CAMBRIDGE International Examinations

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Cambridge IGCSE

Cambridge IGCSE® Biology (0610) Past paper questions and answers

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Cells and cell processes

CORE questions

Core 1

Two characteristics of living organisms are nutrition and respiration.

(a) (i) List **three** other characteristics of living organisms.

1. .....

2. .....

3. ..... [3]

(ii) Name the process by which green plants produce carbohydrates.

..... [1]

[Total: 4]

Core 2

Table 1 describes some of the characteristics of living organisms. Complete the table by identifying each characteristic described. The first one has been completed as an example.

Table 1

Description	Characteristic
Responding to stimuli in the environment	Irritability
Releasing energy from sugars	
Producing more organisms of the same type	
Getting rid of waste chemicals made in the organism	
Obtaining the materials for growth	

[4]

[Total : 4]

Core 3

Fig. 1 shows a red blood cell and a root hair cell.

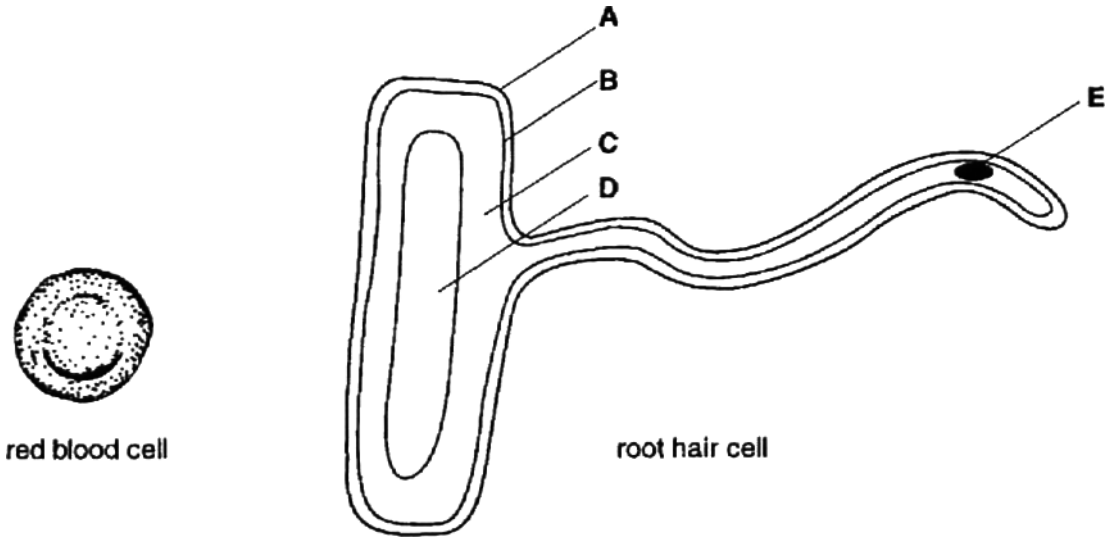


Fig 1

(a) (i) Select **two** structures in the root hair cell which are also present in the red blood cell. In each case state the letter, **A** to **E**, and name the structure.

1. *Letter*.....

Name of structure .....

2. *Letter* .....

Name of structure ..... [2]

(ii) Name **one** structure which is typical of many plant cells but which is not present in the root hair cell.

..... [1]

Core 3

(b) State **one** major function of each cell and describe **one** way in which the cell is adapted to carry out this function.

(i) Red blood cell.

Function .....

.....

Adaptation .....

..... [2]

(ii) Root hair cell.

Function .....

.....

Adaptation .....

..... [2]

[Total : 7]

ALTERNATIVE TO PRACTICAL questions

Alternative to Practical 1

An experiment was carried out to investigate the effect of different concentrations of sucrose solution on the length of potato strips.

Five test-tubes were set up, each containing a different concentration of sucrose solution. Another tube was set up containing the same volume of distilled water.

A strip of potato tissue was placed in each tube. The strips were of equal size and as shown in Fig. 2

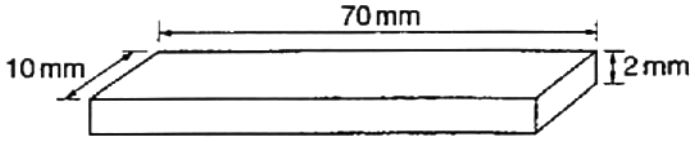


Fig. 2

These strips were completely covered by the solutions and were left in the tubes for 30 minutes. The potato strips were removed and measured. The results are shown in Table 2

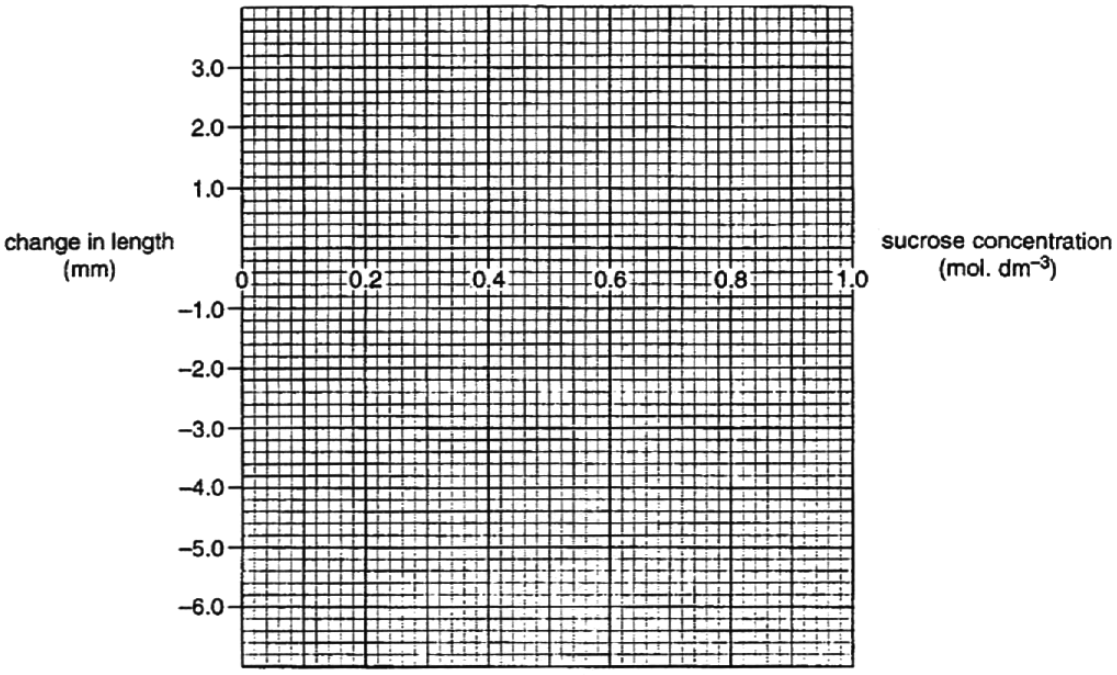
Table 2

concentration of sucrose solution (mol dm^{-3})	initial length (mm)	final length (mm)	change in length (mm)
0	70	73.0	
0.2	70	71.5	
0.4	70	69.0	
0.6	70	67.0	
0.8	70	66.0	
1.0	70	64.5	

Alternative to Practical 1

(a) (i) Complete Table 2 to show the change in length of each strip.

(ii) Plot the changes in length against the concentration of sucrose solution on the axes provided. Join the points using ruled lines.



[3]

(b) (i) What conclusions can be drawn from these results?

.....

.....

.....

.....

..... [3]

(ii) Name the process that has taken place to bring about these changes in the lengths of the potato strips.

..... [1]

EXTENSION questions

Extension 1

(a) Draw a labelled diagram of a **named** specialised plant cell and describe its function. [6]

(b) Describe the structure and functions of mammalian blood cells. [9]

[Total: 15]

Extension 2

(a) What is an *enzyme*? [3]

(b) State the conditions in which enzymes work best. [3]

(c) Outline the parts played by **named** enzymes in each of the following processes:

(i) germination of seeds;

(ii) the use of biological washing powders to remove protein stains;

(iii) fat digestion in the alimentary canal.

[9]

[Total: 15]

Cells and cell processes – answers

Core 1

a (i) any three of these
- growth (or alternative wording)
- movement (or alternative wording)
- irritability / sensitivity (or alternative wording)
- excretion (or alternative wording)
- reproduction (or alternative wording)

(ii) photosynthesis

Core 2

In order in the table

Respiration
Reproduction
Excretion
Nutrition / feeding

Core 3

a (i) B – cell membrane

C – cytoplasm

(ii) chloroplasts

b <u>red blood cell</u>

any one of these functions with its relevant adaptation

carries / combines with oxygen
haemoglobin present

more space for haemoglobin
lack of nucleus

oxygen uptake / release
biconcave shape / increased surface area

<u>root hair cell</u>

uptake of water / minerals
increased surface area / cell extension

reject anchorage as a function

Alternative to Practical 1

a (i) in order in the table

+ 3.0 mm
+ 1.5 mm
- 1.0 mm
- 3.0 mm
- 4.0 mm
- 5.5 mm

(ii) points plotted accurately
neat clear line passing through each point

b (i) potato strips in sucrose solutions lost or decreased in length
potato strips in water or dilute sucrose solutions increased in length
point noted of no change in length

(ii) osmosis

Extension 1

a any six of these points with a maximum of 3 for the diagram (third point)

suitable named plant cell
function described
diagram recognisable with main features drawn, at least 3 accurate labels
cell wall
cytoplasm / reference to lack of cytoplasm
(sap) vacuole
nucleus
chloroplast (or other named feature appropriate to named cell)

b nine points from the following **provided** cell is named

red blood cell or corpuscle / erythrocyte
- reference to lack of nucleus
- description of shape
- provides large surface area (or alternative wording)
- reference to presence of haemoglobin
- carries / transports oxygen

phagocyte / granulocyte / monocyte / neutrophil
- has lobed nucleus
- can change shape / pass out of capillaries
- engulfs bacteria (or alternative wording)
- digests bacteria / foreign material (or alternative wording)

lymphocyte / B cells / T cells
- has large nucleus (or alternative wording)
- produces antibodies
- makes bacteria clump (or alternative wording) / ref. to long term immunity
- produces antitoxins
- neutralises toxins (or alternative wording)

Extension 2

a any three of these
- biological / present in living organisms
- catalyst / speeds up reaction rate / lowers activation energy
- reference to protein nature
- reference to specificity

b any three of these
- reference to optimum temperature / specified temperature eg 25 – 40°C
- reference to optimum pH (or specified pH for named enzyme)
- only work in liquid medium (or alternative wording)
- reference to lack of limiting factors for example concentration of substrate

c (i) any three from
- amylase
- breaks down to starch
- reference to sugar / named sugar **reject** glucose / sucrose
- use, for example for energy / growth / respiration
- reference to sugar being soluble for transport

(ii) any three of these
- protease / named protein enzyme, for example pepsin, trypsin
- breaks down / digests protein
- to amino acids / peptides
- reference to solubility

(iii) any three of these
- lipase
- breaks down / digests protein
- reference to fatty acids and glycerol
- reference to molecules small enough to pass through gut wall / into lymph or lacteal
- reference to site of action, for example small intestine / duodenum / ileum

Animal nutrition

CORE questions

Core 1

(a) Much of the food we eat has to be digested.

(i) Explain why food needs to be digested.

[2]

(ii) Describe the part played by chewing in the process of digestion.

[2]

(b) (i) Describe how food is moved along the oesophagus by peristalsis.

[3]

(ii) Students sometimes wrongly suggest that food falls down into the stomach under the effect of gravity. Suggest **one** piece of evidence which would oppose this idea.

[1]

Core 1

(c) Fig. 1 shows the human digestive system.

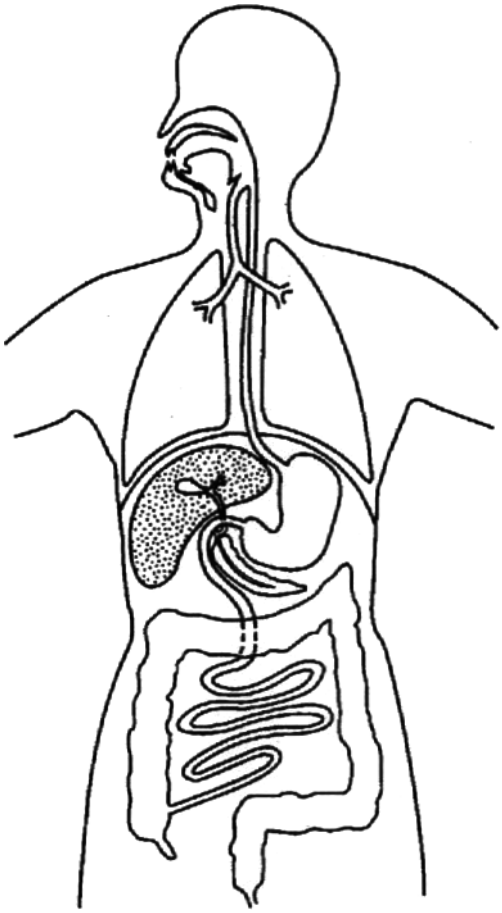


Fig. 1

(i) Using the appropriate letter, label on Fig 1 where each of the following is produced:

an amylase, (**A**);

hydrochloric acid, (**B**);

a lipase, (**C**);

a protease, (**D**).

[4]

(ii) State the nutrient on which protease enzymes act and name the products that are formed.

Nutrient .....

Products ..... [2]

[Total : 14]

Core 2

Table 1 shows information about the composition of a fruit.

Table 1

nutritional component	amount in 100 g of fruit
energy	162 kJ
protein	0.6 g
sugars	8.7 g
fats	trace
fibre	1.6 g
minerals	trace
vitamins	trace

(a) (i) The average daily amount of protein needed by humans is 66 g.

How many kilograms of this fruit would a person need to eat if this was the only source of protein? Show your working.

Answer .....kg [3]

(ii) List the **four** main chemical elements from which protein is made.

1.

2.

3.

4. .....[2]

(b) (i) Describe how you could safely test this fruit to see if it contains reducing sugars.

[3]

(ii) State what you would observe if a reducing sugar is present.

[1]

Core 2

(c) Fruit such as this is an important part of a healthy diet.

(i) Suggest **one** reason for eating food rich in fibre.

[1]

(ii) Name the vitamin which is associated with citrus fruits and green vegetables. State the function of this vitamin in the body.

Vitamin .....

Function .....

[2]

[Total: 12]

Core 3

Fig. 2 shows part of the alimentary canal.

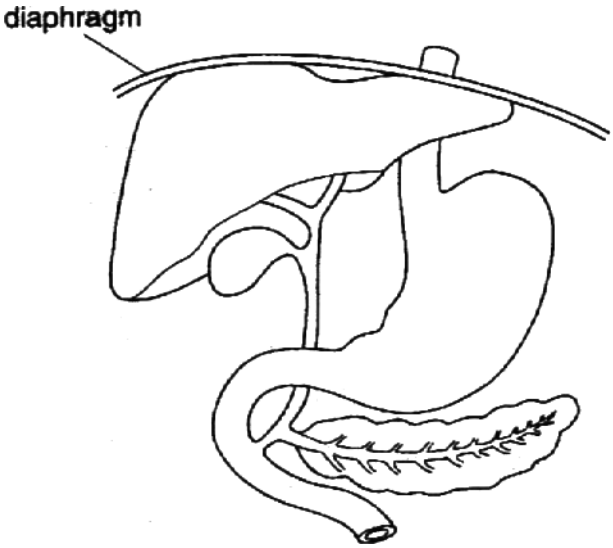


Fig. 2

(a) On Fig. 2 label each of the following structures:

(i) stomach;

(ii) liver;

(iii) pancreas.

[3]

(b) Describe the parts played by the liver and the pancreas in the digestion of fats.

Liver

Pancreas .....

[4]

[Total:7]

ALTERNATIVE TO PRACTICAL questions

Alternative to Practical 1

(a) (i) Describe how you would carry out a test to show the presence of fat in a biscuit. What observation would indicate the presence of fat?

Test

Observation .....

[3]

(ii) Describe how you would use this test to compare the fat content of two different types of biscuit.

..... [2]

(b) Complete the equation below to summarise the process of fat digestion.

fat + water $\xrightarrow[\text{(enzyme)}]{\text{.....}}$ ..... + ... [3]

[Total: 8]

EXTENSION questions

Extension 1

Health workers in America were concerned about the diets of American people. In response a report was published called `Dietary Goals'.

Fig. 3 compares an average 1977 diet with the report's recommended dietary goals.

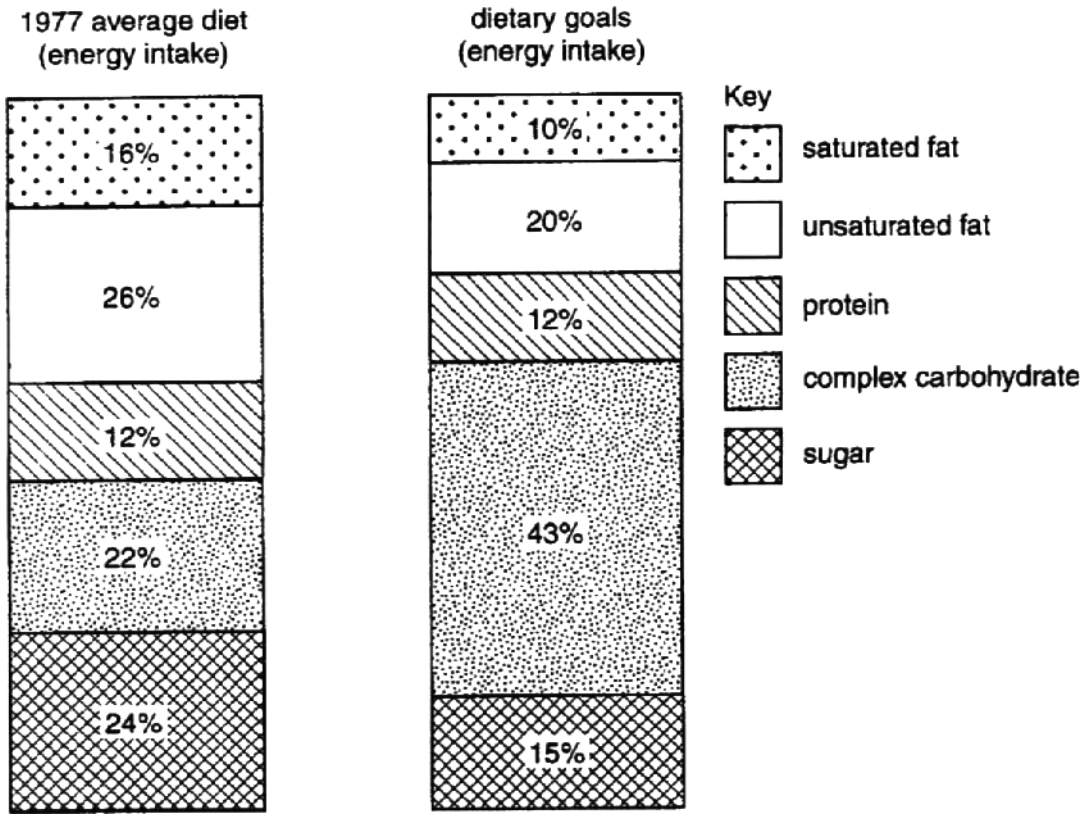


Fig. 3

(a) (i) What recommendations were made about changes to the fat content of the diet?

