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Pre-Leaving Certificate Examination, 2017

Biology

Marking Scheme

Ordinary Pg. 4

Higher Pg. 35

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 Pre-Leaving Certificate Examination, 2017

Biology

Ordinary & Higher Levels

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Pre-Leaving Certificate Examination, 2017

Biology**Ordinary & Higher Levels**

Explanation

Conventions Used

1. A **dash** – before an answer indicates that the answer is a separate answer, which may be considered as independent of any other suggested answers to the question.
2. A **single forward slash** / before an answer indicates that the answer is synonymous with that which preceded it. Answers separated by a forward slash cannot therefore be taken as different answers.
3. A **double forward slash** // is used to indicate where multiple answers are given but not all are required.
4. **Round brackets** () indicate material which is not considered to be essential in order to gain full marks.
5. ‘*etc.*’ is used in this marking scheme to indicate that other answers may be acceptable. In all other cases, only the answer given or ‘words to that effect’ may be awarded marks.
6. Answers which are given in this marking scheme should not be considered as the only possible answers that may be accepted. Answers which are synonymous with or equivalent to those in this marking scheme are also acceptable.
7. Marks for diagrams are shown as follows (*e.g.* 0m, 3m, 6m), where 0m indicates the lowest possible and 6m the highest.

Current Marking Scheme

Assumptions about these marking schemes on the basis of past SEC marking schemes should be avoided. While the underlying assessment principles remain the same, the exact details of the marking of a particular type of question may vary from a similar question asked by the SEC in previous years in accordance with the contribution of that question to the overall examination in the current year. In setting these marking schemes, we have strived to determine how best to ensure the fair and accurate assessment of students’ work and to ensure consistency in the standard of assessment from year to year. Therefore, aspects of the structure, detail and application of the marking schemes for these examinations are subject to change from past SEC marking schemes and from one year to the next without notice.

Pre-Leaving Certificate Examination, 2017

Biology**Ordinary Level
Marking Scheme (400 marks)**

Section A	(5 × 20m)	(100)
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Section A Question 1

1. Use your knowledge of nutrition to answer the following questions. (20)

(a) Fats are composed of fatty acids and **(4m)**

- glycerol

(b) An example of a water-soluble vitamin is **(4m)**

Any 1:

- vitamin C //
- vitamin B

(c) An element found in proteins that is not found in carbohydrates is

Any 1: **(4m)**

- nitrogen //
- sulfur //
- phosphorus

(d) A food that is a good source of fibre in the diet is

Any 1: **(4m)**

- wholemeal cereals //
- wholemeal bread //
- brown pasta //
- brown rice //
- prunes //
- pulses // *etc.*

(e) An example of a trace element is

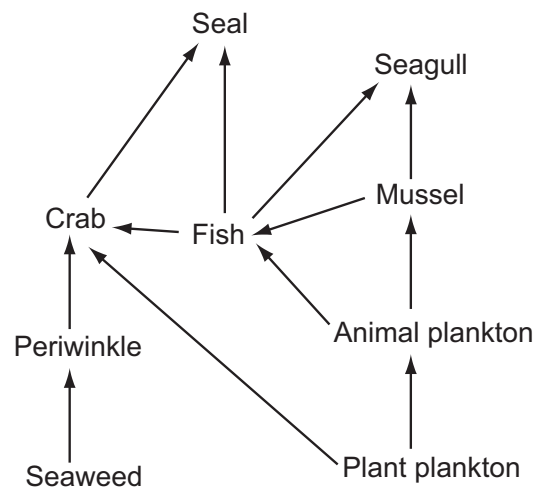
Any 1: **(4m)**

- iron //
- copper //
- zinc // *etc.*

Section A Question 2

2. The diagram shows a food web from the rocky seashore ecosystem.

(20)



(a) Name a producer from the food web.

Any 1: **(3m)**

- seaweed //
- plant plankton

(b) What does the mussel feed on? **(3m)**

- animal plankton

(c) Why is the periwinkle referred to as a primary consumer? **(3m)**

- it feeds on a producer / seaweed

(d) Name **one** carnivore from the food web.

Any 1: **(3m)**

- crab //
- mussel //
- seagull //
- fish //
- seal

Section A Question 2

2. (cont'd.)

(e) Identify a secondary consumer from the food web.

Any 1: **(2m)**

- crab //
- fish //
- mussel

(f) Using the food web above, construct a food chain containing **three** different feeding levels.**** Food chain must contain 3 different feeding levels.****** Food chain must start with a producer.**Any 1: **(3m)**

- seaweed → periwinkle → crab //
- plant plankton → animal plankton → mussel //
- plant plankton → crab → seal //
- plant plankton → animal plankton → fish // *etc.*

**** Award 0m if food chain does not start with a producer.****** Award 0m if no three organisms linked.****** Award 0m if organisms not from web given.**(g) Which organism has the most varied diet according to the food web? **(3m)**

- crab

Section A Question 3

3. (a) Name the **two** types of cell division. ($2 \times 3\text{m}$) (20)

- mitosis
- meiosis

Cancer is the uncontrolled division of abnormal cells.

(b) List **two** possible causes of cancer.

Any 2: ($2 \times 3\text{m}$)

- cigarette smoke //
- asbestos fibres //
- dioxins //
- ultraviolet radiation //
- viruses // *etc.*

(c) Give **one** possible treatment for cancer.

Any 1: (3m)

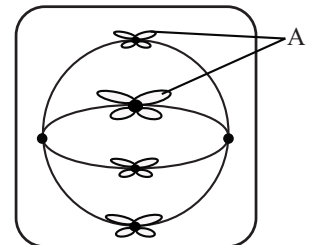
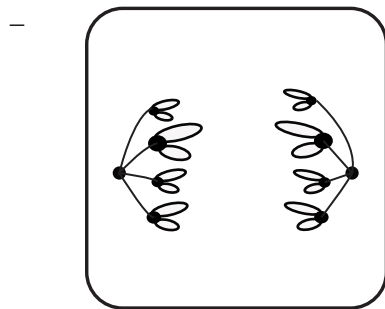
- radiation //
- surgery //
- chemotherapy // *etc.*

(d) The diagram shows stage 2 in one of the types of cell division named in (a) above.

(i) In the space below, draw a diagram to show the next stage of this cell division.

Diagram ($0\text{m}, 3\text{m}$)

- diagram showing chromosomes pulled apart to opposite ends / sides



(ii) Genes are found on the structures labelled A. Identify A. (2m)

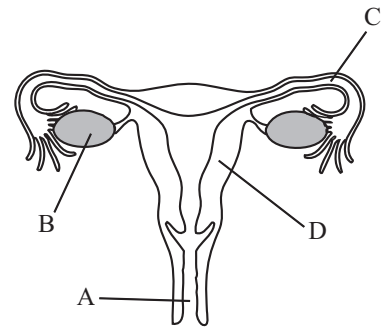
- chromosomes

Section A Question 4

4. The diagram shows the female reproductive system. (20)

(a) Name the parts labelled A, B, C and D. (4 × 3m)

- | | | |
|---|---|-----------------------------|
| A | – | vagina |
| B | – | ovary |
| C | – | fallopian tube / oviduct |
| D | – | uterus / womb / uterus wall |



(b) At which of the labelled parts does each of the following events take place? (4 × 2m)

- | | | |
|---------------|---|---------------------------------|
| Implantation | – | D / uterus / uterus wall / womb |
| Fertilisation | – | C / fallopian tube / oviduct |
| Ovulation | – | B / ovary |
| Copulation | – | A / vagina |

** Accept label letter or name of part for full marks.

Section A Question 5

5. Indicate whether the following statements are true or false by drawing a circle around T or F in each case. ($6 \times 3\text{m} + 2\text{m}$) (20)

Example: White blood cells are part of the immune system.

☒ T F

- (a) A pathogenic organism is an organism that helps fight infections.

T ☒ F

- (b) An antigen is a foreign molecule that helps stimulate the production of antibodies.

☒ T F

- (c) Antibodies are produced by white blood cells.

☒ T F

- (d) Active immunity produces the longest acting immunity.

☒ T F

- (e) Passive immunity develops after getting a vaccine.

T ☒ F

- (f) The flu vaccine can give you the flu.

T ☒ F

- (g) Wax in the ears, mucus in the nose and acid in stomach are all part of the general defence system.

☒ T F

- (a) – false
 (b) – true
 (c) – true
 (d) – true
 (e) – false
 (f) – false
 (g) – true

Section A Question 6

6. Place each term from the following list into **Column B** to match a description in **Column A**. (20)
The first one has been completed for you. (**5 × 4m**)

~~Carbon dioxide~~, Alcohol, Aerobic, Mitochondrion, Lactic acid, Oxygen.

Column A	Column B
A product of aerobic respiration	Carbon dioxide
(a) A reactant needed for aerobic respiration	– oxygen
(b) The part of the cell where stage 2 of aerobic respiration takes place	– mitochondrion
(c) A product of fermentation	– alcohol
(d) The type of respiration that releases a large amount of energy	– aerobic
(e) A product of anaerobic respiration that can cause cramp in human muscle	– lactic acid

- (a) – oxygen
(b) – mitochondrion
(c) – alcohol
(d) – aerobic
(e) – lactic acid

Section B

(2 × 30m)

Section B Question 7

7. (a) (i) Explain what is meant by a *quantitative* study in ecology. (3m) (6)

- records the quantity / amount / number / percentage / frequency

(ii) Name **one** piece of apparatus you could use to collect animals in a quantitative study.

Any 1: (3m)

- pooter //
- sweep net //
- pitfall trap //
- mammal trap //
- beating tray //
- Tullgren funnel //
- Baermann funnel //
- cryptozoic trap // *etc.*

(b) Answer the following in relation to a quantitative survey of plants that you carried out. (24)

(i) Name **one** piece of equipment you used to carry out this survey.

Any 1: (3m)

- quadrat //
- (line / belt) transect(s) //
- line or rope for transect // *etc.*

(ii) How did you use this piece of equipment to carry out the survey?

