



A-Level Biology Question and Answers 2020/2021

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* = topics that contain interactive resources, multiple choice questions or audio files. To interact with this content, please go to www.s-cool.co.uk/biology.

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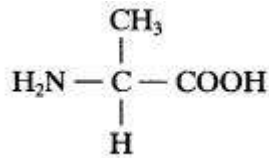
Topics that only contain interactive questions

These topics only contain interactive questions such as animations, multiple choice or audio files. To interact with this content, please go to www.s-cool.co.uk/biology.

- Applications of Genetic Engineering
- Genetics
- Health & Disease
- Making use of the genetic code

Biological Molecules and Enzymes (Questions)

1. a) The diagram shows the formula of a molecule of an organic compound.



(i) To which group of organic compounds does this molecule belong?

(1 mark)

(ii) Give one way in which this molecule differs from other compounds in the group.

(1 mark)

b) The table shows some of the organic compounds found in a bacterial cell.

Compound Percentage of total dry mass Number of different types of molecule

Protein	55	1050
RNA	20.5	463
DNA	3.1	1
Lipid	9.1	4
Glycogen	2.5	1

(i) Glycogen and protein are both polymers. Explain why there can only be one type of glycogen molecule, but there can be many types of protein.

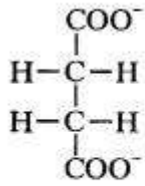
(2 mark)

(ii) Explain why there are many types of RNA found in this cell.

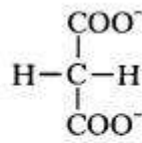
(2 mark)

(Marks available: 6)

2. Succinate is converted to fumarate by the enzyme dehydrogenase. This reaction can be inhibited by adding malonate.



Succinate



Malonate

a) Use this information to explain how malonate acts as an inhibitor.

(2 marks)

b) In an investigation succinate dehydrogenase is mixed with a solution containing both succinate and malonate.

What will happen to the rate of fumarate production when the concentration of succinate is increased?

(2 marks)

(Marks available: 4)

3. (a) Give two functions of proteins in cell surface membranes.

(2 marks)

b) The composition of the inner and outer membranes of a mitochondrion is shown in the table.

	Phospholipid %	Protein %
Outer Membrane	45	55
Inner Membrane	25	75

Suggest an explanation for the difference in the percentage of protein present in the two mitochondrial membranes.

(2 marks)

(Marks available: 4)

Biological Molecules and Enzymes (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) (i) Amino acid.

(ii) Possession of CH₃ group/different R group.

(2 marks)

b) (i) Glycogen consists of glucose/one type of monomer.

Many different amino acids combine to form proteins.

(ii) Include messenger and transfer RNA.

Each gene gives/each protein will be derived from a different messenger RNA.

Each amino acid has a different transfer RNA.

(Max 4 marks)

(Marks available: 6 marks)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) Similar (chemical) structure and shape.

Competes for active site.

(2 marks)

b) Increased rate of fumarate production.

Less competition at active site.

(2 marks)

(Marks available: 4 marks)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a) Carrier molecule; enzyme.

Receptor site for hormones/antibodies.

Transport gate/channel protein.

Antibody.

(max 2 marks)

b) More protein, more enzyme/channel protein.

Used in oxidative phosphorylation/production of ATP/electron transport chain.

(2 marks)

(Marks available: 4)

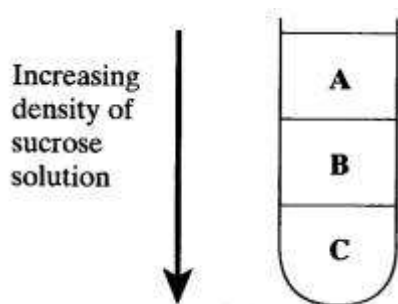
Cells and Organelles (Questions)

1. Cell organelles can be separated by centrifuging a cell extract in a sucrose density gradient. The organelles settle at the level in the sucrose solution which has the same density as their own.

Some animal cells were broken open and the cell extract centrifuged in a sucrose density gradient.

Three distinct fractions were obtained, A, B and C, as shown in the diagram: Some animal cells were broken open and the cell extract centrifuged in a sucrose density gradient.

Three distinct fractions were obtained, A, B and C, as shown in the diagram:



One fraction contained nuclei, one contained ribosomes and a third contained mitochondria.

a) Identify the organelles (i), (iii) and (v) in each fraction and describe one function of each (ii), (iv) and (vi).

Fraction Organelle Function

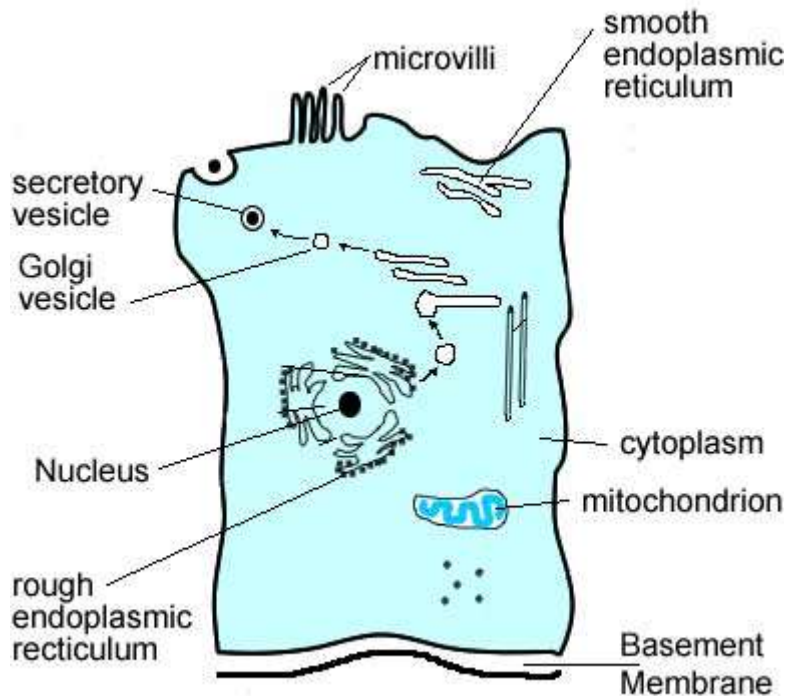
A (i) (ii)

B (iii) (iv)

C (v) (vi)

(Marks available: 4)

2. The diagram shows an epithelial cell from the small intestine of a mammal, as seen with an electron microscope.



a)

(i) Suggest **one** way in which the functions of the rough and smooth endoplasmic reticulum differ.

(ii) Give the evidence from the diagram which supports your answer.

b) Explain how two features visible in the diagram are adaptations for the absorption of products of digestion

(Marks available: 4)

3. Write an essay on how the ultrastructure of different cells is related to their functions.

(Marks available: 25)

Cells and Organelles (Answers)

Answer outline and marking scheme for question: 1

a) Give yourself marks for mentioning any of the points below:

(i) Ribosomes

(ii) Making proteins/assembling amino acid chain/protein synthesis

(iii) Mitochondria

(iv) Respiration/ formation of ATP/ Krebs cycle/ Oxidative phosphorylation.

(v) Nuclei

(vi) DNA/RNA synthesis/ controls protein production/ cell activity/ carries genetic information.

(Marks available: 4)

(1 mark for knowing names of all organelles, and 1 mark for each function explained).

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) (i) Rough ER associated with protein production/ smoother associated with transport.

(ii) Ribosomes present/absent.

(2 marks)

b) Microvilli increase surface area;

Mitochondria involved with active uptake.

(2 marks)

(Marks available: 4)

Answer outline and marking scheme for question: 3

You can give yourself up to 2 marks for discussing any of the following issues, up to a maximum of 16:

General principles

Describe the structure of a eukaryotic cell;

Suitably describe (differences between) plant and animal cells;

Explain structure of prokaryotic cells OR distinguishes them from eukaryotic;

Organelles and their specific functions.

Describe cell wall in plants/prokaryotic cells, including its structure & role in protecting the cell from osmotic damage/ example of cell in which specialised;

Discuss membrane, internal and external, with role in controlling movement of substances/ reference to specialisation (e.g. brush border in absorptive cells);

Describe nucleus, including associated structures related to nuclear function, such as centrioles in nuclear division, or nucleoli;

Describe mitochondria, including structure and functions of matrix and cristae, and example(s) of cells in which they are either numerous or absent;

Describe chloroplasts, including structure and functions of grana and stroma, including example(s) of plant cells in which they are numerous or absent;

Describe endoplasmic reticulum and ribosomes, including their structure and functions, and examples of cells in which they are prominent;

Specific examples of cells with particular functions.

Describe secretory/nerve cell with explanation of ultrastructure relevant to particular aspects of function such as golgi complex/ synapse;

Outline muscle structure/sliding filament hypothesis, related to its function;

Discuss (compare) the structure of male (and female) gamete, and relates differences to function (e.g. flagellum/acrosome);

Give other suitable example, relating ultrastructure to function;

Breadth (max 3 marks)

Deals with prokaryotic and eukaryotic cells;

Describe at least 3 different cells in relating structure to function;

Consider the full range of organelles (in diagram or writing).

Depth (max 3 marks)

Give clear diagram of eukaryotic cell;

Make clear link between structure and function for on cell;

Make clear comparison of two cells that relate structure and function.

In the real exam you will also be awarded marks for quality of language (in this case, there were 3 marks available). It may be difficult for you to judge your own text; however you may be able to get someone else to give you an opinion.

(Marks available: 25)

Classification (Questions)

1. a) Define the following terms:

(i) Species.

(ii) Genus.

b) (i) Who devised the binomial system for naming organisms?

(ii) Why is this system useful for classification?

(Marks available: 4)

2. Define the following terms:

a) (i) Diploblastic.

(ii) Triploblastic.

b) Name two advantages that having a coelom gives an organism.

(Marks available: 4)

3. a) What is phylogenetic classification?

b) List the five kingdoms and give an example of the type of organism belonging to each kingdom.