... [2]

(ii) Suggest why these changes were recommended.

[3]

Extension 1

(b) Complex carbohydrates are long chain molecules.

Name a long chain carbohydrate present in

(i) plant tissue; .....

(ii) animal tissue. ..... [2]

(c) Suggest why a reduction in the sugar content of the diet was recommended.

.....

.....

..... [2]

It was also recommended that people should reduce their salt intake to about 3 g a day.

(d) Suggest why a high salt intake can be dangerous to health.

[1]

Babies need a carefully controlled diet to keep them healthy. Mothers are often advised to feed their babies with breast milk rather than with milk derived from cows (formula milk).

(e) State **three** advantages of feeding a baby with breast milk compared with formula milk.

1. .....

2. .....

3. ..... [3]

[Total: 13]

Extension 2

(a) Describe the processes, beginning with nutrition, which result in the formation of proteins in the leaves of a photosynthetic plant. [8]

(b) (i) Explain how amino acids in the small intestine of a mammal are assimilated into muscle tissue. [3]

(ii) Outline the role of proteins in animals. [4]

[Total: 15]

Animal nutrition – answers

Core 1

a(i) to change food into simple / small / soluble form / molecules
for absorption / diffusion(into intestine wall / villi) / carriage in blood

(ii) any two of these
- make small enough to swallow
- increase surface area of particles
- mix with saliva / enzyme / amylase

b(i) any three of these
- contraction of (circular) muscles behind food / bolus
- relaxation of muscles in front
- occurs rhythmically / in waves
- food forced forward / along tube

(ii) any one of these
- can swallow standing on head / hanging upside down
- can swallow in space with no gravity
- some mammals (standing on four legs) have horizontal oesophagus
- some mammals can regurgitate food against gravity

c(i) A – label to salivary gland / mouth / pancreas
B – label to stomach
C – label to pancreas
D – label to stomach / pancreas / small intestine

(ii) protein / named protein
amino acids / polypeptides / peptides

Core 2

a(i) 66 / 0.6 = 110
110 x 100 g fruit = 11 (kg)

(ii) carbon, hydrogen, oxygen, nitrogen

b(i) add to Benedict's solution / Fehling's reagent
heat
use of water bath / goggles / any other relevant safety practice

(ii) colour change to orange (accept yellow / brick red/ red-brown)

c(i) any one of these
- aids peristalsis / movement of food along gut(or alternative wording)
- prevents constipation(or alternative wording)
- reduces fat absorption / risk of bowel cancer(or alternative wording)

(ii) any one of these
- vitamin C
- maintains healthy skin
- wounds heal more rapidly
- prevents scurvy
- assists uptake of iron

Core 3

a labels correctly placed

b any four of these
- liver: production of bile / bile salts
  emulsifies fats / increases surface area (alternative wording)
  neutralises stomach acid / raises pH
- pancreas
  secretes lipase / enzyme
  digests / breaks down fats
  to fatty acids and glycerol

Alternative to Practical 1

a(i) emulsion test – add ethanol / alcohol
pour into water

observation - cloudiness / white / milky / emulsion

(ii) equal quantities of biscuit / same conditions
one comparison described e.g. of cloudiness

b lipase / esterase
fatty acids and glycerol

Extension 1

a(i) one mark for reduction / one mark for stating figures from
reduce fat / saturated fat / unsaturated fat
reduce fat content from 42% to 30% or by a quarter (or alternative wording)
reduce saturated fat from 16% to 10 % or by a third or by 6%(or alternative wording)
reduce unsaturated fat from 26% to 20% or by a fifth or by 6%(or alternative wording)

(ii) any one from
reference to problems of obesity (resulting from too much fat in the diet)
reference to presence of cholesterol
in (some) saturated fats
can cause atherosclerosis / atheroma / blockage of arteries
reference to heart problems(or alternative wording)
reference to arthritis problems

b(i) starch / cellulose / hemicellulose / amylose / amylopectin / pectin / callose / insulin
Reject glycogen
glycogen / chitin
Reject glucagon

c(i) reference to dental decay(or alternative wording)
reference to problems with obesity(or alternative wording)
leading to heart disease / diabetes

d reference to high blood pressure / greater risk of heart attack (or alternative wording)

e any three of these
breast milk contains antibodies or greater protection from infection
breast milk contains foodstuffs in correct proportions (or alternative wording)

bottle milk may contain bacteria or cause intestine disease (accept breast milk is sterile)
financial implications of bottle milk
some babies are allergic to cow's milk
reference to correct temperature of breast milk
reference to convenience of breast milk or preparation involved with bottle milk
no additives / preservatives in breast milk
reference to bonding through breast feeding
reference to triggering reduction in size of uterus

Extension 2

a(i) any eight of these
reference to absorption of nitrogen-containing salts by roots (accept reference to ions)
by diffusion / active transport
reference to nitrogen-fixing bacteria in root nodules
nitrogen salts transported in xylem
reference to photosynthesis
carbon dioxide is combined with / reacts with water
using energy from (sun)light
reference to chloroplasts / chlorophyll
sugars produced
nitrogen is combined with sugars to make amino acids / proteins

b(i) amino acids pass through ileum wall / epithelium or lining or wall of villus absorbed into <u>blood</u> (stream)
transported to muscles in <u>plasma</u>
amino acids synthesized into proteins (or alternative wording)

(ii) any four of these
reference to growth / repair / formation of new cells
reference to hormones
reference to enzymes
constituent of cell membranes(or alternative wording)
reference to haemoglobin
reference to collagen
reference to keratin
reference to antibodies
reference to fibrinogen / fibrin

Plant nutrition and transport

CORE questions

Core 1

(a) The chemical equation for photosynthesis shown below is incomplete.

$$\underset{\text{water}}{6H_2O} + \text{.....} \xrightarrow[\text{plant pigment}]{\text{energy}} \underset{\text{glucose}}{C_6H_{12}O_6} + \text{.....}$$

(i) Complete the equation in **either** symbols **or** words. [2]

(ii) State the source of energy for this reaction.

[1]

(iii) Name the plant pigment necessary for this reaction.

[1]

(iv) Which mineral is needed by a plant to form this pigment?

[1]

(b) (i) Name the tissue in which the sugar produced in photosynthesis is carried to other parts of the plant.

[1]

(ii) In many plants some of the sugar formed in photosynthesis is converted to starch for storage. Explain the advantage of storing starch rather than sugar.

..... [2]

(iii) Name the carbohydrate, formed from sugar produced in photosynthesis, which is used to build cell walls.

[1]

[Total : 9]

Core 2

Fig. 1 shows changes in the rate of water loss from a plant during part of a day. It also shows changes in the temperature and light intensity over the same period.

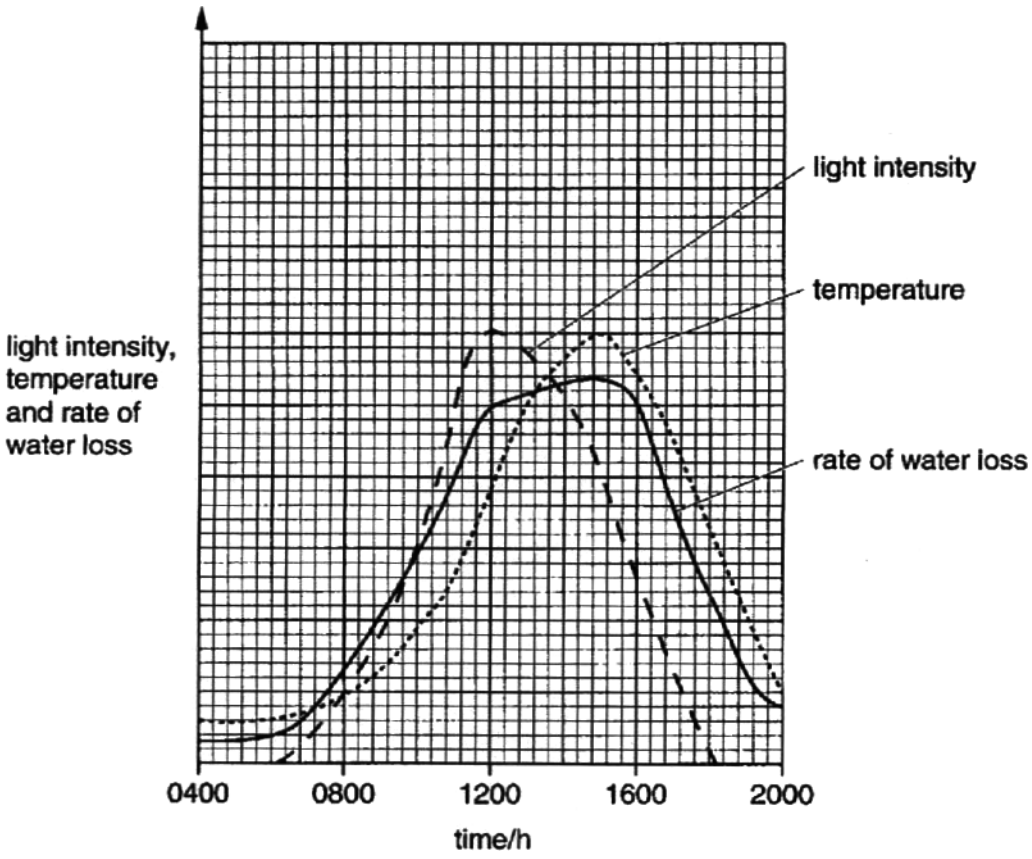


Fig. 1

(a) Explain why the rate of water loss rises steeply between 0700 and 1200 hours.

[3]

(b) Suggest which factor, light intensity or temperature, has the greater effect on the rate of water loss between 1200 and 1500 hours. Explain your answer.

Factor .....

Explanation .....

..... [2]

Core 2

(c) Predict and explain the likely effect on the rate of water loss if there had been heavy rainfall between 1100 and 1200 hours.

Prediction .....

Explanation .....

..... [2]

[Total : 7]

ALTERNATIVE TO PRACTICAL questions

Alternative to Practical 1

Fig. 2 shows three sets of apparatus, **A, B** and **C**, used to measure different biological processes.

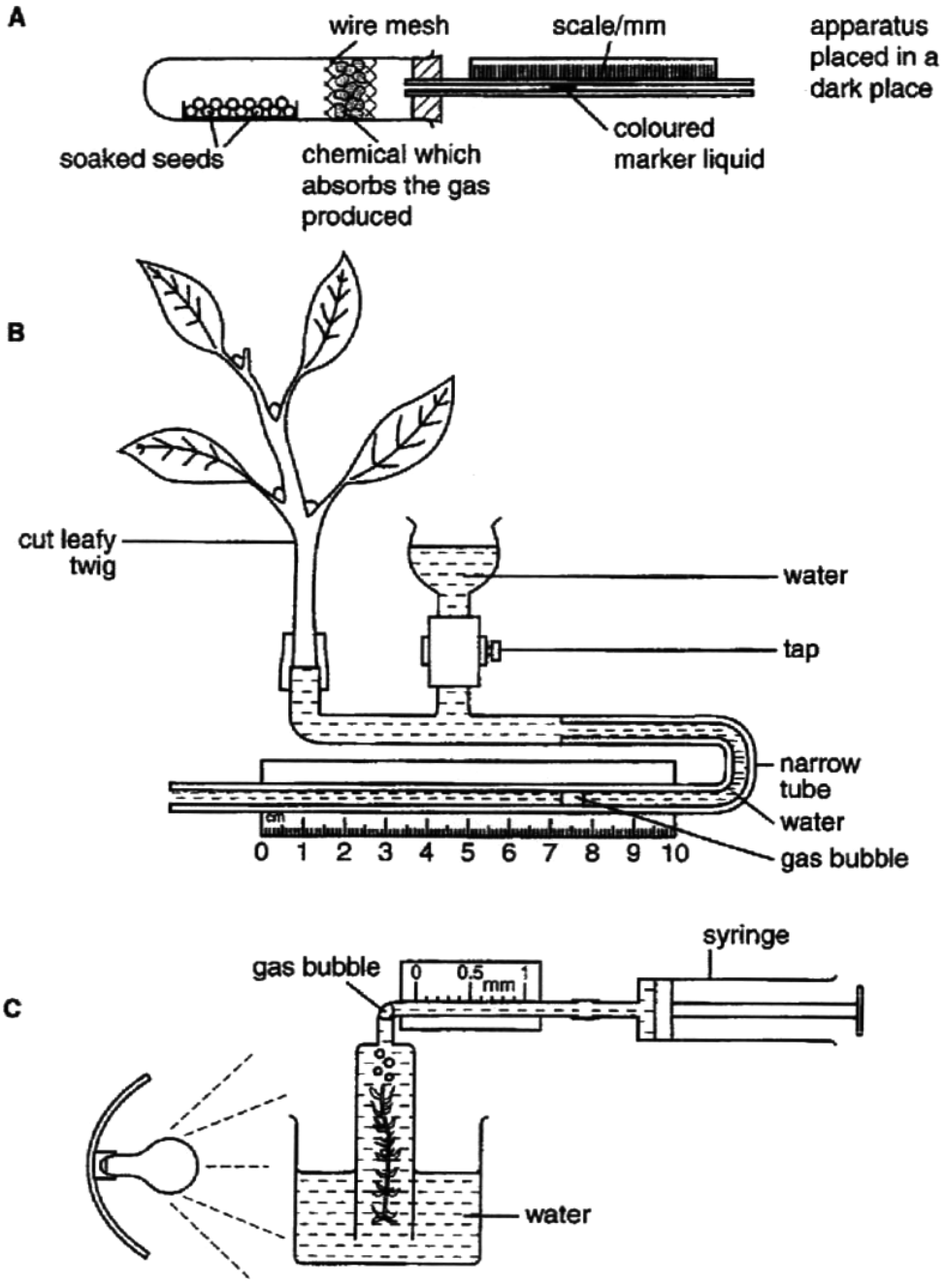


Fig. 2

(a) Name the process that can be measured by each apparatus.

A .....

B .....

C ..... [3]

Alternative to Practical 1

(b) (i) Name the gas which is produced by the process measured using apparatus **A.**

[1]

(ii) Suggest **one** possible control for an experiment using apparatus **A.**

[1]

(c) When using apparatus **B**, it is possible to vary the external conditions. Suggest how changing **one named** external condition would affect the biological process measured by apparatus **B.**

[1]

(d) (i) Name the gas produced by the process measured using apparatus **C.**

[1]

(ii) How would you keep **one named** external factor constant when using apparatus **C**?

[1]

[Total : 8]

EXTENSION questions

Extension 1

Fig. 3 shows part of the lower surface of a typical dicotyledonous leaf.

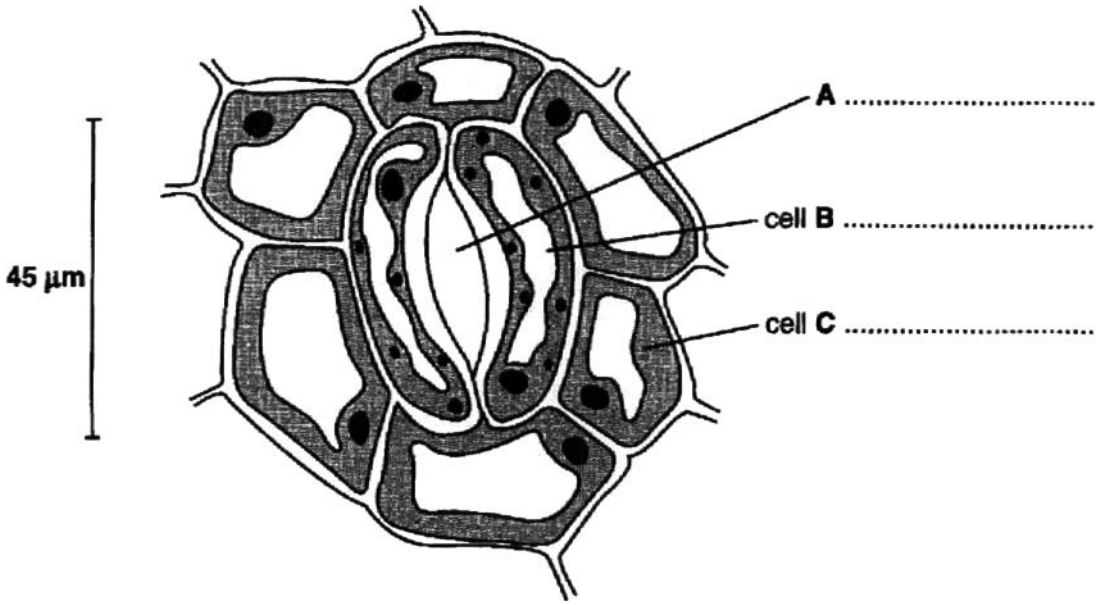


Fig. 3

(a) On Fig. 3, label part **A** and the cells **B** and **C.** [3]

The surfaces of the leaves of two species of plant were studied and the number of stomata per unit area (stomatal frequency) was recorded.

Cobalt chloride paper changes colour in the presence of water.

Pieces of cobalt chloride paper were attached to the upper and lower surfaces of leaves on both plants. The plants were set up for one hour during the day. Any colour changes were recorded. The experiment was repeated for one hour at night. Table 1 shows the results.