****** Throw or randomness explained.

Any 3: (3 × 3m)

Quadrat

- threw over shoulder / randomly //
- counted presence //
- observed presence / absence of //
- measured cover // *etc.*

Line transect

- laid out a line of string / rope //
- staked ends of string / rope //
- tied pieces of string or placed markers at every 1m of the line / forming stations //
- recorded names and heights of plants touching the line at each station // *etc.*

Belt transect

- two line transects laid out parallel to each other //
- usually 1m apart //
- 1m square area marked out to form a row of quadrats //
- recorded presence / frequency of plants // *etc.*

Section B Question 7 (cont'd.)

(b) (cont'd.)

(iii) How did you identify plants?

Any 1: **(3m)**

- (used a) key //
- photo //
- diagram //
- reference books // *etc.*

(iv) How did you present your results?

Any 1: **(3m)**

- map //
- table //
- chart //
- graph // *etc.*

(v) Suggest **one** possible source of error in your study.

Any 1: **(3m)**

- lack of randomness //
- insufficient number of quadrats / stations //
- wrong species identification //
- wrong calculation //
- carelessness //
- unsuitable equipment // *etc.*

(vi) Give **one** reason why the equipment you used in your study would not be suitable for a quantitative study of animals.

Any 1: **(3m)**

- animals may move too quickly //
- animals may not be visible, *e.g.* earthworms // *etc.*

Section B Question 8

8. (a) Define the term *osmosis*. (3 × 2m) (6)

- the movement of water
- across a semi-permeable membrane
- from high to low water concentration

(b) Answer the following in relation to an activity you carried out to demonstrate osmosis. (24)

(i) Draw a labelled diagram of the apparatus you used in this activity.

Diagram (0m, 3m, 6m)

Any 1:

Possible labels

❶ Visking tubing method

- beaker //
- water //
- sucrose solution //
- visking tubing //
- string // *etc.*

❷ Potato method

- raw potato //
- filter paper //
- salt //
- shallow dish //
- water // *etc.*

** Accept any valid diagram with appropriate labels for full marks.

(ii) What acted as the semi-permeable membrane in this activity?

Any 1: (3m)

- visking tubing //
- dialysis tubing //
- cellophane //
- (potato) cell membranes // *etc.*

(iii) What control did you use in this activity?

** Control should correspond to the semi-permeable membrane named above.

Any 1: (3m)

- water //
- cooked potato // *etc.*

(iv) Why do we need controls in investigations? (3m)

- to compare

Section B Question 8 (cont'd.)

(b) (cont'd.)

(v) State the results of your investigation and your control.

Any 1: (2 × 3m)

- | | |
|---|---|
| ① Visking tubing
– sucrose tube is full looking / heavier
– control tube - no change in mass | ② Potato
– raw potato - salt dissolves
– cooked potato - no change to salt |
|---|---|

** Results for investigation and control must be given for full marks.

(vi) Briefly explain the results you have given in part (v) 1 above.

Any 1: (3m)

- water moves by osmosis into the tubing with sucrose solution, therefore increasing the mass of visking tubing //
- water moves by osmosis into the potato well containing salt solution to dissolve the salt // etc.

** Expect reference to direction of water movement.

Section B Question 9

9. (a) (i) Give **one** function of protein in the human body. (6)

Any 1: **(3m)**

- to build muscle //
- to form nails //
- to form hair //
- to form skin //
- to repair cells //
- to make enzymes //
- to make hormones //
- to make antibodies // *etc.*

- (ii) Name **one** good source of protein in the human diet.

Any 1: **(3m)**

- (lean) meat //
- fish //
- chicken //
- eggs //
- nuts //
- seeds // *etc.*

- (b) Use your knowledge of food testing to answer the following questions (24)

1. (i) What chemical did you use to test a food sample for the presence of reducing sugars?

Any 1: **(3m)**

- Benedict's solution //
- Fehling's solution

- (ii) Was heat needed for this test? **(3m)**

- yes

- (iii) Describe the colour change which took place to show that reducing sugars were present. **(3m)**

- blue to (brick) red

2. Describe how you confirmed that a food sample contained fat. **(2 × 3m)**

- rubbed the food on a piece of brown paper
- observed / noted the grease spot / translucent spot on paper

Section B Question 9 (cont'd.)

(b) (cont'd.)

3. A food sample changed colour from brown to blue/black when a chemical was added to it.

(i) What food type does this colour change confirm? **(3m)**

– starch

(ii) What was the name of the chemical used in this food test? **(3m)**

– iodine

(iii) Was heat needed for this test? **(3m)**

– no

Section C Question 10

10. (a) Explain the following terms used in genetics. (9)

(i) Recessive. (3m)

- when an allele is prevented from working by a dominant allele

(ii) Phenotype. (3m)

- the physical makeup / appearance (of individuals)

(iii) Mutation. (3m)

- a change in the amount or structure of DNA

(b) In cattle, the allele for black coat (B) is dominant to the allele for white coat (b). (27)
A bull homozygous for black coat colour is crossed with a cow heterozygous for coat colour.

(i) State the genotype of each parent. (2 × 3m)

- BB
- Bb

(ii) Give the genotype(s) of the gametes produced by each parent. (3 × 3m)

① Bull

- B

② Cow

- B
- b

(iii) State the genotypes and the matching phenotypes of the calves produced by the cross.

① Genotypes (2 × 3m)

- BB
- Bb

② Phenotypes (3m)

- all black coat

** Award 0m if phenotypes given as black and/or white.

(iv) Which parent's gametes determine the sex of the calves? (3m)

- the bull / the male / the father

Section C Question 10 (cont'd.)

(c) (i) What is meant by the term *genetic engineering*? ($2 \times 3\text{m}$) (24)

- the artificial (scientific) manipulation and alteration
- of genes

(ii) Genetic engineering involves five basic steps. Name any **three** of these steps.

Any 3: ($3 \times 3\text{m}$)

- isolation //
- cutting //
- ligation / insertion //
- transformation //
- expression

(iii) Give **one** example of genetic engineering involving:

1. A plant.

Any 1: (3m)

- gene to prevent ripening in tomatoes / long-life tomatoes //
- gene inserted into maize to resist weedkiller //
- salt-resistant gene inserted into rice plants to allow them to grow in salty water // *etc.*

2. An animal.

Any 1: (3m)

- human gene for blood clotting factor in sheep milk //
- human gene for a lung-protecting protein inserted into sheep DNA; sheep then produce the human protein in their milk // *etc.*

3. A micro-organism.

Any 1: (3m)

- human gene for insulin inserted into bacteria, which then produce human insulin //
- human gene for growth hormone inserted into bacteria, which then produce human growth hormone // *etc.*

** Accept any valid example, one from a plant, one from an animal and one from a micro-organism.

Section C Question 11

11. (a) Explain the following terms used in ecology. (9)

(i) Omnivore. (3m)

- an organism that feeds on plants and animals

(ii) Ecosystem. (3m)

- a group of organisms interacting with their environment

(iii) Conservation. (3m)

- the (wise) management of Earth's resources

(b) (i) Distinguish between *biotic factors* and *abiotic factors* by defining each. (2 × 3m) (27)

- biotic - living factors
- abiotic - non-living factors

(ii) 1. Name any **two** abiotic factors you measured during your habitat study.

Any 2: (2 × 3m)

- temperature //
- pH //
- wind speed //
- light intensity //
- humidity //
- rainfall // *etc.*

2. List the equipment you used to measure **each** factor referred to in (ii) 1. above.

** Equipment used should correspond to the abiotic factor named in 1.

Any 2: (2 × 3m)

Abiotic factor

Equipment used to measure

- | | | |
|-----------------|---|---------------------------|
| temperature | – | thermometer // |
| pH | – | pH meter // |
| wind speed | – | anemometer // |
| light intensity | – | light meter // |
| humidity | – | hygrometer // |
| rainfall | – | rain gauge // <i>etc.</i> |

Section C Question 11 (cont'd.)

(b) (cont'd.)

(iii) Plants and animals adapt to changes in their environment to increase their chances of survival.

1. Name **one** plant and **one** animal found in the ecosystem you have studied. (2 × 3m)

** Plant and animal named should correspond to ecosystem studied.

<u>Plant</u>	<u>Animal</u>
– oak tree //	– deer //
– moss //	– owl //
– fern //	– badger //
– seaweed //	– limpet //
– dune grass // <i>etc.</i>	– crab // <i>etc.</i>

2. In the case of the named plant **or** animal, explain how it has adapted to living in this ecosystem.

** Adaptation must correspond to plant or animal named.

Any 1: (3m)

<u>Plant</u>	<u>Adaptation</u>
– oak tree	– long roots for stability //
– moss	– ability to absorb / store large amounts of water //
– fern	– waxy cuticle on frond to prevent water loss //
– seaweed	– holdfast to anchor to rocks //
– dune grass	– long roots to get water // <i>etc.</i>

<u>Animal</u>	<u>Adaptation</u>
– deer	– camouflage coat to blend into woodland / evade predators //
– owl	– large eyes for better night vision //
– badger	– sharp claws for digging roots //
– limpet	– shell to protect against predators //
– crab	– camouflage to blend into sand / seaweed / evade predators // <i>etc.</i>

(c) If waste is not disposed of correctly it may cause pollution. (24)

(i) List **two** types of pollution associated with waste disposal.

Any 2: (2 × 3m)

- air pollution //
- water pollution //
- ground pollution

Section C Question 11 (cont'd.)

(c) (cont'd.)

(ii) Suggest **three** ways of minimising household waste.

Any 3: **(3 × 3m)**

- reduce the consumption of unnecessary goods //
- reduce the amount of unnecessary packaging //
- reuse by donating unwanted clothes to charity //
- reuse glass bottle and jars //
- recycle paper, glass, plastics, organic waste // *etc.*

(iii) Give an example of how micro-organisms are used in waste management.

Any 1: **(3m)**

- bacteria and fungi in soil digest organic material in landfill sites //
- bacteria and fungi consume or digest waste in secondary sewage treatment // *etc.*

(iv) A species of plant disappears from an ecosystem as a result of pollution.
Suggest **two** possible effects the loss of this plant might have on the other organisms (plant or animal) living in the ecosystem.

