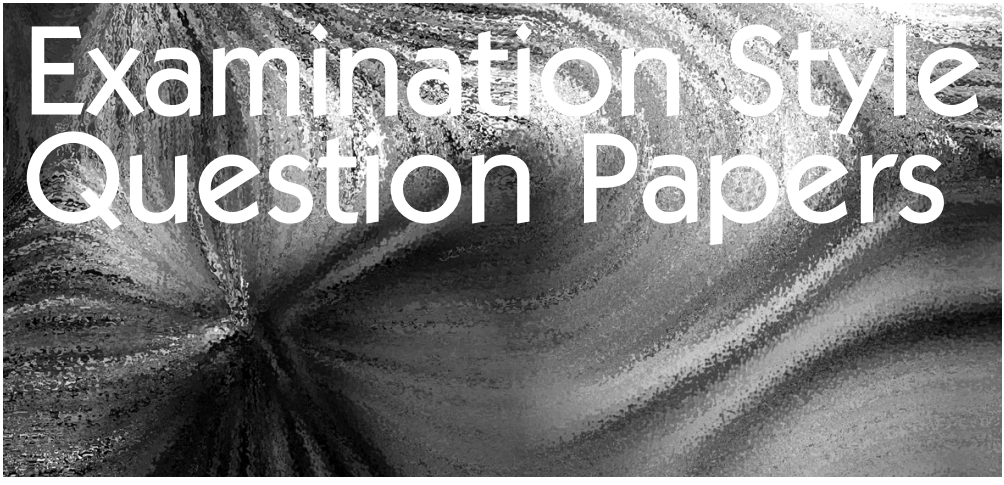
For **Edexcel** Specifications

Advanced Subsidiary

Biology or Biology (Human)



AS Unit 1 - Molecules & cells

AS Unit 2B - Exchange, transport & reproduction

AS Unit 2H - Exchange, transport & reproduction in humans

AS Unit 3 - Energy & the Environment

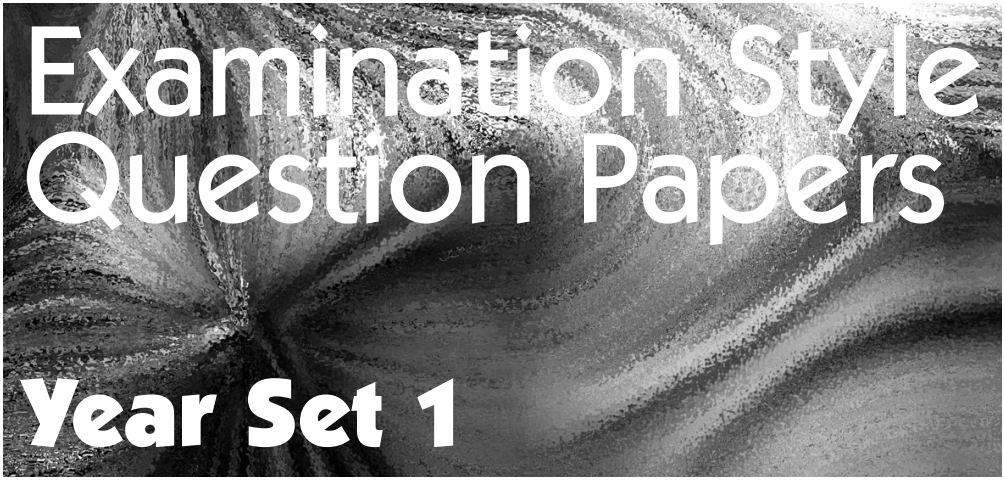
Complete with Assessment Grids & Mark Schemes

FELTHAM PRESS

For **Edexcel** Specifications

Advanced Subsidiary

Biology or Biology (Human)



AS Unit 1 - Molecules & cells
AS Unit 2B - Exchange, transport & reproduction
AS Unit 2H - Exchange, transport & reproduction in humans
AS Unit 3 - Energy & the Environment

Complete with Assessment Grids & Mark Schemes

FELTHAM PRESS

Name:

Examination Style Question Papers

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 1 - Molecules and cells
Year Set 1

Time allowed 1 hour 20 minutes

Instructions:

- Answer ALL NINE questions in the spaces provided.

Information

- The questions will score from four to twelve marks.
- The short questions will test mainly knowledge and understanding of the content of the unit.
- The longer questions will present stimulus material related to the specification content. These questions will also test skills of interpretation of data or information related to the content of the unit.
- At least one question requires an answer written in continuous prose
- Mark allocations are shown in brackets.
- The maximum mark for this paper is 70.
- This type of paper would carry 33.3 per cent of the total marks for AS level.
- Quality of Written Communication will be assessed.
- Scientific terminology should be used where appropriate.
- A calculator may be used.

Question 1

The picture below shows part of an animal cell as seen under an electron microscope at a magnification of x 25 000, with all parts shown accurately to scale.

a) Identify structures **A** to **C.**

A _____ *(1)*

B _____ *(1)*

A _____ *(1)*

b) Describe two ways in which a bacterial cell differs from the cell shown above.

i) _____ *(1)*

ii) _____ *(1)*

c) Calculate the actual size of structure C as measured between the two points marked X. Show your workings.

_____

_____

_____

_____ *(3)*

Total 8

Question 2

Fick's law states that diffusion rate is proportional to:
surface area x difference in concentration/ thickness of exchange surface

a) Explain how each of the factors in the equation affects the rate of diffusion.

i) Surface area.

_____

_____ *(1)*

ii) Difference in concentration.

_____

_____ *(1)*

iii) Thickness of exchange surface.

_____

_____ *(1)*

b) What feature of a mitochondrion increases its surface area for diffusion?

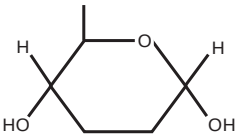
_____

_____ *(1)*

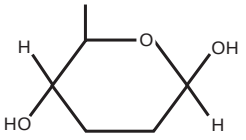
Total 4

Question 3

a) The structure of alpha glucose and beta glucose is shown below:



α-glucose



β-glucose

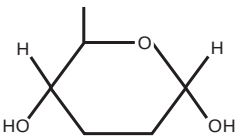
i) The short-hand convention used in drawing organic molecules in this way omits the carbon atoms. Indicate on one of the diagrams above where the 6 carbon atoms of glucose are to be found. *(1)*

ii) Describe how the two molecules shown differ in structure.

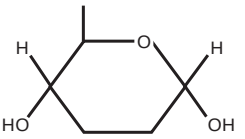
_____

_____ *(1)*

b) Two alpha glucose molecules are shown below.



α-glucose



α-glucose

i) Indicate on the diagram how the disaccharide maltose would be formed. *(1)*

ii) What type of reaction is this known as?

_____ *(1)*

iii) Name the chemical bond formed in this way.

_____ *(1)*

Total 5

Question 4

a) Give a definition of the term catalyst.

_____

_____ *(1)*

b) Name an enzyme and the reaction that it catalyses.

_____

_____ *(1)*

c) What is meant by the term 'enzyme specificity'.

_____

_____ *(1)*

d) Enzymes are denatured by extremes of pH. Explain what is meant by the term 'denatured'.

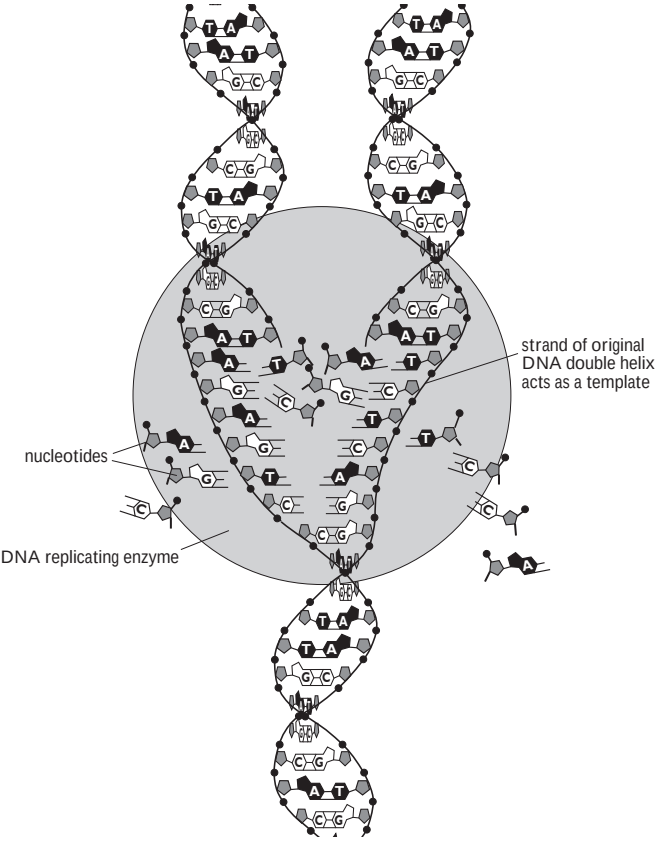
_____

_____

_____ *(2)*

Total 5

Question 5



Study the diagram of replicating DNA shown above and answer the questions that follow.