(Marks available: 6)

Classification (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) (i) All members of a species are capable of interbreeding to produce fertile offspring. A species will have a particular set of characteristics.

(ii) A genus is a group of similar or closely related species.

(2 marks)

b) (i) Carl von Linne/Linnaeus.

(ii) Closely related species are grouped together.

Latin is used so there is no language barrier; the organism only has one 'true' name.

(2 marks)

(Marks available: 4)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) (i) An animal possessing 2 major tissue layers. These include the outer layer (the ectoderm) and the inner layer (the endoderm).

(ii) An animal possessing 3 major tissue layers. It has a middle layer (the mesoderm), between the endoderm and the ectoderm.

(2 marks)

b) Choose from:

It enables independent movement of the gut wall and the body wall.

It provides space for the enlargement and development of internal organs.

It may act as a circulatory medium for transport of materials or a storage area of excess or waste materials.

(2 marks)

(Marks available: 4)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a) A system of classification that reflects the evolution of organisms.

(1 mark)

b) Monera: Bacteria/cyanobacteria

Protocista: Algae/protozoa.

Fungi: Mould/yeast/mushrooms

Plantae: Angiosperms/ferns/conifers

Animalia: Sponges/flatworms/mammals

(5 marks)

(Marks available: 6)

DNA and the Genetic Code (Questions)

1. a) Draw and label a simple diagram of an RNA nucleotide containing uracil.

In 1961 biologists made synthetic mRNA. When they produced mRNA containing only uracil nucleotides, it coded for one type of amino acid, phenylalanine. When mRNA was produced with alternating uracil and guanine nucleotides, two types of amino acid were coded for, valine and cysteine. This is summarised in the table.

Nucleotide sequence in mRNA Amino acids coded for

UUUUUUUUUUUUUUUUU phenylalanine

UGUGUGUGUGUGUGUGU valine and cysteine

b) For the amino acid phenylalanine what is?

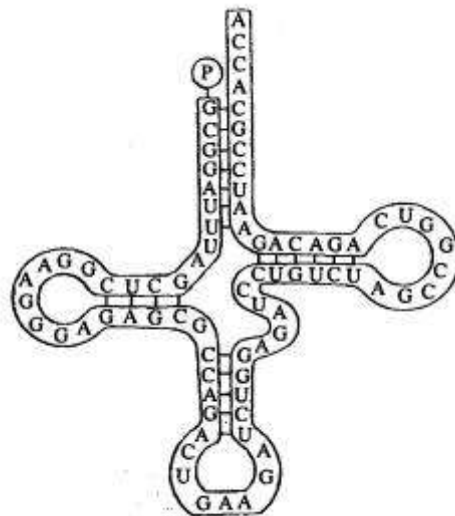
(i) the corresponding DNA base sequence,

(ii) the tRNA anticodon?

c) Explain how the information in the table supports the idea of a triplet code.

(Marks available: 8)

2. The diagram shows the structure of a tRNA molecule.



- a)** Give two ways in which the structure of a tRNA molecule differs from that of a DNA molecule.
- b)** Explain how the specific shape of the tRNA molecule shown in the diagram is determined by the pattern of bonding.
- c) (i)** Give the base sequence of the anticodon of this tRNA molecule.
- (ii)** Which mRNA codon would correspond to this anticodon?

(Marks available: 6)

3. Write an essay on:

Now nucleic acids are suited to their functions in living organisms.

(Marks available: 25)

DNA and the Genetic Code (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for the following:

a) Drawing shows phosphate, pentose and uracil;
arranged in correct sequence;
details of molecular structure correct;

(3 marks)

b) (i) AAA

(ii) AAA

(2 marks)

c) Single base coding for 4 amino acids;
double base coding for 42 amino acids;
GUG/UGU for valine;
UGU/GUG for cysteine;
only possible code UUU for phenylalanine.

(3 marks)

(Marks available: 8)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) ribose/deoxyribose;
single strand/double strand/helix;
uracil/thymine

(max 2 marks)

(b) bases pair by hydrogen bonding;
complementary pairing/GC/UA;
clover leaf shapes have no bonds/not compatible.

(max 2 marks)

c) (i) GAA

(ii) CUU

(2 marks)

(Marks available: 6)

Answer outline and marking scheme for question: 3

You can give yourself up to 2 marks for discussing any of the following issues in A, B, C and D up to a maximum of 16:

a) Types and structure of nucleic acid:

1. The types of nucleic acids - DNA, mRNA, tRNA;
2. The basic structure of a nucleic acid (e.g. DNA) -nucleotide chain, sugar phosphate backbone;
3. How DNA and RNA are different (to include both U vs T and ribose vs deoxyribose).

b) Storage of genetic information:

1. DNA is stable - because it has a double-stranded structure/is retained in the (eukaryote) nucleus - so is less likely to be corrupted;
2. mRNA is labile, (because it is single-stranded) so it is 'around' to promote (specific) protein synthesis for only a limited amount of time;
3. Explanation of general structure of tRNA/need for having a range of tRNA molecules.

c) Genetic information is able to be copied/transcribed:

1. Explanation of complementary base pairing - principle and detail - A=T (U), G=C;
2. Nature of replication of DNA (idea of 'accuracy' in mitosis/semi-conservative nature);
3. Nature of transcription of mRNA (location, enzymic process).

d) Genetic information is used in protein synthesis:

1. Principle of coding/information transfer/'central dogma' (DNA to RNA to protein);
2. Details of the genetic code - triplet per amino acid, idea of 'dictionary' , sense and nonsense;
3. Way in which the sequence of nucleotides in DNA controls/is translated into - the amino acid sequence in a polypeptide gene product;
4. Way in which a change in DNA sequence may alter the gene product/its potential activity.

Breadth (max 3 marks)

Does the answer appropriately:

- deal with each of DNA, mRNA and tRNA?
- locate the different processes in the cell?
- Consider the breadth of functions (C & D)?

Selection of appropriate material ('Depth') (max 3 marks)

Does the answer appropriately:

- describe / give diagram of NA structure?
- distinguish transcription & translation?
- and fully explain the process of translation?

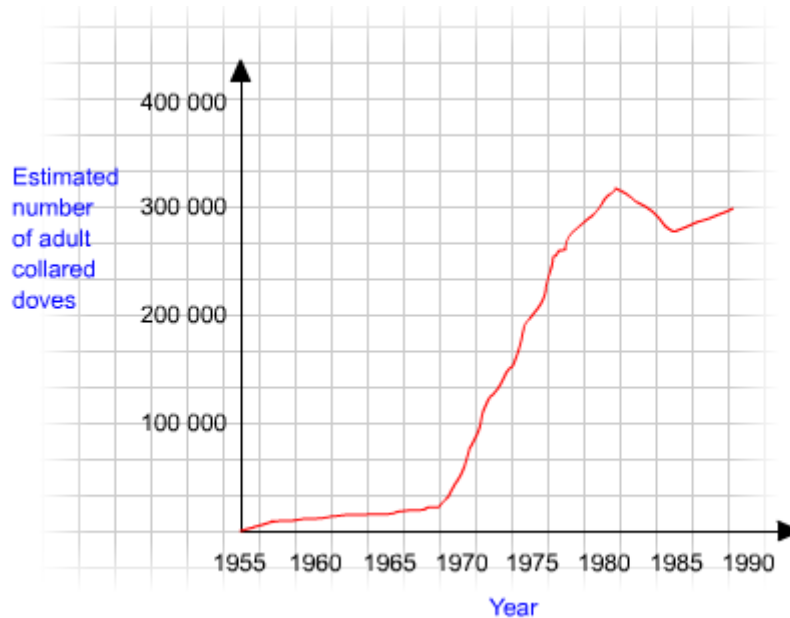
(Award one mark within each category for each point to maximum of 3)

In the real exam you will also be awarded marks for quality of language (in this case, there were 3 marks available). It may be difficult for you to judge your own text; however you may be able to get someone else to give you an opinion.

(Marks available: 25)

Ecological Concepts (Questions)

1. The graph shows the changes in the size of the collared dove population in Britain following the introduction of these birds in 1955.

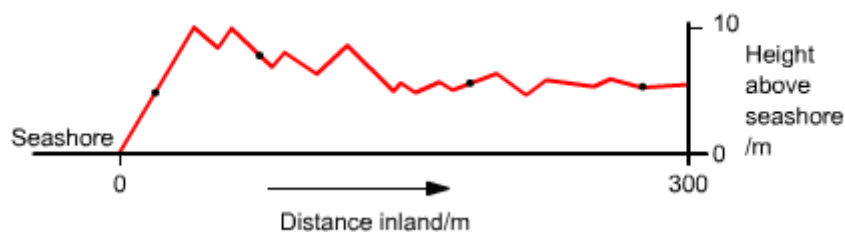


- a) Describe the pattern of population growth shown in the graph.
- b) Explain how a named density dependent factor might have affected population size in the 1980s.

(Marks available:

2. The diagram shows a profile along a transect showing succession on some coastal sand dunes.

Point	A	B	C	D
Index of diversity	1	2.3	5.4	6.1



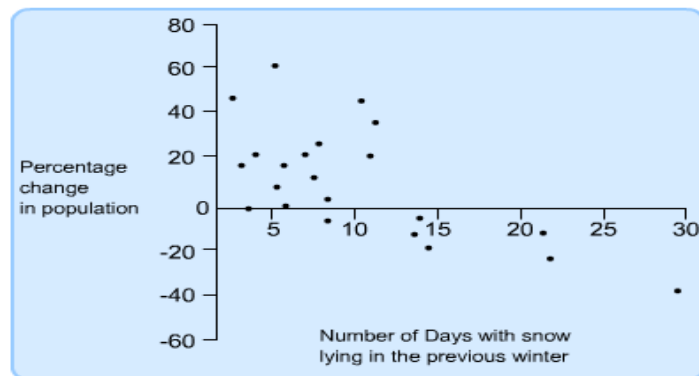
a) What data must be collected in order to be able to calculate an index of diversity of plants at one of the points along the transect?

b) Suggest an explanation for the trend in diversity along the transect.