Any 2: **(2 × 3m)**

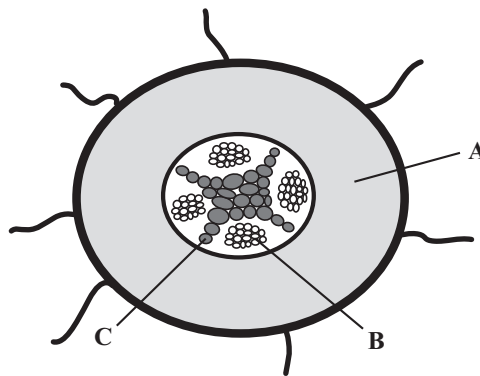
- less food //
- lack of shelter //
- migration //
- death //
- new species move in //
- attracts different types of species into the area //
- increased competition for resources // *etc.*

Section C Question 12

12. (a) All living things on Earth can be classified into five kingdoms: plants, animals, Monera, Protista and Fungi. (9)
- Name the kingdom to which **each** of the following organisms belongs:

1. *Amoeba* (3m)
 - Protista
2. *Rhizopus* (3m)
 - Fungi
3. Bacteria. (3m)
 - Monera

- (b) The diagram shows a transverse section of a dicotyledonous (dicot) plant root. (27)



- (i) Name the parts labelled A, B and C. (3 × 3m)

- A – ground tissue
 B – phloem
 C – xylem

** Award 3m only if A or B is labelled as vascular tissue.

- (ii) Give one feature of the diagram that indicates it is a root and not a stem.

Any 1: (3m)

- xylem in shape of 'X' //
- phloem / xylem not 'in centre' (as in a stem) //
- presence of root hairs

- (iii) Name the part of the seed that develops into the root. (3m)

- radicle

** Allow 'embryo'.

Section C Question 12 (cont'd.)

(b) (cont'd.)

(iv) Give **two** functions of a root.Any 2: **(2 × 3m)**

- absorb water //
- absorb minerals //
- transport absorbed materials to the shoots //
- anchorage //
- store food // *etc.*

(v) Some roots become modified for food storage. Give **one** example of a plant that has a modified root for storing food.Any 1: **(3m)**

- carrot //
- turnip //
- parsnip // *etc.*

(vi) Plants can be monocotyledonous or dicotyledonous. Give any **one** difference between a monocotyledonous plant and a dicotyledonous plant.Any 1: **(3m)**Monocotyledons

- one 'seed leaf' //
- long narrow leaf //
- parallel veins in leaf //
- scattered vascular bundles //
- flower parts in multiples of three //
- fibrous roots

Dicotyledons

- two 'seed leaves' //
- broad leaf //
- network of veins in leaf //
- ring of vascular bundles //
- flower parts in multiples of four or five //
- tap roots

(c) (i) Draw a large labelled diagram of the flowering plant. Label the following on your diagram: stem, leaf, flower, bud.

(24)

Diagram **(3m)**Labels **(4 × 1m)**(ii) Give a function of **each** of the four parts you have labelled in (i) above.

❶ Stem

Any 1: **(2m)**

- transports water and minerals from roots to leaves and flowers //
- supports the aerial parts of a plant //
- transports food made in leaves to the roots //
- can store food //
- can carry out photosynthesis // *etc.*

Section C Question 12 (cont'd.)

(c) (ii) (cont'd.)

2 LeafAny 1: **(2m)**

- makes food by photosynthesis //
- exchanges gases //
- cools the plant, by the loss of water //
- stores food // *etc.*

3 BudAny 1: **(2m)**

- the site of new growth / development in a plant //
- gives rise to new shoots and leaves // *etc.*

4 Flower **(2m)**

- reproduction // *etc.*

(iii) Meristematic tissue is an example of a plant tissue.

1. Explain the term *meristem*. **(3m)**

- (a tissue) capable of cell division or mitosis

2. Where in a plant can meristematic tissue be found?

Any 1: **(3m)**

- tips of roots //
- tips of shoots //
- buds // *etc.*

(iv) By what process does water enter the roots of a plant? **(3m)**

- osmosis

Section C Question 13

13. (a) (i) What is meant by metabolism? **(3m)** (9)
- the sum of all chemical reactions (in an organism or in a cell)
- (ii) 1. Metabolism can be either catabolic or anabolic. One of these types of metabolism involves complex molecules being broken down into simpler ones. Which of the underlined words best describes this type of metabolism? **(3m)**
- catabolic
2. Give an example of the type of reaction referred to in (ii) 1. above.
- Any 1: **(3m)**
- digestion //
 - respiration //
 - decay of dead plants and animals // *etc.*
- (b) Enzymes play an important role in metabolism. (27)
- (i) What is an enzyme? **(3m)**
- a (protein / organic) catalyst / a biological catalyst
- (ii) To which group of biomolecules do enzymes belong? **(3m)**
- proteins
- (iii) Where in a cell are these biomolecules made? **(3m)**
- ribosome(s)
- (iv) At what temperature do enzymes work best in humans? **(3m)**
- 37 °C
- ** Accept any figure with range 35-37 °C
- (v) Name a factor other than temperature which affects the rate of enzyme action. **(3m)**
- pH
- (vi) What is meant by the term *immobilised* in relation to enzymes? **(3m)**
- (enzymes) are trapped in a gel (or in sodium alginate) / fixed to each other

Section C Question 13 (cont'd.)

(b) (cont'd.)

(vii) Answer the following questions in relation to practical work you carried out to investigate enzyme activity.

1. Name an enzyme that you used.

Any 1: **(3m)**

- amylase //
- catalase //
- pepsin // *etc.*

2. Name the substrate it acts on.

** Substrate should correspond to enzyme named.

Any 1: **(3m)**EnzymeSubstrate

- | | | |
|----------|---|------------------------|
| amylase | – | starch // |
| catalase | – | hydrogen peroxide // |
| pepsin | – | protein // <i>etc.</i> |

3. Name **one** product of the reaction.

** Product should correspond to enzyme and substrate named.

Any 1: **(3m)**Enzyme & SubstrateProduct

- | | | |
|------------------------------|---|-------------------------|
| amylase & starch | – | maltose // |
| catalase & hydrogen peroxide | – | oxygen // |
| pepsin & protein | – | peptides // <i>etc.</i> |

(c) (i) Draw a large labelled diagram of a typical plant cell and label at least **three** parts. (24)Diagram (0m, 3m)Any 3 correct labels (3 × 1m)

** Diagram must show definite shape and/or cell wall.

(ii) List **two** structures present in a plant cell not found in an animal cell.Any 2: **(2 × 3m)**

- cell wall //
- chloroplasts //
- large vacuole

Section C Question 13 (cont'd.)

(c) (cont'd.)

(iii) During your investigations, you prepared and examined plant cells under the light microscope. Answer the following in relation to that practical.

1. From what plant did you get the cells? **(3m)**

– onion

** Accept any other appropriate plant.

2. What stain did you use? **(3m)**

– iodine

** Accept 'methylene blue' but not 'methyl blue'.

3. What was the function of the stain? **(3m)**

– to highlight the nucleus

** Accept any other appropriate answer.

(iv) Name the primary source of energy for a plant cell. **(3m)**

– the sun / light

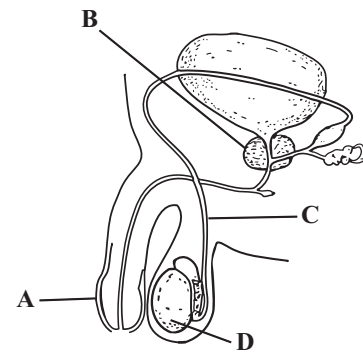
Section C Question 14

14. Answer any **two** of (a), (b), (c).**(30, 30)**

(a) The diagram shows the male reproductive system.

(30)(i) Name the parts labelled A, B and C. **(3 × 3m)**

- A – penis
 B – prostate
 C – sperm duct or vas deferens



(ii) Give the function of the part labelled D.

- Any 1: **(3m)**
 – makes sperm //
 – makes testosterone

(iii) In which labelled part does meiosis take place? **(3m)**

- D

(iv) Why must D be kept at a temperature below body temperature?

- Any 1: **(3m)**
 – meiosis does not take place properly at normal body temperature (37 °C) //
 – cooler temperature required for successful production of sperm

(v) 1. Name the main sex hormone in males. **(3m)**

- testosterone

2. This hormone causes the development of secondary sexual characteristics. Name **two** secondary sexual characteristics in males.

- Any 2: **(2 × 3m)**
 – enlargement of larynx, deepening the voice //
 – broadening of the shoulders //
 – growth of pubic, facial and underarm hair //
 – increased sebum production in skin //
 – growth spurt //
 – increased muscular and bone development // *etc.*

(vi) Give **one** cause of infertility in men.

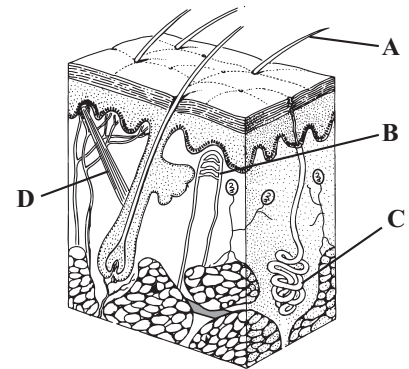
- Any 1: **(3m)**
 – smoking //
 – substance abuse, *e.g.* drug abuse, alcohol abuse //
 – use of steroids //
 – mumps //
 – exposure to chemicals //
 – exposure to radiation //
 – low levels of testosterone // *etc.*

Section C Question 14 (cont'd.)

(b) The diagram shows the human skin. (30)

(i) Name the parts labelled A, B, C and D. (4 × 3m)

- A – hair (shaft)
- B – capillaries / blood vessels //
- C – sweat gland
- D – erector muscle



(ii) What happens to structure A when the body is very hot? (3m)

- it flattens / lies flat on surface of skin

(iii) The skin is one of the excretory organs in humans. Name **one** substance excreted by the skin.

Any 1: (3m)

- water //
- salt / sodium chloride //
- urea

(iv) Give **two** other functions of the skin.