a) On the diagram:

i) label the two new strands of DNA; *(1)*

ii) mark with an 'X' a pair of complementary bases. *(1)*

iii) indicate with an arrow the direction in which the new strands of DNA are being formed. *(1)*

b) With reference to the diagram describe what is meant by semi-conservative replication;

_____

_____

_____ *(3)*

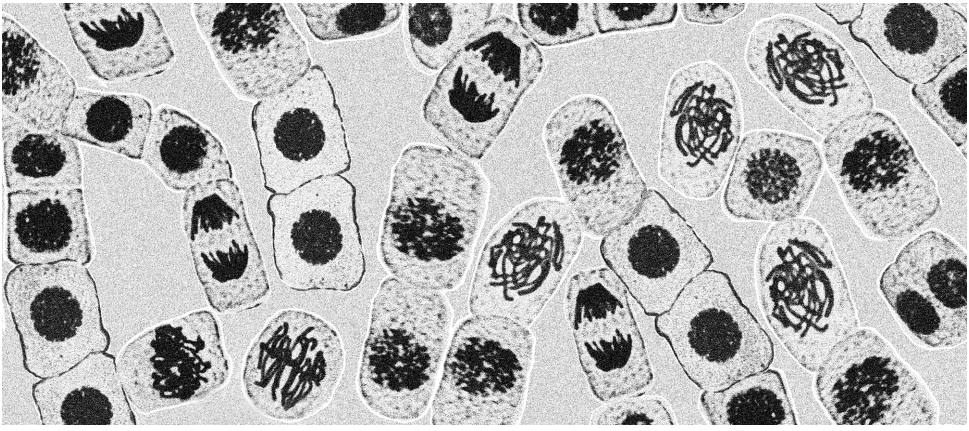
c) Name an enzyme involved in catalysing the chemical reactions of DNA replication

_____ *(1)*

Total 7

Question 6

Study the illustration below of stained cells from a squashed plant root tip cells, showing various stages of mitosis, and then answer the questions that follow.



a) **i)** Indicate with an X on the illustration a cell which is showing the separation of chromatids *(1)*

ii) Indicate with a Y on the illustration a cell which is showing the chromosomes lining up on the equator of the nuclear spindle. *(1)*

iii) Explain why plant root tips are a good source of cells undergoing mitosis.

_____

_____

_____ *(2)*

Question continued...

b) In the space below make an accurate drawing, enlarged x 1.5, of two cells showing different stages in mitosis.

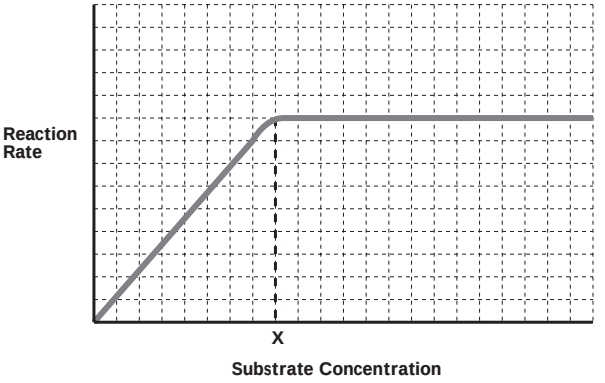
Do not label your drawing.

(5)

Total 8

Question 7

The graph below shows the rate of an enzyme catalysed reaction (with the amount of enzyme fixed) plotted against increasing substrate concentration



a) **i)** Explain what is meant by a rate limiting factor.

_____

_____

_____ *(2)*

ii) Identify the rate limiting factor up to point X on the graph.

_____ *(1)*

iii) Identify the rate limiting factor past point X on the graph.

_____ *(1)*

b) Describe what would happen to the rate of reaction if more enzyme was added at point X

_____

_____

_____ *(2)*

c) Explain the levelling off of the rate of reaction seen in the graph in terms of the formation of enzyme substrate complex.

_____

_____

_____

_____

_____ *(5)*

Total 11

Question 8

The data below are from an experimental investigation on osmosis carried out by a student using cylinders of well washed beetroot tissue from which no pigment was leaking.

Immersed in	Initial mass (g)	Mass (g) after 30 minutes	% difference
distilled water	2.81	2.97	+5.70
0.3 M sucrose solution	2.79	2.89	+3.60
1.0 M sucrose solution	2.78	2.60	-6.10

Where M = molarity which is a measure of concentration.

a) Explain the figures in the table in terms of osmosis for the cells immersed in each of the following.

i) Distilled water.

(3)

ii) 0.3 M sucrose solution.

(1)

iii) 1.0 M sucrose solution.

(2)

b) Explain the following results, observed after the cylinders of beetroot tissue from the above experiment were subjected to the following treatments.

i) When placed in distilled water they all showed a gain in mass of around 5.7% compared to their original mass.

(1)

ii) When gradually brought to the boil, red pigment flooded into the distilled water.

(2)

c) One of the problems with experiments in which changes of mass of tissues are measured is that relatively large amounts of water are held in the cellulose cell wall. Explain why this gives an inaccurate picture of water movement by osmosis in experiments such as the one described.

(3)

Total 12

Question 9

Give an account of the structure, properties and functions of the cell surface membrane.

Total 10

Assessment Grid

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 1 - Molecules and cells
Year Set 1

	Question Number									
Specification Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
1.1 Molecules			**5**							**5**
1.2 Enzymes				**5**	**1**		**11**			**17**
1.3 Cellular organisation	**8**	**4**			**6**			**12**	**10**	**40**
1.4 Cell cycle						**8**				**8**

Total 70

	Question Number									
Assessment Objective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
AO1										
Knowledge with Understanding	**8**	**4**	**5**	**5**	**5**	**5**	**4**	**5**	**4**	**45**
AO2										
Application/Analysis/Evaluation					**2**	**3**	**7**	**7**	**6**	**25**

Total 70

Mark Schemes for Question Paper

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 1 - Molecules and cells
Year Set 1

Instructions

; = 1 mark / = alternative response

Question 1

The picture below shows part of an animal cell as seen under an electron microscope at a magnification of x 25 000, with all parts shown accurately to scale.

a) Identify structures A to C.

A nucleus;

B mitochondrion;

C rough or granular endoplasmic reticulum; *(3)*

b) Describe two ways in which the structure of a bacterial cell differs from the cell shown above.

i) & ii) any two from

bacterium cell has no mitochondria;

no nucleus;

no endoplasmic reticulum; *(2)*

c) Calculate the actual size of structure C as measured between the two points marked X. Show your workings.

distance between points x-x = 25 mm;

magnification = x 25 000

therefore actual size = 25 divided by 25 000;

= 0.001 mm / 1.0 µm; *(3)*

Total 8

Question 2

Fick's law states that diffusion rate is proportional to:
surface area x difference in concentration/ thickness of exchange surface

a) Explain how each of the factors in the equation affects the rate of diffusion:

i) surface area

the larger the surface area the faster the diffusion rate; *(1)*

ii) difference in concentration

the larger the difference in concentration the faster the diffusion rate; *(1)*

iii) thickness of exchange surface

the thicker the exchange surface the slower the diffusion rate/ vice versa; *(1)*

b) What feature of a mitochondrion increases its surface area for diffusion?

the folding(s) of the internal membrane / cristae; *(1)*

Total 4

Question 3

a) The structure of alpha glucose and beta glucose is shown below:

i) The short-hand convention used in drawing organic molecules in this way omits the carbon atoms. Indicate on one of the diagrams above where the 6 carbon atoms of glucose are to be found.

all 6 carbons accurately marked; *(1)*

ii) Describe how the two molecules shown differ in structure.

positions of OH and H groups on carbon one reversed; *(1)*

b) Two alpha glucose molecules are shown below:

i) Indicate on the diagram how the disaccharide maltose would be formed.

removal of elements of water correctly indicated; *(1)*

ii) Name the type of reaction that you have indicated on the diagram.

condensation reaction; *(1)*

iii) Name the chemical bond formed in this way.

glycosidic bond *(1)*

Total 5

Question 4

a) Give a definition of the term catalyst.

a substance which speeds up the rate of a reaction;

without itself being used up;

both needed for the mark; *(1)*

b) Name an enzyme and the reaction that it catalyses.

both needed for the mark; *(1)*

c) What is meant by the term 'enzyme specificity'.

an enzyme will only catalyse a specific reaction or type of reaction; *1)*

d) Enzymes are denatured by extremes of pH. Explain what is meant by the term 'denatured' rendered irreversibly inactive.

as a result of permanent disruption of their 3 D structure / active site; *(2)*

Total 5

Question 5

Study the diagram of replicating DNA shown below and answer the questions that follow.

a) On the diagram:

i) label the two new strands of DNA. *(1)*

ii) mark with an 'X' the position of a pair of complementary bases. *(1)*

iii) indicate with an arrow the direction in which the new strands of DNA are being formed. *(1)*

b) With reference to the diagram describe what is meant by semi-conservative replication;

each daughter DNA double helix;

has conserved one strand of the original DNA double helix;

therefore half of daughter DNA double helix 'old' and half 'new'. *(2)*

c) Name an enzyme involved in catalysing the chemical reactions of DNA replication

DNA polymerase *(1)*

Total 7

Question 6

Study the illustration below of stained cells from a squashed plant root tip, showing various stages of mitosis, and answer the following questions.