(Marks available: 5)

3. The wren is a small, insect-eating bird. The percentage change in size of the wren population from one year to the next was estimated over a number of years.

The number of days with snow lying in the previous winter was also recorded. This information is shown on the graph.



a) (i) Describe the relationship between the number of days with snow lying and the change in population size.

(ii) Suggest and explain a reason for this relationship.

b) A comparison was made between the number of breeding pairs of wrens each year and their breeding success.

Number of breeding pairs of wrens/ millions Percentage increase in population size

1.2 55

1.9 48

2.5 35

2.9	25
3.9	2

Suggest an explanation for the relationship between the size of the breeding population and breeding success.

(Marks available: 6)

Ecological Concepts (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) Description contains elements of slow increase and stability/slight decline;

Quantitative definition of change in rate of increase and peak.

(2 marks)

b) Identity of an appropriate density dependant factor (e.g. food supply/predation)

When population at high density leads to decrease;

When population at low density allows recovery.

(3 marks)

(Marks available: 5)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) The number of different plants/organisms of each species present;

Total number of species/plants of all species.

(2 marks)

b) Harsher/less stable environmental conditions at start;

Such as dry sand/high salt content/low nitrate/humus;

Few species able to tolerate these conditions.

(3 marks)

(Marks available: 5)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a) (i) The more days of snow the lower the increase in the population/fewer birds (or converse).

Negative correlation/above 11-13 days of snow.

Negative change/decrease in population.

(ii) Fewer birds to breed.

Explanation using data (e.g. food hidden under snow/too cold for birds to survive).

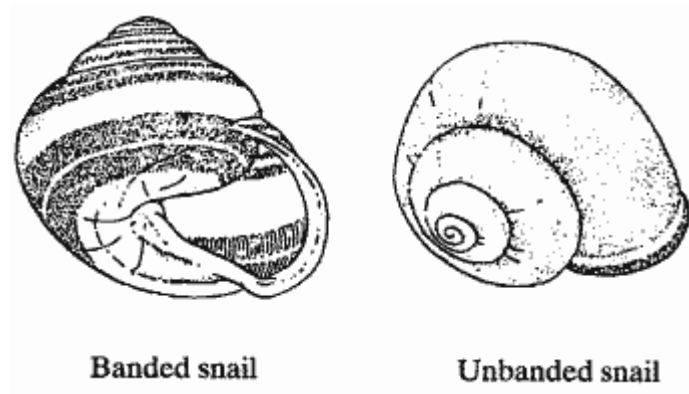
b) More breeding pairs produces more competition.

Less breeding success.

(Marks available: 6)

Evolution (Questions)

1. *Cepaea nemoralis* is a common British snail which is found in a variety of habitats. The shells of this species of snail vary in the pattern of dark bands found on the surface. The drawings show a banded snail and an unbanded snail.



Song thrushes feed on these snails. A bird finds a snail and takes it to a suitable stone known as an anvil. It hits the snail shell against the stone, breaks it open and eats the soft parts. The remains of the shell can be found on the ground near the thrush's anvil stone.

In one investigation, two areas of woodland floor were cleared of all snails and equal numbers of banded and unbanded snails were then introduced. Over the next two weeks the snail shells found around the anvil stones in one area were compared with the shells of living snails found in a control area where there were no thrushes. The results are shown in the table.

	Number of unbanded snails	Number of banded snails
Snail shells found around anvil stones	153	264
Shells of living snails found in control area	204	217

- a) Describe and explain the effect of predation by thrushes on the snails in this investigation.
- b) The presence of bands on the shells of *C. nemoralis* is controlled by a single gene with two alleles. Explain how natural selection might account for different proportions of these alleles.

Explain how natural selection might account for different proportions of these alleles in different habitats.

- c) In order to collect the sample of living snails in the control area, quadrats were placed at random in the area and all the snails found in the quadrat were collected.

Explain why it is necessary to:

(i) Place the quadrats at random;

(ii) Ensure that every snail found within the quadrat was collected.

d) In a separate investigation, the population of *C. nemoralis* was estimated using the mark-release-recapture method.

(i) Giving a reason for your answer, describe where on the shell you would mark the snails.

(ii) Explain why the results would be more accurate if there was only a short time between releasing the marked snails and catching the second sample.

(Marks available: 8)

2. Write an essay on the causes and nature of the variation on which natural selection depends.

(Marks available: 25)

3. Write an essay on:

The interactions between organisms of the same and different species

(Marks available: 25)

Evolution (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) Take higher proportion of banded snails;
Unbanded better camouflaged/less conspicuous
to predators.

(2 marks)

b) Different proportions of banded and Unbanded snails survive in different habitats;
Able to breed and pass on selected alleles/genes.

(2 marks)

c) (i) Avoid bias/get representative sample/enable
statistical test to be applied

(ii) Otherwise more conspicuous snails might be
collected.

(2 marks)

d) (i) Mark undersurface/inside lip otherwise they will be more conspicuous/likely to be predated/harm the
animal.

(ii) They would be removed from the population by the thrushes/snails dying/immigration/emigration/breeding.

(2 marks)

(Marks available: 8)

Answer outline and marking scheme for question: 2

You can give yourself up to 2 marks for discussing any of the following issues up to a maximum of 16:

Nature of variation:

- Clear explanation of continuous variation, including the idea of frequency distribution.
- Explanation of the roles of genetics .and. the environment in producing variation;

- Continuous variation -accounted for in terms of polygenic characters.

Causes of variation:

- Reshuffling of genes via sexual reproduction e.g. meiosis, independent assortment, crossing over, random fertilisation - (any two of these);
- Mutation as the random/main cause of (persistent) variation affecting natural selection;
- Types of mutation explained (chromosomal and gene) OR given in terms of heritability i.e. germ cf. somatic cell mutation;
- Cause of mutation (high energy radiation/ particles OR named chemical mutagen);
- Gene mutation as the result of a change in (sequence of bases) in DNA which may result in change in the (amino acid sequence of a) polypeptide;
- Such a change in polypeptide structure may result in change in way protein functions;

Variation in relation to Natural Selection:

- Explain how (any 2 of) predation, disease, competition give differential survival/reproduction;
- Explain that organisms with selective advantages are more likely to survive, reproduce and pass on their genes to the next generation;
- Explain how the process of natural selection may result in changes in the allele and phenotype frequency and may lead to the formation of new species;
- Quote a specific example to explain how variation is acted upon via natural selection to produce changes within species.

Breadth (max 3 marks)

Does the answer appropriately:

- Distinguish continuous/discontinuous variation.
- Consider variation in relation to natural selection.
- Show a wide view of causes of variation.

Depth (max 3 marks)

Does the answer appropriately explain?

- Effects of genetics or environment on variation.
- That genetic variation/mutation is necessary for natural selection.
- Consider variation in terms of DNA.

(Marks available: 25)

Answer outline and marking scheme for question: 3

You can give yourself up to 2 marks for discussing any of the following issues in A, B, C and D up to a maximum of 16:

A. General:

1. Explain that interactions may (profoundly) influence the distribution OR size of populations;
2. Make clear that an ecosystem can only support a certain size of population, which varies according to limiting factors;
3. Gives factors affecting population size (3 or more of) food supply space, light, predation and disease;
4. Explains niche - position or status of organism within community resulting from its adaptations, physiology and behaviour, including its energy source, period of activity etc.

B. Types of interaction:

1. Explains predation, giving nature and example, and balance between predator/prey populations (relative population sizes, that are rarely stable, and periodically fluctuate);
2. Explains principle of competition - i.e. when niches overlap - interactions between populations in which each adversely affects the other (in e.g. food, nutrients, space, light, or other common need);
3. General explanation of (1 interspecific) association - parasitism, commensalisms, mutualism (symbiosis);
4. Pollination/dispersal - discussion of either, with a suitable example;
5. Suitably explains coloration -cryptic or disruptive example;
6. Suitably explains mimicry and warning coloration, with example of Batesian, Mullerian, automimicry.

C. Inter and intraspecific interactions:

1. Detailed example of one interspecific association e.g. parasitism or mutualism;
2. Suitable example of intraspecific association e.g. social organisation in insects, or in mammals;
3. Clear explanation of interspecific competition with suitable example;
4. Clear explanation of intraspecific competition with suitable example.

D. Possible additional areas:

1. Suitably thorough treatment of human influence, with e.g. explanation of biological control;
2. Suitable treatment of competition in relation to natural selection - competitive exclusion, specialization through competition, competition and evolution.

Breadth (3 marks)

Does the answer appropriately:

- deal with a full range of factors (in A3)?
- give examples for both animals and plants?
- discuss at least 4 types of interaction?

(Selection of appropriate material Depth) (3 marks)

Does the answer appropriately:

- make clear the concept of a niche?
- distinguish interspecific/intraspecific interaction?
- distinguish density independent and dependent factors?

In the real exam you will also be awarded marks for quality of language (in this case, there were 3 marks available). It may be difficult for you to judge your own text; however you may be able to get someone else to give you an opinion.

(Marks available: 25)

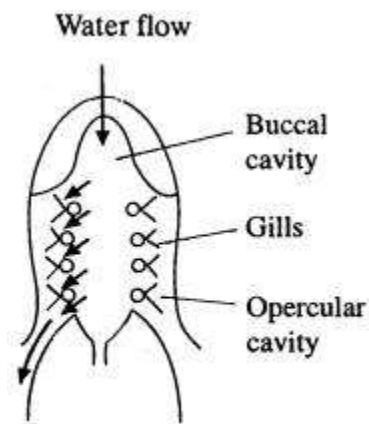
Gas Exchange (Questions) *

1. a) (i) Give one similarity between the way in which oxygen from the atmosphere reaches a muscle in an insect and the way it reaches a mesophyll cell in a leaf.

