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9700/23

May/June 2013

1 hour 15 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

Electronic calculators may be used.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **12** printed pages.

Answer **all** the questions.

For
Examiner's
Use

- 1 Fig. 1.1 is an electron micrograph of a transverse section of palisade mesophyll tissue in the leaf of the flowering plant, *Zinnia elegans*.



magnification $\times 7000$

Fig. 1.1

- (a) Name the features labelled **A**, **B** and **C**.

A

B

C

[3]

- (b) Calculate the width of the vacuole across the line **X-Y**.

Show your working and give your answer to the nearest micrometre (μm).

answer μm [2]

- (c) The membrane surrounding the vacuole, called the tonoplast, has a fluid mosaic structure.

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Describe the structure of this membrane.

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..... [4]

- (d) Palisade mesophyll cells have very large vacuoles.

Explain how water moves from the xylem in the leaf into these vacuoles.

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..... [3]

[Total: 12]

2 Read the following passage.

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A method called *in vitro* translation is often used by scientists to produce proteins in the laboratory. The method uses extracts from animal cells, plant cells or bacteria. These are chosen because they have high levels of protein synthesis. The cells are treated so that the cell walls, if present, and cell membranes are broken down and then treated so that any of the cell's own DNA and mRNA are destroyed. When mRNA from any source is added to these extracts, it will be translated into the corresponding protein.

(a) Explain why:

- (i) the cells are chosen on the basis of their high level of protein synthesis

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 [2]

- (ii) the cell walls (if present) and cell membranes need to be broken down

.....

 [1]

- (iii) the cell's own mRNA needs to be destroyed

.....

 [1]

- (iv) mRNA from any source can be translated in any type of extract.

.....

 [2]

- (b) State **two** differences between the cell structures used in translation in prokaryotes and eukaryotes.

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..... [2]

- (c) Scientists usually find that the method of *in vitro* translation is less efficient than *in vivo* translation, which occurs in cells.

Suggest a reason for this.

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..... [1]

[Total: 9]

3 Fig. 3.1 shows part of the nitrogen cycle.

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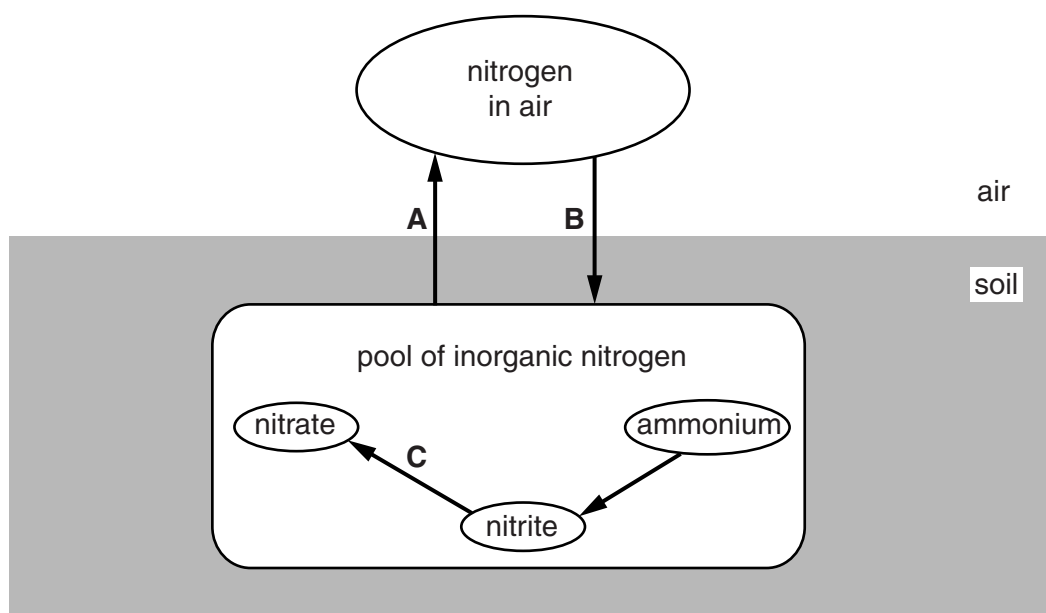


Fig. 3.1

(a) (i) Name processes **A**, **B** and **C**.

A

B

C

[3]

(ii) Dead animal and plant material can also contribute to the pool of inorganic nitrogen in soil.

Describe how this happens.

.....

 [3]

(b) Other inorganic substances, such as phosphate, are cycled entirely within the soil.

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(i) State **one** use for phosphate and **one** use for nitrate in organisms.

phosphate

nitrate

[2]

(ii) Nitrogen and phosphate are both cycled more rapidly in ecosystems where there are high rates of growth within trophic levels and high rates of energy flow between trophic levels.

With reference to the use of **both** nitrogen and phosphate in organisms, explain this statement.