a) i) Indicate with an 'X' on the illustration a cell which is showing the separation of chromatids. *(1)*

ii) Indicate with an 'Y' on the illustration a cell which is showing the chromosomes lining up on the equator of the nuclear spindle. *(1)*

iii) Explain why plant root tips are a good source of cells undergoing mitosis.

growing regions;

apical meristem just behind tip;

produce nuclei by mitosis in all directions; (2)

b) In the space below make an accurate drawing, enlarged x 1.5, of two cells showing different stages in mitosis. Do not label your drawing.

correct size / magnification;

correct proportions;

correct number of cells

chromosomes accurately represented;

no shading; *(4)*

Total 8

Question 7

The graph below shows the rate of an enzyme catalysed reaction (with the amount of enzyme fixed) plotted against increasing substrate concentration

a) i) Explain what is meant by a rate limiting factor.

that factor that is controlling / 'limiting' the rate of reaction at any given time;

any change in the factor results in a change in the rate of reaction; *(2)*

ii) Identify the rate limiting factor up to point X on the graph.

substrate concentration; *(1)*

iii) Identify the rate limiting factor past point X on the graph.

enzyme concentration; *(1)*

b) Describe what would happen to the rate of reaction if more enzyme was added at point X.

rate would increase;

as substrate is limiting factor; *(2)*

c) Explain the levelling off of the rate of reaction seen in the graph in terms of the formation of enzyme substrate complex.

enzyme forms enzyme substrate complex by combination with substrate;

at active site;

by 'lock and key' induced fit;

when saturated with substrate all enzymes immediately taken up in enzyme substrate complex;

rate of formation cannot be speeded up by addition of more substrate; *(5)*

Total 11

Question 8

The data below are from an experimental investigation on osmosis carried out by a student using cylinders of well washed beetroot tissue from which no pigment was leaking.

a) Explain the figures in terms of osmosis in:

i) distilled water,

cell contents have a lower water potential than distilled water;

as a result of dissolved solutes;

water enters through partially permeable cell surface membrane by osmosis; *(3)*

ii) 0.3 M sucrose solution,

the water potential gradient operates in the same direction but is less steep; *(1)*

iii) 1.0 M sucrose solution,

1.0 M sucrose solution has a lower water potential than the cell contents;

therefore water leaves the cell by osmosis; *(2)*

b) Explain the results after the cylinders of beetroot tissue from the above experiment were then subjected to the following treatments.

i) When placed in distilled water they all showed a gain in mass of around 5.7% compared to their original mass.

effects of osmosis reversible;

therefore showed gains similar to cylinder in distilled water originally; *(1)*

ii) When they are gradually brought to the boil, red pigment flooded into the distilled water.

membrane structure broken down by heat;

therefore becomes fully permeable to pigment which floods out; *(2)*

c) One of the problems with experiments in which changes of mass of tissues are measured is that relatively large amounts of water are held in the cellulose cell wall. Explain why this gives an inaccurate picture of water movement by osmosis in experiments such as the one described.

cellulose cell wall completely permeable;

outside the cell surface membrane;

plays no part in osmosis but contributes to changes in mass; *(3)*

Total 12

Question 9

Give an account of the structure, properties and functions of the cell surface membrane.

1 'fatty' in nature, two layers of phospho-lipids bilayer);

2 hydrophobic poles together, hydrophilic poles 'outwards';

3 stabilised by cholesterol;

4 surface proteins / glycoproteins for recognition and communication;

6 glycolipids;

6 embedded proteins, some enzymes catalysing membrane reactions;

7 some carriers involved with active transport across the membrane;

8 some 'pore' proteins allowing passage of water soluble solutes;

9 the fluid mosaic model;

10 partially permeable selective barrier to the passage of materials into and out of cells;

12 maintains the integrity of the contents;

13 can be involved in movement e.g. pseudopodia in white cells;

14 endocytosis and exocytosis;

Total 10

Examination Style Question Papers

Name:

EDEXCEL Specification AS Biology and Biology (Human)

Units 2B and 2H - Exchange, Transport and Reproduction

Year Set 1

Time allowed 1 hour 20 minutes

Instructions:

- Answer NINE questions in the spaces provided.

Information

- The questions will score from four to twelve marks.
- You must answer Section 1 and

  EITHER Section B: Biology

  OR Section H: Biology (Human)
- The short questions will test mainly knowledge and understanding of the content of the unit.
- The longer questions will present students with stimulus material related to the specification content. These questions will also test skills of interpretation of data or information related to the content of the unit.
- At least one question requires an answer written in continuous prose
- Mark allocations are shown in brackets.
- The maximum mark for this paper is 70.
- This type of paper would carry 33.3 per cent of the total marks for AS level.
- Quality of Written Communication will be assessed.
- Scientific terminology should be used where appropriate.
- A calculator may be used.

You must answer Section 1 and
EITHER Section B: Biology OR Section H: Biology (Human)

Section 1

Answer ALL FOUR questions in this section.

Question 1

The rate of diffusion across a surface is proportional to:
surface area x difference in concentration/thickness of exchange surface

By reference to the alveoli as surfaces involved in gas exchange, explain how each of the factors in the equation affects the rate of diffusion:

a) surface area

_____

_____

_____ *(2)*

b) difference in concentration

_____

_____

_____ *(2)*

c) thickness of the exchange surface

_____

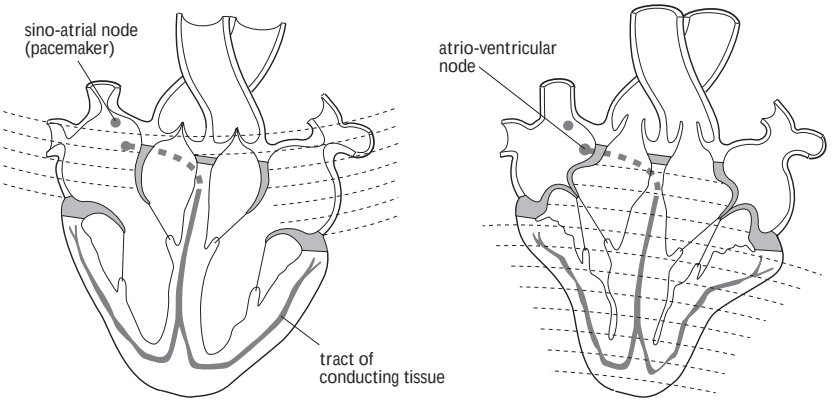
_____

_____ *(2)*

Total 6

Question 2

The diagrams below show vertical sections of the heart at different stages of the cardiac cycle where the spread of electrical activity through the walls is indicated by the radiating curved lines.



a) Draw arrows on the diagrams above to show the direction electrical activity spreads through the walls of the heart. *(1)*

b) Relate this pattern of spread of electrical activity, and the resultant contractions of the atria and ventricles in the cardiac cycle, to the direction of the blood flow through the heart.

(3)

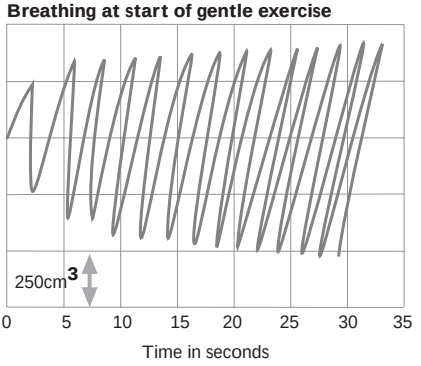
c) Describe what causes the heart valves to open and close during the cardiac cycle.

(2)

Total 6

Question 3

The diagram below is of a trace from a respirometer measuring the breathing of a person at rest who then starts exercising at a rate which causes them to start breathing more heavily and quickly.



a) Ventilation of the lungs is by tidal flow in and out of a single air tube the trachea. What are the main disadvantages of this method of ventilating a respiratory system?

_____

_____ *(2)*

b) Using the trace in the diagram above:

i) Calculate the tidal volume at rest.

_____ *(1)*

ii) Calculate the breathing rate at rest.

_____ *(1)*

iii) Calculate the volume of air moved through the system per minute during exercise.

_____

_____

_____ *(3)*

c) State two changes in the blood which stimulate the increase in breathing rate during exercise,. Where are the receptors located that respond to these changes in the blood.

_____

_____

_____ *(3)*

Total 10

Question 4

The drawing below is of an X-ray of the stomach and first part of the duodenum after a barium meal (which shows up in X-rays).

a) Describe and explain the appearance in the drawing of:

i) the stomach,

(3)

ii) the first part of the duodenum,

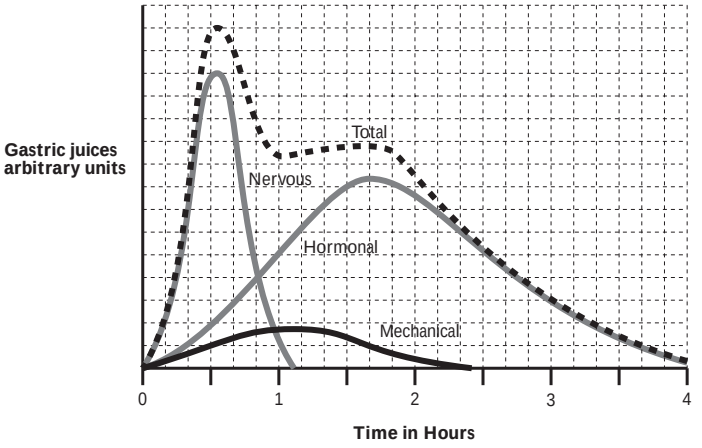
(3)

b) Brunner's glands are a distinctive feature of the first part of the duodenum. Describe their function.