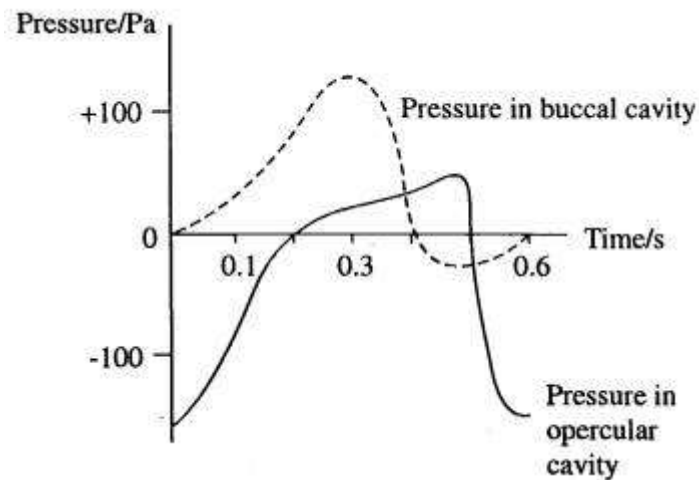
(ii) Give one difference in the way in which carbon dioxide is removed from a muscle in an insect and the way in which it is removed from a muscle in a fish.

(2 marks)

The diagram shows the way in which water flows over the gills of a fish.



The graph below shows the changes in pressure in the buccal cavity and in the opercular cavity during a ventilation cycle.



b) Use the graph to calculate the rate of ventilation in cycles per second.

(1 mark)

c) For most of this ventilation cycle, water will be flowing in one direction over the gills explain the evidence from the graph that supports this.

(2 marks)

d) Explain how the fish increases pressure in the buccal cavity.

(2 marks)

(Marks available: 7)

2. The diagram shows a chamber set up for an investigation into the movement of woodlice in response to humidity.

Eleven chambers were set up, each with a different relative humidity obtained by using different concentrations of a solution in the base of the chamber. A woodlouse was placed in each chamber.

The rate of movement was recorded. This was repeated ten times for each of the chambers using different woodlice each time, and the means were plotted on a graph.

a) Explain how the response shown increases the chance of survival of woodlice in natural conditions.

(2 marks)

b) (i) Suggest why woodlice were kept in a dry environment for a short time before the investigation was carried out.

(ii) suggest why different woodlice were used each time.

(2 marks)

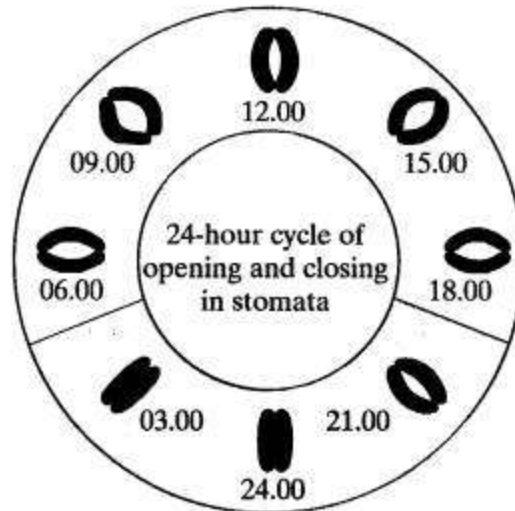
c) (i) name the type of behaviour observed in this investigation.

(ii) Give a reason for your answer.

(2 marks)

(Marks available: 6)

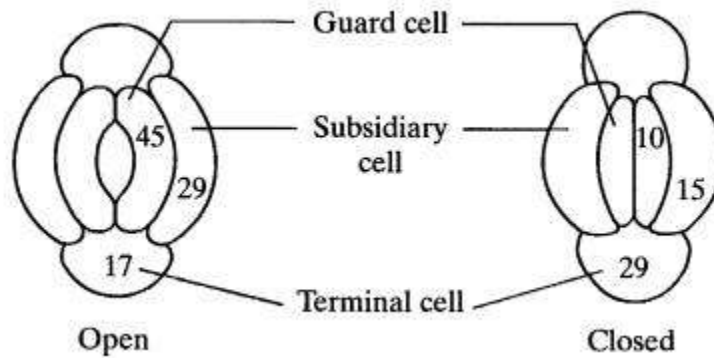
3. The drawing shows a 24-hour cycle for the opening and closing of stomata from the same plant.



a) Explain how this opening and closing of stomata is advantageous to the plant.

(2 marks)

b) The diagram shows the potassium (K^+) ion concentrations in the cells around an open and closed stoma in Commelina. The concentrations are in arbitrary units.



(i) Explain how the movement of K^+ ions accounts for the opening of the stoma.

(ii) Explain how K^+ ions are moved against a concentration gradient.

(5 marks)

(Marks available: 7)

Gas Exchange (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) (i) Diffuses (directly to cells concerned).

(ii) Transported in blood of a fish/lost through gills in fish/through tracheae/spiracle in insect.

(2 marks)

b) 100 (cycles per minute)

(1 mark)

c) Water will flow from high pressure to low pressure; pressure in buccal cavity is higher than in opercular cavity.

(2 marks)

d) Muscles surrounding buccal cavity contract; mouth shuts; floor of buccal cavity rises/volume decreases.

(2 marks)

(Marks available: 7)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) Move faster in environment where they are more likely to desiccate/dry/slower in environments where no dehydration occurs; increases chance of finding suitable environment/remaining in a favourable environment.

(2 marks)

b) (i) To make them more active (at the beginning of the experiment) animals all in same state of hydration at beginning.

(ii) Natural variation in response/large sample enables the typical response to be found.

(2 marks)

c) (i) kinesis

(ii) (Rate of movement) related to intensity of a stimulus.

(2 marks)

(Marks available: 6)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a)

Open during the day to allow entry of carbon dioxide;

Closed at night/midday to reduce transpiration/evaporation/water loss.

b)

(i) K^+ ions move into guard cells;

Water potential of guard cells becomes more negative;

Water enters;

How uptake of water causes stoma to open;

(ii) Energy/respiration/ATP/active transport;

Intrinsic proteins/carriers/channels.

(5 marks)

(Marks available: 7)

Genetic Engineering (Questions)

1. Read the following passage and then answer the questions that follow.

Cancers occur when cell division gets out of control. Faults in a gene called p53 are associated with nearly all cancers. A test that could be used to detect a faulty p53 gene would obviously be a good idea.

There are genes in a cell that prevent it dividing. The protein produced by the p53 gene switches on these genes and so stops cell division. If p53 stops working the cell is likely to become cancerous.

Faulty p53 can now be detected simply and cheaply with a test based on yeast. The test is much cheaper than gene sequencing. It is much more reliable because knowing the sequence of bases in a DNA molecule does not allow us to distinguish harmless mutations from potentially harmful ones.

The new test works by inserting the p53 gene into yeast DNA in which another gene, called ADE2 has been inserted. If the p53 gene works, it switches on the ADE2 gene. As a result the yeast cells appear white in colour. If the p53 gene does not work, the ADE2 gene is not switched and the yeast cells appear red in colour.

- a) (i)** Draw a simple flow chart to show how the p53 gene helps to prevent cancer.
- (ii)** Explain how the product of the ADE2 gene might act to change the colour of the yeast cells.
- b)** Explain what is meant by gene sequencing.

(Marks available: 5)

2. One of the aims of genetic engineering is to produce a protein as cheaply and easily as possible.

In order to do this, the gene that triggers production of the desired protein is inserted into a host organism.

- a)** State three reasons why bacteria make good host organisms.
- b) (i)** Define a vector in relation to genetic engineering?
- (ii)** Define a plasmid in relation to genetic engineering?

(Marks available: 5)

- 3. a) (i)** What is non-coding DNA?
- (ii)** Why is non-coding DNA used in genetic fingerprinting?
- b)** Suggest two uses for genetic fingerprinting.

(Marks available: 4)

Genetic Engineering (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) (i) Flow chart showing:

p53 gene produces protein.

Protein switches on gene preventing cell division.

(ii) Red products converted into white;

ADE2 controls enzymes governing this step.

(4 marks)

b) Determining base and sequence (of gene)

(1 mark)

(Marks available: 5)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) Asexual reproduction, parent cells produce identical daughter cells.

Grow quickly.

Easily manipulated.

Has simple chromosome.

Contains plasmids.

(3 marks)

b) (i) A carrier DNA molecule, the desired gene can be inserted.

(ii) A small extrachromosomal circular piece of DNA naturally found in bacteria. Often used as a vector.

(2 marks)

(Marks available: 5)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a) (i) Does not code for a protein.

(ii) Contains repetitive sequence of bases/variable number tandem repeats

The size of these VNTRs varies according to the individual. Half come from one parent half from the other. only identical twins have the same VNTRs.

b) Identifying particular plants/animals with particular alleles of a gene for selective breeding.

Identifying a particular microbe so correct treatment can be given.

Establishing paternity

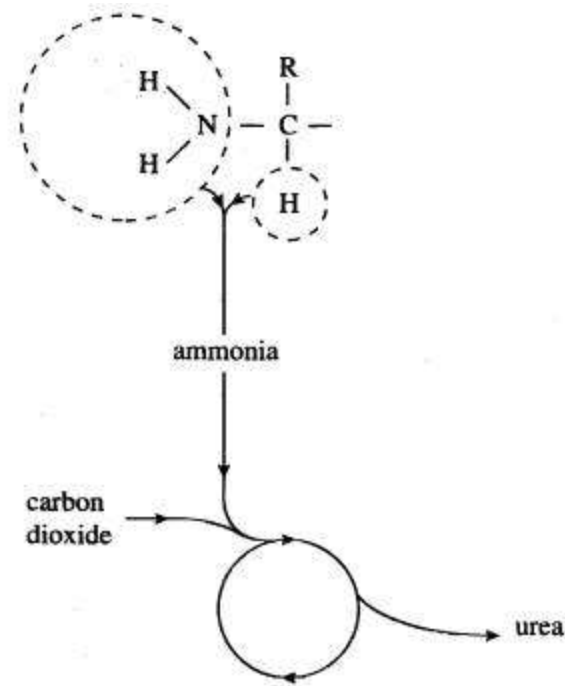
Confirming animal pedigrees.