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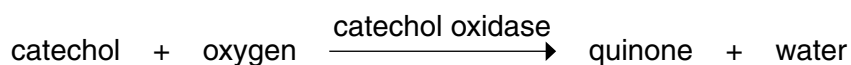
..... [3]

[Total: 11]

- 4 The enzyme, catechol oxidase, causes a brown colour to develop when slices of many fruits, such as apples, are exposed to air.

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Use

The enzyme catalyses the following reaction:



Quinone is then immediately further oxidized in air to a brown-coloured substance. Catechol and quinone are colourless.

A student investigated the rate of this reaction under different conditions.

- (a) State how the student could follow the progress of this reaction.

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..... [1]

In the first investigation, the student measured the initial rate of the reaction in varying concentrations of catechol. The results are shown in Fig. 4.1.

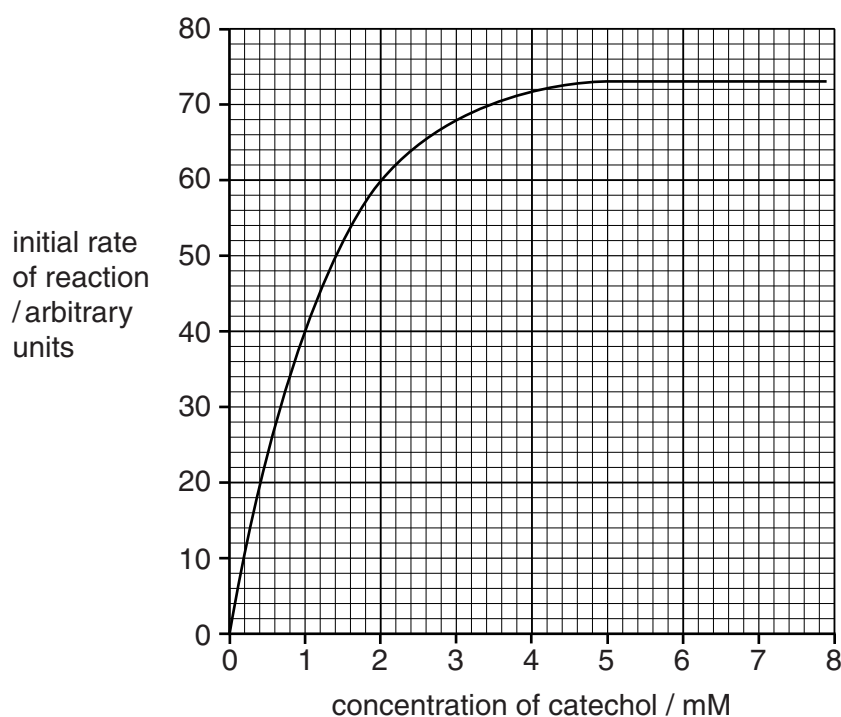


Fig. 4.1

- (b) Explain the results shown in Fig. 4.1.

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..... [5]

- (c) In a second investigation, the student repeated the experiment, but this time added a competitive inhibitor, para-hydroxybenzoic acid (PHBA), to each reaction mixture.

- (i) Sketch **on Fig. 4.1** the results that would be obtained for this second investigation. [2]

- (ii) Explain the effect that PHBA will have on the action of phenoloxidase.

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..... [2]

- (d) Lemon juice contains citric acid. Adding even a small amount of diluted lemon juice to apple slices slows the appearance of the brown colour.

Suggest an explanation for this observation.

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..... [2]

[Total: 12]

- 5 (a) Explain the importance of mitosis in multicellular organisms.

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..... [3]

A protein, mitosis-promoting factor (MPF), has been identified in cells. MPF is a globular protein made from two polypeptide chains.

- (b) Place a tick (✓) in the box next to the type, or types, of protein structure shown by MPF.

primary	☐
secondary	☐
tertiary	☐
quaternary	☐

[1]

The presence of MPF is known to cause prophase to start.

- (c) Describe the changes that occur during prophase in an animal cell.

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..... [4]

- (d) MPF normally begins to break down and stops functioning during anaphase.

Suggest the possible consequences of MPF **not** breaking down.

*For
Examiner's
Use*

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..... [3]

[Total: 11]

6 Measles is an infectious disease, while lung cancer is not.

(a) Explain why lung cancer is sometimes referred to as a 'lifestyle disease'.

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..... [2]

(b) State the type of pathogen that causes measles and state its mode of transmission.

pathogen

transmission

..... [2]

(c) Between January and April 2011, 118 measles cases were reported in the USA, where measles was previously thought to be virtually eradicated.

Suggest a reason for this rise in measles cases.

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..... [1]

[Total: 5]

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Fig. 1.1 © DR JEREMY BURGESS/SCIENCE PHOTO LIBRARY.

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