Any 2: (2 × 3m)

- protects from pathogens / bacteria //
- acts as waterproof layer / prevents fast dehydration //
- insulates against cold //
- reduces damage caused by UV radiation //
- may be coloured or shaped to act as a camouflage / warning / attractant //
- nourishes the body by making vitamin D from sunlight //
- regulates temperature //
- provides information to the nervous system // *etc.*

(v) A human being is an endotherm.

1. What is an endotherm? (3m)

- an organism whose body temperature is independent of the environmental temperature

2. What is the main source of body heat in endotherms?

Any 1: (3m)

- carbohydrate (or named) //
- lipids //
- respiration //
- liver //
- muscle //
- food //
- metabolism

Section C Question 14 (cont'd.)

- (c) In humans the nervous system and the endocrine system work together to coordinate all the activities in the body. (30)

- (i) The nervous system is made up of the central nervous system (CNS) and the peripheral nervous system (PNS).

1. To which of these two systems does the brain belong? (3m)
 - central nervous system / CNS
2. Name **one** other part of the system referred to in (i) 1. above. (3m)
 - spinal cord

- (ii) Three types of neuron carry nerve messages.

1. Name any **two** types of neuron.

Any 2: (2 × 3m)

- sensory //
- motor //
- interneuron

2. For each type of neuron you name, give the direction in relation to the brain in which the nerve impulse travels.

** Direction of impulse should correspond to neuron named.

Any 2: (2 × 3m)

<u>Neuron</u>	<u>Direction of nerve impulse</u>
sensory	– to the brain //
motor	– from the brain //
interneuron	– within the brain

- (iii) The endocrine system produces hormones. What is a hormone?

- a chemical messenger (3m)

Any 1: (3m)

- secreted by ductless gland //
- transported in the blood //
- to a target area //
- causing a response

- (iv) Give **two** differences between a nerve response and a hormone response.

Any 2: (2 × 3m)

Nerve response

- fast / immediate acting //
- carried mostly by electrical impulses //
- fast transmission //
- effect is localised //

Hormone response

- slow acting //
- carried by chemicals //
- slow transmission (in blood) //
- effects may be widespread // *etc.*

Section C Question 15

15. Answer any **two** of (a), (b), (c). (30, 30)

(a) (i) Explain the term *digestion*. (3m) (30)

- the breakdown of food by the body (by chemical / physical means)

(ii) Name **one** human tooth type **and** give its function.

** Tooth named (3m), Function given (3m).

** Function should correspond to the tooth named.

Any 1: (6m)

<u>Tooth</u>	<u>Function</u>
– canine	– gripping / stabbing / tearing food //
– incisor	– cutting / slicing / biting food //
– pre-molar	– grinding / crushing food //
– molar	– grinding / crushing food // <i>etc.</i>

(iii) Peristalsis begins when food enters the oesophagus.

What is peristalsis? (3m)

- involuntary wave of muscular contractions

(iv) Describe the following changes that happen to food in the stomach:

1. Mechanical changes. (3m)

- stomach wall contracts to churn food into a liquid (called chyme)

2. Chemical changes.

Any 1: (3m)

- pepsin digests proteins //
- hydrochloric acid softens food //
- hydrochloric acid changes pH of food

(v) Bile is a viscous yellow-green liquid which aids digestion.

1. Where is bile produced? (3m)

- the liver

2. Where is bile stored? (3m)

- the gall bladder

3. Where does bile act in the alimentary canal? (3m)

- small intestine / duodenum / ileum

Section C Question 15 (cont'd.)

(a) (cont'd.)

- (vi) Many symbiotic ('good') bacteria can be found in the large intestine.
State **one** benefit that humans get from having these bacteria.

Any 1: **(3m)**

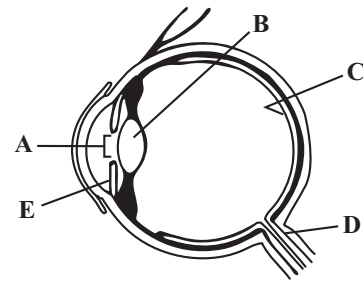
- produce vitamins (B group and K) //
- out-compete pathogens or complement immune system //
- break down fibre

Section C Question 15 (cont'd.)

(b) The diagram shows the human eye. (30)

(i) Name the parts labelled A, B and C. (3 × 3m)

- A – pupil
- B – lens
- C – retina



(ii) Which letter represents the coloured part of the eye? (3m)

- E

(iii) 1. Name the nerve D. (3m)

- optic (nerve)

2. Give the function of the nerve D. (3m)

- carry images to brain

(iv) There are two different types of light receptors in the eye.

1. Name the **two** types of light receptors. (2 × 3m)

- rods
- cones

2. In which labelled part of the eye are they found? (3m)

- C / retina

3. Give **one** difference between the two types of light receptors.

Any 1: (3m)

Rods

- 120 million per eye //
- detect black and white //
- work in dim light //
- found all over retina //
- narrow cell //

Cones

- 6 million per eye //
- detect colour (red, green, blue) //
- work in bright light //
- found mostly at fovea //
- wide cell // etc.

Section C Question 15 (cont'd.)

(c) Answer the following in relation to plant responses. (30)

(i) What name is given to a plant's growth response to light? (3m)

- phototropism

(ii) How does this growth response benefit a plant?

Any 1: (3m)

- plant gets more light so can carry out more photosynthesis //
- plant gets more light so can produce more food

(iii) 1. Name **two** stimuli, other than light, that plants respond to.

Any 2: (2 × 3m)

- gravity //
- touch //
- chemicals //
- water

2. Give **one** example of a plant response to any one stimulus referred to in (iii) 1. above.

Any 1 (3m)

- | | |
|--|--|
| <ul style="list-style-type: none"> – gravity // – touch // – chemicals // – water // | <p>Any 1:</p> <ul style="list-style-type: none"> – roots grow towards gravity // – stems grow away from gravity // <i>etc.</i> – climbing plants / tendrils around objects // <i>etc.</i> – roots grow towards minerals // <i>etc.</i> <p>Any 1:</p> <ul style="list-style-type: none"> – pollen tubes grow towards water // – roots grow towards water // <i>etc.</i> |
|--|--|

(iv) Name a growth regulator produced by plants.

Any 1: (3m)

- auxin //
- ethylene //
- abscisic acid // *etc.*

(v) Where in a plant are growth regulators produced? (3m)

- meristem or growing tips

(vi) How are growth regulators transported within a plant? (3m)

- vascular tissues / xylem / phloem

(vii) List **two** uses for plant growth regulators in horticulture.

Any 2: (2 × 3m)

- stimulate formation of roots in cuttings //
- stimulate formation of new plants in tissue culture //
- ripen bananas // *etc.*

Pre-Leaving Certificate Examination, 2017

Biology**Higher Level
Marking Scheme (400 marks)**

Section A (5 × 20m) **(100)**

Section A Question 1

1. Answer any **five** of the following parts (a) to (f): (20)

Any 5: (5 × 4m)

(a) Give **two** functions of water in a cell.

Any 2: (2 × 2m)

- acts as a solvent //
- acts as a reaction medium //
- maintains cell shape // *etc.*

(b) Name a protein that has a structural role in humans.

Any 1: (4m)

- keratin //
- collagen //
- myosin // *etc.*

(c) Give an example of a catabolic reaction.

Any 1: (4m)

- respiration //
- fermentation //
- glycolysis // *etc.*

(d) Which **two** elements are present in the ratio 2:1 in carbohydrates? (4m)

- hydrogen and oxygen (2:1)

**** Both elements are required and in correct order / ratio.**

Section A Question 1 (cont'd.)

- (e) Name a vitamin involved in the formation of connective tissue. (4m)
- vitamin C
- (f) Where would you expect to find lipoproteins in human cells? (4m)
- cell / plasma membrane

Section A Question 2

2. (a) What is the precise meaning of the term *conservation* as used by ecologists? (20)

Any 1: (3m)

- the wise management of the Earth's resources to maintain a wide range of habitats //
- the wise management of the Earth's resources to prevent the death and extinction of organisms

(b) Suggest **two** reasons for conserving wild species.

Any 2: (2 × 3m)

- to prevent extinction //
- to protect habitats //
- to encourage biodiversity //
- to reveal possible heretofore undiscovered resources //
- to maintain a species' right to exist // *etc.*

(c) Explain the term *pollution*. (3m)

- any harmful addition to the environment

(d) Give an example of a human activity that results in the pollution of air or water.

Any 1: (3m)

- dumping / littering //
- sewage disposal //
- transport //
- electricity generation //
- radioactive processes //
- agricultural activities //
- industrial activities // *etc.*

(e) Suggest a method of controlling the pollution that results from the activity referred to in (d).

Any 1: (2m)

- ** Any matching counteracting method to answer given in (d).

(f) Give **one** example of the use of micro-organisms in waste management.

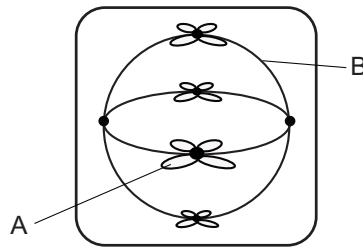
Any 1: (3m)

- break down waste in sewage treatment plants //
- break down organic / biodegradable material in landfill / digesters / compost heaps // *etc.*

Section A Question 3

3. The diagram shows a stage of mitosis.

(20)



(a) Identify the stage of mitosis shown in the diagram. **(3m)**

– metaphase

(b) Name the parts labelled A and B. **(2 × 2m)**

A – chromatid / chromosome

B – spindle / spindle fibre

** Do not accept 'fibre' on its own.

(c) Explain the significance of mitosis in single-celled organisms. **(3m)**

– (allows single-celled organisms) to reproduce / increase numbers

(d) Once mitosis is complete, the cell divides. What is this process called in the case of animal cells? **(3m)**

– cleavage

(e) What does the term *cancer* mean in relation to cells? **(3m)**

– when cells lose the ability to control the rate of mitosis

(f) Suggest **two** possible causes of cancer.

Any 2: **(2 × 2m)**

– UV light //

– asbestos fibres //

– cigarette smoking //

– dioxins // etc.