Establishing genetic diversity for gene banking.

(Marks available: 4)

Homeostasis (Questions) *

1. The diagram shows the process by which urea is formed from an amino acid.



a) (i) Complete the diagram to show the chemical structure of the amino acid.

(ii) Name the cycle of reactions in which urea is produced from ammonia.

b) In a mammalian kidney, the concentration of urea in the filtrate at the beginning of the collecting duct is approximately thirty times that of the urea in the blood plasma. At the end of the collecting duct it is approximately fifty times that of the blood.

Explain what causes the change in urea concentration along the collecting duct.

(Marks available: 4)

2. The diagram shows the main blood vessels going to and from the liver.

a) In a healthy person the blood glucose level in the hepatic vein fluctuates much less than that in the hepatic portal vein.

Explain why this is so.

b) Blood sugar level is more or less consistent, even if a person has not eaten for several days.

How does gluconeogenesis help to maintain this constant blood sugar level?

c) Suggest why people suffering from diabetes are advised to eat their carbohydrates in the form of starch rather than sugars.

(Marks available: 6)

3. The photo shows an African elephant.

a) (i) Explain why a large mammal such as an elephant might be expected to experience difficulties in regulating its body temperature in a hot climate.

ii) There are many blood vessels just below the surface of the skin on the back of an elephant's ears.

Suggest how this might help an elephant to regulate its body temperature.

b) In many parts of Africa, the year is divided into a wet and a dry season. Elephants often move from one habitat in the dry season to another in the wet season.

Name this type of movement.

(Marks available: 7)

Homeostasis (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) (i) The diagram is completed with a COOH group.

(ii) Ornithine cycle.

(2 marks)

b) Ammonia is extremely toxic.

Can only be handled by the body if sufficiently dilute.

Large amounts of water are available in the body.

(2 marks)

(Marks available: 4)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) Blood glucose in hepatic portal vein increases after a meal/variable absorption from gut.

Excess glucose; converted to glycogen in the liver.

Insufficient glucose; liver glycogen broken down.

(3 marks)

b) Glucose produced from molecules other than glycogen.

Produced from lipids/proteins/amino acids.

(1 mark)

c) Starch is broken down/digested.

Therefore slower uptake/no rapid rise in blood sugar.

(2 marks)

(Marks available: 6)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a) (i) Elephants are homiotherms. They generate heat by metabolic processes.

Has small surface area compared to volume/less heat can be lost.

(ii) Large ears increase surface area.

Blood brings heat from core/body/cooler blood is returned.

More heat can be lost by radiation.

Flapping/holding ears out increases flow of air over surface.

(6 marks)

b) Migration

(1 mark)

(Marks available: 7)

Immunity (Questions)

1. a) Explain what is meant by the 'first line of defence'.

b) (i) What are antigens?

(ii) How are antigens used in the first line of defence?

(Marks available: 3)

2.

a) Describe the five stages of phagocytosis of a bacterium by a neutrophil?

b) Explain one weakness of the second line of defence.

(Marks available: 6)

3.

a) Describe briefly what a vaccine is made up of.

b) State two measures used to create safe vaccines.

(Marks available: 3)

Immunity (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) Physical and chemical barriers to disease. They are non-specific.

(1 mark)

b) (i) Chemical markers on each cell

(ii) Your body recognises the antigens on your cells as your own anything with different antigens to you stimulates an immune response.

(2 marks)

(Marks available: 3)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) (i) The bacteria is attracted to the membrane of the neutrophil.

(ii) Phagocytosis, the bacteria is engulfed.

(iii) Once in the neutrophil, lysosomes (vesicles containing digestive enzymes) will form and make their way towards the phagosome containing the bacteria.

(iv) The lysosomes fuse with the phagosome

(v) The bacteria is killed and digested by the enzymes.

(5 marks)

b) It can't deal completely with any one particular micro-organism (some pathogens will nearly always survive this attack)

It cannot remember past infections

(1 mark)

(Marks available: 6)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a) Small quantities of the antigen attached to the disease causing organism.

(1 mark)

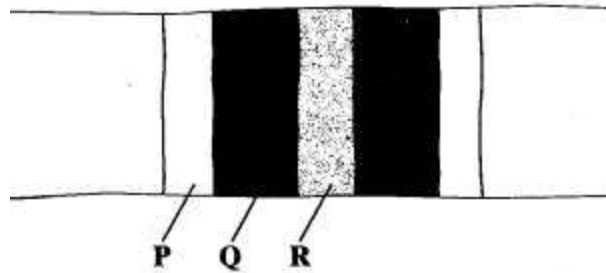
b) The disease cell may be altered, killed or use altered toxins.

(2 marks)

(Marks available: 3)

Movement and Support in Animals (Questions)

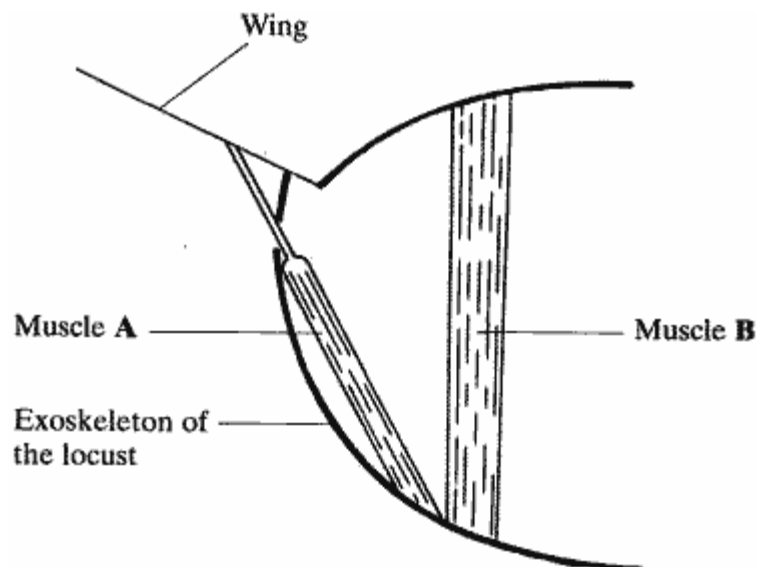
1. The diagram shows the appearance of a sarcomere from a relaxed muscle fibril, as seen with a light microscope.



- a) Use your knowledge of the sliding filament hypothesis to explain the appearance of each of the bands P, Q and R.
- b) Draw a similar diagram to show the appearance of the sarcomere when the fibril is contracted.

(Marks available: 4)

2. The drawing shows some of the main flight muscles of a locust.



- a) What name is used to describe the action of a pair of muscles such as A and B?
- b) Explain how the action of muscles A and B brings about movement of the wing.

(Marks available: 3)

3. Complete the table below (showing the differences between the three muscle types):

	Muscle Type		
	Skeletal	Cardiac	Smooth
Function	(a)	(b)	(c)
Cell	(d)	(e)	(f)
Control of Contraction	(g)	(h)	(i)
Speed of contraction	(j)	(k)	(l)

(Marks available: 4)

Movement and Support in Animals (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) P - Actin.

Q - Actin + Myosin.

R - Myosin.

(3 marks)

b) Diagram with narrower P region and no/very thin R region.

(1 mark)

(Marks available: 4)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) Antagonistic.

(1 mark)

b) Muscle A contracts, pulls wing down.

Muscle B contracts, pulls wing up.

(2 marks)

(Marks available: 3)

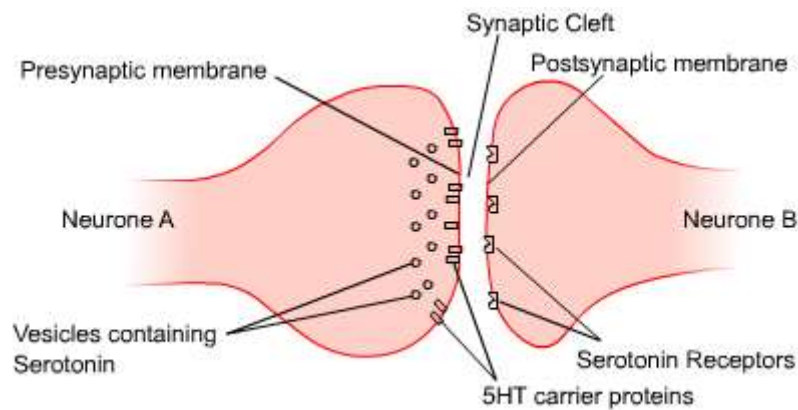
Answer outline and marking scheme for question: 3

	Muscle Type		
	Skeletal	Cardiac	Smooth
Function	Locomotion	Pumping blood through heart	Lines blood vessels
Cell	Striated	Specialised striated	Unstriated
Control of Contraction	Voluntary	Involuntary	Involuntary
Speed of contraction	Rapid	Intermediate	Slow

(Marks available: 4)

Nervous and Hormonal Control (Questions)

1. Serotonin is a neurotransmitter which is produced by certain neurones in the brain. One of its effects is to increase the activity of sensory neurones in the brain. It also usually improves a person's mood and keeps them awake. the diagram shows a synapse at which serotonin is the neurotransmitter.



a) Explain how the release of the neurotransmitter serotonin, by neurone A would initiate an impulse in neurone B.

b) The serotonin is normally rapidly reabsorbed from the synaptic cleft by 5HT carrier proteins in the presynaptic membrane.

Suggest one advantage of rapidly reabsorbing the serotonin.