(3)

Question continued...

c) The graph below shows the phases of secretion of gastric juices after food enters the mouth.



i) List the sequence in which the different stimuli have their major effect.

_____

_____ *(1)*

ii) How long after food has entered the mouth does the total gastric secretion reach its peak?

_____ *(1)*

iii) Name the site of origin of the hormones which stimulate the secretion of gastric juices.

_____ *(1)*

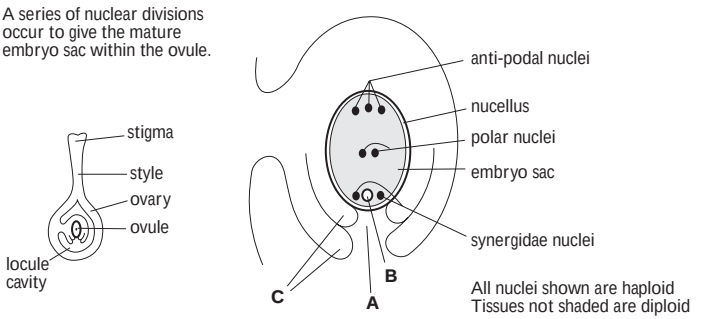
Total 12

Section B : Biology

Answer ALL FIVE questions in this section.

Question B5

The diagrams below show the the main features of the ovule of a typical flowering plant.



a) Match each of the following with the appropriate letter A, B, or C.

i) Ovum or egg nucleus

_____ *(1)*

ii) Micropyle

_____ *(1)*

b) Give brief definitions of the following.

i) Pollination.

_____

_____

_____ *(2)*

ii) Fertilisation

_____

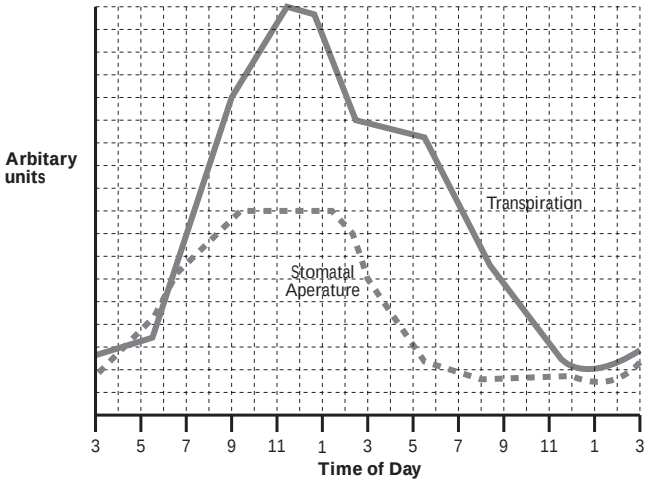
_____

_____ *(2)*

Total 6

Question B6

The graph below shows the relationship between the degree of opening of the stomata (stomatal aperture) and the rate of transpiration over a 24 hour period under natural conditions on a summer's day.



a) i) Describe the general relationship between the stomatal aperture and the rate of transpiration.

_____

_____

_____ *(2)*

ii) Explain how the transpiration rate can rise and fall independent of the stomatal aperture.

_____

_____

_____

_____ *(3)*

(b) Some plants e.g. desert plants, close their stomata during the day and open them at night. Explain the advantage of this pattern of opening and closing to these plants.

_____

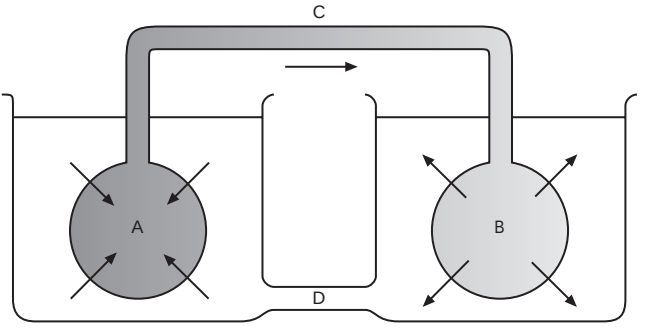
_____

_____ *(2)*

Total 7

Question B7

The diagram below is of a simple model used to demonstrate the mass flow hypothesis for the translocation of sugars in the phloem.



a) Identify which part of the model represents:

i) the phloem;

_____ *(1)*

ii) the xylem

_____ *(1)*

b) For the movement of water and dissolved sugars to be maintained from chamber A to chamber B sugars must be continually added to A and removed from B. Identify the regions equivalent to A an B, and the processes that achieve these changes in the plant.

_____

_____

_____

_____

_____

_____

(5)

Total 7

Question B8

a) List two differences in structure between phloem tissue and xylem tissue that are relevant to their functions.

_____

_____

_____ *(2)*

(b) State the function of the phloem.

_____

_____

_____ *(2)*

c) If a length of stem of a living plant is killed by heating in a 'steam jacket' applied to that region, translocation stops but transpiration continues. Explain these observations with regard to the nature of phloem and xylem.

_____

_____

_____ *(2)*

Total 6

Question B9

Give an account of the ways in which xerophytes are adapted to survive in conditions of water shortage.

Total 10

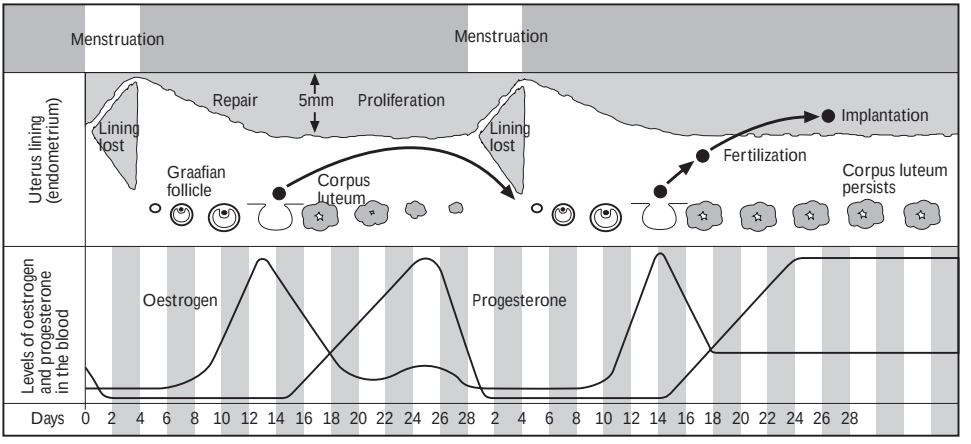
Mark Scheme

Section H : Biology (Human)

Answer ALL FIVE questions in this section.

Question H5

Study the diagram of the ovarian (menstrual) cycle in the human female and answer the following questions.



a) **i)** What event in the ovary coincides with the peak in the level of oestrogen in the blood?

_____ *(1)*

ii) What event results in the maintenance of high levels of progesterone in the blood beyond the normal time period?

_____ *(1)*

(b) Give one function for each of the following:

i) follicle stimulating hormone

_____ *(1)*

ii) luteinising hormone

_____ *(1)*

iii) oestrogen

_____ *(1)*

iv) progesterone

_____ *(1)*

Total 6

Question H6

a) Explain the significance of reduction division (meiosis) on chromosome number in gamete formation .

_____

_____

_____ *(2)*

(b) Explain the significance of chiasmata formation in the first division of reduction division (meiosis).

_____

_____

_____ *(2)*

Total 4

Question H7

a) Give a definition of epithelial tissue.

_____

_____ *(1)*

b) Identify the type of epithelial tissue found in the following sites within the human body.

i) Bowman's capsules in the kidney

_____ *(1)*

ii) Bile duct and renal tube

_____ *(1)*

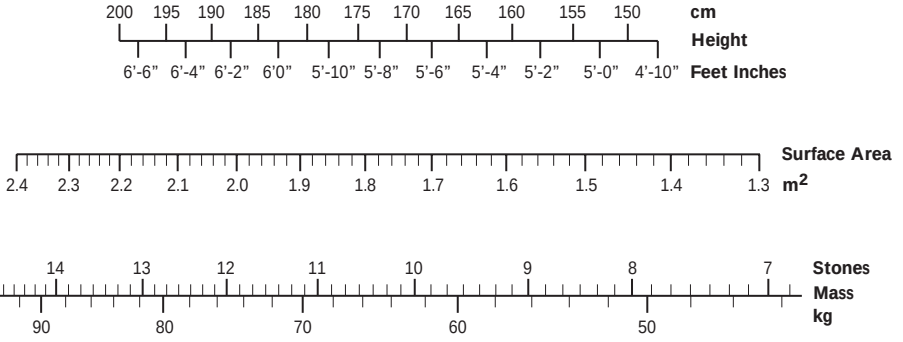
iii) Stomach and small intestine

_____ *(1)*

Total 4

Question H8

The relationship between the size of an organism or structure, and the surface area to volume ratio is significant in the exchange of substances and heat. The nomogram below enables the surface area of an individual to be estimated from their height and weight.



a) Estimate the surface area of the two individuals:

i) X with a height of 195 cm and a weight of 71 kg,

_____ *(1)*

ii) Y with a height of 165 cm and a weight of 72kg.