Table 1

plant species	stomatal frequency		colour change to cobalt chloride paper			
			day		night	
	lower surface	upper surface	lower surface	upper surface	lower surface	upper surface
Cassia fistula	0	18	✗	✓	✗	✗
Bauhinia monandra	22	0	✓	✗	✗	✗

Key
✓ colour change
✗ no colour change

(b) Describe the differences in stomatal distribution between the two species of plant.

..... [2]

Extension 1

(c) (i) Explain the colour changes to the cobalt chloride paper during the day.

[3]

(ii) Suggest why there was no colour change for either plant at night.

[1]

(d) Outline the mechanism by which water in the roots reaches the leaf.

.....

.....

.....

..... [3]

(e) State and explain the effect of the following on transpiration rate:

(i) increasing humidity;

..... [2]

(ii) increasing temperature.

..... [2]

[Total : 16]

Extension 2

Fig. 4 shows an aphid feeding on a plant stem. Its mouthparts are hollow tubes which are pushed into the stem to remove sugar solution.

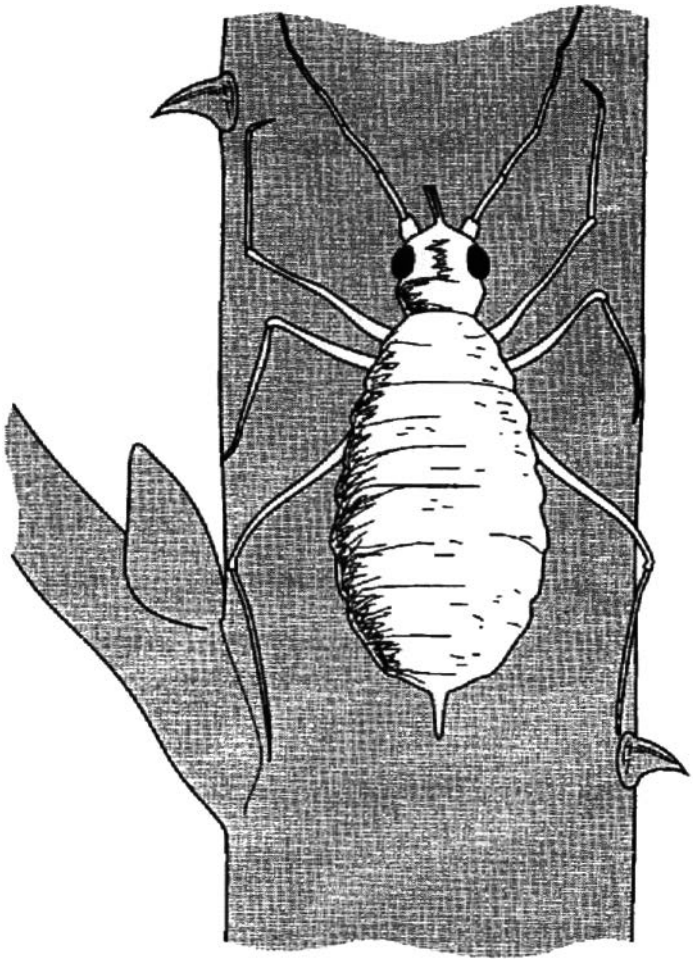


Fig. 4

(a) Aphids are arthropods. State **two** features, visible in Fig. 4, which are common to all arthropods.

1. .....

2 ..... [2]

(b) In which tissue, and by what processes, does the sugar solution move through the plant?

Tissue .....

Processes .....

..... [3]

Extension 2

Some of the sugar solution was collected from the plant stem. Plant cells were placed on a microscope slide and covered with this sugar solution.

(c) (i) Describe what changes would occur to each of the cell parts listed below, if the sugar solution was more concentrated than the sap in the cell vacuole.

Sap vacuole

Cytoplasm

Cell wall

[3]

(ii) Explain, in terms of water potential gradient, how these changes occur.

[3]

(d) Systemic pesticides can be used to kill pests such as aphids. Describe how the application of these pesticides to leaves kills aphids feeding on the stem.

..... [2]

[Total : 13]

Extension 3

A student carried out an experiment to investigate the growth of floating water plants taken from a pond. Equal masses of the plants were placed into three separate glass containers **A, B** and **C**, similar to the one shown in Fig. 5

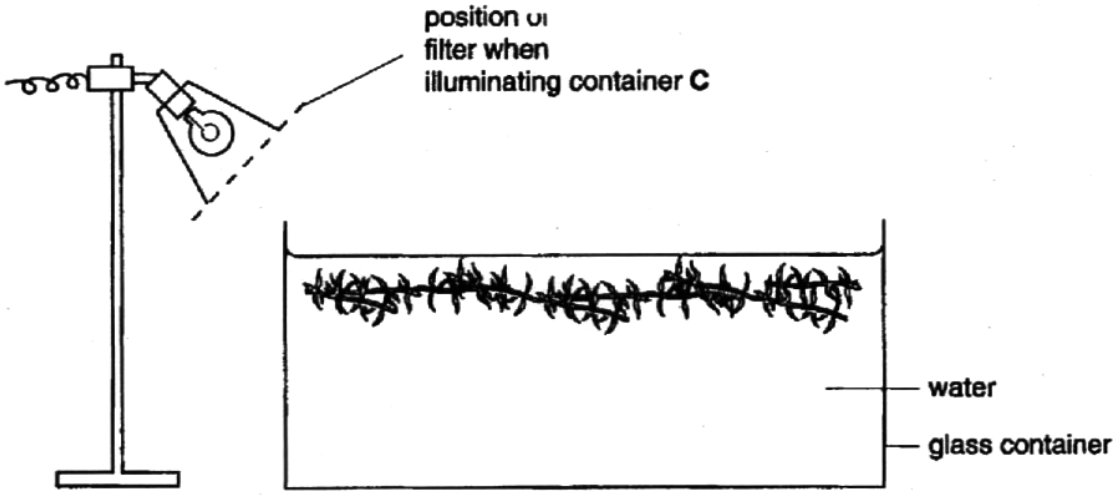


Fig. 5

Container **A** was lit by a 250 W bulb, **B** was lit by a 75 W bulb and **C** was lit by a 250 W bulb with a coloured filter in front of the lamp, as shown in Fig. 5

At weekly intervals, the plants were removed from each container in turn, gently dried, weighed and returned to the containers after their mass had been recorded. Fig. 6 shows the results plotted on a graph.

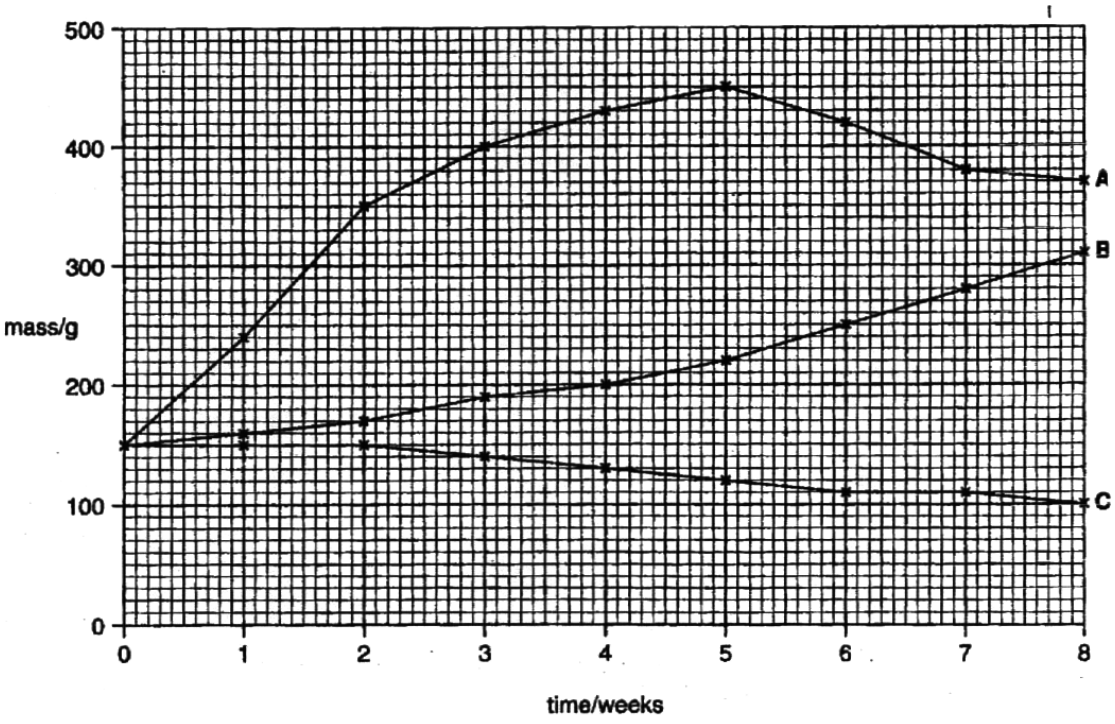


Fig. 6

Extension 3

(a) With reference to Fig. 6 calculate the percentage increase in mass of the plants in container **A** during the first five weeks of the experiment. (Show your working.)

% increase .....[2]

(b) Suggest why the mass of plants in container **A** began to decrease after week 5, while the mass of plants in **B** continued to increase.

Container **A** .....

Container **B** .....

..... [2]

(c) During the eighth week, in which container would there be the least dissolved oxygen? Explain your answer.

Container .....

Explanation .....

..... [2]

Plant nutrition and transport – answers

Core 1

a any three of these
- light intensity increases
- the stomata open
- increase in temperature
- greater rate of evaporation / transpiration / diffusion

b factor- temperature

explanation- as light decreases the rate of loss continues to rise / temperature and water loss curves peak at the similar time

c prediction- rate of water loss / transpiration falls / lower

explanation- air saturated / humid (thus less evaporation)

Core 2

a(i) $6CO_2$ / carbon dioxide

$6O_2$ / oxygen

(ii) sun / solar / sunlight

(iii) chlorophyll

(iv) magnesium / iron / nitrate / ammonium

b(i) phloem

(ii) starch is insoluble

has no osmotic effect / easier to retain in storage / prevent it being moved

(iii) cellulose

Alternative to Practical 1

a A respiration / use of oxygen

B transpiration / uptake of water / water loss

C photosynthesis

b(i) carbon dioxide / CO_2

(ii) one from
- glass beads
- stones
- empty tube
- boiled, sterile, dry or dead seeds

c one from

moving air / wind / fan / dry air	speed up process
enclosed in a bag / increase humidity	slow process
cold air	slow process
hot air	speed up process
in darkness	slow process
in light / sunny	speed up process

d(i) oxygen / O_2

(ii) any one of these

light-intensity	fixed position of bulb / keep light on / same wattage /
temperature-	heat shield / in water bath / heat filter
carbon dioxide-	add hydrogen carbonate to water
biotic idea-	use same piece of waterweed

Extension 1

a any two from
- presence of segmented body or abdomen
- presence of jointed limbs or appendages
- presence of head or eyes
- presence of exoskeleton

b

<u>tissue</u>	phloem / sieve tubes
<u>processes</u>	reference to translocation
	reference to active transport or active uptake

c(i)

<u>sap vacuole</u>	gets smaller / shrinks / loses water / reference to increase in concentration
<u>cytoplasm</u>	moves away from (cell) wall
<u>cell wall</u>	no longer curves outwards

(ii) any three points
- water potential in vacuole / cell is higher than outside
- due to lower concentration of sugar molecules / higher concentration if water molecules in vacuole / cell
- so water moves out by osmosis
- through (cell) membrane

d pesticides are absorbed into the leaf / plant / stem
aphids feed on / suck / remove poisonous sap

Extension 2

a

A	stoma / stomatal pore
B	guard cell
C	epidermal cell / epidermis

b <u>upper surface</u>
C. Fistula has 18 stomata while B. Monhandra has none
<u>lower surface</u>
C. Fistula has no stomata while B. Monhandra has 22

c(i) three of these points
- water is only lost if stomata are present
- stomata open during the day
- so water (vapour) is lost
- reference to transpiration

(ii) stomata are closed at night

d any three of these points
- reference to xylem
- water enters xylem vessel through pots in walls
- reference to transpiration stream / pull
- reference to capillary action
- reference to root pressure

e(i) rate will decrease
reference to smaller gradient for diffusion

(ii) rate will increase
more energy for evaporation
warm air can hold more water vapour than cold air

Extension 3

a $\frac{300}{150} \times 100$
$= 200\%$

b <u>container A</u>
- depletion of salts / nutrients
- seeds released
- disease
- shortage of carbon dioxide
- reached end of life cycle

<u>container B</u>
- photosynthesis
- growth
- nutrients not exhausted
- food stores
- sufficient carbon dioxide

c container C
least or no photosynthesis occurring
respiration exceeds photosynthesis
death of plant so bacteria active, using up oxygen

Respiration and the human transport system

CORE questions

Core 1

Two characteristics of living organisms are nutrition and respiration.

(a) (i) List **three** other characteristics of living organisms.

1. .....

2. .....

3. ..... [3]

(ii) Name the process by which green plants produce carbohydrates.

[1]

(b) Living organisms release gases into the atmosphere as a result of their various activities. Complete the table, using a tick (✓) or a cross (✗), to show which gases are released.

	carbon dioxide released into the atmosphere	oxygen released into the atmosphere
animals in bright light		
green plants in bright light		
animals in the dark		
green plants in the dark		

[4]

[Total : 8]

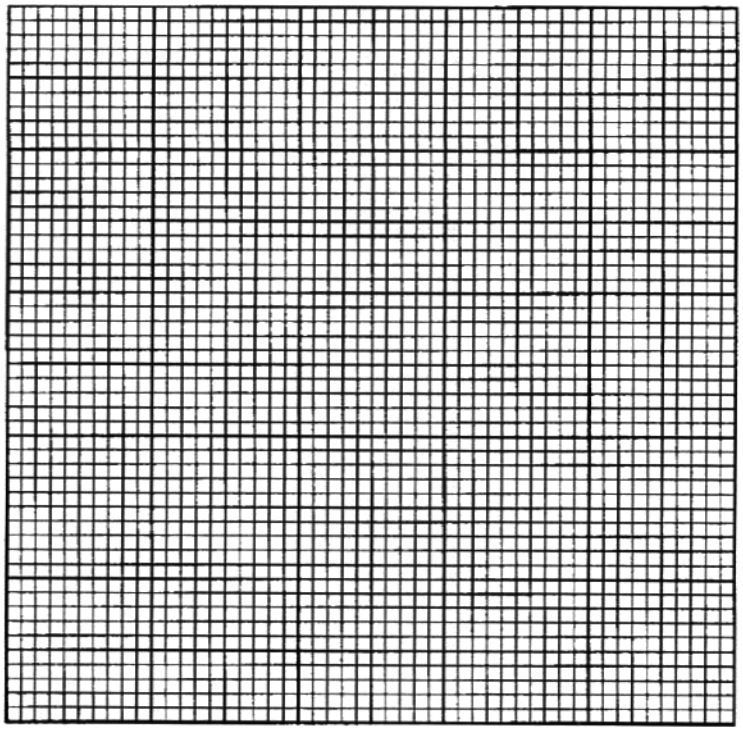
Core 2

(a) Table 1 shows the frequency of human blood groups in a population.

Table 1

human blood group	% frequency in the population
A	46
B	9
AB	3
O	42

(i) Plot the data in the table as a bar chart on the grid below.



[3]

(ii) What type of variation is illustrated by these data? State a reason for your answer.

Type of variation .....

Reason .....

. [2]

Core 3

Fig. 1 shows a section through the heart.

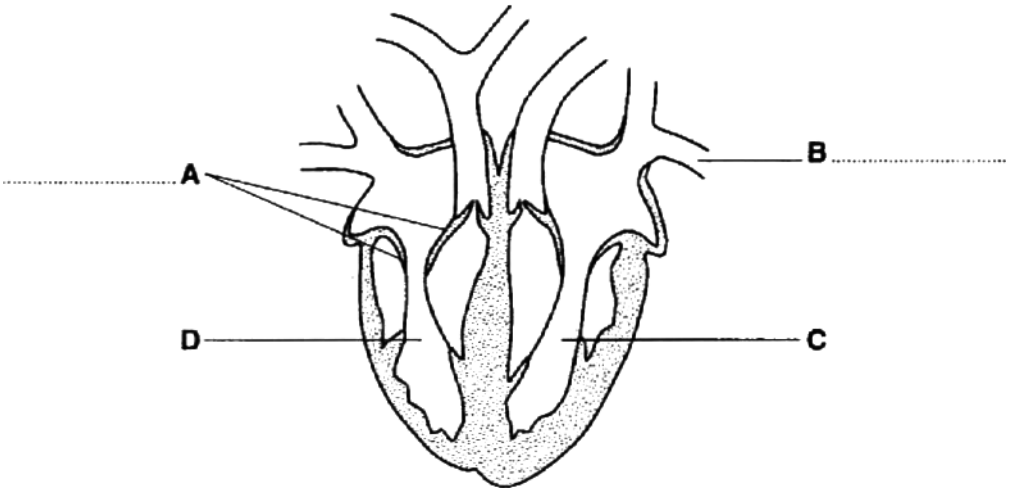


Fig. 1

(a) On Fig. 1

(i) name the parts labelled **A** and **B**; [2]

(ii) shade the cavity of the ventricle which contains oxygenated blood; [1]

(iii) suggest why the wall around chamber **C** is much thicker than that around chamber **D.**

..... [2]

(b) The coronary arteries supply blood to the heart muscle.

(i) Suggest **two** activities of humans which might cause a clot in a coronary artery.

1. .....

2. ..... [2]

(ii) Explain what might be the result of such a blockage.

..... [2]

Core 3

(c) Fig. 2 shows a plan of the circulatory system.