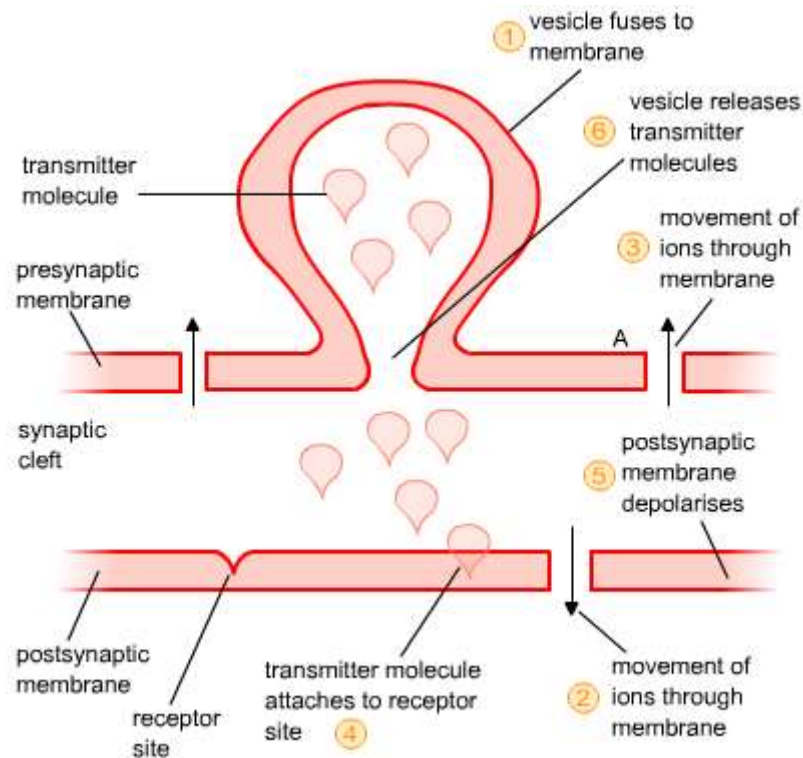
c) The active ingredient in the drug Ecstasy, is MDMA. MDMA blocks the attachment of serotonin molecules to the 5HT carrier proteins.

(i) suggest how MDMA may temporarily improve a person's mood.

(ii) MDMA may cause long term damage to the 5HT carrier proteins. This leads to a depressed mood. Suggest why.

(Marks available: 7)

2. The diagram shows some of the events which occur in a synapse after the arrival of an impulse at the presynaptic membrane.



- Put the events 1-6 on the diagram in the correct sequence.
- Name the ions labelled A and B.
- Name one transmitter molecule released by synaptic vesicles.

(Marks available: 4)

3. One example of homeostasis is the regulation of blood pressure. If there is a fall in blood pressure, nerve impulses are sent from receptors in the walls of the heart and associated blood vessels to the brain. As a result, nerves of the autonomic nervous system are stimulated and impulses are sent to the heart to control its rate of beating.

- Which region of the brain controls the heart rate?
- Describe the role of the autonomic nervous system in controlling heart rate.

(Marks available: 4)

Nervous and Hormonal Control (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) Diffusion across cleft/to postsynaptic membrane.

Attachment to receptors.

Depolarisation/influx of sodium ions/change in permeability to ions.

Action potential produced/inside becomes more positive.

(max 3 marks)

b) Prevents continuing stimulation/prevents succession of action potentials/allows further transmission across synapse.

(1 mark)

c) (i) Serotonin stays in cleft/stays attached to receptors/not reabsorbed.

Continues to produce action potentials/impulses to stimulate 'mood enhancing centre'.

(ii) Reduced supply of serotonin.

(3 marks)

(Marks available: 7)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) Correct order is 316425:

Movement of ions through membrane.

Vesicle fuses to membrane

Vesicle releases transmitter molecules.

Transmitter molecule attaches to receptor site.

Movement of ions through membrane.

Postsynaptic membrane depolarises.

(1 mark)

b) A= Calcium.

B = Sodium

(2 marks)

c) Noradrenaline/acetylcholine.

(1 mark)

(Marks available: 4)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a) Medulla; medulla oblongata.

(1 mark)

(b) Reference to: sympathetic and parasympathetic systems.

Antagonistic effect.

Sympathetic speeds up heart/parasympathetic slows heart down.

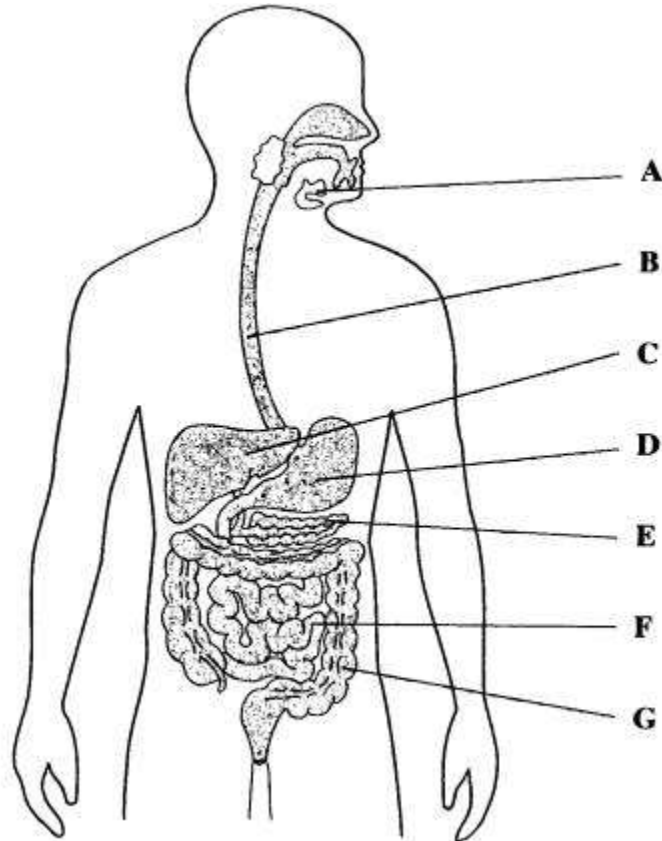
Acts on SAN.

(3 marks)

(Marks available: 4)

Nutrition and Digestion (Questions) *

1. The drawing shows the human digestive system.



a) Give the letter of an organ where each of the following is produced:

(i) endopeptidase

(ii) maltase

b) Name the compounds which are produced by the digestion of triglyceride.

c) Describe one role of bile in digestion of triglycerides.

(Marks available: 5)

2. The secretion of digestive juices into the mammalian gut is controlled by the endocrine and nervous systems.

Stimulus that triggers secretion	Effect	Digestive juice secreted
a)	Parasympathetic nerve stimulates salivary gland	Saliva
Contact of food with stomach	b) secreted	Gastric juice
Contact of food with duodenum lining	Cholecystokinin secreted	c)
Contact of food with duodenum lining	d) secreted	Alkaline fluid from pancreas

What should go in place of the letters a), b), c) and d) to complete the table?

(Marks available: 4)

3. This diagram shows a section through a mollusc:

a) Describe how this mollusc obtains its food.

b) The intestine of this mollusc was used to investigate enzyme activity. The intestine was ground into a paste. An equal amount of this paste was added to a solution of protein and to a solution of starch in separate dialysis tubing. The dialysis tubing was left in separate beakers of water for two hours. The chromatograms show the results of this investigation.

Explain the results of this investigation

(Marks available: 6)

Nutrition and Digestion (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) (i) D or E

(ii) F

(max 2 marks)

b) fatty acid and glycerol/monoglyceride

(max 1 mark)

c) **EITHER:**

emulsification or description e.g. fat drops to droplets;

larger surface area of fat for lipase/digestive enzymes to act on.

OR:

neutralisation of stomach acid;

optimum pH for lipase/digestive enzymes

(max 2 marks)

(Marks available: 5)

Answer outline and marking scheme for question: 2

a) Sight/smell/taste of food

b) Gastrin

c) Pancreatic juice/bile

d) Secretin

(1 mark for each correct answer)

(Marks available: 4)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a) Stream of water carries particles/food;
in through siphon;
Trapped by mucus;
Cilia direct/transports particles/water current towards mouth.

(max 3 marks)

b) Mixture contains starch and protein digesting enzymes;
Digestion produces soluble products/small molecules/named products;
Products diffuse into water/through dialysis tubing.

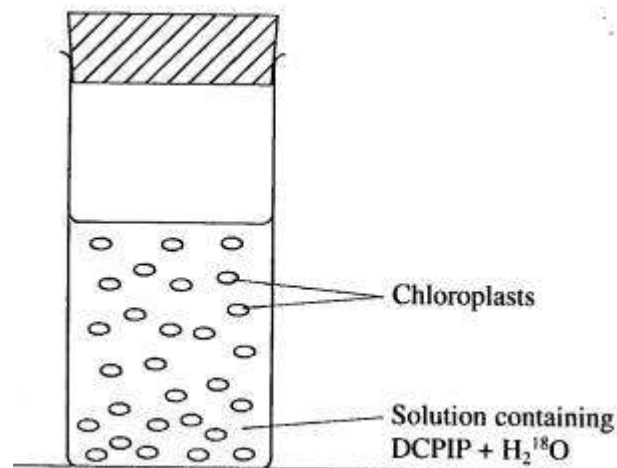
(max 3 marks)

(Marks available: 6)

Photosynthesis (Questions)

1. In an investigation of the light dependent reaction of photosynthesis, chloroplasts were placed in a tube containing water in which some of the molecules were labelled with ^{18}O (H_2^{18}O). The tube had a few drops of DCPIP, a hydrogen acceptor, added.

DCPIP is a blue dye which goes colourless when reduced. All carbon dioxide was removed from the tube.



The tube was exposed to light. After one hour the air space above the chloroplast suspension was found to contain oxygen molecules labelled with ^{18}O . The DCPIP had turned from blue to colourless.

a) Explain

(i) the presence of the $^{18}\text{O}_2$ in the tube;

(ii) why the DCPIP turned colourless.

b) Name the **two** products produced in the light dependent reaction that are used in the light independent reaction.