_____ *(1)*

iii) Calculate the surface area to volume ratio of individuals X and Y.

_____

_____ *(2)*

Question continued...

(b) Making the oversimplified assumption that body mass is directly proportional to body volume, use the figures to:

i) describe which of the two individuals would have the higher heat **loss** (all other physiological factors being equal) when both were exposed to the same environmental conditions including an external temperature of 10ºC with no special protective clothing.

(4)

ii) describe which of the two individuals would have the higher heat **production** under the same conditions as in (b) i).

(4)

Total 12

Question H9

Give an account of the the effects of reduced atmospheric pressure at high altitudes on the human body.

Total 10

Assessment Grid

EDEXCEL Specification
AS Biology and Biology (Human)

Units 2B and 2H - Exchange, Transport and Reproduction

Year Set 1

BIOLOGY	Question Number									
Specification Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
2B.1 Exchange & Environment	**6**		**10**	**12**						**28**
2B.2 Transport systems		**6**				**7**	**7**	**6**		**26**
2B.3 Adaptations & Environment									**10**	**10**
2B.4 Sexual reproduction					**6**					**6**
										Total 70

BIOLOGY	Question Number									
Assessment Objective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
AO1										
Knowledge with Understanding	**6**	**3**	**7**	**9**	**6**	**2**	**2**	**4**	**4**	**43**
AO2										
Application/Analysis/Evaluation		**3**	**3**	**3**		**5**	**5**	**2**	**6**	**27**
										Total 70

HUMAN BIOLOGY	Question Number									
Specification Section					**5**	**6**	**7**	**8**	**9**	**Total**
2H.1 Exchanges & Environment							**4**			**4**
2H.2 Transport of materials										
2H.3 Human ecology								**12**	**10**	**22**
2H.4 Human reproduction					**6**	**4**				**10**
										Total 36

HUMAN BIOLOGY	Question Number									
Assessment Objective					**5**	**6**	**7**	**8**	**9**	**Total**
AO1										
Knowledge with Understanding					**6**		**4**	**4**		**14**
AO2										
Application/Analysis/Evaluation						**4**		**8**	**10**	**22**
										Total 36

Mark Schemes for Question Paper

EDEXCEL Specification
AS Biology and Biology (Human)

Units 2B and 2H - Exchange, Transport and Reproduction

Year Set 1

Instructions

; = 1 mark / = alternative response

Section 1

Answer ALL FOUR questions in this section.

Question 1

The rate of diffusion across a surface is proportional to:

surface area x difference in concentration/ thickness of exchange surface

a) By reference to the alveoli as surfaces involved in gas exchange explain how each of the factors in the equation affects the rate of diffusion:

i) surface area

alveoli have a large surface area exposed to air and blood in the capillaries;

the larger the surface area the faster the diffusion rate; *(2)*

ii) difference in concentration

blood flowing in the pulmonary capillaries and air moving in and out of the alveoli maintain the difference in concentration of oxygen and carbon dioxide;

the larger the difference in concentration the faster the diffusion rate; *(2)*

iii) thickness of the exchange surface

the distance between the air and the red blood cells is small;

the thinner the exchange surface the faster the diffusion rate; *(2)*

Total 6

Question 2

The diagrams below show vertical sections of the heart at different stages of the cardiac cycle where the spread of electrical activity through the walls is indicated by the radiating curved lines.

a) Draw arrows on the diagrams above show the direction in which electrical activity spreads through the walls of the heart.

arrows radiating downwards and across in atria and upwards in ventricles;

possibly downwards in septum; *(1)*

(b) Relate this pattern of spread of electrical activity, and the resultant contractions of the atria and ventricles in the cardiac cycle, to the direction of the blood flow through the heart.

arrow radiating downwards in atria results in downward contraction of atria;

forcing blood downwards into the ventricles;

arrow radiating upwards in ventricles results in upward contraction of ventricles;

forcing blood upwards into pulmonary arteries and main aorta; *(3)*

c) Describe what causes the heart valves to open and close during the cardiac cycle.

heart valves are passive structures incapable of initiating movement;

pressure of blood forces valves open or shut;

dependent upon their one-way arrangement; *(2)*

Total 6

Question 3

The diagram below is of a trace from a respirometer measuring the breathing of a person at rest, who then starts exercising at a rate which causes them to start breathing more heavily and quickly.

a) Ventilation of the lungs is by tidal flow in and out of a single air tube the trachea. What are the main disadvantages of this method of ventilating a respiratory system?

stationary air close to the respiratory surface;

diffusion gradients of respiratory gases decrease; *(2)*

b) Using the trace in the diagram above.

ii) Calculate the tidal volume at rest from the trace in the diagram above.

500 cm^3 *(1)*

iii) Calculate the breathing rate at rest.

24 complete breaths per minute; *(1)*

iv) Calculate the volume of air moved through the system per minute during exercise.

tidal volume = 3.5 x 250 = 875 cm^3;

3 breaths per 5 seconds = 2625 cm^3

x 12 for one minute = 31.5 dm^3 per minute; *(3)*

b) State two changes in the blood which stimulate the increase in breathing rate during exercise. Where are the receptors that respond to these changes in the blood.

increase in carbon dioxide;

decrease in pH / increase in acidity;

carotid bodies and the respiratory control centres in the brain; *(3)*

Total 10

Question 4

The drawing below is of an X-ray of the stomach and first part of the duodenum after a barium meal (which shows up in X-rays).

a) Describe and explain the appearance in the drawing of:

i) the stomach,

opaque barium meal shows up black;
clear area at top;
air and gastric secretions;
the 'J' shape demonstrates the 'hopper and mill' functions;
pyloric sphincter / constriction marks end of stomach / entry to duodenum; *(3)*

ii) the first part of the duodenum,

small amounts of food chyle) entering from the stomach;
via the pyloric sphincter muscle;
constricted and expanded regions indicate;
peristaltic / wave-like contractions of circular and longitudinal muscle in wall;
moving the 'bolus' along the duodenum; *(3)*

b) Brunner's glands are a distinctive feature of the first part of the duodenum. Describe their function.

secrete alkaline juice rich in mucus;
for correct pH for action of pancreatic enzymes;
alkaline salts neutralise stomach acid;
mucus protects mucosa of the first part of the duodenum;
against damage by acid chyme from stomach; *(3)*

c) The graph below shows the phases of secretion of gastric juices after food enters the mouth.

i) List the sequence in which the different stimuli have their major effect.

nervous, mechanical, hormonal *(1)*

ii) How long after food has entered the mouth does the total gastric secretion reach its peak?

about 30 minutes; *(1)*

iii) Name the site of origin of the hormones which stimulate the secretion of gastric juices.

stomach wall; *(1)*

Total 12

Section B : Biology

Answer ALL FIVE questions in this section.

Question B5

The diagrams show the the main features of the ovule of a typical flowering plant.

a) Match each of the following with the appropriate letter A, B, or C.

i) Ovum or egg nucleus = B *(1)*

ii) Micropyle = A *(1)*

b) Give brief definitions of the following.

i) Pollination.

transfer of pollen from the pollen sac of the stamen;
to the stigma of the carpel; *(2)*

ii) Fertilisation

the fusion of two gametic nuclei;
to produce a fertilised egg or zygote; *(2)*

Total 6

Question B6

The graph below shows the relationship between the degree of opening of the stomata (stomatal aperture) and the rate of transpiration over a 24 hour period under natural conditions on a summer's day.

a) i) Describe the general relationship between the stomatal aperture and the rate of transpiration.

as one rises so does the other;

with their highest values around midday;

and their lowest values in the dark; *(2)*

ii) Explain how the transpiration rate can rise and fall independent of the stomatal aperture.

once stomata opened maximally no longer limiting factor;

rise and fall of transpiration affected by environmental factors which become limiting;

change in temperature / change in humidity /change in air movements; *(3)*

b) Some plants e.g. desert plants, close their stomata during the day and open them at night. Explain the advantage of this pattern of opening and closing to these plants.

in hot dry conditions danger of excess water loss by transpiration;

via stomata therefore shut during day therefore must open at night for carbon dioxide uptake. *(2)*

Total 7

Question B7

The diagram below is of a simple model used to demonstrate the mass flow hypothesis for the of the translocation of sugars in the phloem.

a) Identify which part of the model represents:

i) the phloem;

C; *(1)*

ii) the xylem;

D; *(1)*

b) For the movement of water and dissolved sugars to be maintained from chamber A to chamber B sugars must be continually added to A and removed from B. Identify the regions equivalent to A and B, and the processes that achieve these changes in the plant.

chamber A = leaves;

carrying out photosynthesis;

at a rate in excess of respiration in the light;

chamber B = roots;

carrying out respiration on the products of the excess of photosynthesis over respiration in the leaves; *(5)*

Total 7

Question B8

a) List two differences in structure between phloem tissue and xylem tissue that are relevant to their functions.