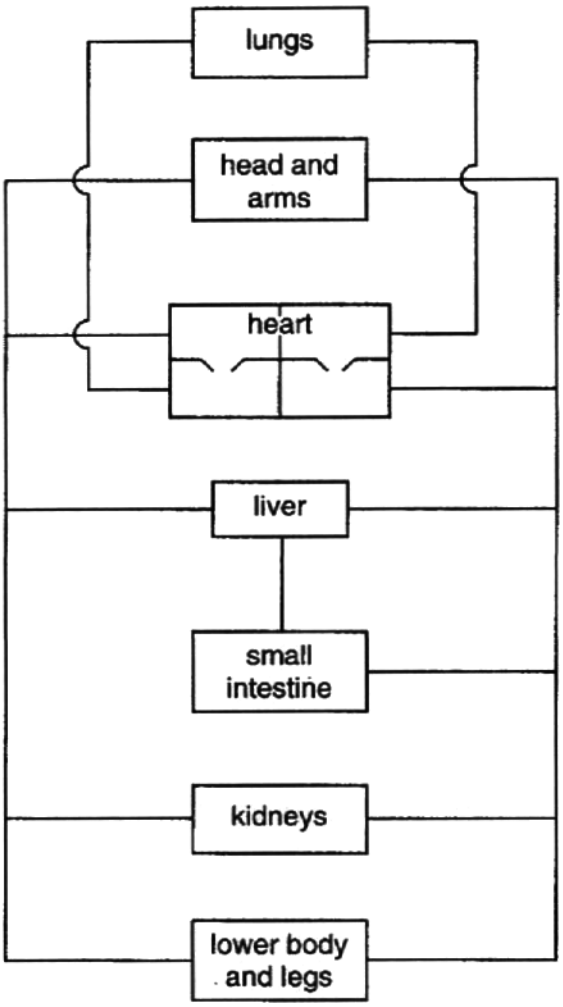


Fig. 2

On Fig. 2

(i) label where urea is formed; [1]

(ii) label where urea is excreted; [1]

(iii) show, using a series of arrows, the route taken by urea between these two organs. [2]

[Total : 13]

ALTERNATIVE TO PRACTICAL questions

Alternative to Practical 1

Fig. 3 shows the apparatus that was used to investigate the activity of yeast in a glucose solution.

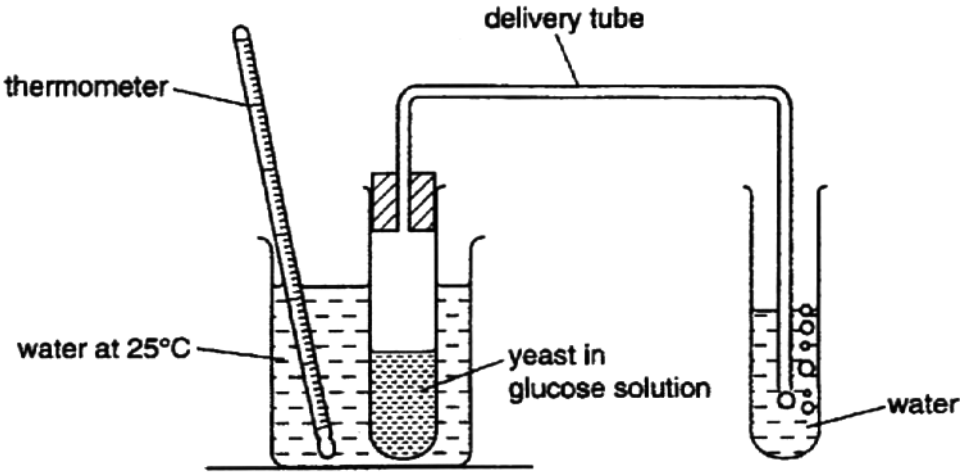


Fig. 3

The number of bubbles released in one minute was counted. This was repeated another four times.

The temperature in the water bath was then raised to 35 °C and five more counts were made.

Table 2

	number of bubbles released in one minute	
	25 °C	35 °C
1	11	17
2	12	19
3	14	20
4	13	16
5	10	18
total		
mean (average)		

Alternative to Practical 1

(a) (i) Complete Table 3.1 to show the totals and mean numbers of bubbles released at each temperature. [2]

(ii) Name the physiological process in yeast which is investigated in this experiment.

[1]

(iii) State the effect of raising the temperature on the activity of yeast.

Explain your answer.

Effect

Explanation .....

[3]

(b) (i) Name the gas present in the bubbles.

(ii) Describe a test you could use to identify this gas.

..... [2]

(c) Explain why it is better to leave the apparatus for a few minutes at each temperature before beginning to count the bubbles.

..... [2]

[Total : 10]

EXTENSION questions

Extension 1

(a) Describe the functions of each of the following parts of the heart:

(i) right atrium;

(ii) right ventricle;

(iii) tricuspid valve.

[9]

(b) Outline the likely causes of a heart attack and suggest what preventive measures can be taken to maintain a healthy heart. [6]

[Total: 15]

Extension 2

An athlete takes part in a race.

(a) Describe and explain what happens to her breathing rate as a result of the race. [5]

(b) The level of adrenaline increases at the start of the race. Describe the effect of this increased level of adrenaline in the athlete's body. [4]

(c) At the end of the race the athlete's body temperature has increased. Outline the body processes which cause her temperature to return to normal after the race. [6]

[Total: 15]

Respiration and the human transport system – answers

Core 1

a(i) any three of these
- growth
- movement
- irritability / sensitivity
- excretion
- reproduction

(ii) photosynthesis

b

	carbon dioxide released into the atmosphere	oxygen released in to the atmosphere
animals in bright light	√	X
green plants in bright light	X	√
animals in the dark	√	X
green plants in the dark	√	X

Core 2

a for three marks
axes oriented correctly
both axes labelled and with suitable scale on frequency axis
all four columns correctly plotted

b type discontinuous variation
reason there are no intermediate values between the four groups / there are distinctly separate sets of values

Core 3

a(i) A tricuspid / right atrio-ventricular / right cuspid valve
B pulmonary vein

(ii) all of cavity of left ventricle shaded

(iii) thicker wall can generate a greater pressurs / more powerful push / pump

(iv) to pump / push / force blood further / all round the body / not just to the lungs

b(i) any two of these
smoking
fat / cholesterol rich diet
lack of exercise
stress

(i) restrict supply of oxygen / glucose / sugar to heart / ventricle
muscle in area dies / heart ttack/ cannot respire

c(i) label to liver

(ii) label to kidney

(iii) arrows from liver to heart and heart to kidneys
arrows from heart to lungs and back to heart

Alternative to Practical 1

a(i)

	25 °C	35 °C
total	60	90
mean (average)	12	18

(ii) respiration / fermentation

(iii) Effect — increase in number of bubbles released per min reference to a numerical increment

Explanation — reference to role of enzymes involved / kinetic energy / more molecular collisions of enzyme and substrate

b(i) carbon dioxide

(ii) limewater turns milky white

c agitation of tubes
equilibrium / temperature to be reached

Extension 1

a(i) any three from these
- receives blood from vena cava
- reference to blood being deoxygenated
- acts as reservoir
- reference to thin muscle wall
- contracts / reference to atrial systole to move blood to right ventricle

(ii) any three of these
- receives blood from right atrium
- reference to thick / thicker muscle wall
- reference to builds up blood pressure
- contracts / reference to ventricular systole to move blood to lungs via pulmonary artery

(iii) any three of these
- reference to position
- prevents backflow of blood / maintains blood flow in one direction
- reference to closing a ventricular systole / when pressure starts to build in right ventricle
- so blood can only leave via pulmonary artery

b any six of these
- reference to high saturated or animal fat diet / reduce saturated or animal fat content of diet
- reference to too much cholesterol / reduce cholesterol content of diet
- fat / cholesterol builds up on coronary artery
- atherosclerosis / atheroma
- high salt diet / reduce salt content of diet
- stress / stress management
- high blood pressure
- smoking / stop smoking
- lack of exercise / take regular exercise
- obesity / take control of diet to reduce obesity

Extension 2

a any five of these
- breathing rate increases
- to increase amount of oxygen / to replace used oxygen
- needed for aerobic respiration
- reference to muscles
- repaying oxygen debt
- remova of lacic acid
- reove / exhale morecarbon dioxide
- control of breathing rate by brain

b any four of these
- increased heart rate / pulse rate
- to move blood faster
- so more oxygen / glucose goes to muscles
- non-essential processes slow down
- increased air flow into lungs / breathing rate
- so aerobic respiration increases
- stimulates conversion of glycogen to glucose
- increases mental awareness

c any six of these
- increase in sweat production
- secreted from sweat glands
- onto skin
- sweat evaporated
- removing heat from skin surface / reference to cooling effect
- vasodilation
- arterioles
- more blood flows near skin
- blood carries heat
- so heat is lost from skin
- panting causes heat loss from lungs
- hairs lowered to allow more heat loss

Coordination, response and homeostasis

CORE questions

Core 1

(a) State the term which is used to describe the maintenance of a constant internal environment in the human body.

[1]

(b) Describe how each of the following processes helps to maintain the temperature of the body:

(i) sweating;

..... [2]

(ii) vasodilation.

[3]

[Total : 6]

Core 2

Fig. 1 shows the urinary system and its blood supply.

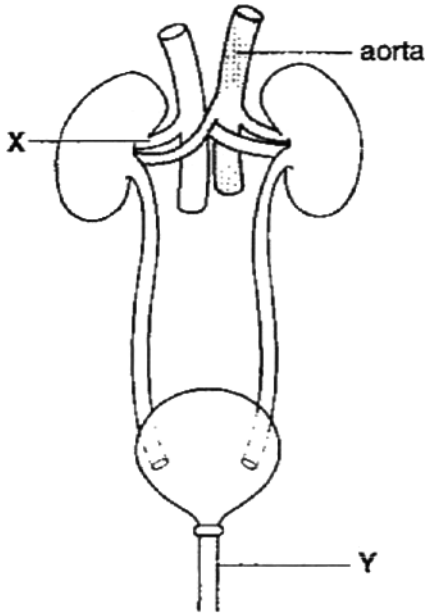


Fig. 1

(a) (i) Identify the structures labelled **X** and **Y** on Fig. 1.

X .....

Y ..... [2]

(ii) A function of the kidney is to remove urea from the blood. State **one** other function of the kidney.

..... [1]

(b) The liver forms urea by breaking down excess amino acids. Name **two** other substances which are broken down by the liver.

1. .....

2. ..... [2]

(c) The liver and kidneys are organs which help to maintain a constant internal environment.

Which term describes this process?

..... [1]

[Total:6]

Core 3

(a) A student reaching for a book on a bookshelf pricks his finger on the sharp point of a nail. He pulls his hand away very quickly.

(i) State the type of response which has occurred.

[1]

(ii) What is the effector in this response?

[1]

(iii) Name the type of nerve cell which links the central nervous system to the effector.

[1]

(b) Fig. 2 shows part of the leg of a crab.

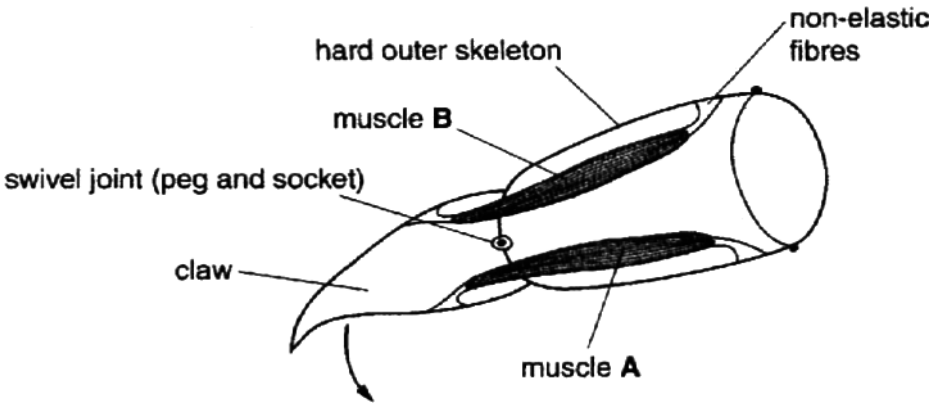


Fig. 2

(i) State what happens to muscles, **A** and **B**, in order for the claw to move in the direction of the arrow.

Muscle **A** .....

Muscle **B** ..... [1]

(ii) Why do muscles in the leg occur in pairs?

[1]

(iii) Suggest why the fibres which join the muscle to the skeleton are non-elastic.

[1]

[Total : 6]]

ALTERNATIVE TO PRACTICAL questions

Alternative to practical 1

Fig. 3 shows a rotating clinostat with five seedlings attached.

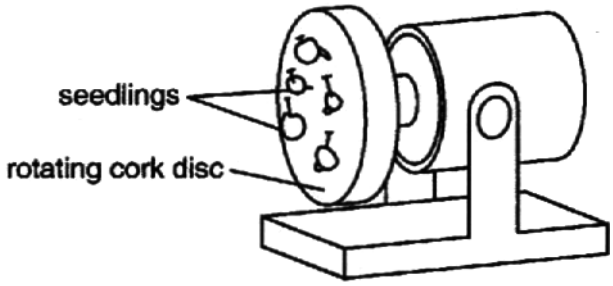
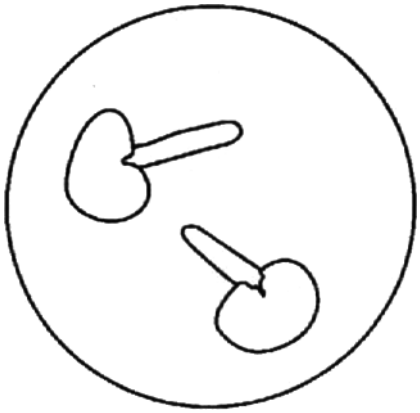


Fig. 3

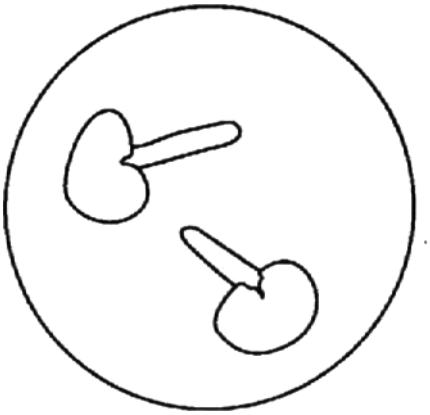
The cork disc is rotated slowly so that all sides of the seedlings are equally exposed to the stimulus of gravity.

(a) (i) On the diagram below, show the appearance of the seedlings after being attached to the rotating clinostat for two days. No labels are required.



[1]

(ii) On the diagram below, show the appearance of the seedlings after two days if the clinostat had **not** been rotating.



[2]

Alternative to practical 1

(iii) Explain the new appearance of the seedlings in (a) (ii) after two days.

..... [2]

(b) (i) What condition must be provided to ensure continued growth of the seedlings over the two day period?

[1]

(ii) How could this be achieved?

[1]

(c) Describe how you would ensure that **only** the response to gravity is being investigated.

[1]

[Total : 8]

EXTENSION questions

Extension 1

(a) (i) Define the term *reflex action*. [3]

(ii) Describe the pupil reflex and explain its advantages. [5]

(b) Distinguish between rods and cones in terms of function and distribution. [4]

(c) Suggest how damage to **three named** parts of the eye could result in impaired vision or blindness. [3]

[Total:15]

Extension 2

(a) (i) Define the term *reflex action*. [3]

(ii) Describe the pupil reflex and explain its advantages. [5]

(b) Distinguish between rods and cones in terms of function and distribution. [4]

(c) Suggest how damage to **three named** parts of the eye could result in impaired vision or blindness. [3]

[Total:15]

Coordination, response and homeostasis – answers

Core 1

a homeostasis

b(i) evaporation of sweat / water
removes heat from the body / cools the body / reference to latent heat of vaporisation

(ii) arterioles in skin relax
increased blood flow through surface capillaries
more heat loss from body by convection / radiation

Core 2

a(i) **X** – renal vein

Y – urethra

(ii) remove water / salts (from blood) or

osmoregulation or

control of water / salt content (of the blood)

b any two from these

alcohol
drugs / named drug
haemoglobin
hormones / named hormone
toxins

c homeostasis

Core 3

a(i) reflex response / action / involuntary / automatic

(ii) arm muscles / named arm muscle / muscle (unqualified)

(iii) motor (neurone)

b(i) **A** – contracts **B** – relaxes **reject** – expands / stretches

(ii) to pull leg / part of leg in opposite / different directions

(iii) to pass / transmit all of muscle pull to skeleton / not to lose some pull in stretching the fibres

Alternative to Practical 1

a(i) diagram shows all seedlings with longer straight roots

(ii) diagram shows all seedlings with curved roots towards source of gravity correct extended growth region

(iii) root tip / root / radicle responds towards gravity / grows downwards / shows geotropism
reject points downwards / bends (or alternative wording)

correct reference to role of auxins

b(i) any one from
- water / moisture
- air / oxygen
- correct temperature / heat / warmth

reject carbon dioxide, light, minerals

(ii) must link to b(i)

<u>water / moisture</u>
protective covering / glass / plastic box / keep seedlings moist / prevent seedlings drying out / adds water daily / supply water / soaked cotton wool

<u>warmth</u>
heat from lamp / in temperature box / facing the sun / out of air conditioned area / warm room

<u>air / oxygen</u>
ventilation / fan / breathing

c keep apparatus in the dark / uniform continuous light / red light / in light from all directions / keep moist to avoid hydrotropism

Extension 1

a(i) automatic response
to a stimulus
and one from
- reference to very fast
- reference to innate / not learned

(ii) any six points from these
- light shines on (or alternative wording) retina
- electrical impulse generated (or alternative wording)
- passed to brain via motor neurones
- to iris
- circular muscles contract **reject** references to ciliary muscles
- to make pupils smaller
- protects rods and cones / retina from damage
- reflex is very fast / does not require thought / does not require decision

b any four from
- cones detect colour
- reference to three types of cones / detect red, green, blue
- cones needed for fine detail

rods cannot detect colour / only produce image in black and white
- rods distributed all over retina

cones concentrated in fovea / yellow spot
cones only stimulated by bright light / rods sensitive to dim light

c any three from these
rods / cones / retina / damaged by bright light so not receptive
lens cloudy or damaged so light cannot pass through
cornea cloudy or damaged so light cannot pass through
eyeball deformed / retina detached so cannot focus
optic nerve damaged so no impulses transmitted (or alternative wording)

Extension 2

a any four points from these

excretion
removal from the body of waste products of metabolism
reference to substances which are poisonous / in excess / surplus to requirements

egestion
removal of faeces from the body
reference to via anus

b drawing marks
includes aorta, renal artery, kidney, ureter, bladder and urethra
drawing clear and parts correctly labelled

explanation
reference to blood from aorta to renal artery
blood enters kidney
water filtered out
reference to formation of urine
urine passes down ureter
reference to storage in bladder
reference to sphincter muscle and role
urine passes through urethra

c any four from
reference to deamination / breakdown of proteins or amino acids
reference to formation of urea
reference to breakdown of hormones / named hormones
reference to breakdown of alcohol
reference to breakdown of nicotine / other named drugs

Reproduction in plants

CORE questions

Core 1

A plant was allowed to disperse its seeds naturally. The seedlings were examined two weeks after they had started to grow. They were found to be of very different heights.