(Marks available: 5)

2. Write an essay on Photosynthesis and its importance in ecosystems.

(Marks available: 25)



Photosynthesis (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) (i) oxygen produced during photolysis/using light energy; from breakdown of water

(ii) DCPIP accepted hydrogen/protons/H⁺

(3 marks)

b) NADPH/reduced NADPH: ATP

(2 marks)

(Marks available: 5)

Answer outline and marking scheme for question: 2

You can give yourself up to 2 marks for discussing any of the following issues up to a maximum of 16:

Mechanism of photosynthesis

The structure and role of chloroplasts in relation to photosynthesis;

Light-dependent stage, light energy excites electrons in chlorophyll;

Energy in excited electrons used to generate ATP & reduced NADP;

Photolysis of water donates hydrogen & oxygen released;

Light-independent stage - carbon dioxide is accepted by ribulose biphosphate to form two molecules of glycerate 3-phosphate;

ATP and reduced NADP used to reduce GP to carbohydrate;

Ribulose biphosphate is regenerated, cyclical nature of scheme;

Importance to ecosystems

You have explained how process uses light energy to synthesise organic molecules, necessary for heterotrophs from inorganic materials;

You have explained that photosynthesis is the major route by which energy enters an ecosystem, and is transferred through trophic levels and dissipated;

You have explained how photosynthesis is responsible for recycling the gases oxygen (and carbon dioxide) and so its significance to aerobes/animals;

You have explained how the rate of photosynthesis varies in ecosystems, due to limiting factors of temperature, carbon dioxide concentration, and light intensity;

You have considered other factors in ecosystems affecting rate or productivity e.g. sun & shade plants, leaf structure, different types of

Photosynthesis;

You have considered an aspect of human activity related to photosynthesis in ecosystems e.g. crop production, glasshouse management, greenhouse effect;

Breadth (max 3 marks)

Uses more than one ecosystem to illustrate; considers process from the viewpoints of the whole organism and the ecosystem;

Considers factors affecting its rate;

Depth (max 3 marks)

Deals clearly with both stages;

Considers photosynthesis in terms of the energy it contributes to ecosystems

Makes fully clear the importance of photosynthesis to ecosystems;

In the real exam you will also be awarded marks for quality of language (in this case, there were 3 marks available). It may be difficult for you to judge your own text; however you may be able to get someone else to give you an opinion.

Reproduction (Questions) *

1. Graph A shows the concentration of **FSH** and **LH** in plasma during a woman's menstrual cycle.

Graph B shows the concentration of two hormones X and Y produced in the ovary during the same menstrual cycle.

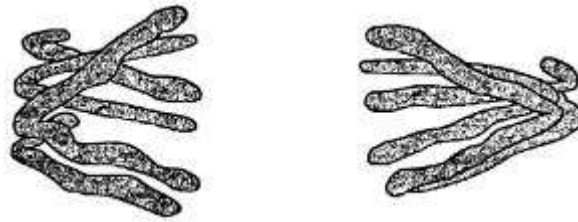
Concentration of
hormone in plasma /
arbitrary units.

Concentration of
hormone in plasma /
arbitrary units.

- a) Where are FSH and LH produced?
- b) Name hormones X and Y.
- c) (i) On which day did ovulation occur in this woman's cycle?
(ii) Explain the evidence for your answer to (i).
- d) Describe an example of negative feedback involving two of these hormones.

(Marks available: 8)

2. a) Explain why root tips are particularly suitable material to use for preparing slides to show mitosis.
- b) Give a reason for carrying out each of the following steps in preparing a slide showing mitosis in cells from a root tip.
- (i) The tissue should be stained.
 - (ii) The stained material should be pulled apart with a needle and gentle pressure applied to the cover slip during mounting.
- c) The drawing has been made from a photograph showing a cell undergoing mitosis.

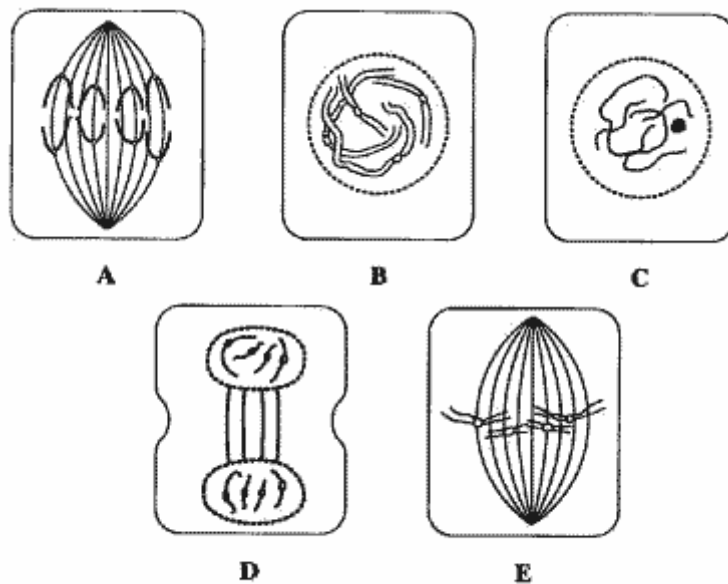


(i) In which stage of mitosis is the cell shown in this drawing?

(ii) Describe one piece of evidence, visible in the drawing, which could be used to confirm that this cell is not in the first division of meiosis.

(Marks available: 5)

3. The drawings A-E show stages of mitosis in an animal cell.



a) Which of the drawings A -E shows

(i) anaphase;

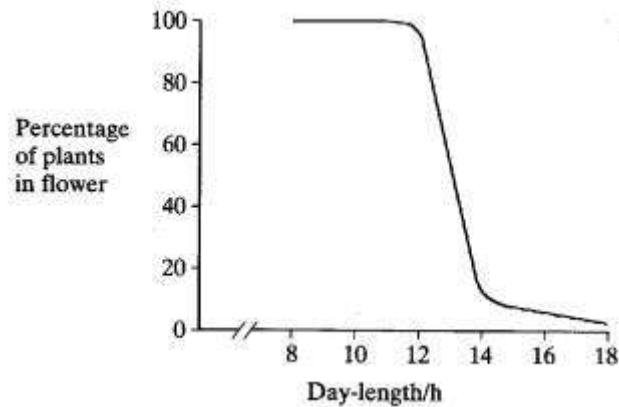
(ii) telophase;

(iii) metaphase?

b) Give two processes which occur during interphase and which are necessary for nuclear division to take place.

(Marks available: 5)

4. a) The graph shows the relationship between day-length and flowering in a species of plant.



(i) This species of plant comes into flower in the autumn in Britain. Use the graph to explain why.

(ii) All plants of this species flower at about the same time. Suggest how this may be of benefit for the survival of the species.

b) Flowering in this plant is stimulated by a pigment. The active form of this pigment is slowly synthesised from an inactive form in darkness. In the light the active form is rapidly converted back to the inactive form.

(i) Name this pigment that stimulates flowering.

Three groups of the plants with undeveloped flower buds were exposed on a regular daily cycle to the periods of light and darkness shown in the chart.

(ii) Explain why flowering was initiated in the plants in group B, but not in group A.

(iii) Explain why the plants in group C did not flower.

(Marks available: 7)

Reproduction (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) Pituitary gland

(1 mark)

b) X = Oestrogen

Y = Progesterone

(2 marks)

c) (i) Day 16

(ii) oestrogen (reaches a peak followed by decline) on day 14. LH rises (2 days later) to give ovulation/peaking.

(3 marks)

d) Either oestrogen build up inhibiting FSH; or progesterone build up; inhibiting LH/FSH.

(2 marks)

(Marks available: 8)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) cells dividing/active growing region.

(1 mark)

b) (i) in order to distinguish the chromosomes/show up nuclear material.

(ii) Separate the cells/produce a thinner cell layer.

(2 marks)

c) (i) Anaphase.

(ii) Chromosomes not visible as paired structures.

(2 marks)

(Marks available: 5)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a) (i) A

(ii) D

(iii) E

(3 marks)

b) Replication of DNA;

ATP production;

Synthesis of spindle/proteins/relications of centrioles.

(max 2 marks)

(Marks available: 5)

Answer outline and marking scheme for question: 4

Give yourself marks for mentioning any of the points below:

a) (i) Daylight decreasing/night length increasing in autumn;

Plants flower as day length falls below 14 hours day/night length over 10 hours;

Allow 1 mark for saying 'short-day plants' or 'plants flower only when days are short'.

(ii) Increased chance of pollination/reproduction/fertilisation.

(3 marks)

b) (i) Photochrome;

(ii) Longer dark period (of over 12 hours) for group B;

Enough active form to induce flowering in group B/not in group A;

(iii) Active form reconverted in short light period.

(4 marks)



(Marks available: 7)

Respiration (Questions) *

1. The bar chart shows the sources of energy for 1 hour of cycling.

a) What percentage of the energy came from carbohydrates?

b) Glycogenolysis and gluconeogenesis both contribute to the formation of respiratory substrates during exercise.

What is meant by:

(i) Glycogenolysis?

(ii) Gluconeogenesis?

(Marks available: 3)

2. a) What part do the following coenzymes play in respiration?

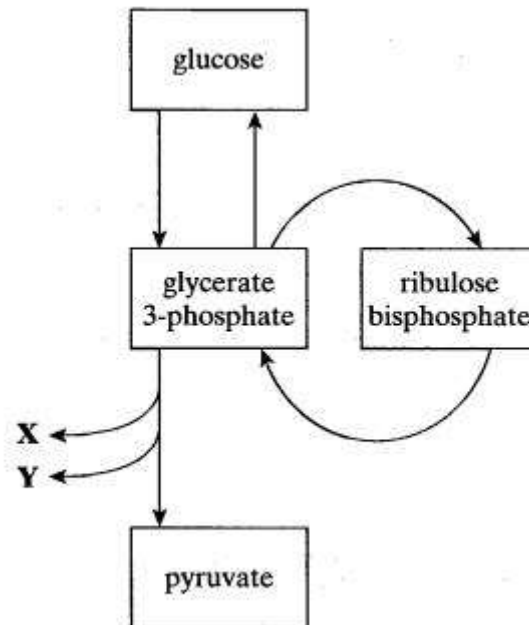
(i) NAD

(ii) Coenzyme A

b) NAD is made from the vitamin niacin. Niacin is required only in small quantities in the human diet. Explain why?

