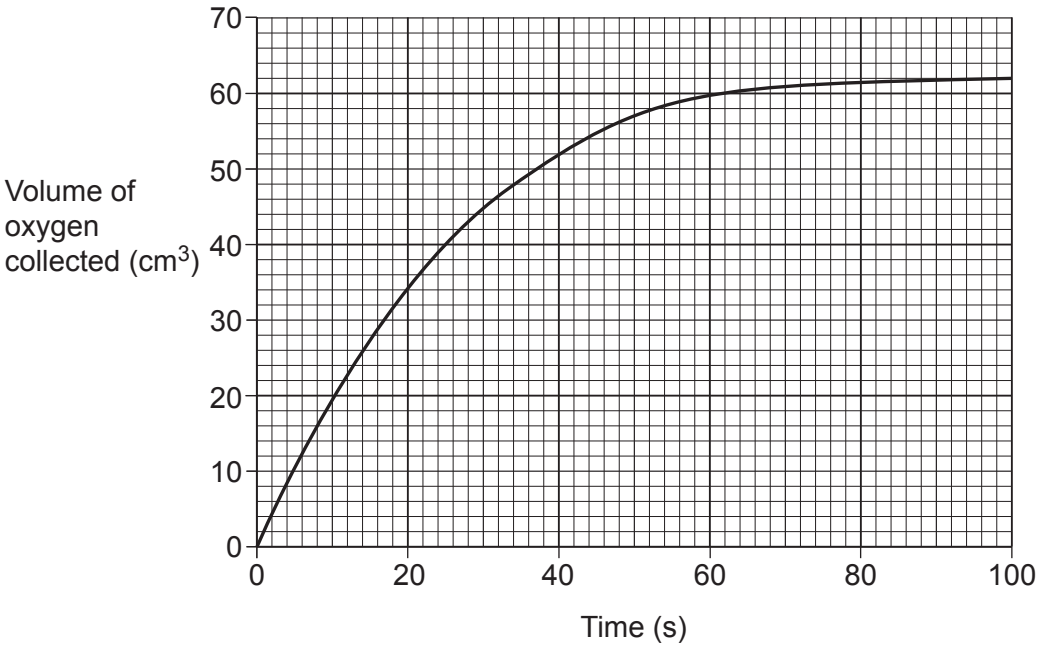
(b) Peas can be used in experiments as a source of catalase.

Catalase is an enzyme that catalyses the breakdown of hydrogen peroxide to water and oxygen gas.

A student mashes some peas in distilled water to release the catalase.

They investigate the effect of temperature on the rate of the enzyme reaction.

The graph shows the results they obtain at 20 °C.



(i) Use the graph to calculate the initial rate of the reaction.

Give your answer to **2** significant figures.

Initial rate of the reaction = ... $cm^3 s^{-1}$ **[3]**

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(ii) The student repeats this experiment at 30 °C and finds the initial rate of reaction to be 4.34 $cm^3 s^{-1}$.

Calculate the Q_{10} for catalase.

Give your answer to **2** significant figures.

Q_{10} for catalase = ... **[1]**

(c) The student completes a different experiment to investigate the effect of pH on enzyme action.

Suggest how they would vary **and** detect the pH in their experiment.

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..... **[2]**

(d) Explain how increasing the substrate concentration affects the enzyme activity.

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..... **[4]**

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4

(a)

(i) The European dust mite is an insect with the binomial name *Dermatophagoides pteronyssinus*.

State **one** advantage of the binomial naming system.

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.....

..... **[1]**

(ii) Complete the table with the names of the taxa for the European dust mite.

Taxa	**Name**
Kingdom	
Genus	
Species	

[2]

(b) Organisms were originally classified into five kingdoms.

State **two** general features of organisms classified in the Plantae kingdom that are **not** features of organisms that are classified in the Fungi kingdom.

Feature 1 .....

.....

Feature 2 .....

.....

[2]

(c) State the relationship between classification and phylogeny.

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..... **[1]**

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(d) State **two** differences between the five kingdom and three domain classification systems.