(i) Suggest **three** environmental factors which could have affected the height of the seedlings.

1. .....

2. .....

3. ..... [3]

(ii) The seedlings all developed from the seeds of a single plant. The plants which later developed from these seedlings showed a number of inherited differences. Suggest **three** possible reasons for these inherited differences.

1. .....

2. .....

3. .....

[3]

[Total : 11]

Core 2

Fig 1 shows a section through a bean flower.

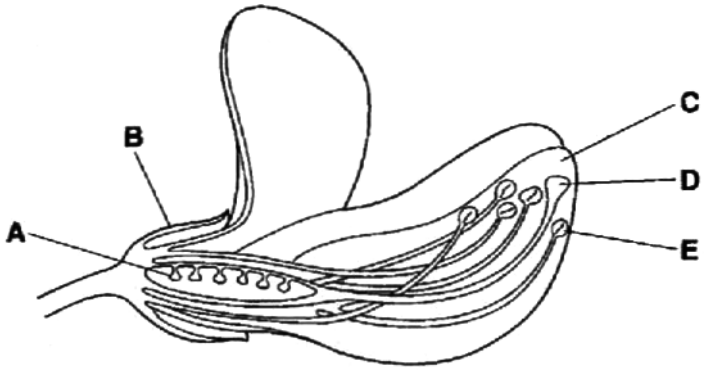


Fig.1

(a) Name the parts labelled **A** and **B.**

A .....

B ..... [2]

(b) This flower is insect pollinated. Suggest how parts **C, D** and **E** help in pollination of this flower.

[3]

(c) After pollination the ovules develop into seeds. Describe the events which occur after pollination and which result in the formation of seeds.

[4]

[Total : 9]

EXTENSION questions

Extension 1

Fig. 2 is a longitudinal section through a root tip showing the regions of growth and development.

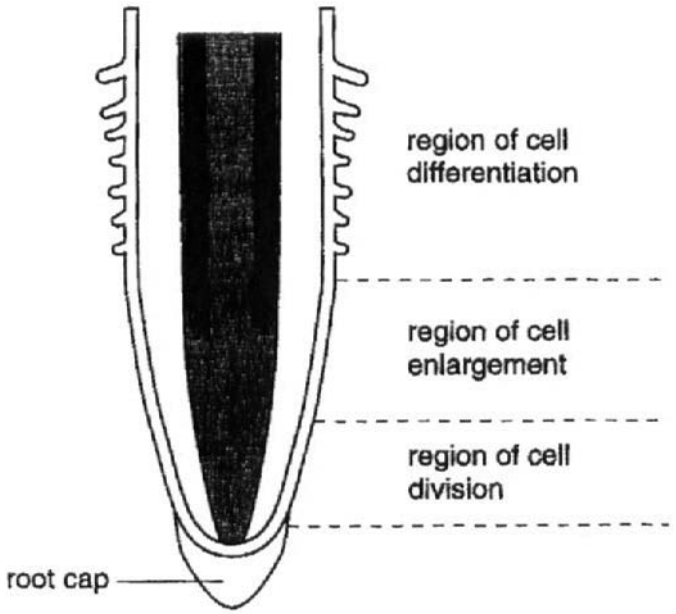


Fig. 2

(a) Distinguish between the terms *growth* and *development*.

[3]

(b) Outline what happens in the region of cell division.

[3]

Extension 1

The enlarging cells get bigger by absorbing water.

(c) (i) Name the process responsible for this absorption of water.

[1]

(ii) What condition must exist in a cell for water absorption to occur?

[1]

(iii) Which cell feature prevents the enlarging cells from bursting?

[1]

(iv) Suggest how the enlargement of these cells makes the root grow longer.

..... [2]

In the region of cell differentiation, a number of different tissues are formed.

(d) (i) Define the term *tissue*.

..... [2]

(ii) Table 1 contains some information about root tissues and their functions. Complete the table.

Table 1

name of tissue	function
xylem	
	transport of sugars
	absorption of water from the soil

[3]

[Total: 16]

Extension 2

(a) Define the term *pollination*. [2]

(b) Describe the structure of a **named** insect-pollinated flower and state the functions of its parts. [10]

(c) Describe how cross-pollination leads to variation in a species. [3]

[Total:15]

Extension 3

(a) Discuss, giving examples, how the use of modem technology has resulted in increased food production. [9]

(b) How is plant growth affected by a deficiency of magnesium ions? [3]

(c) How can minerals, trapped in the bodies of dead animals, become available for plant use? [3]

[Total:14]

Reproduction in plants – answers

Core 1

(i) any three of these
- amount / brightness of sunlight / light
- water availability
- mineral supply
- rooting space
- other soil factors e.g. pH
- disease infections / damage by herbivores / animals
- affected by competitor species

(ii) any three of these
- meiosis leading to variations in ovules / female gametes / nuclei
- meiosis leading to variation on pollen grains / male gametes / nuclei
- second / male parent may be different for different seeds / fertilisation of ovules from different pollen grains
- possibility of mutations / specific mutagen action
- correct reference to different genotypes of parents / heterozygous state for some genes

Core 2

a
A ovule / ovary
B sepal / calyx

b
C (petals are) coloured / bright / shaped / produce nectar / have nectar guides to attract insects
D (stigma / style) receives pollen from pollinator / insect
E (anther / stamen) produces pollen / place pollen on insect

c
fusion of gametes / nuclei / fertilisation
plus any three of these
- pollen tube grows / develops / forms
- through / down style / to ovary
- to micropyle / ovule / embryo sac
- male gamete passes through pollen tube / moves to female gamete/nucleus
- zygote develops into embryo
- reference to female gamete as egg cell, ovum

Extension 1

a
<u>growth</u> at least one from
- increase in size or number of cells or dry mass / getting larger
- irreversible / permanent
- due to cell division

<u>development</u> at least one from
- increase in complexity
- formation of different cells / tissues / organs / additions of new features

b
three references from
- mitosis
- chromosomes
- division of nucleus
- formation of new cells / daughter cells

being identical / of same genetic composition

c(i) osmosis / diffusion

(ii) higher concentration of solutes than outside the cell / lower water potential in cell

(iii) cell wall

(iv) two points from
cell swells up / becomes turgid / gets longer / elongates
press against each other
results in increase in overall length of root / whole root gets longer
downward growth as a result of upper part of root being anchored
cells elongate vertically

d(i) group of cells of the same type
carrying out the same function

(ii)

name of tissue	function
(xylem)	transport of water or minerals / support
phloem / sieve tubes	(transport of sugars)
root hair (cells)	(absorption of water from soil)

Extension 2

a transfer of pollen
from anther / stamen to stigma

b ten marks from the following
named insect-pollinated flower
sepals, description of position or shape or appearance
reference to protection of flower while in bud
petals, description of position or shape or appearance
attracting insects / acting as landing stage / guides present to direct insects to nectar
stamen = anther + filament
anther, description of position or shape or appearance
pollen
filament, description of position or shape or appearance
supports anther
carpel = stigma + style + ovary
stigma, description of position or shape or appearance
receives pollen
style, description of position or shape or appearance
supports stigma for pollination / acts as a pathway for pollen tube
ovary, descriptions of position or shape or appearance
contains ovules / reference to site of fertilisation / becomes the fruit
nectary position / reference to scent
produces nectar
flower stem supports flower
for greater visibility to insects
receptacle acts as base for other flower parts
ovule and position
forms seeds

c reference to mixing of genetic material
can result in different genotypes
so phenotypes / offspring appearance can be different

Extension 3

a any nine from these
- chemical or artificial fertilisers provide more of named mineral or element
- results in greater crop yield (linked to above)
- pesticides / fungicides reduces crop damage by insects or fungi / farm animal infestation
- herbicides reduce competition between crop and weeds for named requirements (e.g. light / minerals / water)
- reference to use of machinery
- larger areas of land to be cultivated / saves time
- reference to artificial selection of crop types
- results in greater yield / ability to grow crops on harsh climates
- reference to genetic engineering / cloning
- one example of use
- reference to use of bacteria to make yoghurt
- reference to use of yeast in bread-making
- reference to use of single cell protein to make meat substitutes
- reference to controlled conditions in greenhouse
- reference to improved weather forecasting and application
- use of satellites to observe crop disease / need for fertiliser
- use of computerisation and application
- reference to intensive animal farming / fish farming
- use of animal food concentrates / balanced feeding
- use of antibiotics / hormones / other drugs for animal rearing / plant growing or fruit production
- reference to biological control of pests

b any three of these
- needed for production of chlorophyll
- needed to trap sunlight
- reference to photosynthesis
- no sugars produced
- so protein synthesis not possible
- reference to chlorosis / yellowing of leaves / pale leaves

c reference to decomposition / rotting
by fungi / bacteria / saprophytes / named decomposers
releases minerals into the soil

Human reproduction

CORE questions

Core 1

(a) State what is meant by the term *sexual reproduction*.

[3]

(b) Fig. 1 shows the mate reproductive system.

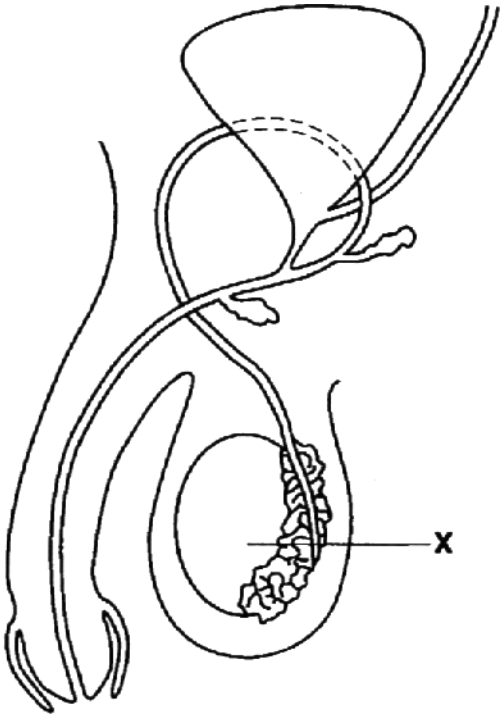


Fig. 1

(i) Name the part labelled **X** and state **two** of its functions.

Name .....

Function 1 .....

Function 2 .....

[3]

(ii) Birth control can be brought about by surgery. Mark clearly on Fig. 1 where such an operation would be carried out in a male. [1]

Core 1

(c) The male sex hormone causes a number of changes in the body during puberty.
State **two** of these changes other than changes to the reproductive system.

1. .....

.....

2. .....

..... [2]

[Total : 9]

Core 2

Table 1 shows the average masses of girls and boys from birth to 20 years of age.

Table 1

girls		boys	
age/years	mass/kg	age/years	mass/kg
0	3	0	4
1	9	1	10
4	16	4	16
8	25	8	28
12	40	12	38
16	53	16	59
20	56	20	65

(a) (i) Plot both sets of data as separate curves on the grid provided opposite. [5]

(ii) Using your graph, state at which ages the average masses of girls and boys are the same.

..... [2]

(iii) State **two** factors, apart from its sex, which could affect the mass of a baby at birth.

1. .....

2. ..... [2]

(b) (i) What evidence in the graph shows that girls undergo puberty before boys?

[1]

(ii) Name the hormone responsible for the changes which occur at puberty in females.

[1]

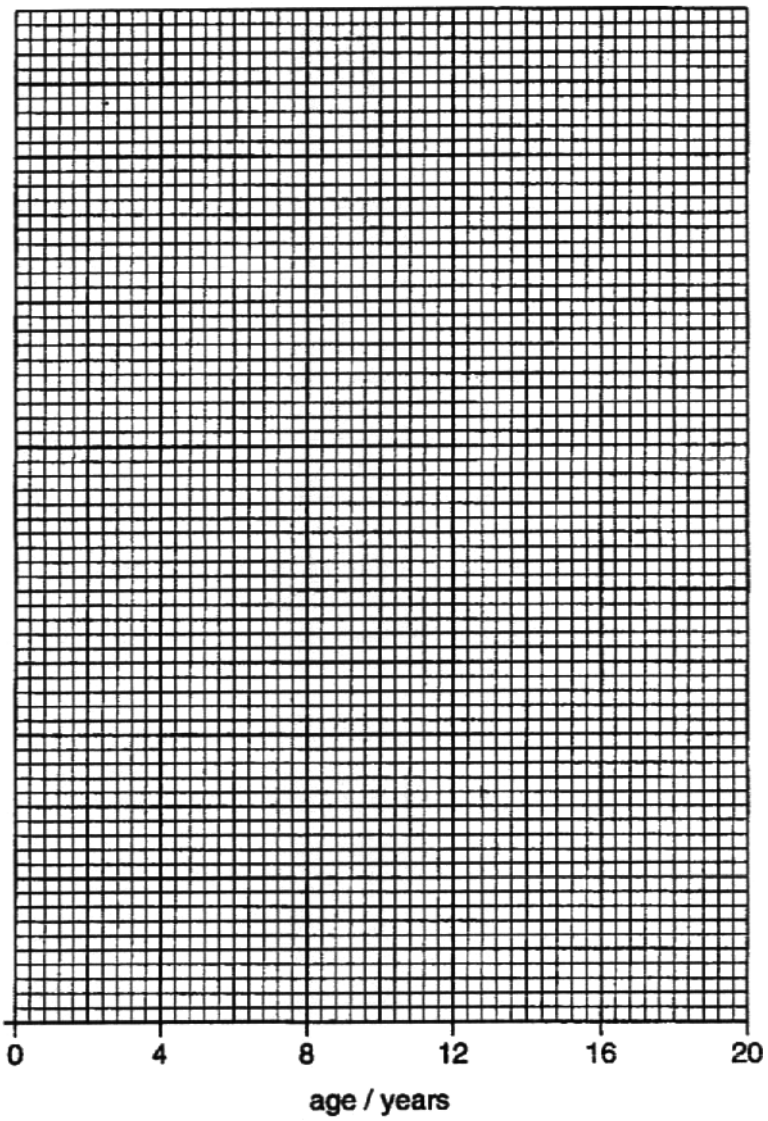
(iii) State **two** changes which occur at puberty in females.

1. .....

2. .....

[Total: 13]

Core 2



EXTENSION questions

Extension 1

Pregnant women at high risk of having a baby with Down's syndrome are often offered an amniocentesis. This technique is shown in Fig. 2

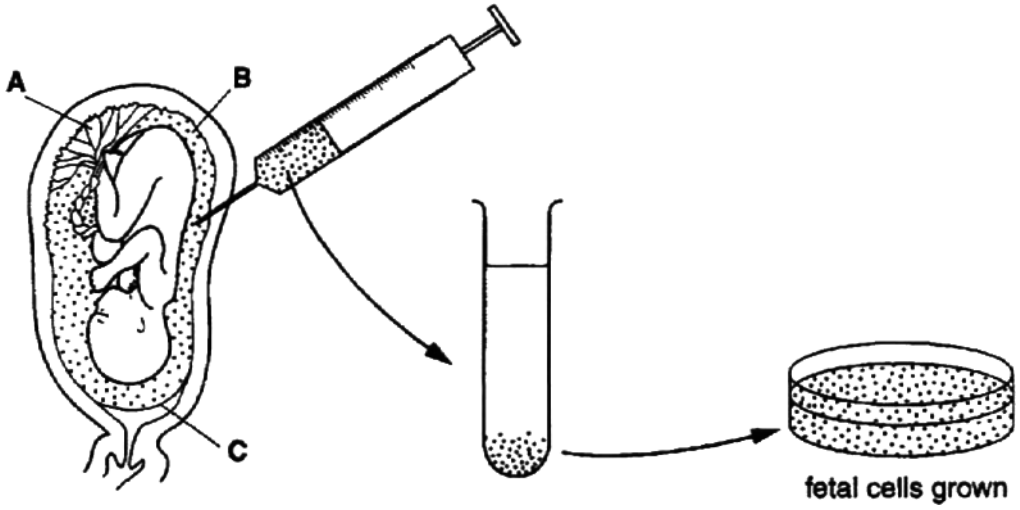


Fig. 2

(a) Complete the table by identifying the parts labelled **A, B** and **C** and stating a function of each one.

part	name	function
A		
B		
C		

[6]

The technique involves taking a sample of **B** from within the uterus. Fetal cells in the sample are then grown and analysed.

(b) (i) Suggest how the cells would be different from normal cells if the fetus has Down's syndrome.

.... [1]

(ii) What is the cause of this difference?

[1]

Extension 1

(c) Suggest how the sex of the fetus could be identified by observation of fetal cells.

[3]

During pregnancy women may also be monitored in other ways, including urine sampling.

(d) Suggest why the urine of pregnant women is analysed.