Phloem	Xylem
cytoplasmic contents	empty cell lumen;
cellulose cell walls	lignified cell walls;
sieve plates	no end walls in vessels;

(2)

b) State the function of the phloem.

transport / translocation of organic substances;

from 'sources' to 'sinks' *(2)*

c) If a length of stem in a living plant is killed by heating in a 'steam jacket' applied to that region, translocation stops but transpiration continues. Explain these observations with regard to the nature of phloem and xylem.

phloem must be living for translocation to occur;

xylem is a dead tissue unaffected by heat; *(2)*

Total 6

Question B9

Give an account of the ways in which xerophytes are adapted to survive in conditions of water shortage.

modifications to increase water uptake;
decrease water loss by transpiration;
water uptake increased by extensive root systems;
transpiration decreased by stomatal modifications e.g.;
reduction in number;
none on top surface;
sunken in grooves and pits;
covered with 'hairs';
open stomata at night and close in day;
with corresponding change in photosynthesis;
leaf surface area reduced to needles or spines;
leaf fall in dry periods;
leaf folding and rolling in dry periods;
thick waxy cuticle on leaves;

Total 10

Examination Style Question Papers

EDEXCEL Specification AS Biology and Biology (Human)

Name:

Unit 3 - Energy and the Environment

Year Set 1

Time allowed 1 hour

Instructions:

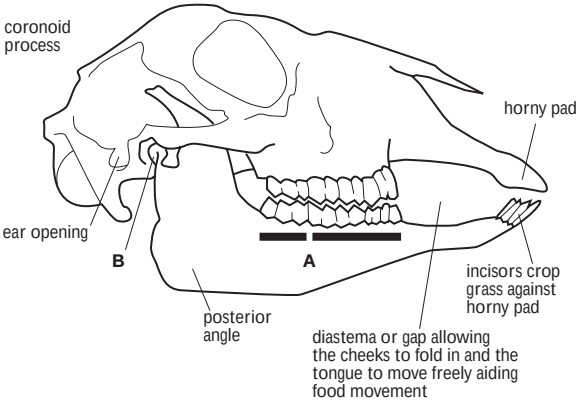
- Answer ALL THREE questions in the spaces provided.

Information

- Mark allocations are shown in brackets.
- The maximum mark for this paper is 38
- The short questions will test mainly knowledge and understanding of the content of the unit.
- The longer questions will present students with stimulus material related to the specification content. These questions will also test skills of interpretation of data or information related to the content of the unit.
- Quality of Written Communication will be assessed.
- Scientific terminology should be used where appropriate.
- A calculator may be used.

Question 1

The diagram below shows a skull of a sheep which is a ruminant herbivore.



b) Describe the problems presented by vegetation as a food source for herbivores.

(2)

b) For each of the labelled structures A and B briefly explain how they are adapted to a herbivorous diet.

A *(1)*

B *(1)*

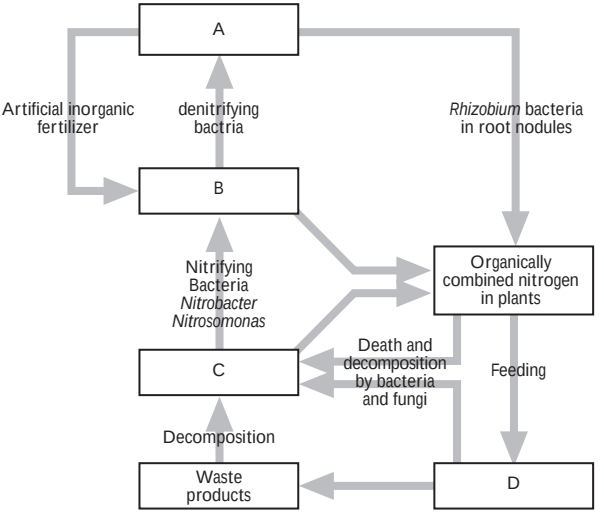
c) Describe another adaptation to a herbivorous diet in ruminants apart from the modifications of the skull.

(2)

Total 6

Question 2

The flow chart below is a simple representation of the Nitrogen Cycle.



a) Match the letters in the blank boxes with the most appropriate of the following:

Nitrates, Ammonium salts, Nitrogen in air, Animals

A _____ *(1)*

B _____ *(1)*

C _____ *(1)*

b) **i)** Name a saprobiontic organism;

_____ *(1)*

ii) The amount of naturally fixed nitrogen in a fertile soil can be supplemented by the addition of nitrate containing fertilisers. However, under average conditions only about 50% will be utilised by plants with much being washed (leached) out by rainfall into rivers and eventually lakes or oceans. Nitrates which reach natural underground reservoirs of fresh water aquifers) represent a health hazard.

Examine the diagram of the nitrogen cycle and name which organisms could be used in water purification works to remove these nitrates, and explain how they would achieve the removal of nitrates from water supplies.

_____

_____

_____

_____ *(3)*

Question continued...

c) Explain why there is so much nitrogen containing substance:

i) in the faeces of herbivorous animals,

_____

_____

_____ *(2)*

ii) the urine of animals.

_____

_____

_____

_____ *(3)*

Total 12

Question 3

Study the passages and the diagram and answer the following questions.

a) The laws of thermodynamics determine the one way flow of energy. The first law states, that energy cannot be created or destroyed, although it may be transformed from one type, e.g. light, into another, e.g. potential energy of food.

Name the process by which energy is transformed from light into the potential energy of food, and give a named example of an organism that carries out this transformation.

(1)

b) The second law of thermodynamics states that no process involving an energy transformation can occur unless there is a degradation of energy from a concentrated form into a dispersed form, with some always being dispersed into unavailable heat energy. Thus no transformation, e.g. light to food, can be 100% efficient. The second law of thermodynamics is also known as the law of entropy, entropy being a measure of disorder in terms of the amount of unavailable heat energy in a closed thermodynamic system.

Explain whether 'unavailable heat energy' has any role in an ecosystem.

(2)

c) Organisms and ecosystems maintain their highly ordered low entropy disorder state by transforming energy from high to low utility states in a controlled manner.

Explain this statement with reference to the principle of the food chain.

(1)

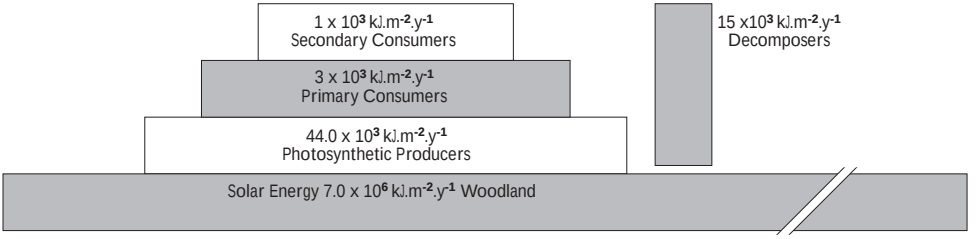
d) The interaction of energy and materials in an ecosystem is of primary concern to ecologists. In fact the one-way flow of energy and the circulation of materials are the two great principles of general ecology. (Odum)

Two major substances are recycled in all ecosystems. For each one give the name of the element being recycled and then describe in what form each substance is being taken up from, and being released into, the environment.

(2)

Question continued...

A pyramid of energy



(e) i) Calculate the percentage efficiency of transfer of energy between the photosynthetic producers and the primary consumers.

_____ *(1)*

ii) Describe the specific ways in which energy is lost between the the primary and secondary consumers.

_____

_____

_____

_____ *(3)*

Question continued...

Ecosystems Classified According to Source and Level of Energy (Odum)	Annual Energy Flow $kJ.m^{-2}$
Unsubsidised Natural Solar-powered Ecosystems e.g. open oceans, upland forests	4200 - 42 000
Naturally subsidised Solar-powered Ecosystems e.g. tidal estuaries.	42 000 - 168 000
Man subsidised Solar-powered Ecosystems e.g. agriculture	42 000 - 168 000

In addition to energy from the sun a coastal estuary receives an input of energy from tides, waves and currents, which contribute to the work of recycling mineral nutrients and transporting food in from other ecosystems.

"In a very real sense organisms in the estuary are adapted to utilise tidal power." (Odum)

f) **i)** Identify the ecosystem in the table which has the widest range of figures representing annual energy flow through ecosytems and explain why your choice has the widest range of annual energy flow.

(1)

ii) Explain how agriculture is a Man subsidised Solar-powered Ecosystem.

(5)

g) In the light of your answer to (f) (ii) explain why the figures for an estuary are the same as those for agriculture.

(1)

h) Explain why claims that livestock increase in mass by as much as 50% when fed on concentrated dry feed are misleading when compared to the efficiency of conversions in natural ecosystems.

(2)

Total 20

Assessment Grid

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 3 - Energy and the Environment
Year Set 1

	Question Number									
Specification Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
3.1 Modes of nutrition	**6**									**6**
3.2 Ecosystems										
3.3 Energy flow										
3.4 Recycling of nutrients		**12**								**12**
3.5 Energy resources			**20**							**20**
3.6 Human influences										
										Total 38

	Question Number									
Assessment Objective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**0**	**0**	**Total**
AO1										
Knowledge with Understanding	**4**	**4**	**7**							**15**
AO2										
Application/Analysis/Evaluation	**2**	**8**	**13**							**23**
										Total 38

Mark Schemes for Question Paper

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 3 - Energy and the Environment
Year Set 1

Instructions

; = 1 mark / = alternative response

Question 1

The diagram below shows a skull of a sheep which is a ruminant herbivore.

a) Describe the problems presented by vegetation as a food source for herbivores.

relatively low in nutrients therefore large volumes must be processed;

cellulose cell walls (with silica in grasses) tough barrier to extraction; *(2)*

b) For each of the labelled structures A and B briefly explain how they are adapted to a herbivorous diet.