Section A Question 4

4. Use your knowledge of human development in the female reproductive system to answer the following questions. (20)

(a) Name the structure formed after the zygote divides by mitosis. (3m)

- morula

(b) Approximately 5 days after fertilisation, the structure referred to in (a) develops into a hollow ball of cells. What is this hollow ball of cells called? (3m)

- blastocyst

(c) Approximately 10 days after fertilisation, the structure referred to in (b) forms the embryo. Name the **three** germ layers formed from the cells of the embryo and for **each** germ layer, give **one** organ or system which develops from it.

** Organ or system should correspond to the germ layer named.

- ectoderm (2m) Any 1: (2m)
 - skin //
 - hair //
 - nails //
 - nervous system
- mesoderm (2m) Any 1: (2m)
 - skeleton //
 - respiratory system //
 - excretory system //
 - circulatory system
- endoderm (2m) Any 1: (2m)
 - inner lining of digestive system //
 - inner lining of respiratory system //
 - liver //
 - pancreas //
 - lining of the follicles of the thyroid gland and thymus // etc.

(d) What important structure is formed from the embryonic and uterine tissues? (2m)

- the placenta

Section A Question 5

5. In the case of the following pairs of terms, clearly distinguish between the first term and second term by writing a brief sentence about each. (20)

- | | | | |
|-----|-------------------------------|-------------|--|
| (a) | Antibody. (2m) | – | a protein produced by white blood cells in response to an antigen |
| | Antigen. (2m) | – | a foreign molecule that stimulates the production of antibodies |
| (b) | Active immunity. (2m) | – | production of a person's own antibodies in response to antigens |
| | Passive immunity. (2m) | – | when a person is given antibodies formed by another organism |
| (c) | B lymphocyte (B cell). | Any 1: (2m) | |
| | | – | mature in bone marrow // |
| | | – | control bacterial infections and some viral infections // |
| | | – | produce antibodies // |
| | | – | recognise antigens |
| | T lymphocyte (T cell). | Any 1: (2m) | |
| | | – | mature in thymus gland // |
| | | – | (helper) stimulate B cells to produce antibodies // |
| | | – | (killer) produce perforin, which causes abnormal cells to burst // |
| | | – | (suppressor) turn off immune responses // |
| | | – | (memory) survive a long time to trigger immunity to same antigen // <i>etc.</i> |
| (d) | Antibiotic. (2m) | – | chemicals produced by bacteria / fungi to kill other bacteria / fungi without harming human tissue |
| | Vaccine. (2m) | – | a non-disease causing dose of antigens which induces an antibody response |
| (e) | General defence system. (2m) | – | acts as a barrier to prevent infection / prevents all pathogens entering body |
| | Specific defence system. (2m) | – | attacks particular / specific pathogens |

Section A Question 6

6. (a) ATP is a product of the light-dependent stage of photosynthesis. (20)

(i) What does the abbreviation ATP stand for? **(3m)**

– adenosine triphosphate

** All words correct for full marks.

(ii) What is the function of ATP in cells?

Any 1: **(3m)**

– energy store //
– energy carrier

(iii) In what part of the cell does the light-dependent stage of photosynthesis take place? **(3m)**

– chloroplast

(b) NADPH is another product of the light-dependent stage of photosynthesis.

(i) What is the source of the hydrogen ions (protons) to make the NADPH?

Any 1: **(3m)**

– splitting of water //
– hydrolysis //
– (protons come from) a pool of H^+ ions

(ii) Why is oxygen considered to be a waste product of the light-independent stage? **(3m)**

– (oxygen) is not used anywhere else in photosynthesis

(iii) List **two** possible fates for the oxygen product of this stage. **(3m + 2m)**

– released into atmosphere
– (re)used in respiration

Section B (2 × 30m)

Section B Question 7

7. (a) In relation to the scientific method, explain **each** of the following: (6)

(i) Hypothesis (3m)

- a suggested explanation for an observation / an educated guess

(ii) Replicate. (3m)

- a repeat of an experiment

(b) (i) To demonstrate osmosis two cellophane bags were half-filled with a 3% salt solution. The bags were placed in two beakers, one containing a 10% salt solution and one containing distilled water. Both were left for 30 minutes. (24)

Describe, using words or a diagram, the appearance of the cellophane bag:

1. In the 10% salt solution. (3m)

- cellophane bag shrivelled up

2. In the distilled water. (3m)

- cellophane bag swelled up

** Accept answers given in diagram form.

(ii) Answer the questions below in relation to an investigation you carried out to show the effect of an environmental factor on the rate of photosynthesis.

1. State the environmental factor you studied, and explain how you varied it.

** Method should correspond to the environmental factor named.

Any 1: (3m)

- | | |
|------------------|---|
| – light | – moved light towards, or away from, plant // |
| – carbon dioxide | – used different concentration solutions of sodium hydrogen carbonate |

** Expect factor and how varied for full marks.

2. How did you measure the rate of photosynthesis? (3m)

- counted the number of bubbles produced per minute / unit time

Section B Question 7 (cont'd.)

(b) (cont'd.)

(iii) Answer the questions below in relation to an investigation you carried out to determine the conditions required for the germination of seeds.

1. What were the conditions necessary for germination to occur in seeds? (**3 × 1m**)

- oxygen
- moisture (water)
- suitable temperature (warmth)

2. Describe the control you used in this investigation. (**3m**)

- seeds given all three conditions

(iv) In the course of your practical work you used iodine solution. State **two** different uses for iodine solution. (**2 × 3m**)

- testing for starch
- staining cells, *etc.*

Section B Question 8

8. (a) The human circulatory system is described as a closed system. (6)

(i) In relation to the human circulatory system, what is meant by a *closed* system? (3m)

- blood flows / is contained within a continuous system of vessels, *etc.*

(ii) Distinguish clearly between the *pulmonary* circuit and the *systemic* circuit in a two-circuit circulatory system.

Any 1: (3m)

pulmonary circuit

- from the heart to the lungs and back to the heart

systemic circuit

- from the heart to the rest of the body and back to the heart

(b) Answer the following questions in relation to the dissection you carried out to investigate the structure of a heart. (24)

(i) How did you distinguish between the ventral and dorsal surfaces of the heart?

Any 1: (3m)

- ventral surface is more rounded //
- thick-walled arteries are on ventral surface //
- the ventricle on the left side of the heart is thicker / firmer than that on the right side //
- coronary blood vessels

(ii) There are four main blood vessels attached to the heart.
How did you identify which were arteries and which were veins?

Arteries

Any 1: (3m)

- thick walls //
- no valves //
- position on heart // *etc.*

Veins

Any 1: (3m)

- thin walls //
- valves //
- position on heart // *etc.*

** Accept 'position on the heart' only once in relation to either blood vessel.

Section B Question 8 (cont'd.)

(b) (cont'd.)

- (iii) Describe how you dissected the right side of the heart to enable you to identify the internal structures of the atrium and ventricle. Use suitably labelled diagrams if necessary.

** Right side must be identified or shown.

Description

Any 4: (4 × 3m)

- placed heart ventral side up on a dissecting tray //
- used a scalpel / other named cutting instrument //
- made a cut (one vertical, one horizontal) in right ventricle to view the tendons / papillary muscle, the flaps of the tricuspid valve and thin walls of the ventricle //
- made a (circular) cut in the right atrium to observe very thin walls and the tricuspid valve //
- observed pulmonary artery, inferior vena cava, superior vena cava //
- safety procedure stated, *e.g.* wore gloves, wore goggles, wore a lab coat // *etc.*

- (iv) Outline how you located the semi-lunar valves.

Any 1: (3m)

- cut down the length of the pulmonary artery //
- cut down the length of the aorta

Section B Question 9

9. (a) Are fungi *prokaryotic* or *eukaryotic* organisms? (3m) (6)

- eukaryotic (organisms)

Give a reason for your answer.

Any 1: (3m)

- have a membrane-bound nucleus //
- have membrane-bound organelles, *e.g.* mitochondria //
- are multicellular organisms // *etc.*

(b) Answer the following questions in relation to the growth of leaf yeasts in the laboratory. (24)

(i) A sterile nutrient medium should be used. What is the significance of the medium being sterile?

Any 1: (3m)

- no contamination //
- fair test

(ii) Suggest **one** reason why leaf yeasts are more plentiful in July than in March.

Any 1: (3m)

- more leaves on trees //
- better / warmer conditions for growth of leaf yeast

(iii) How did you introduce the leaf samples onto the sterile medium?

Any 1: (3m)

- used a flamed / sterilised tweezers / forceps / equipment //
- attached leaf yeasts to lid of petri dish / placed on petroleum jelly on lid of petri dish //
- attached leaf with upper surface facing up to the lid using petroleum jelly

(iv) How did you incubate the petri dishes once you had attached the leaf samples?

Any 2: (2 × 3m)

- (incubated at) 25-30 °C //
- 3 days //
- inverted //
- sealed // *etc.*

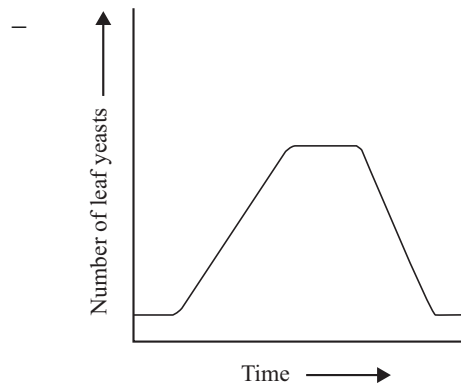
Section B Question 9 (cont'd.)

(b) (cont'd.)

(v) How did you recognise the presence of the yeasts? **(3m)**

– pink or red colonies (must have colour)

(vi) Using the axes below, draw a graph to show how the number of leaf yeasts varied following their introduction into the petri dish.