..... [2]

[Total: 13]

Extension 2

(a) Describe the movement of **named** materials from the mother to the fetus. [6]

(b) Describe the signs, symptoms and effects of the disease syphilis. [6]

(c) Explain

(i) how HIV is transmitted, and

(ii) how its spread can be prevented. [7]

(d) Explain why the methods for treating syphilis cannot be used for the treatment of AIDS. [2]

Human reproduction – answers

Core 1

a increase in numbers / producing new individuals
requiring the fusion / joining
of gametes / sperm and ovum / two special cells / genetic material / DNA
form two individuals

b(i) X – testis
production of sperm / gametes
production of testosterone / male hormone

(ii) mark / cut shown clearly on sperm duct, not at the junction with the urethra

c any two from
deepening of voice / breaking of voice
development of facial hair
development of pubic / axillary hair
widening of shoulder girdle
enlargement of limb muscles

Core 2

a(i) five marks awarded as follows
vertical axis labelled
logical scale
points plotted accurately
points joined
lines identified

(ii) 10 / 11 years
14 / 15 years

(iii) any two from
mother's diet
genetic factors
disease
if mother smokes / passive smoking
if it is a single / multiple birth / premature birth

b(i) increase in mass in teenage years begins earlier / girls at 12 are heavier then boys

(ii) oestrogen

(iii) any two of these
onset of menstrual cycle / periods start / ovulation starts
widening of hips
development of breasts / mammary glands
axillary hair / pubic hair
redistribution of fat layer under skin

Extension 1

a

A = placenta	reference to transfer / exchange of materials, mother to foetus / v.v.
B = amniotic fluid	cushions foetus from physical damage / absorbs excretory materials from foetus / supports foetus

C = amnion / amniotic sac / amniotic membrane
contains amniotic fluid / secretes amniotic fluid

b(i) reference to presence of 47 chromosomes / extra chromosome

(ii) reference to mutation
reference to unequal chromosome division
reference to extra number 21 chromosome

c reference to use of microscope / analyse or observe chromosomes
presence of xx chromosomes = girl / female
presence of xy chromosomes = boy / male

d EITHER
reference to testing for presence of glucose
to test for diabetes

OR

reference to testing for protein
reference to possible consequences of protein loss
reference to testing for diseases
reference to testing for drugs
reference to checking hormone levels

Extension 2

a any six of these points
reference to placenta
allows maternal blood to come close to that of foetus
allows diffusion of materials
reference to foetal capillaries
reference to transfer of oxygen
from maternal red blood cells / haemoglobin
reference to transfer of glucose / amino acid / other named nutrient
reference to transfer of antibodies
reference to plasma, linked to above
pass from placenta to foetus via umbilical cord / vein

b any six of the following
chancre / hard lump / painless sore / blister
on part of body which contacted partner
reference to rash / sore throat
reference to raised temperature
reference to headache
reference to ulceration / sores on other parts of body
reference to discharge
any tertiary symptom or effect: hair loss / teeth / nose / skeleton / skin / brain / nervous system / liver / blood vessels / paralysis / blindness / infertility / insanity /
aneurism / death / damage to foetus
reference to 3 stage disease / stages named

c(i) any four of these
transmitted in named body fluid e.g. blood, semen
passed during unprotected sex
reference to use of shared needles / razors / unsterilised needles
reference to blood transfusions with unscreened blood / organ transplants
reference to transmission from mother to foetus

(ii) any three of these
- reference to education about AIDS / HIV
- use of condom during sexual intercourse / reference to safe sex
- use of sterile needles / do not share needles / avoid contact with contaminated
- blood
- avoid casual sex

d any two from
- syphilis is caused by a bacterium
- HIV is a virus, not AIDS
- antibiotics are not effective against viruses

Inheritance and evolution

CORE questions

Core 1

Hair colour in mice is controlled by a gene with two alleles. A homozygous black-haired mouse was bred with a homozygous brown-haired mouse. All the offspring were black-haired.

(a) (i) Explain what is meant by the terms *homozygous* and *recessive*.

Homozygous .....

Recessive .....

..... [2]

(ii) Which is the dominant hair colour in mice?

[1]

(b) One of the heterozygous black-haired offspring was bred with a homozygous brown-haired mouse.

(i) Using the symbols **B** and **b** to represent the two alleles, draw a genetic diagram to show the outcome of this cross. [4]

(ii) State the ratio of the phenotypes of the offspring.

[1]

[Total : 8]

Core 2

Fig. 1 shows, in outline, the stages of the division of a cell.

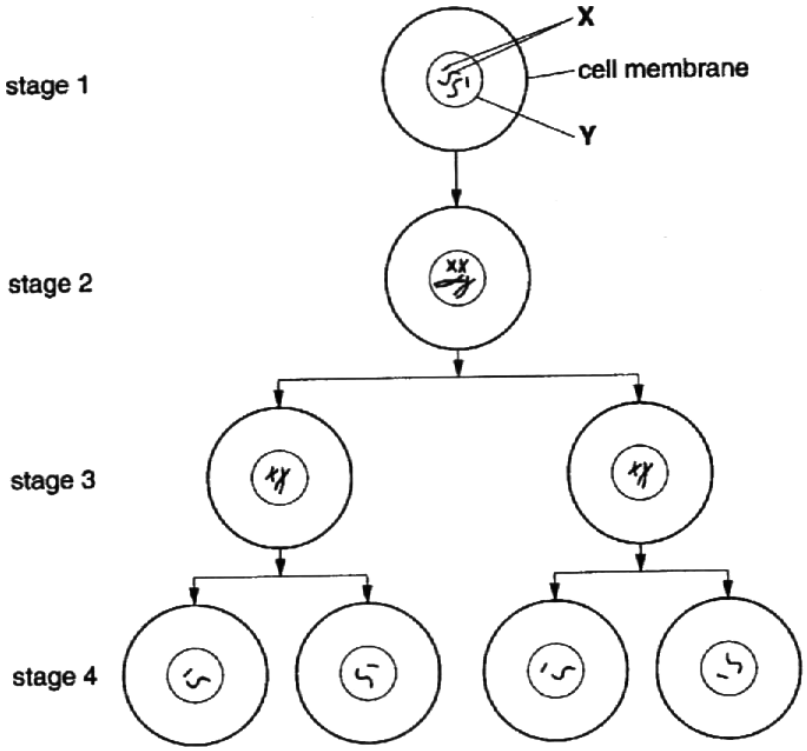


Fig. 1

(a) (i) Name the structures labelled **X** and **Y.**

X .....

Y .....

[2]

(ii) Identify, with a reason, the type of cell division shown in Fig. 1.

Type of cell division .....

Reason .....

[2]

(iii) Name an organ in the body where this type of cell division occurs.

[1]

(b) What process must occur if a cell in stage 4 is to form a cell similar to that shown in stage 1?

[1]

[Total : 6]

Core 3

Fig. 2 shows the inheritance of a condition in humans known as phenylketonuria (PKU).

This condition affects the liver, causing it to produce toxins which can affect the mental health of the sufferer.

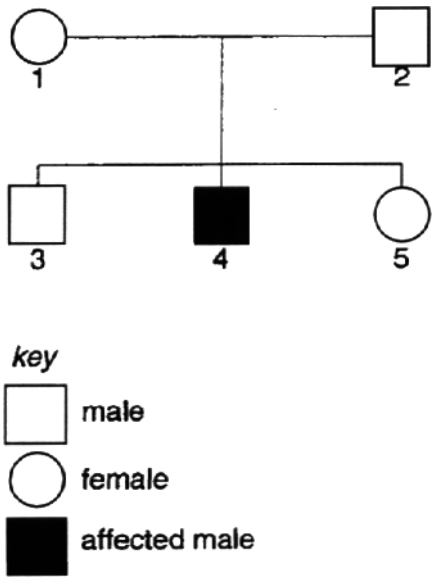


Fig. 2

(a) State, with an explanation, whether the allele for PKU is dominant or recessive.

[3]

(b) (i) Using the symbols **H** for the dominant allele and **h** for the recessive allele, state the genotypes of individuals 1 and 4.

Individual 1. .....

Individual 4. ..... [2]

(ii) What are the **two** possible genotypes of individual 3?

[1]

[Total : 6]

ALTERNATIVE TO PRACTICAL questions

Alternative to Practical 1

Fig. 3 is a photograph of a flight feather of a bird.

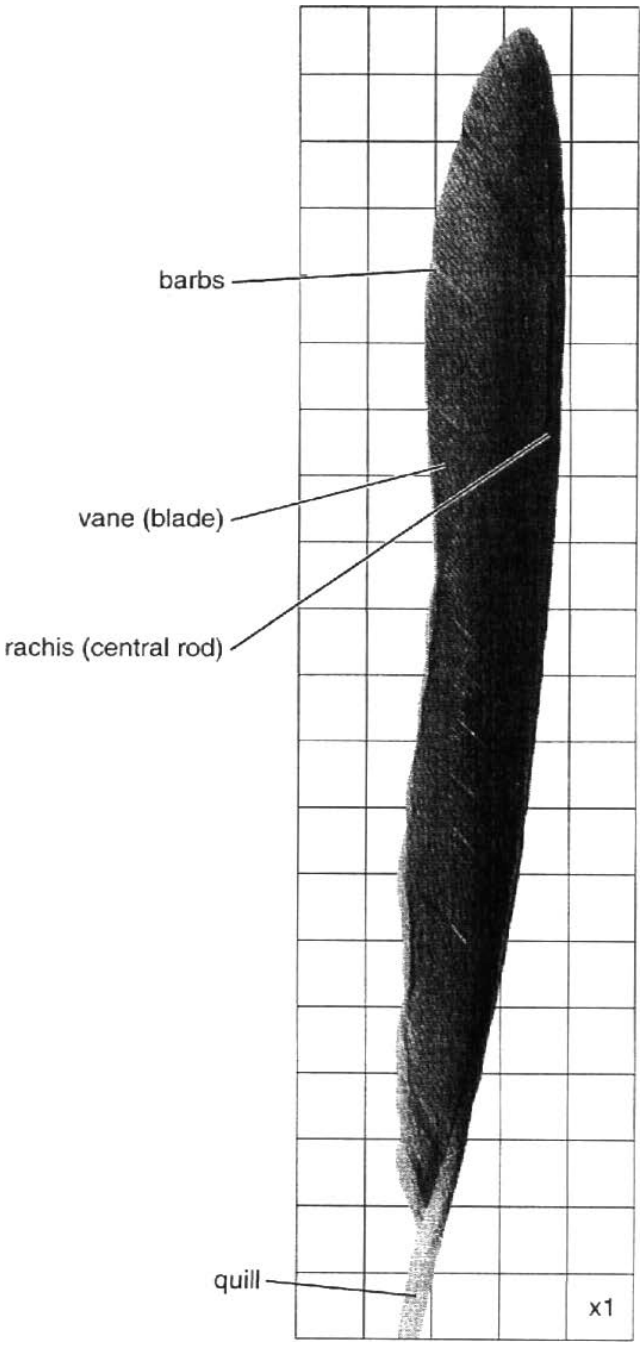


Fig. 3

(a) Determine the surface area of the feather, excluding the quill.

Show your working.

Surface area of feather .....cm^2 [3]

Alternative to Practical 1

Fig. 4 is a photograph of a down feather. These feathers form a dense layer close to the skin surface of a bird.

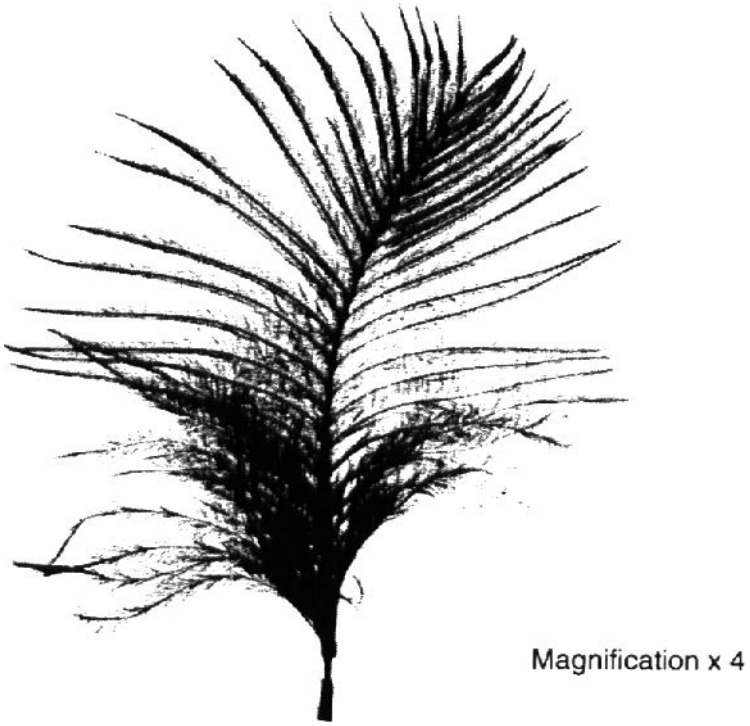


Fig. 4

(b) Complete Table 1 to show **three visible** differences between the flight feather in Fig. 3 and the down feather in Fig. 4.

Table 1

	flight feather	down feather
1	....	....
2	....	....
3	....	....

[3]

Alternative to Practical 1

(c) (i) Suggest how the down feathers may be important especially to young birds in cold climates.

..... [2]

(ii) Using a beaker of hot water to represent a young bird, describe an experiment you could carry out to support your suggestion in (c) (i).

[3]

[Total : 11]

EXTENSION questions

Extension 1

Cystic fibrosis is an inherited disorder in humans in which an important protein is not produced. This protein is responsible for preventing the accumulation of thick and sticky mucus in the breathing tubes. The allele which causes cystic fibrosis is recessive to the normal allele (F).

(a) State the genotype of

(i) a carrier of cystic fibrosis; ..... [1]

(ii) a sufferer of cystic fibrosis ..... [1]

(b) Draw a genetic diagram to show if it is possible for a man with a dominant pair of alleles and a woman who is a carrier to produce a baby with cystic fibrosis. Identify the phenotypes of the children.

[4]

(c) Suggest how the build up of sticky mucus would affect a sufferer of cystic fibrosis.

..... [2]

[Total : 8]

Extension 2

Some people suffer from sickle cell anaemia. They have abnormal red blood cells.

(a) (i) Describe the shape of a **normal** red blood cell.

[1]

(ii) State how the appearance of an abnormal red blood cell from a sufferer of sickle cell anaemia differs from a normal red blood cell.

[1]

(iii) What is the effect of sickle cell haemoglobin on the function of the red blood cell?

[1]

The allele for normal haemoglobin is represented by the symbol H^A. The allele for sickle cell haemoglobin is represented by the symbol H^S. The alleles are codominant.

(b) State the genotypes for

(i) a person with normal haemoglobin;

[1]

(ii) a heterozygous person;

[1]

(iii) a person with sickle cell anaemia.

[1]

(c) Which of the genotypes stated in (b) is likely to result in

(i) the greatest protection from malaria?

[1]

(ii) the greatest risk of an early death in a malaria-free country?

[1]

A man with sickle cell anaemia married a woman heterozygous for sickle cell.

(d) Using a genetic diagram, predict the possible percentage of their children that would suffer from sickle cell anaemia.

Percentage ..... [5]

[Total : 13]

Extension 2

A man with sickle cell anaemia married a woman heterozygous for sickle cell.

(d) Using a genetic diagram, predict the possible percentage of their children that would suffer from sickle cell anaemia.

Percentage ..... [5]

[Total : 13]

Inheritance and evolution – answers

Core 1

a(i) homozygous – both alleles present are the same / individual received the same allele from both parents / gametes

recessive – an allele which is only exhibited when present in the homozygous state / when the dominant allele is not present / masked by dominant allele, not gene

(ii) black

b(i) up to 4 points are scored for the following
use of capital B for dominant (black) allele / lower case b for recessive allele
correct genotypes for both parents (Bb, bb)
gametes correctly displayed (B, b and b, b or b)
correct genotypes of offspring (Bb, bb)
correct phenotypes identified (for all offspring)

(ii) correct ratio predicted (1:1 or 1 in 2 or 50%, 50%)

Core 2

a(i) X – chromosomes
Y – nucleus / nuclear membrane

(ii) meiosis – four nuclei are produced / number of chromosomes / genetic material is halved / new nuclei haploid

(iii) ovary / testis / gonad

b fertilisation / fusion of sperm and ovum / gametes / formation of zygote

Core 3

a recessive
4 has inherited PKU from parents (or alternative wording)
as it is not apparent in 1 or 2 / neither parent shows it / if dominant a parent would show it / have PKU

b(i) 1 – Hh
4 – hh

(ii) HH and Hh

Alternative to Practical 1

a working includes
squares to be marked on the feather
breakdown of rows into sub-totals / tally grids
total to be in the range 25 – 30 cm^2

b three visible differences to include references to shape, area, appearance of barb or blade, appearance of rachis (central rod), size or shape of quill

c(i) insulation / traps air / keeps it warm / stops heat escaping / traps heat maintains body temperature / homiothermy / warm blooded reference to young birds do not fly or less

active so generate less heat / large surface area to volume ratio / no regulation of body temperature / not able to keep temperature the same

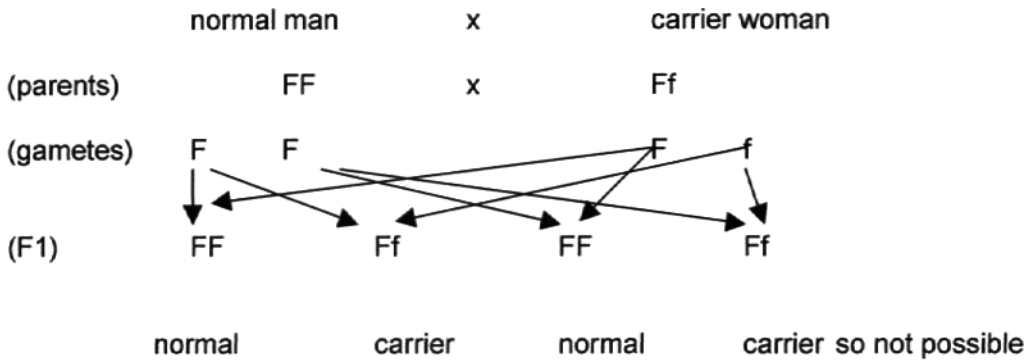
(ii) any three of these within the context of a fair test
uses several feathers or any insulation to wrap around a body / glassware
use of thermometer to follow cooling recorded at intervals
comparison of apparatus with and without any covering or with flight feathers

Extension 1

a(i) Ff

(ii) ff

b



c any two of these
reference to trachea /bronchi / bronchioles / alveoli blocked or congested
makes gaseous exchange more difficult
reference to lack of energy / respiration impaired
reference to being more susceptible to infections
reference to digestion affected

Extension 2

a(i) biconcave disc

(ii) reference to sickle / crescent shaped

(iii) able to carry / absorb less oxygen

b(i) H^AH^A

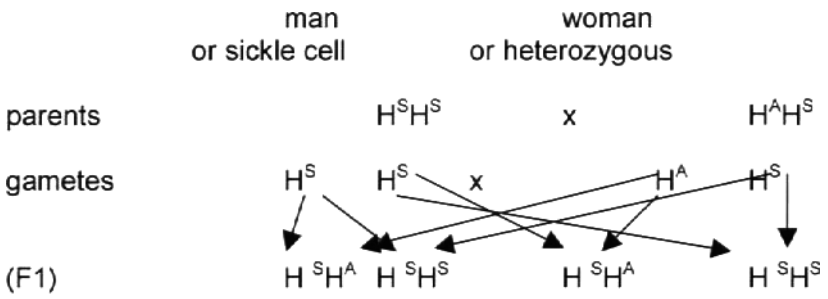
(ii) H^AH^S

(iii) H^SH^S

c(i) H^SH^S

(ii) H^SH^S

d



percentage = 50

Organisms and environment

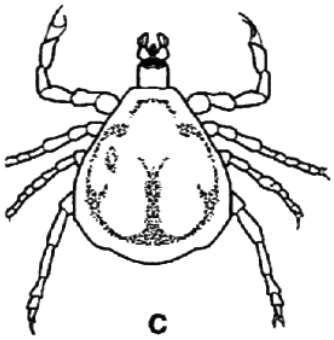
CORE questions

Core 1

Fig. 1 shows five arthropods, each of which could carry disease organisms.