(Marks available: 5)

3. The diagram shows chemical pathways involved in respiration and photosynthesis.



a) Name the process that produces pyruvate from glucose.

b) Name the compounds labelled X and Y.

c) (i) In which part of the chloroplast is glycerate 3-phosphate converted into ribulose biphosphate?

(ii) Describe the role of ribulose biphosphate in photosynthesis.

(Marks available: 5)

Respiration (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) 57

(1 mark)

b) (i) Breakdown of glycogen to glucose

(ii) Breakdown of lipids/protein to respiratory substrates/sugars carbohydrate/glucose.

(2 marks)

(Marks available: 3)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) (i) Hydrogen acceptor carrier; role in oxidative phosphorylation/Krebs cycle/glycolysis/electron transfer.

(ii) Transfers acetyl compound/ C_2 to C_4 acceptor; into mitochondrion/Krebs cycle.

(4 marks)

b) Reference to reuse/recycling of coenzymes.

(1 mark)

(Marks available: 5)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a) Glycolysis/oxidation

(1 mark)

b) Reduced NAD/NADH; ATP

(2 marks)

c) (i) Stroma

(ii) Combines with/accepts carbon dioxide

(2 marks)

(Marks available: 5)

Transport (Questions)

1. The roots of two groups of pea plants were placed in solutions containing radioactive potassium ions. For the experimental plants a respiratory inhibitor was added to the solution. At regular intervals the solutions surrounding the roots were tested for radioactive potassium ions. The table shows the results of this investigation.

Time from placing roots in solution/minutes	Concentration of radioactive potassium ions in the solutions surrounding the roots/arbitrary units	
	<i>Experimental plants</i>	<i>Control plants</i>
0	7.5	7.5
15	6.6	3.3
30	6.4	2.9
60	6.3	2.4
120	6.3	1.2
240	6.3	0.6

a)

(i) The rate of uptake of potassium by the experimental plants in the first 15 minutes was 0.06 units per minute.

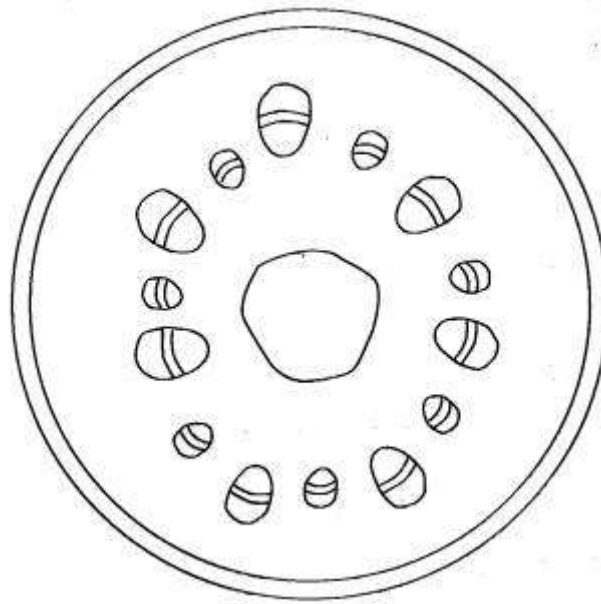
Calculate the rate of uptake of potassium by the control plants over the same time period.

(ii) Suggest an explanation for the difference between the rates of uptake of the experimental and control plants in the first 15 minutes.

(iii) The rate of potassium ion uptake in the control plants in the first hour was faster than in the second hour. Suggest why.

b)

At the end of the investigation sections were cut across the stems of the pea plants and the amount of radioactivity measured. The diagram shows a section across the stem of a pea plant.



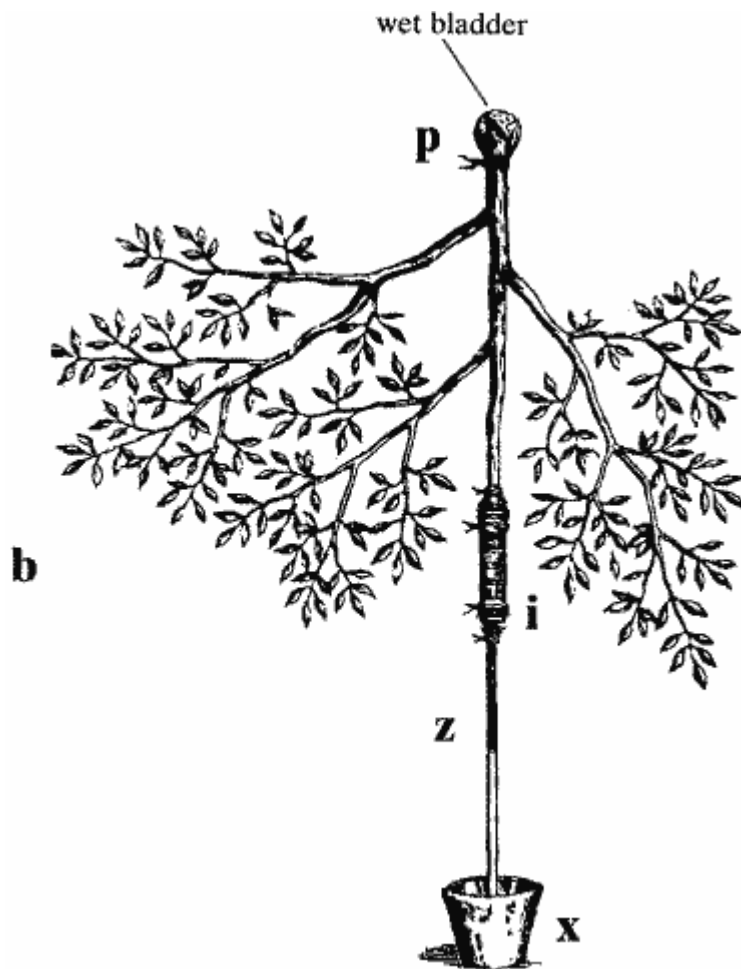
(i) Give **one** feature by which this section can be recognised as a stem.

(ii) Using a guideline, label and name the tissue in which you would expect to find the greatest amount of radioactivity.

(Marks available: 7)

2. A biologist named Stephen Hales described how he carried out an investigation in 1727.

- I cut a branch (b) off an apple tree about 1 metre long, then sealed the cut end (p) and tied a piece of wet bladder over it.
- Then I cut off the other end of the branch at (i) and attached a glass tube (z) to it.
- After filling the glass tube with water, I placed the lower end in a bowl of mercury (x).



(Reproduced from Vegetable staticks, Bales, S., by permission of the Royal Botanic Gardens, Kew)

- I left the apparatus outside on a warm afternoon.
- By 3.00 p.m. the mercury had risen over 30 cm.
- When the mercury reached the cut end of the stem (i) air bubbles appeared and the mercury slowly ran back into the bowl (x).

a) Suggest a hypothesis that was being tested in this investigation.

b) (i) Through which tissue in the stem is most water transported?

(ii) Give one structural feature of this tissue which enables it to transport water rapidly (as shown in Hales's demonstration).

c) Explain, in terms of the cohesion-tension theory,

(i) why the level of mercury rose during the investigation;

(ii) why the level of mercury fell towards the end of the investigation.

(Marks available: 7)

3. Read the extract and then answer the questions which follow.

Fish breathe easy by putting the squeeze on blood cells.

In the gills of a fish blood passes through structures called lamellae, two thin membranes held apart by cells which look like the pillars supporting a roof. Video recordings of this flow show that red blood cells become deformed as they pass between the pillar cells.

Normally the red blood cells of a trout are oval and measure 13.5 by 8.4 micrometres. As the cells flow through the lamellae, however, they stretch to more than 18 micrometres in length, and take the shape of a letter C or S. Some of the red blood cells get jammed between the pillar cells, blocking the progress of other blood cells.

This means that red blood cells passing through the gill lamellae travel about 50 per cent further than the shortest path. This helps to explain why fish gills are so good at picking up oxygen from water.

(Reproduced by permission of New Scientist)

- a) The function of red blood cells is to transport oxygen. How is oxygen transported in red blood cells?
- b) (i) Explain the advantage to the trout of the change in shape of its red blood cells as they pass through the gills.
- (ii) Explain the advantage to the trout of some red cells getting jammed between the pillar cells.

(Marks available: 5)

Transport (Answers)

Answer outline and marking scheme for question: 1

Give yourself marks for mentioning any of the points below:

a) (i) 0.28 (units per minute)

(ii) uptake in (control plants) by active transport;

Use energy/ATP from respiration;

Amount absorbed by experimental plants is due to diffusion.

(iii) Concentration falls therefore rate of diffusion falls;

Active transport involves carrier/membrane proteins;

More potassium ions so more chance of collision with carriers.

(5 marks)

b) (i) Cylindrical arrangement of vascular bundles/vascular tissues in bundles;

(ii) Correct label to Xylem.

(2 marks)

(Marks available: 7)

Answer outline and marking scheme for question: 2

Give yourself marks for mentioning any of the points below:

a) e.g. water can travel downwards/both ways in a stem/water movement through plant is passive;

(1 mark)

b)

(i) xylem

(ii) e.g. no cross walls/continuous tubes/hollow/lignified/perforated end walls.

(2 marks)

c)

(i)

- water evaporates/leaves transpire;
- lowers water potential in leaf cells;
- reducing pressure in xylem/leaf cells 'pull' water out of xylem;

(ii)

EITHER:

Air entered vessels;

No longer a continuous column held by cohesive forces/H bonds broken;

OR

Mercury is heavy/dense/viscous;

Cohesive forces insufficient to hold mercury up/mercury not cohesive to walls of xylem.

(4 marks)

(Marks available: 7)

Answer outline and marking scheme for question: 3

Give yourself marks for mentioning any of the points below:

a)

As ox haemoglobin/by haemoglobin/combined with haemoglobin.

(1 mark)

b)

(i) Greater surface area;

For oxygen to diffuse through.

(ii) Red cell in gill capillaries for longer period; haemoglobin more likely to be saturated with oxygen/more oxygen absorbed.

(4 marks)

(Marks available: 5)