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[2]

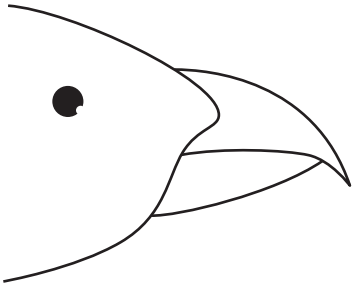
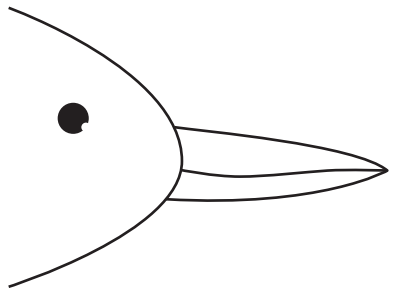
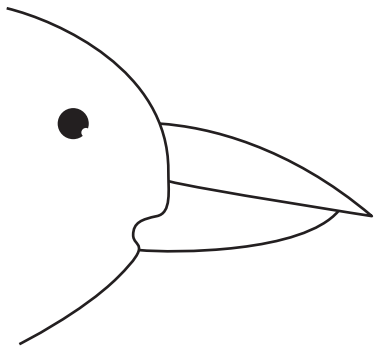
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(e)* Darwin observed birds called finches on the Galapagos Islands.

All the different species of finches evolved from one species of finch that arrived from mainland South America about one million years ago.

The table shows the type of beak and the preferred food of three of the finch species.

Each of these three finch species lives in a different environment.

Finch species	Diagram of beak shape	Beak type	Food
Vegetarian finch		Crushing beak with biting tips	Buds, leaves and fruit growing on trees
Warbler finch		Probing beak with probing tips	Flying insects and grass dwelling insects
Cactus finch		Probing beak with crushing tips	Cactus flowers and nectar

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Using the information in the table, explain Darwin's theory of evolution by natural selection.

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Extra answer space if required.

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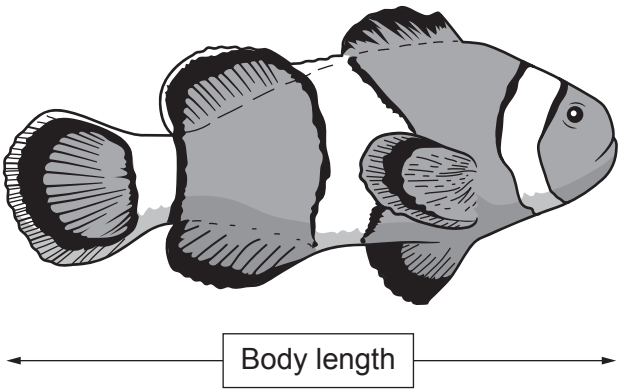
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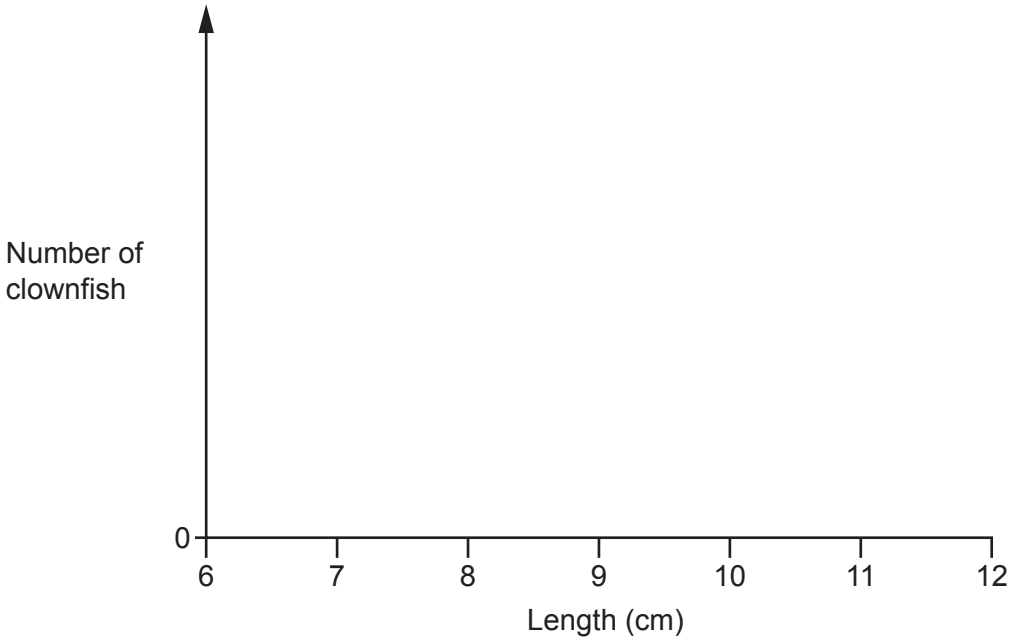
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(a) Clownfish, *Amphiprion ocellaris*, live in the Indian Ocean. They have a mean body length of 8 cm.