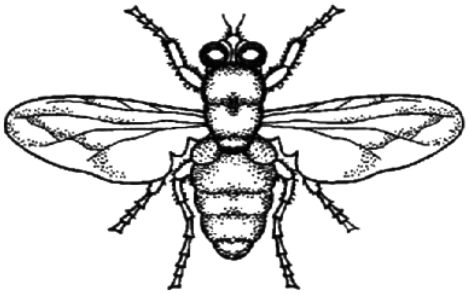
A

B



C

D



E

Fig. 1

Core 1

Use the key to identify each of the animals. Complete Table 1 to show your identifications.

KEY

1	Wings present	Go to 2
	Wings absent	Go to 3
2	Wings longer than the abdomen	*Musca*
	Wings shorter than the abdomen	*Anopheles*
3	Has three pairs of legs	Go to 4
	Has four pairs of legs	*Ornithodorus*
4	All pairs of legs of similar length	*Pediculus*
	One pair of legs shorter than the other two pairs	*Pulex*

Table 1

Name of arthropod	Letter
Anopheles	
Musca	
Ornithodorus	
Pediculus	
Pulex	

[4]

[Total : 4]

Core 2

Fig. 2 shows single leaves from each of six different trees.

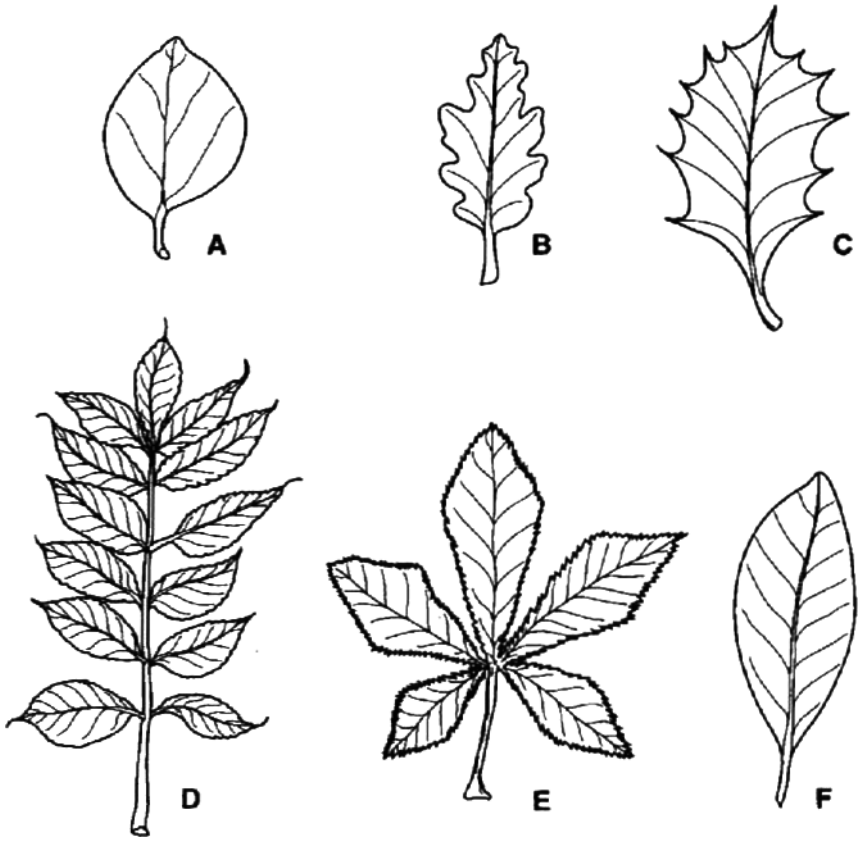


Fig. 2

Use the key below to identify from which tree each leaf comes. Write the name of each tree in the correct box of Table **2.** As you work through the key, tick the boxes in Table **2** to show how you identified each leaf. Leaf A has been identified for you as an example.

Key

			Name of tree
1	(a)	Leaf with a smooth outline	2
	(b)	Leaf with a jagged outline	3
2	(a)	Leaf about the same length as width	*Cydonia*
	(b)	Leaf about twice as long as it is wide	*Magnolia*
3	(a)	Leaf divided into more than two distinct parts	4
	(b)	Leaf not divided into more than two distinct parts	5
4	(a)	Leaf divided into five parts	*Aesculus*
	(b)	Leaf divided into ten or more parts	*Fraxinus*
5	(a)	Leaf with pointed spines along its edge	*Ilex*
	(b)	Leaf with rounded lobes along its edge	*Quercus*

Core 2

Table 2

Leaf	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	Name of tree
A	✓		✓								*Cydonia*
B											
C											
D											
E											
F											

[4]

[Total : 4]

Core 3

Fig. 3 shows a nitrogen cycle for open grassland.

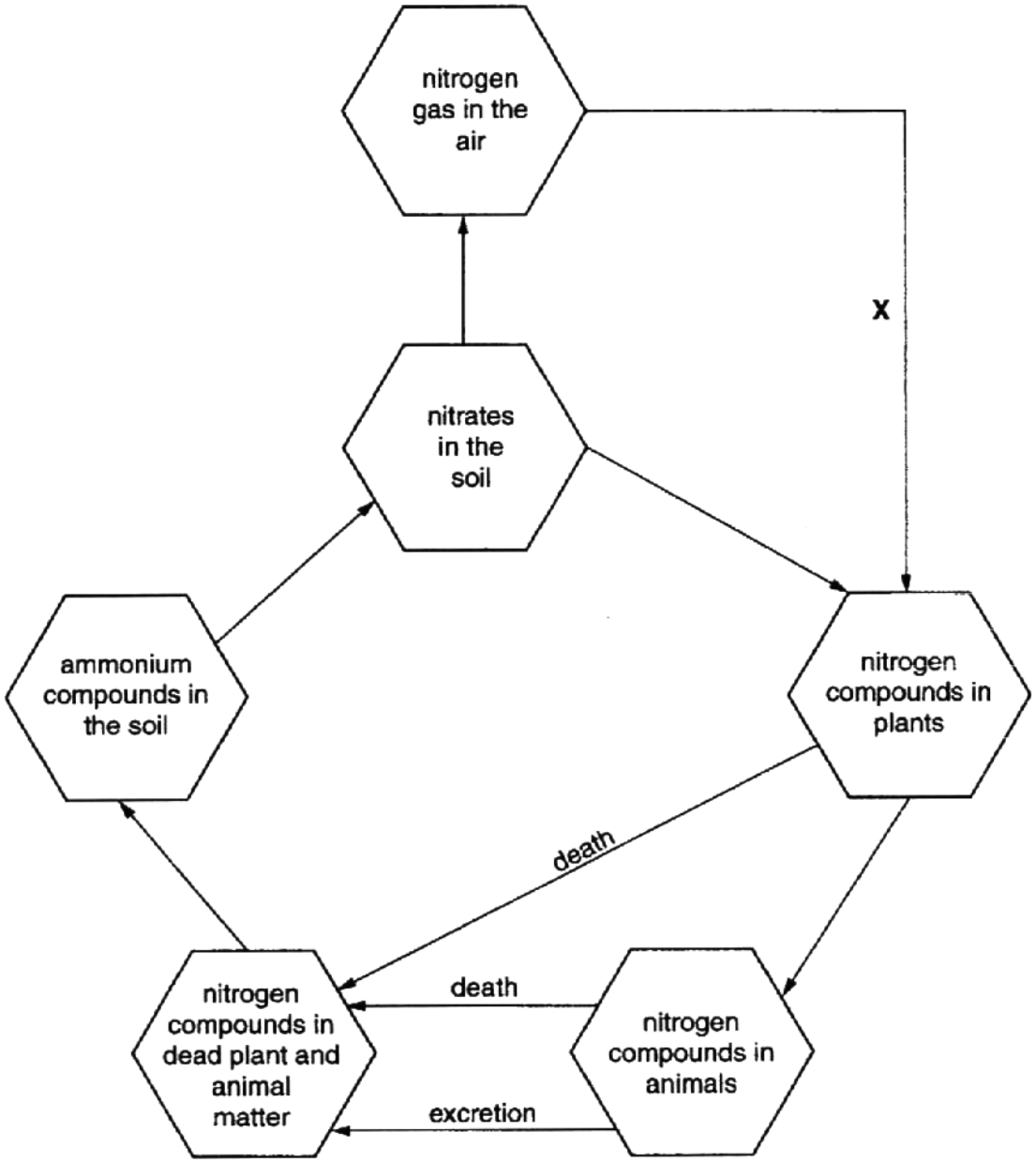


Fig. 3

(a) (i) Name **one** nitrogen compound found in plants.

. [1]

(ii) Name an example of a nitrogen compound which is excreted by mammals.

[1]

Core 3

(iii) Process **X** can only occur in certain plants. Which group of organisms carry out this process and where in a plant are they found?

Organism .....

Where found ..... [2]

(b) The grassland is ploughed up and turned into farmland. Crops of maize are grown on it year after year.

(i) Predict and explain the effect of this change on the nitrogen cycle and on the crop yield.

Effect on the nitrogen cycle .....

Effect on crop yield .....

[4]

(ii) Suggest **one** way in which the farmer could prevent the effect on crop yield.

[1]

[Total : 9]

ALTERNATIVE TO PRACTICAL questions

Alternative to Practical 1

Fig. 4 shows a food web for a freshwater pond.

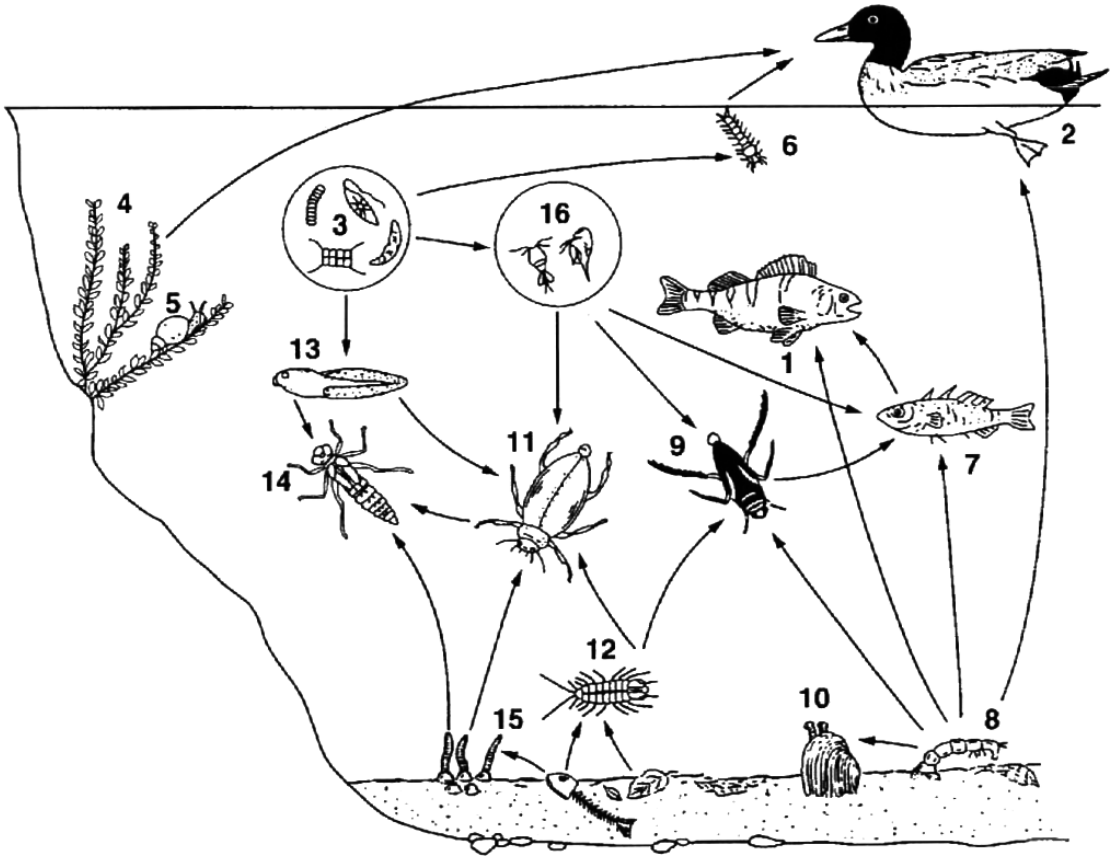


Fig. 4

(organisms 3 and 16 are greatly enlarged)

(a) Two trophic levels are listed below. For each level, state **two** examples from Fig. **4** Identify them by their **numbers.**

(i) *Primary consumers (herbivores)* ..... and .....

(ii) *Secondary consumers (carnivores)* ..... and .....

[2]

Alternative to a practical 1

(b) Using only the numbers in Fig. 4 construct a simple food chain with **five** stages.

..... [2]

(c) Suggest how you could collect large numbers of the microscopic organisms numbered **3** in Fig. 4.

..... [2]

[Total : 6]

EXTENSION questions

Extension 1

(a) Distinguish between the following groups of organisms:

(i) viruses and bacteria;

(ii) arachnids and crustacea;

(iii) monocotyledons and dicotyledons. [12]

(b) Using an example, explain the term *binomial system*. [3]

[Total : 15]

Extension 2

Fig. 5 shows the proportion of all known species in each of the main groups of organisms.

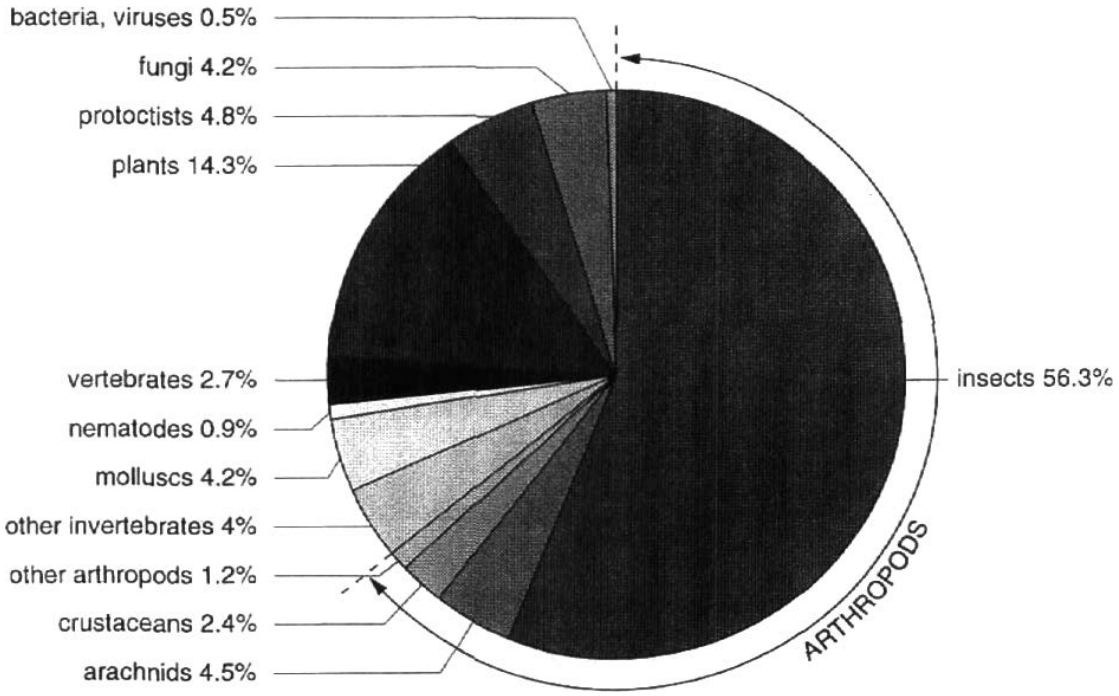


Fig. 5

(a) (i) Apart from insects, which group of organisms in Fig. 5 has the most known species?

[1]

(ii) Fungi are shown as a separate group of organisms. State **two** reasons why fungi are **not** classified as plants.

1. .....

2. ..... [2]

Extension 2

(b) (i) Use information from the pie chart to calculate what percentage of the arthropods are insects. Show your working.

.....% [2]

(ii) State **one** feature of insects which contributes to their success and explain how this feature is beneficial to the group.

Feature .....

Explanation .....

[3]

(c) 2.7% of all known species are vertebrates. Birds is one class of vertebrates.

(i) State **one** feature which distinguishes this class from ail the other vertebrate classes.

[1]

(ii) State **one** external feature which birds have in common with fish.

[1]

(d) It is estimated that 1.7 million species of organisms have been named. Use data from the pie chart to calculate the total number of plant species known. Show your working.

Total ..... [2]

[Total: 12]

Organisms and environment – answers

Core 1

Name of arthropod	Letter
Anopheles	B
Musca	E
Ornithodorus	C
Pediculus	A
Pulex	D

Core 2

The table shows the correct answers, up to four correct gain credit.

Check carefully that no extra ticks are added.