B - loose jaw articulation allows side to side grinding movements of cheek teeth; *(1)*

A - battery of ridged molars and premolars for grinding vegetation; *(1)*

c) Describe another adaptation to a herbivorous diet in ruminants apart from the modifications of the skull.

modifications of the gut for 'rumination' / chewing the cud;

elaboration of the oesophagus and stomach for mutualistic fermenting microorganisms; *(2)*

Total 6

Question 2

The flow chart below is a simple representation of the Nitrogen Cycle.

a) Match the letters in the blank boxes with the most appropriate of the following:

Nitrates, Ammonium salts, Nitrogen in the air, Animals

A - Nitrogen in the air *(1)*

B - Nitrates *(1)*

C - Ammonium salts *(1)*

b) **i)** Name a saprobiontic organism;

Rhizopus; *(1)*

ii) The amount of naturally fixed nitrogen in a fertile soil can be supplemented by the addition of nitrate containing fertilisers. However, under average conditions only about 50% will be utilised by plants with much being washed (leached) out by rainfall into rivers and eventually lakes or oceans. Nitrates which reach natural underground reservoirs of fresh water aquifers) represent a health hazard.

Examine the diagram of the nitrogen cycle and name which organisms could be used in water purification works to remove these nitrates, and explain how they would achieve the removal of nitrates from water supplies.

denitrifying bacteria;

under anaerobic conditions use nitrates as final oxygen acceptor in respiration

liberating nitrogen gas; *(3)*

c) **i)** Explain why there is so much nitrogen containing substance:

in the faeces of herbivorous animals,

inefficiencies of digestion of plant material;

nitrogen containing substances in microorganisms from gut; *(2)*

ii) the urine of animals.

animals cannot store excess protein / amino acids;

therefore excess in diet and also from general turnover of proteins in metabolism;

metabolised to nitrogen containing waste products e.g. urea; *(3)*

Total 12

Question 3

Study the passages and the diagrams and answer the following questions.

The laws of thermodynamics determine the one way flow of energy. The first law states, that energy cannot be created or destroyed, although it may be transformed from one type, e.g. light, into another, e.g. potential energy of food.

a) Name the process by which energy is transformed from light into the potential energy of food, and give a named example of an organism that carries this out this transformation.

photosynthesis;

any green plant; *(1)*

The second law of thermodynamics states that no process involving an energy transformation can occur unless there is a degradation of energy from a concentrated form into a dispersed form, with some always being dispersed into unavailable heat energy. Thus no transformation, e.g. light to food, can be 100% efficient. The second law of thermodynamics is also known as the law of entropy, entropy being a measure of disorder in terms of the amount of unavailable heat energy in a closed thermodynamic system.

b) Explain whether 'unavailable heat energy' has any role in an ecosystem.

by raising temperature of organisms provides optimum conditions for enzyme activity;

by sharing lost heat animals can reduce heat gradients with environment;

therefore conserving body heat; *(2)*

Organisms and ecosystems maintain their highly ordered low entropy disorder state by transforming energy from high to low utility states in a controlled manner.

c) Explain this statement with reference to the principle of the food chain.

a series of feeding of trophic levels / energy transfers between organisms each capable of best exploiting that trophic level; *(1)*

The interaction of energy and materials in an ecosystem is of primary concern to ecologists. In fact the one-way flow of energy and the circulation of materials are the two great principles of general ecology. (Odum)

d) Two major substances are recycled in all ecosystems. For each one give the name of the element being recycled and then describe in what form each substance is being taken up from, and being released into, the environment.

carbon as carbon dioxide;

nitrogen as ammonium ions; *(2)*

(e) i) Calculate the percentage efficiency of transfer of energy between the photosynthetic producers and the primary consumers.

3/44 x 100 = 6.8 % *(1)*

Question continued...

ii) Describe the specific ways in which energy is lost between the primary and secondary consumers.

inefficiencies of digestion and absorption;

energy lost as heat in reactions of liver and muscle contraction;

energy lost in excretory products; *(3)*

Ecosystems Classified According to Source and Level of Energy (Odum)	Annual Energy Flow $kJ.m^{-2}$
Unsubsidised Natural Solar-powered Ecosystems e.g. open oceans, upland forests	4200 - 42 000
Naturally subsidised Solar-powered Ecosystems e.g. tidal estuaries.	42 000 - 168 000
Man subsidised Solar-powered Ecosystems e.g. agriculture	42 000 - 168 000

In addition to energy from the sun a coastal estuary receives an input of energy from tides, waves and currents, which contribute to the work of recycling mineral nutrients and transporting food in from other ecosystems.

"In a very real sense organisms in the estuary are adapted to utilise tidal power." (Odum)

(f) **i)** Identify the ecosystem in the table which has the widest range of figures representing annual energy flow through various ecosytems and explain why your choice has the widest range of annual energy flow.

Unsubsidised Natural Solar-powered Ecosystems x10;

estimates only / impossible to measure accurately;

differences in energy flows in terrrestrial and aquatic ecosystems; *(2)*

ii) Explain how agriculture is a Man-subsidised Solar-powered Ecosystem.

inorganic fertilisers require energy for their production;

imported organic fertilisers require energy for their transport;

the incorporation of fertilisers into the soil requires energy;

cultivation of the soil ie turnover and mixing requires energy;

control of pests with pesticides requires energy; *(5)*

(g) In the light of your answer to (f) (ii) explain why the figures for an estuary are the same as those for agriculture.

tidal power equivalent to input of energy into agriculture by man; *(1)*

(h) Explain why claims that livestock increase in mass as much as 50% when fed on concentrated dry feed are misleading when compared to efficiency of conversions in natural ecosystems.

food being dry weight concentrate is being compared with;

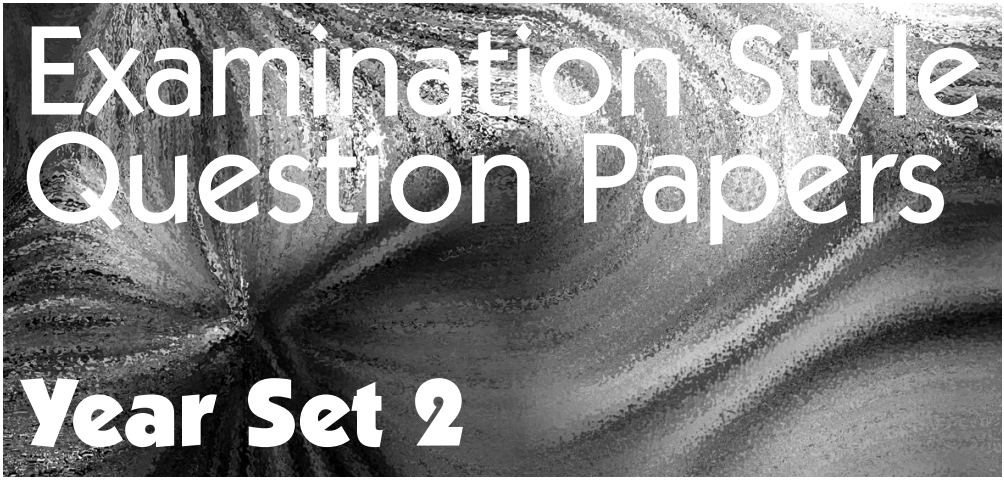
wet weight of livestock; *(2)*

Total 20

For **Edexcel** Specifications

Advanced Subsidiary

Biology or Biology (Human)



AS Unit 1 - Molecules & cells
AS Unit 2B - Exchange, transport & reproduction
AS Unit 2H - Exchange, transport & reproduction in humans
AS Unit 3 - Energy & the Environment

Complete with Assessment Grids & Mark Schemes

FELTHAM PRESS

Examination Style Question Papers

EDEXCEL Specification
AS Biology and Biology (Human)

Name:

Unit 1 - Molecules and cells
Year Set 2

Time allowed 1 hour 20 minutes

Instructions:

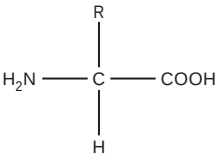
- Answer ALL NINE questions in the spaces provided.

Information

- The questions will score from four to twelve marks.
- The short questions will test mainly knowledge and understanding of the content of the unit.
- The longer questions will present stimulus material related to the specification content. These questions will also test skills of interpretation of data or information related to the content of the unit.
- At least one question requires an answer written in continuous prose
- Mark allocations are shown in brackets.
- The maximum mark for this paper is 70.
- This type of paper would carry 33.3 per cent of the total marks for AS level.
- Quality of Written Communication will be assessed.
- Scientific terminology should be used where appropriate.
- A calculator may be used.

Question 1

The structural formula of an amino acid is shown below.