A student looks at data on variation in the body length of adults in a species of clownfish.



(i) Using the axes, sketch the shape of the graph you would expect the student to find.



[1]

(ii) Individuals in a population show variation.

Name **two** causes of variation.

Cause 1 .....

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Cause 2 .....

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[1]

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(b) Clownfish are multicellular bony fish.

Explain why multicellular organisms need a specialised exchange surface.

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..... **[2]**

(c) State **one** feature that both gill lamellae **and** root hairs have that makes them efficient as an exchange surface.

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..... **[1]**

(d) Explain why bony fish need water to flow over their gills for gaseous exchange to take place.

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..... **[4]**

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6

(a) Spirometer readings were taken from a person at rest and during exercise.

- Their tidal volume at rest was 480 cm^3.
- Their ventilation rate at rest was 5 dm^3 per minute.
- During exercise their tidal volume increased by 70%.

(i) Calculate the breathing rate of the person at rest.

Give your answer to the nearest whole number.

Breathing rate = ... breaths per minute **[2]**

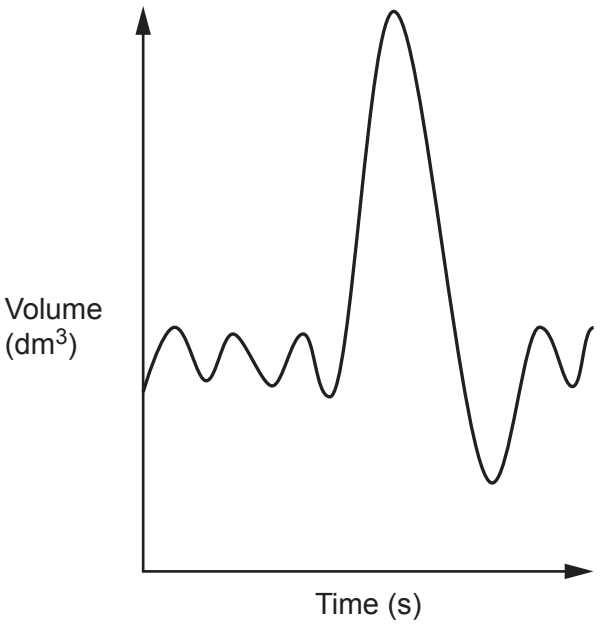
(ii) Calculate the person's tidal volume during exercise.

Tidal volume during exercise = ... cm^3 **[1]**

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(b) A study shows that long term exposure to dust affects a person's lung function by reducing their vital capacity.

The graph shows a spirometer trace for a person with healthy lung function.



Suggest how a spirometer trace would be different for a person with long term exposure to dust.

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..... **[1]**

(c) A student makes the following statement about ventilation in humans:

"During inspiration the diaphragm contracts and flattens. Internal intercostal muscles contract, moving the ribs upwards. The volume of the thorax increases, so the pressure in the thorax is now higher than atmospheric pressure. This forces air into the lungs."

Identify **and** correct the **two** errors in this statement.

Error and correction 1 .....

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Error and correction 2 .....

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[2]

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(d) The table shows components in the mammalian gaseous exchange system.

Complete the table by stating **one** role of each component.

Components	Role
Incomplete rings of cartilage in the trachea	
Smooth muscle in the bronchioles	
Elastic fibres in the alveoli	

[3]

END OF QUESTION PAPER

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EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.

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