Lag phase shown **(3m)**Log and stationary or log and decline phase shown **(3m)**

Section C

(4 × 60m)

Section C Question 10

10. (a) All organisms need to have the ability to maintain suitable constant conditions in their cells and bodies, such as fluid balance, temperature and chemistry. (9)
- (i) What term is used to describe this ability? (3m)
- homeostasis
- (ii) Name **two** organs, other than the kidneys, which help humans to maintain a constant fluid balance. (2 × 3m)
- skin
 - lungs
- (b) Urine production involves the processes of filtration and reabsorption. (27)
- (i) Explain **each** of the underlined processes.
- filtration (3m)
- small substances are pushed out of the bloodstream into kidneys
- reabsorption (3m)
- nutrients are returned to / taken back into the blood
- (ii) The nephron is the functional unit of the kidney.
1. Name the site of filtration in the nephron. (3m)
 - glomerulus / Bowman's capsule
 2. By what process is glucose reabsorbed in the nephron? (3m)
 - diffusion
 3. Give the precise site of action of the hormone ADH (vasopressin) in the nephron.
 - Any 1: (3m)
 - collecting duct //
 - distal convoluted tubule

Section C Question 10 (cont'd.)

(b) (cont'd.)

(iii) A medical laboratory tested two urine samples.

1. The first urine sample was found to contain protein.
Would this be considered a normal result? **(3m)**

– no

Explain your answer. **(3m)**

– protein molecules too big (to pass into the filtrate)

** Allow a 'yes' answer with appropriate reason.

2. The second urine sample was found to contain glucose.
Would you consider this to be a normal result? **(3m)**

– no

Explain your answer. **(3m)**

– glucose (in the filtrate should have been) reabsorbed

- (c) (i) Give the precise location in the human body of **each** of the following endocrine glands: thyroid, adrenal(s), thymus. **(3 × 2m)**

(24)

<u>Endocrine gland</u>	<u>Location</u>
thyroid	– neck
adrenal(s)	– top of kidney(s)
thymus	– behind the breastbone in the upper chest

- (ii) Name a hormone produced by **each** of the glands in (i) and give a function of **each** hormone.

** Hormone named (2m), Function given (2m).

** Function should correspond to the hormone named.

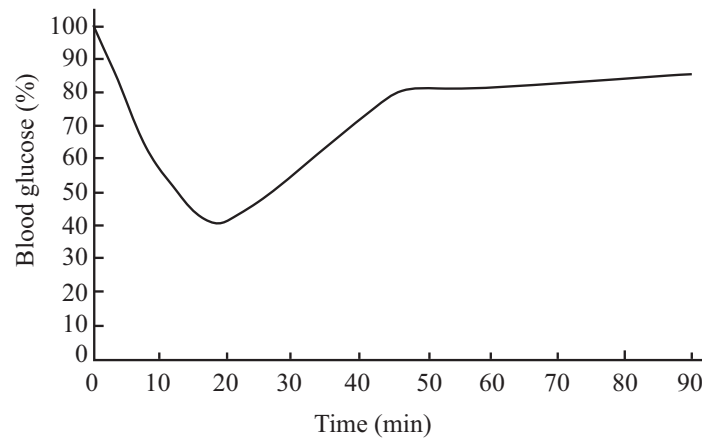
Any 3: **(3 × 4m)**

<u>Endocrine gland</u>	<u>Hormone</u>	<u>Function</u>
thyroid	– thyroxine	– controls rate of metabolism
adrenal(s)	– adrenaline	– controls 'fight or flight' response
thymus	– thymosin	– matures / activates lymphocytes

Section C Question 10

(c) (cont'd.)

- (iii) An insulin injection was administered to an individual at 0 minutes. The graph shows how this injection of insulin affected the blood glucose levels of that individual.



1. What is the effect of injecting insulin? **(2m)**
 - reduces % blood glucose (or explained)
2. For how long did the insulin injection affect the level of glucose in the blood? **(2m)**
 - 90 minutes
3. What property of insulin means that it has to be administered by injection? **(2m)**
 - (it is) a protein (so would be digested if taken orally)

Section C Question 11

11. (a) (i) What is meant by the term *genetic engineering*? (3m) (9)
- the artificial manipulation of alteration of genes
- (ii) State **one** application of genetic engineering in **each** of the following:
1. A plant.

Any 1: (3m)

 - herbicide-resistant plants //
 - slow-ripening tomatoes //
 - ‘golden’ rice, containing carotene from carrots (vitamin A) // etc.
 2. A micro-organism

Any 1: (3m)

 - interferon //
 - production of hormones, e.g. insulin //
 - production of enzymes // etc.
- (b) Colour blindness is a sex-linked characteristic in humans. Normal vision results from the possession of a dominant allele (C). (27)
- (i) What is meant by the term *sex-linked*? (3m)
- the gene controlling a certain characteristic is located on the X (or sex) chromosome
- (ii) What term is used to describe a person who has a gene for colour blindness but who does not exhibit the condition? (3m)
- carrier
- (iii) 1. Show by means of diagrams the genotypes and phenotypes of the possible offspring of a colour blind father and a mother who is heterozygous for the condition.
- father XYc_ mother XXCc (2 × 2m)
 - gametes: Xc, Y_ XC, Xc (2 × 2m)
- ** Both male gametes only correct 2m in total.
 ** Both female gametes only correct 2m in total.
- ** Genotype (1m), Phenotype (1m).
- Offspring
- | <u>Genotype</u> | | <u>Phenotype</u> | |
|-----------------|---|----------------------|----------|
| XXCc | – | female normal vision | (2 × 1m) |
| XXcc | – | female colour blind | (2 × 1m) |
| XYC_ | – | male normal vision | (2 × 1m) |
| XYc_ | – | male colour blind | (2 × 1m) |

Section C Question 11 (cont'd.)

(b) (cont'd.)

2. What percentage of the male offspring are colour blind? **(2m)**
 - 50%
3. Is it possible for this couple to have a colour blind daughter? **(1m)**
 - yes

Briefly explain your answer.

- Any 1: **(2m)**
- both parents carry the gene for colour blindness //
 - the mother also carries the gene for colour blindness

(c) In your answer book, say whether **each** of the following statements is true or false **and** give a reason for your choice in each case: **(4 × 6m)** **(24)**

**** True/False (3m), Relevant explanation (3m).**

(i) mRNA is found in the nucleus *and* the cytoplasm in a cell.

- true
- mRNA is produced in the nucleus and moves to the cytoplasm

(ii) Down's Syndrome is a condition caused by a gene mutation.

- false
- (Down's Syndrome is) caused by a change in chromosome number

(iii) The shape of a protein in an enzyme is vital to its function.

- true
- active site needs to fit substrate

(iv) Transcription occurs in the ribosomes in a cell.

- false
- transcription is the making of the mRNA from the DNA template and it takes place in the nucleus of the cell

Section C Question 12

12. (a) (i) Humans can be classified as primary consumers and secondary consumers. Explain **each** of the underlined terms. (9)
- ① Primary consumers (3m)
- organisms which feed on plants / producers
- ② Secondary consumers (3m)
- organisms which feed on animals / primary consumers / carnivores
- (ii) Give **one** example of a producer from a **named** ecosystem you have studied.
- Any 1: (3m)
- any green plant from named habitat
- Possible examples
- grass (meadow / grassland) //
 - buttercup (meadow / grassland)
 - fern (woodland) //
 - algae (seashore) //
 - plant plankton (seashore) // *etc.*
- ** Plant named should be appropriate to the ecosystem named.
- (b) (i) What is the function of the nitrogen cycle? (3m) (27)
- make (inactive) nitrogen (from the air) available for use by living things by plants and/or animals
- (ii) Micro-organisms in the form of bacteria are important drivers of the nitrogen cycle. List any **three** categories of these bacteria and briefly describe the specific role of **each** in the nitrogen cycle.
- ** Category (1m), Role (3m).
- ** Named category must correspond to role in nitrogen cycle for full marks.
- Any 3: (3 × 4m)
- | <u>Category</u> | <u>Role in nitrogen cycle</u> |
|-----------------------------------|--|
| – nitrogen-fixing bacteria | – convert nitrogen gas to nitrates (NO ₃) // |
| – decomposers / bacteria of decay | – break down plant or animal material to ammonia, which is released into the soil // |
| – nitrifying bacteria | – convert ammonia (ammonium) to nitrites (or nitrates) // |
| – denitrifying bacteria | – convert nitrates in soil to nitrogen gas |

Section C Question 12 (cont'd.)

(b) (cont'd.)

- (iii) Name another type of micro-organism which plays a major role in the nitrogen cycle and briefly describe its role. **(6m)**

**** Name (3m), Role (3m).**

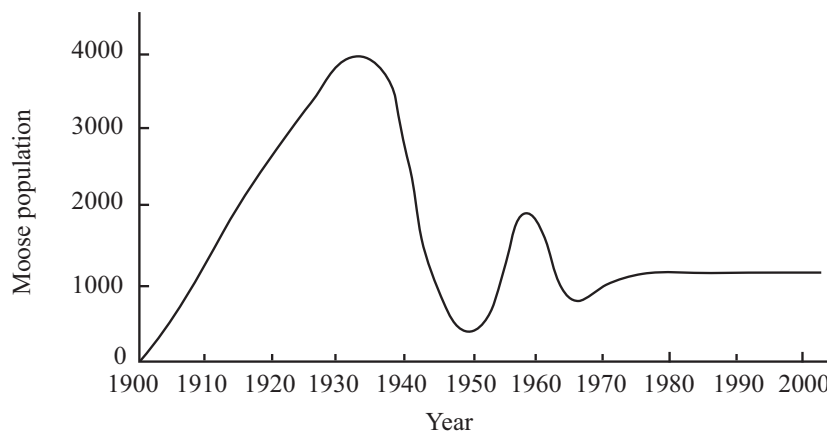
- fungi
- convert dead plants and animals into ammonia in the soil

- (iv) During the nitrogen cycle, plants absorb compound X from the soil. This is used in the synthesis of plant proteins. Animals then break down these proteins to form compound Y, which is used in the synthesis of animal proteins.

Name the compounds X and Y. **(2 × 3m)**

- X – nitrates
Y – amino acid(s)

- (c) The graph below shows changes to the population of moose in Canada. Moose did not have a natural predator until wolves arrived around 1950. Moose eventually became a staple part of the wolves' diet. (24)



- (i) Why, other than because of the absence of predators, in your opinion, did the moose population increase rapidly between 1920 and 1930?

Any 1: **(3m)**

- plenty of food //
- lack of competition //
- better weather / milder winter // *etc.*

**** Accept other reasonable answers.**

- (ii) Suggest a reason why the moose population decreased between 1930 and 1940.