Leaf	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	Name of tree
A											
B		x				x				x	Quercus
C		x				x			x		Ilex
D		x			x			x			Fraxinus
E		x			x		x				Aesculus
F	x			x							Magnolia

Core 3

a(i) any one of these
amino acid
protein
enzyme
named plant protein
enzyme

(ii) urea

(iii) nitrogen fixing bacteria
in root nodules or roots of leguminous plants or a named example

b(i) <u>nitrogen cycle</u>
plant or crop material removed from field, less material to decay
less nitrates released or formed

<u>crop yield</u>

would gradually decrease over a period of years
less nitrates to form protein or new cells

(ii) add fertilisers or manure
use of leguminous crops or named example

Alternative to Practical 1

a(i) two from 16, 6, 13, 5, 2

(ii) two from 14, 11, 10, 9, 7, 1

b 3 → 16 → 9 → 7 → 1 Links must carry arrows.

c any two from these
- using a fine net / centrifuge / filter / sieve
- detail of how the apparatus is used
- sample soil from the river bed
- details of how this could be sorted
- shine light
- to attract organisms

Extension 1

a(i) any four from

BACTERIA	VIRUSES
have a cell wall	have a protein coat
have DNA (strand)	have RNA or DNA
Are larger	are smaller
have a slime capsule	have no slime capsule
have a membrane	have no membrane
have cytoplasm	have no cytoplasm
Can reproduce outside cells	can only reproduce inside living cells
show all life processes	only show reproduction
Can have flagellum	no flagellum

(ii) any four from

ARACHNIDS	CRUSTACEA
have 4 pairs of legs / 8 legs	have 5 pairs of legs / 10 legs or more
have no antennae	have antennae / have two pairs
have simple eyes	have compound eyes
have chelicerae / poison fangs	have no chelicerae / poison fangs
have a cephalothorax	poorly defined cephalothorax
have thin / no carapace	have thick carapace
breathe with gill / lung books	have gills

(iii) any four from

MONOCOTS	DICOTS
have one cotyledon / food store / seed leaves	have two cotyledons / food stores / seed leaves
have strap-shaped leaves	have broader leaves
flower parts are grouped into threes	flower parts are grouped in 4's / 5's / larger numbers
have fibrous roots	have tap roots
have stomata evenly distributed on both leaf surfaces	have stomata unevenly distributed on leaf surfaces
have vascular bundles scattered	vascular bundles arranged in ring

b three of the following points

named example using genus and species
reference to two names for the organism
reference to genus and species
reference to use in classification

Extension 2

a(i) plants

(ii) any two from
reference to method of nutrition or no chlorophyll
no cellulose cell walls or reference to chitin present
hyphae present or reference to mycelium

b(i) $\frac{56.3}{64.4} \times 100$
= 87.4%

(ii) Possible features

wings / impermeable cuticle or exoskeleton / antennae / 3 pairs of legs / compound eyes / small size / large numbers formed through reproduction

Possible explanations linked to named features

Wings: reference to flying, to find food, to escape from predators, to find a mate

Cuticle: to reduce water loss, to survive in hot or dry places, muscle attachment, protection from predators, protection of internal organs

Antennae: to sense food, early warning of predators, to sense a mate

Small size: easy to hide from predators, only small amounts of food or water needed to survive

Large numbers: some will survive to breed, reference to variation

Spiracles: for ventilation, control of ventilation

Reproduce in large numbers: so some will survive, increases chances of variation to cope with environmental change

c(i) Presence of feathers/beak

(ii) refernce to scales/eyes/tail/mouth/anus

d(I) $\frac{1700000}{100} \times 14.3$
$= 243100$

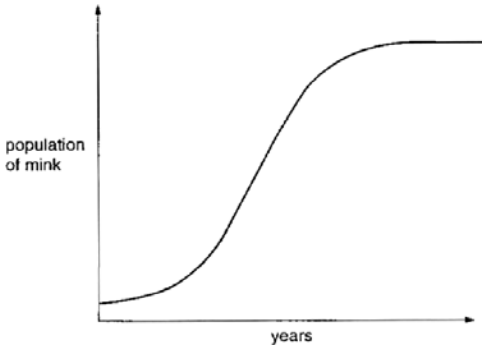
Human influences on the environment

CORE questions

Core 1

In the summer of 1998 about 2000 mink were released from captivity into one area of forest in southern Britain. Mink are aggressive carnivorous mammals.

The graph shows how the population of mink might change over a few years if there were no human interference.



(a) State **three** factors which would cause the mink population to become constant.

1. .....

.....

2. .....

.....

3. .....

..... [3]

(b) It might be expected that a graph for human world population would show a similar pattern. However, it is now thought that the human population will continue to grow steadily. Suggest **three** reasons why this might happen.

1. .....

.....

2. .....

.....

3. .....

..... [3]

[Total : 6]

Core 2

Fig. 1 shows a food web which includes some organisms in the African grasslands.

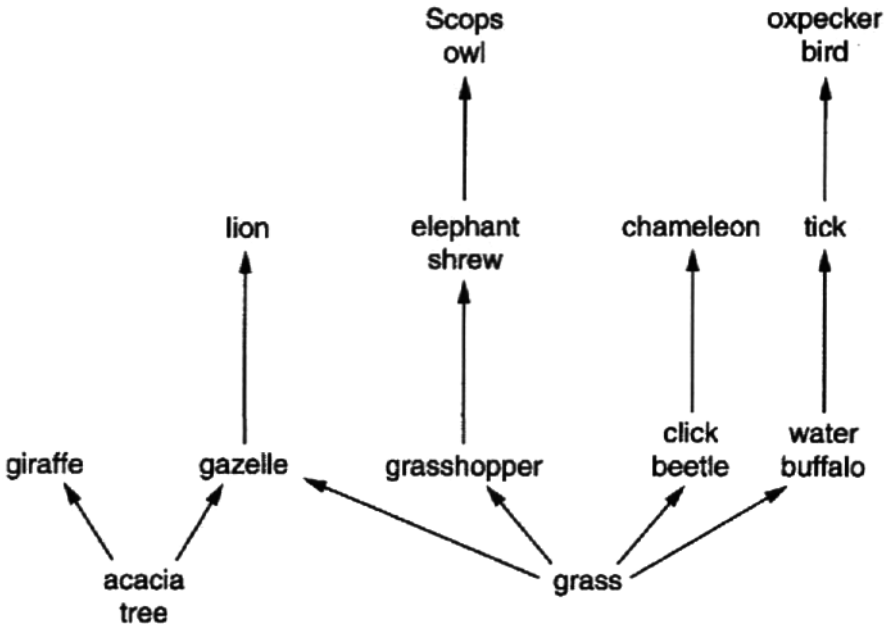


Fig. 1

(a) (i) In the space below draw a food chain consisting of **four** organisms. The organisms must be part of the food web.

[2]

(ii) Using examples from the food web, explain the difference between producers and consumers.

[4]

Core 2

(b) When weather conditions are favourable the grasshopper population can suddenly increase enormously.

Predict and explain the effect this might have on the

(i) Scops owl population;

..... [2]

(ii) water buffalo population;

..... [2]

(iii) giraffe population.

[3]

[Total : 13]

Core 3

Sheep were first taken to the island of Tasmania in 1814. Fig. **2** shows changes in the size of the sheep population in Tasmania between 1818 and 1930.

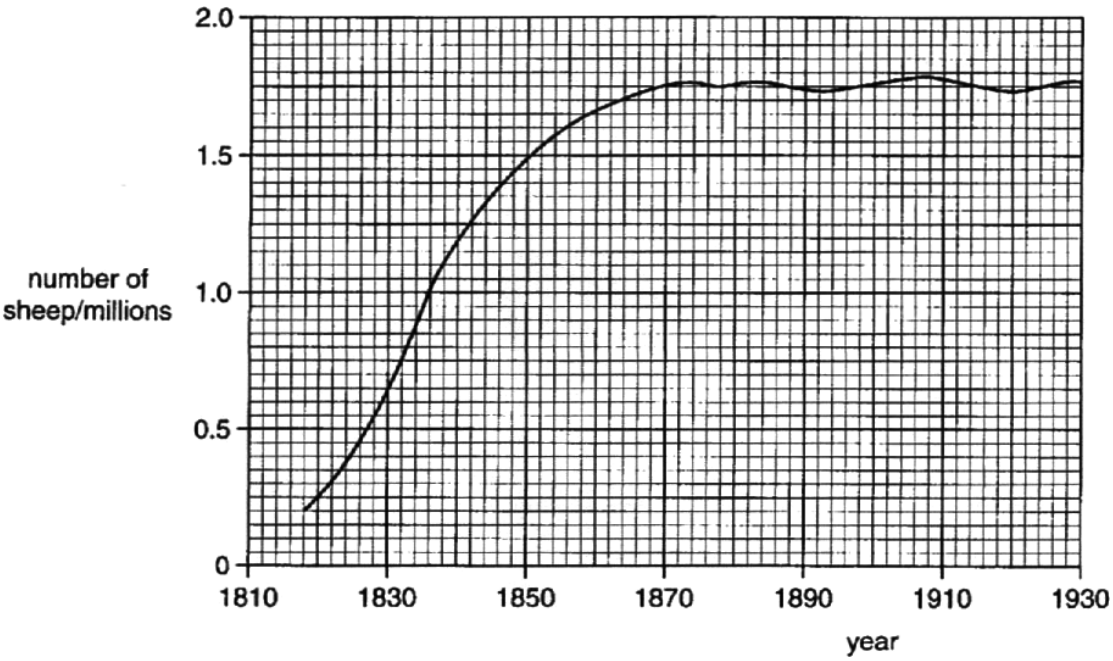


Fig. 2

(a) State the size of the sheep population in 1842.

[1]

(b) (i) Suggest biological reasons for the steep rise in the number of sheep between 1830 and 1840.

..... [2]

(ii) Suggest biological reasons for the shape of the curve between 1870 and 1890.

..... [2]

[Total : 5]

ALTERNATIVE TO PRACTICAL questions

Alternative to Practical 1

Samples of animals living on the surface of logs in a woodland were collected.

The animals found on the top and sides were brushed carefully into a tray.

The animals found on the underside of the logs were brushed carefully into a second tray.

The animals were identified, sorted into groups and counted. This information was recorded in Table 2 1

Table 1

animal group	feeding category	number of animals	
		top and sides of log	underside of log
snails	herbivores	4	3
mites	herbivores	12	9
larvae of flies	herbivores	1	8
centipedes	carnivores	0	5
spiders	carnivores	2	7
beetles	carnivores	2	4
woodlice	detritivores*	2	10
millipedes	detritivores*	1	4

* Detritivores are animals that eat dead matter such as fallen leaves.

(a) (i) Complete Table 2 to show the numbers of animals in each feeding category expressed as a percentage of the total number of animals found on the underside of the logs.

Table 2

feeding category	number of animals found on the underside of the logs	percentage %
Herbivores	20	
Carnivores	16	
Detritivores	14	
Total	50	100

[2]

Alternative to Practical 1

(ii) Using Fig. **3**, construct a pie chart to show the proportion of herbivores, carnivores and detritivores collected from the underside of the logs.

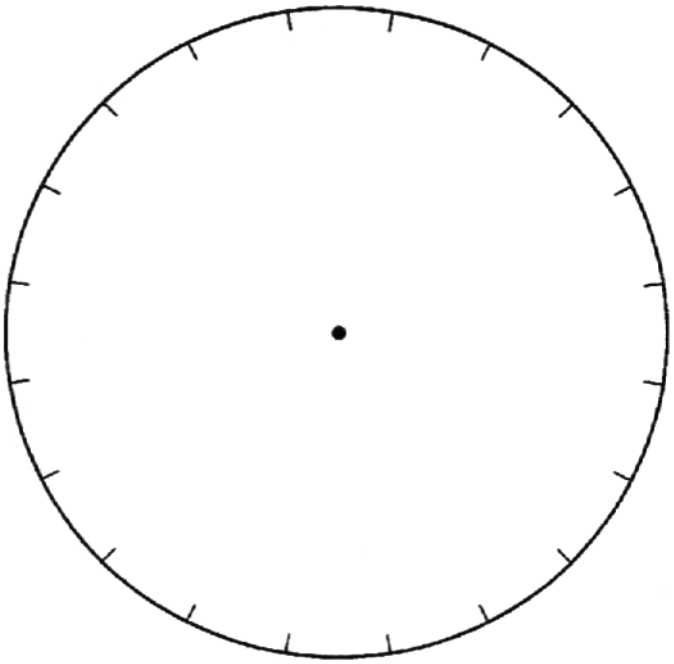


Fig. 3

[2]

(b) Suggest **two** reasons why most animals were found on the underside of the logs.

1. .....

.....

2. .....

.....[2]

(c) Describe an investigation you could carry out to compare the number of animals living amongst fallen leaves in two different woodland habitats.

[4]

[Total : 10]

EXTENSION questions

Extension 1

South Uist is a small island which provides one of the few remaining summer habitats for a bird called the Corncrake (*Crex crex*). It lives in hay fields where it feeds on insects, worms and seeds. South Uist provides a good habitat because there are plenty of hay fields where the Corncrake can nest and there are few predators.

However, a small mammal called the Hedgehog (*Erinaceus europaeus*) was released onto the island. The Hedgehog also has few natural predators and will feed on the eggs of Corncrakes, as well as on insects and worms. The number of Hedgehogs on South Uist has risen rapidly to 10 000 while Corncrakes are becoming endangered as their numbers worldwide are falling.

(a) (i) State **two** features which birds and mammals have in common.

1. .....

2. .....

(ii) State **two** features which distinguish birds from mammals.

1. .....

2. .....

[4]

(b) Suggest why isolated islands such as South Uist are more easily colonised by birds than mammals.

[1]

(c) State **three** reasons why South Uist provides a good habitat for Corncrakes.

1. .....

2. .....

3. ..... [3]

(d) Explain why Corncrakes are becoming endangered by Hedgehogs.

.....

.....

..... [2]

Extension 1

(e) Draw a food web to show the feeding relationships described in the passage. Assume that insects and worms feed on leaves.

[4]

(f) Suggest two ways by which the extinction of the Corncrake may be prevented.

1. .....

.....

2. .....

..... [2]

[Total : 16]

Extension 2

(a) Describe and explain the possible effects of allowing untreated sewage to enter a small lake. [5]

(b) Outline a treatment of sewage which would produce re-usable water. [6]

(c) Describe how a plant living in a dry habitat is adapted to conserve water. [4]

Human influences on the environment – answers

Core 1

a any three of these
- predators of the mink
- competition with other predators for the same food
- prey limited by availability of prey's food
- disease / parasites

b any three of these
- humans have no natural predators
- food supplies may be moved from areas of excess to areas of shortage
- medical advances in disease prevention
- medical advances in curing / treating patients
- humans modify habitats for themselves
- limited use of family planning programmes

Core 2

a(i) grass or plant; grasshopper; water buffalo; elephant shrew; tick; Scops owl / oxpecker; grass or plant; bird

linked by arrows pointing towards the consumers

(ii) named producer example

makes its own food / glucose / gains energy by photosynthesis

named consumer example

gains energy / takes in / eats ready-made food / other organisms

b(i) Scops owl population would rise – plague of grasshoppers would increase elephant shrew population / food if Scops owl will increase

water buffalo population would fall – more grass eaten by grasshoppers / less food available for water buffalo

(ii) grasshoppers eat more grass so less food for gazelles

either gazelles eat more acacia so less food for giraffes and population falls

or gazelle population falls and eats less acacia so more food for giraffes so population rises

Core 3

a 1.25 million

b(i) any two from these
- most of offspring surviving
- little / no competition for / plenty of food / space
- few / no natural parasites / predators / diseases
- no limiting factors

(ii) any two of these

births equal deaths
some factor / food supply limiting / competition for food / space / because of overcrowding
introduction of / increase in parasites / disease / predators / competitor species / deliberate husbandry

Alternative to Practical 1

a(i) in order in the table

40
32
28

(ii) the pie chart should show
correct proportions for the segments
correct order of segments (largest starting at 12 position and going clockwise in decreasing size)

b wet / damp
darkness (or alternative wording)

c to include four of these points
hand search and / or Tullgren funnel
sample standard area
same time of year
identify animals and trophic levels
repetition of samples

Extension 1

a(i) any two from
four limbs
body covering (or alternative wording)
backbone
warm blooded
lungs

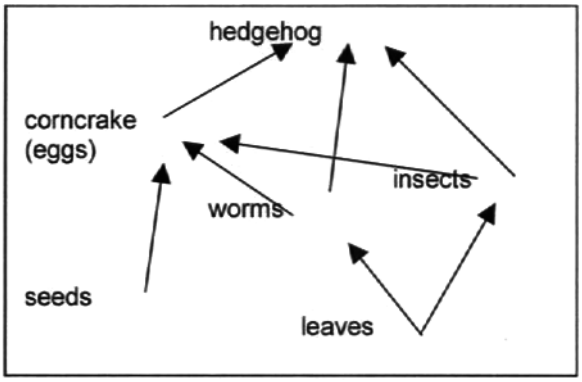
(ii) any two from, provided feature linked to correct group
birds have feathers / animals have fur
birds lay eggs / mammals produce live young
mammals suckle young
birds have a beak
birds have scales on legs

b birds can fly over water or it is difficult for mammals to swim long distances

c few predators present
hay fields present for nesting
hay fields provide a food source (or alternative wording)

d any two of these
hedgehogs eat corncrake eggs
hedgehogs eat the same food / reference to insects or worms
corncrakes nest on the ground

e



f any two of these
- remove / exterminate hedgehogs from the island
- create corncrake sanctuaries (which are hedgehog-fre)
- introduce corncrakes to other islands
- reference to captive breeding programme

Extension 2

a any five of the following points
- reference to the presence of nitrates / phosphates
- effect of above i.e. plants grow faster
- reference to light blocked out for deeper plants
- plants die (linked of the above points)
- dead plants provide food for bacteria
- numbers of bacteria increase
- animals in water die due to lack of oxygen
- bacteria respire (aerobically), using up oxygen
- reference to eutrophication
- reference to possible presence of disease- causing organisms

b any six of the following points
- sewage screened (or alternative wording) to remove large objects
- settling tanks allow grit to settle out
- sludge allowed to settle out
- reference to anaerobic conditions killing aerobic pathogens, linked to above
- remaining liquid sprayed onto stones or clinker
- reference to presence of protoctists / bacteria
- microorganisms feed on sewage
- harmful substances removed, linked to above
- reference to aerobic stage killing many anaerobic bacteria
- reference to clear water effluent produced (or alternative wording)
- reference to chlorination

c any four of these
- thick cuticle
- reduced number of stomata
- stomata only open at night
- rolled leaves
- hairs on leaves
- leaves reduced to spines
- deep or long roots
- fleshy stem