Any 1: **(3m)**

- lack of food //
- increase in other species of consumer //
- harsh weather conditions //
- culling by humans // *etc.*

**** Accept other reasonable answers.**

Section C Question 12

(c) (cont'd.)

(iii) What effect did the arrival of the wolves have on the moose population? **(3m)**

- (moose population) initially increased (at first / after 1950) but then decreased (from 1960 on / within a few years) // *etc.*

** Accept other reasonable answers.

(iv) Suggest a reason why the moose population levelled out from about 1970 onwards.

Any 1: **(3m)**

- achieved a population size that could be adequately supported by the environment the moose live in //
- survival of the fittest //
- adaptation //
- conservation // *etc.*

** Accept other reasonable answers.

(v) 1. Suggest **one** possible effect on the moose population **and one** possible effect on the wolf population if a niche was created for another herbivore in the habitat.

** Expect one point of information on each population.

Moose population

Any 1: **(3m)**

- may decrease //
- may stay the same

Wolf population

Any 1: **(3m)**

- may increase //
- may stay the same

2. Give a reason for each answer you have given above.

Moose population

Any 1: **(3m)**

- may drop due to increased competition for food from the new herbivore //
- may stay the same as the herbivore may occupy a different niche to the moose // *etc.*

Wolf population

Any 1: **(3m)**

- may increase as there is now an increase in prey with arrival of new herbivore //
- may stay the same as the herbivore may be an unsuitable food source for wolves // *etc.*

** Accept other appropriate answers.

Section C Question 13

13. (a) Enzymes play an important role in controlling metabolic reactions in plants and animals. (9)

(i) What is an enzyme? (3m)

- a biological (or protein) catalyst

(ii) Comment on the molecular shape of enzymes. (3m)

- folded / 3D / globular

(iii) Name a process, other than digestion, that occurs in a plant or animal cell which requires the use of enzymes.

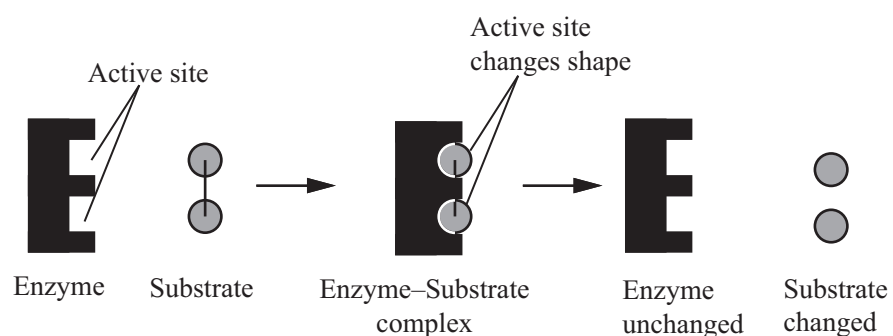
Any 1: (3m)

- germination //
- photosynthesis //
- respiration //
- repairing cellular DNA //
- assembly of a DNA strand // etc.

(b) (i) Describe, with the aid of diagrams, the Active Site Theory of enzyme action. (27)

Any 4: (4 × 3m)

- active site of enzyme matches specific substrate //
- substrate causes active site to change slightly //
- enzyme–substrate complex (ESC) forms //
- the substrate alters //
- to form products //
- enzyme remains unchanged //
- the active site returns to its original shape
- enzyme is available to be reused // etc.



** Deduct 3m if no diagram given.

(ii) What is meant by the term *denaturation* in relation to enzymes? (3m)

- loss of shape and loss of function / when an enzyme loses its ability to react with its substrate

Section C Question 13 (cont'd.)

(b) (cont'd.)

(iii) State **two** ways by which an enzyme may be denatured.

- Any 2: (2 × 3m)
- high (or low) pH //
 - high temperature (above 50 °C)
 - radiation //
 - agitation //
 - high salinity //
 - alcohol

(iv) Name **two** enzymes found in the digestive system **and** state precisely where in the digestive system **each** is active.

- ** Enzyme and site of action should be named for 3m.
 ** Site of action should correspond to the enzyme named.

- Any 2: (2 × 3m)
- | <u>Enzyme</u> | <u>Site of action</u> |
|---------------|-----------------------|
| – amylase | Any 1:
– mouth // |
| | – duodenum |
| – lipase | – duodenum |
| – pepsin | – stomach |

(c) Bioprocessing often involves the use of immobilised enzymes in a bioreactor. (24)

(i) What does the term *immobilisation* mean when used in relation to enzymes? (3m)

- attaching or fixing (enzymes) to each other or to another inert material or trapping in a gel

(ii) What is a bioreactor? (3m)

- vessel in which living cells or their products are used to make a product

(iii) In your practical studies you prepared an enzyme immobilisation and examined its application.

1. Name the enzyme you used. (2m)
 - sucrase (yeast)
2. Name the substrate you used. (2m)
 - sucrose
3. Name the product of the reaction. (2m)
 - glucose

Section C Question 13 (cont'd.)

(c) (iii) (cont'd.)

4. How did you test for the presence of the product? **(3m)**

- (used) glucose test strips / Clinistix / Diastix

5. How would you store your immobilised beads overnight?

Any 1: **(3m)**

- (rinse and) cover with pure water //
- (dry in filter paper and) store in refrigerator // *etc.*

(iv) Give **two** advantages of using immobilised enzymes rather than free yeast in alcohol production.Any 2: **(2 × 3m)**

- can be reused //
- are easy to extract (from product) //
- pure product //
- increased stability so reduces amount of enzyme needed in a reaction //
- enzyme efficiency is not affected by immobilisation // *etc.*

Section C Question 14

14. Answer any **two** of (a), (b), (c). (30, 30)

(a) (i) List **two** reasons why fungi are not classified as plants. (2 × 3m) (30)

- do not possess chlorophyll / heterotrophic
- cell wall is made of chitin rather than cellulose

(ii) Fungi can be saprophytic or parasitic.

1. Explain **each** of the underlined terms.

Saprophytic (3m)

- feeds on dead (or decaying) matter

Parasitic (3m)

- feeds on a live host of different species, usually causing harm

2. Give an example of a saprophytic fungus **and** a parasitic fungus.

Saprophytic fungus

Any 1: (3m)

- *Rhizopus* //
- mushrooms // *etc.*

Parasitic fungus

Any 1: (3m)

- athlete's foot //
- ringworm //
- potato blight fungus // *etc.*

(iii) Write notes on **each** of the following topics in relation to *Rhizopus*.

1. Gametangia.

Any 1: (3m)

- form when cross walls form during sexual reproduction
- formed from progametangia //
- they fuse to form zygospore // *etc.*

2. The role of meiosis in the lifecycle of *Rhizopus*.

Any 1: (3m)

- reduces the chromosome number (after fertilisation) in sexual reproduction //
- creates the haploid hypha, which grows out of the zygospore to produce a sporangium at the tip

(iv) Describe how yeast reproduces.

Any 2: (2 × 3m)

- parent cell divides by mitosis //
- one nucleus and some cytoplasm enter a small bud //
- the bud may separate or remain attached - budding

Section C Question 14 (cont'd.)

- (b) (i) List **two** methods of natural vegetative propagation in plants. (30)

Any 2: (2 × 3m)

- runners //
- root tubers //
- leaf plantlets //
- bulbs // *etc.*

- (ii) List **two** methods used by horticulturalists to artificially propagate plants.

Any 2: (2 × 3m)

- cuttings //
- grafting //
- layering //
- micropropagation // *etc.*

- (iii) Write notes on how vegetative propagation differs from reproduction by seed in plants. In each case your notes should contain **two** points.

Any 4: (4 × 3m)

Vegetative propagation

- no variations //
- all plants susceptible to the same disease //
- overcrowding //
- no seed bed //
- simple //
- fast growth //
- no waste //
- no outside agents needed (for dispersal, *etc.*) // *etc.*

Reproduction by seed

- show variations //
- more resistance to disease //
- less competition (due to seed dispersal) //
- seed bed forms in soil //
- complex //
- slow growth //
- wasteful //
- dependent on outside agents (for pollination, dispersal, *etc.*) // *etc.*

- (iv) Explain the biological basis for **each** of the following.

1. Not removing spring bulbs, e.g. tulips, until approximately 6 weeks after flowering. (3m)

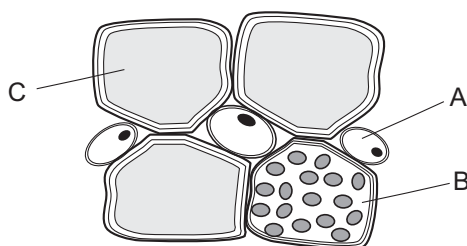
- to allow bulbs to reform for following year's growth

2. Trimming hedges regularly to keep a hedge thick and full at the base. (3m)

- removing the apical meristem causes apical dominance to be lost

Section C Question 14 (cont'd.)

- (c) The diagram shows a transverse section of a vascular tissue in a flowering plant.



- (i) Name the vascular tissue shown. **(3m)** **(30)**

– phloem

- (ii) Name the parts labelled A, B and C. **(3 × 2m)**

A – companion cell

B – sieve plate

C – sieve tube

- (iii) Give the function of the parts labelled A and B. **(2 × 3m)**

A – controls the activities of sieve tube elements

B – transports food throughout plant

- (iv) 1. Name the vascular tissue which transports water in a plant. **(3m)**

– xylem

2. Name and briefly explain any **two** processes involved in the upward movement of water in plants.

** Process named (3m), Process explained (3m).

** Explanation should correspond to the process named.

Any 2: **(2 × 6m)**

Process

Process explained

– root pressure

– water in (to roots) pushes water up //

– transpiration

– water out (of leaves) pulls water up / creates tension //

– adhesion

– water is attracted to walls of xylem //

– cohesion

– water molecules attracted to each other / allows a continuous stream

Section C Question 15

15. Answer any **two** of (a), (b), (c). (30, 30)

(a) (i) Distinguish clearly between the *axial* skeleton and the *appendicular* skeleton. (30)

Any 1: (3m)

- | | | |
|------------------------------|---|--|
| <i>axial skeleton</i> | – | runs down the centre of the body and consists of the skull, vertebrae, ribs and sternum |
| <i>appendicular skeleton</i> | – | runs along the sides of the body and consists of the shoulder (pectoral) girdle, the pelvic (hips) girdle and their respective attached limbs, the arms and the legs |

(ii) Give a function of **each** of the following in relation to the growth of bone:

1. Osteoblasts. (3m)

- forms bone cells which produce protein or collagen

2. Osteoclasts. (3m)

- digests bone in (medullary) cavity and deposit calcium into blood (for bone renewal)

3. Growth plate.

Any 1: (3m)

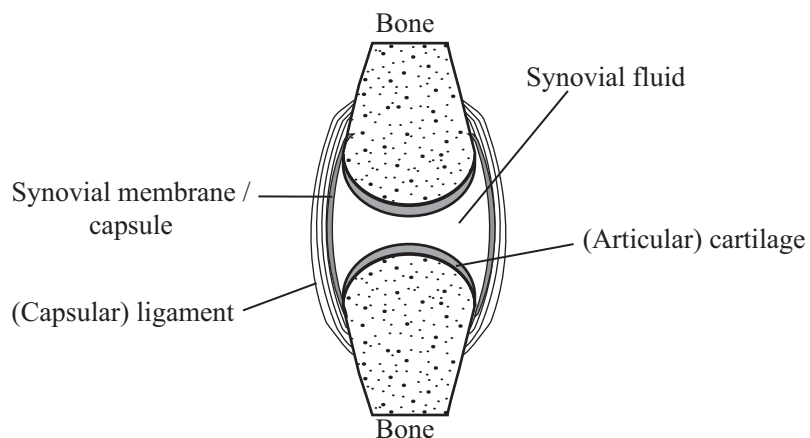
- forms cartilage which turns into bone //
- forms cartilage which elongates bone

(iii) 1. Draw a diagram to show the structure of a synovial joint. Label **three** parts of the joint that you have drawn, other than bones.

Diagram (0m, 3m, 6m)

Any 3 labels: (3 × 1m)

- (articular) cartilage //
- synovial membrane / capsule //
- synovial fluid //
- (capsular) ligament



Section C Question 15 (cont'd.)

(a) (iii) (cont'd.)

2. Explain the functions of any **two** parts that you have labelled.

** Function must relate to part of joint named.

Any 2: (2 × 3m)

<u>Part of joint</u>	<u>Function</u>
(articular) cartilage	Any 1: – absorbs shock // – reduces wear / friction // – protects joint
synovial membrane / capsule	– secretes / contains synovial fluid
synovial fluid	Any 1: – allows friction-free movement // – absorbs shock
(capsular) ligament	– holds bones of joint together

(iv) Name a factor on which the renewal of bone depends.

Any 1: (3m)

- physical activity //
- hormones //
- diet

Section C Question 15 (cont'd.)

(b) Answer the following questions in relation to red blood cells. (30)

(i) Where precisely in the body are red blood cells made? (2 × 3m)

- red bone marrow
- of long bones / ribs / vertebrae / breast bone

(ii) State **one** way in which red blood cells differ from plant cells.

Any 1: (3m)

- no nucleus //
- live three months only //
- no cell wall //
- no vacuole //
- no mitochondria // *etc.*

(iii) State **two** ways, other than colour and function, in which red blood cells differ from white blood cells.

Any 2: (2 × 3m)

- more numerous //
- smaller //
- no nucleus // *etc.*

(iv) 1. Where in the body are red blood cells broken down?

Any 1: (3m)

- liver //
- spleen

2. The products of the breakdown of red blood cells help to form bile.
Give **two** functions of bile in relation to digestion. (2 × 3m)

- emulsifies lipids
- neutralises chyme / raises pH

(v) 1. Name a condition associated with lack of red blood cells. (3m)

- anaemia

2. Name the trace element which is an essential component of haemoglobin in red blood cells. (3m)

- iron

Section C Question 15 (cont'd.)

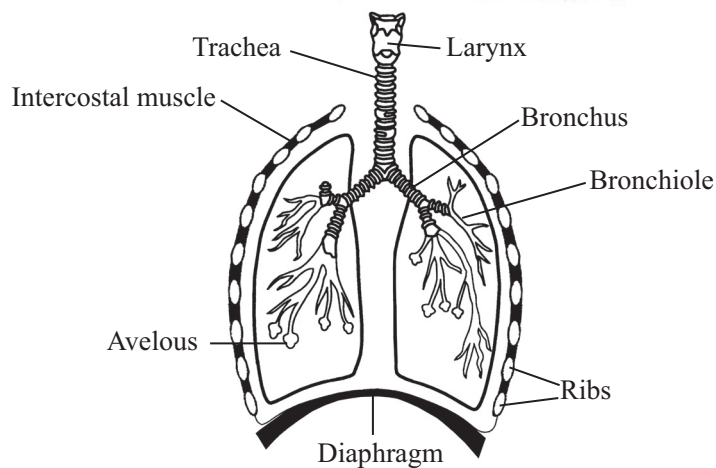
- (c) (i) Draw a large labelled diagram of the respiratory system. (30)

Diagram (0m, 3m, 6m)

Labels

Any 6: (6 × 1m)

- trachea //
- bronchi //
- bronchioles //
- alveoli //
- rib cage //
- diaphragm //
- intercostal muscles // *etc.*



- (ii) Where does gas exchange take place in the respiratory system? (3m)

- alveolus / alveoli

- (iii) What part of the brain is responsible for controlling breathing? (3m)

- medulla oblongata

- (iv) Identify a cause for a **named** disorder of the respiratory system.

- ** Respiratory disorder named (3m), Possible cause given (3m).
 ** Cause should correspond to disorder named.

Any 1: (2 × 3m)

Disorder

- asthma //

Cause

Any 1:

- allergens, *e.g.* pollen, dust mites, *etc.* //
- stress / anxiety //
- exercise //
- lung infections // *etc.*

Section C Question 15 (cont'd.)

(c) (iv) (cont'd.)

- bronchitis

Any 1:

- smoking //
- exposure to high levels of air pollution //
- exposure to toxic chemical dust, *e.g.* asbestos //
- colds / flu // *etc.*

(v) Where does gas exchange take place in plants?

Any 1: **(3m)**

- stoma / stomata
- lenticels

(vi) Name a factor that controls gas exchange in plants and animals. **(3m)**

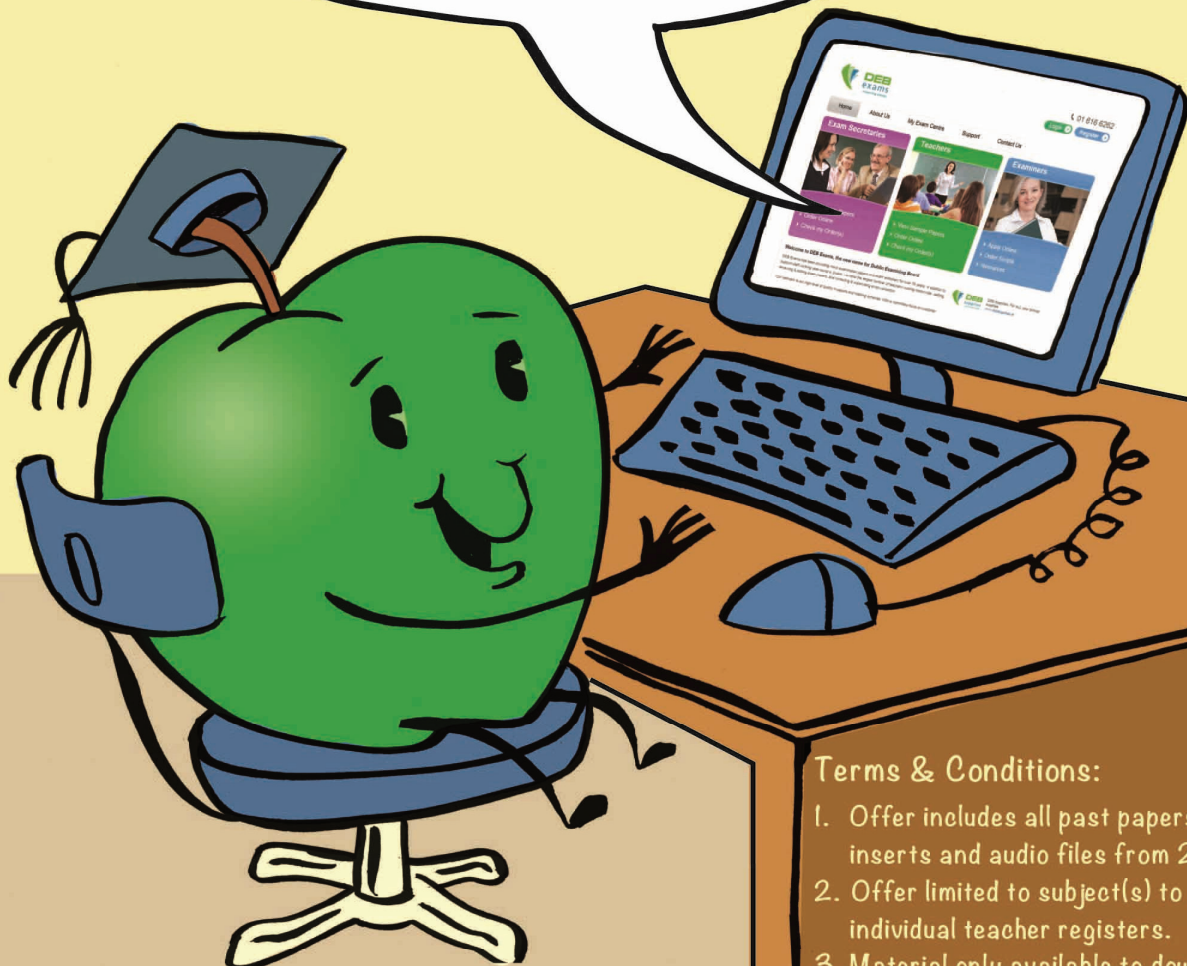
- carbon dioxide //

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