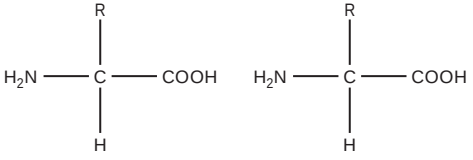


a) There are about 20 different types of amino acid to be found in proteins from living organisms, explain how the structural formula shown above applies to them all even though they are different.

(2)

b) On the diagram below show how two amino acids can combine.

(2)



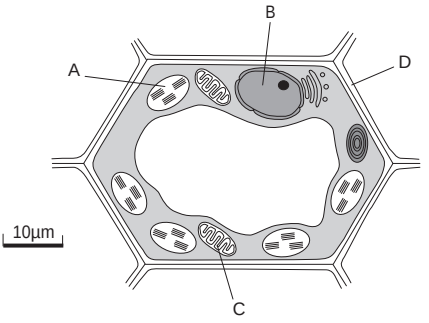
c) Name the type of bond formed by the combination of two amino acids.

(1)

Total 5

Question 2

Study the diagram of a generalised plant cell as seen under the electron microscope and answer the questions that follow.



a) Identify structures **A** to **D**

A _____ *(1)*

B _____ *(1)*

C _____ *(1)*

D _____ *(1)*

b) Name a structure in the diagram which would not be visible under even the best light microscope.

_____ *(1)*

Total 5

Question 3

a) Explain what is meant by the following terms, with regard to the uptake of substances by cells:

i) facilitated diffusion

_____

_____

_____ *(2)*

ii) active transport

_____

_____

_____ *(3)*

b) Explain why, when respiration is inhibited in cells bathed in pure water, substances, especially ions, are released from the cells.

_____

_____

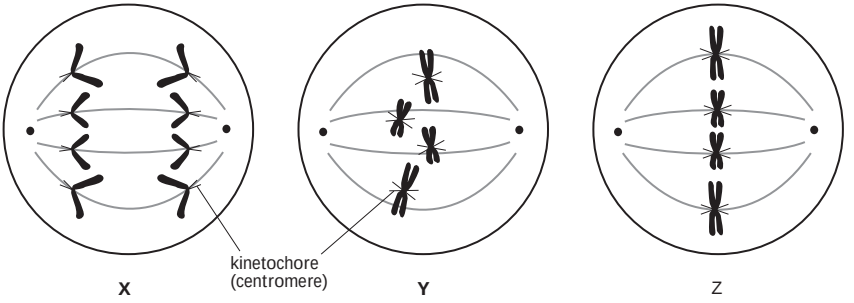
_____

_____ *(3)*

Total 8

Question 4

Study the diagrams below of different stages in mitosis and answer the following questions.



a) Write the letters in the correct order to match the sequence in which these stages occur in mitosis.

(1)

b) Describe what is occurring with respect to the chromosomes / chromatids in each of the stages shown in diagrams Y and Z.

(4)

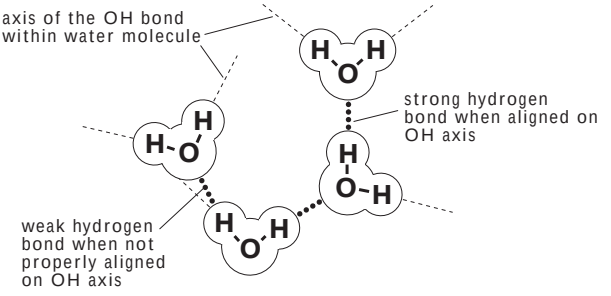
c) Explain the shape of the chromosomes in diagram X.

(3)

Total 8

Question 5

The diagram shows a representation of the 'dipolar nature' of water.



a) Explain how the 'dipolar nature' of water accounts for the following characteristics of water.

i) The high latent heat of vaporization.

(2)

ii) Surface tension.

(1)

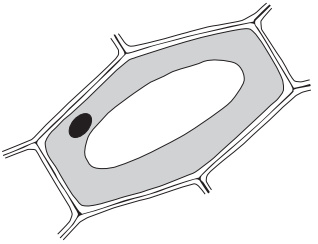
b) Describe the importance to living organisms of the fact that water has its highest density at 4ºC.

(1)

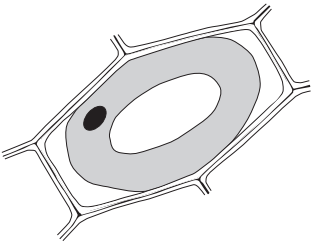
Total 4

Question 6

The diagrams below show two plant cells, each bathed in a different external solution.



Cell A



Cell B

a) **i)** Identify the cell which is in a solution more dilute than the cell contents.

_____ *(1)*

ii) Describe the appearance of the cell which is in a solution more concentrated than the cell contents.

_____

_____

_____ *(2)*

Question continued...

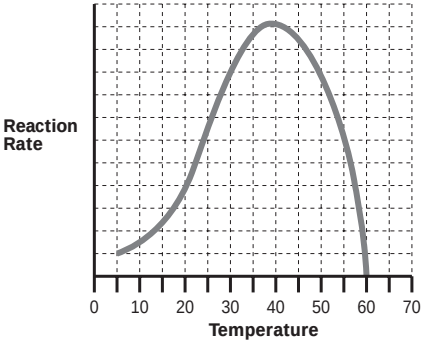
b) In the space below make an accurate drawing, enlarged x 1.5, of the two cells. Do not label your drawing.

(5)

Total 8

Question 7

The graph shows the effect of changing temperature on the rate of an enzyme controlled reaction.



a) i) Identify the optimum temperature for this enzyme.

_____ *(1)*

ii) Identify the temperature at which the enzyme is completely denatured.

_____ *(1)*

b) i) Explain why the rate of reaction slows at temperatures below the optimum.

_____

_____

_____ *(3)*

ii) Explain why the rate of reaction slows at temperatures above the optimum..

_____

_____

_____ *(2)*

c) A graph of rate of enzyme reaction against pH would have a similar shape as the one above, but there is an important difference between the state of the enzyme at the lowest temperature and the state of the enzyme at the lowest pH. Explain what this difference is.

_____

_____

_____

_____ *(3)*

Total 10

Question 8

a) The genetic code consists of a sequence of bases on a strand of DNA, and can be represented by a series of letters on a line as shown below

T A C C G T T C T A C C

i) Describe what the letters represent, and give their names.

(2)

ii) Draw a similar line with letters to represent the complementary strand of DNA.

(1)

iii) Draw a similar line with letters to represent the complementary strand of mRNA to the original DNA strand shown at the start of the question.

(1)

b) The table below shows the genetic code on a strand of mRNA for selected amino acids.

Amino acid	mRNA codons
alanine	GCA, GCC, GCG, GCU
argenine	AGA, AGG, CGA, CGC, CGG, CGU
tryptophan	UGG
lysine	AAA, AAG
methionine	AUG (also acts as the 'start' codon so that every polypeptide chain initially starts with methionine)

Using the information in the table give answers to the following.

i) Write out the sequence of amino acids coded for by the original strand of DNA shown above in part (a) of the question.

(2)

ii) Explain what is meant by describing the genetic code as 'degenerate'.

(2)

iii) Explain what is meant by describing the genetic code as 'non-overlapping'.

(4)

Total 12

Question 9

Give an account of the nature and functions of fibrous and globular proteins as illustrated by collagen and insulin.

Total 10

Assessment Grid

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 1 - Molecules and cells
Year Set 2

	Question Number									
Specification Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
1.1 Molecules	**5**				**4**				**10**	**19**
1.2 Enzymes							**10**			**10**
1.3 Cellular organisation			**8**			**8**		**12**		**28**
1.4 Cell Cycle		**5**		**8**						**13**

Total 70

	Question Number									
Assessment Objective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
AO1										
Knowledge with Understanding	**5**	**5**	**8**	**5**	**4**	**6**	**3**	**4**	**4**	**44**
AO2										
Application/Analysis/Evaluation				**3**		**2**	**7**	**8**	**6**	**26**

Total 70

Mark Schemes for Question Paper

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 1 - Molecules and cells
Year Set 2

Instructions

; = 1 mark / = alternative response

Question 1

The structural formula of an amino acid is shown below.

a) There are about 20 different types of amino acid to be found in proteins from living organisms, explain how the structural formula shown above applies to them all even though they are different.

the R group varies in structure;

providing the variation between them; *(2)*

b) On the diagram below show how two amino acids can combine.

showing removal of elements of water;

formation of CO-NH bond; *(2)*

c) Name the type of bond formed by the combination of two amino acids.

peptide bond; *(1)*

Total 5

Question 2

a) Identify structures A to D

A = Chloroplast

B = Nucleus

C = Mitochondrion

D = Cell wall *(4)*

b) Name a structure in the diagram which would not be visible under even the best light microscope.

ribosome *(1)*

Total 5

Question 3

a) Explain what is meant by the following terms, with regard to the uptake of substances by cells:

i) facilitated diffusion

diffusion down a diffusion gradient;

from higher concentration to lower concentration;

speeded up/ made easier by the presence of special carriers in the membrane; *(2)*

ii) active transport

uptake against the prevailing diffusion gradient;

from lower concentration to higher concentration;

involving carriers in cell membrane;

using energy from respiration / ATP; *(3)*

b) Explain why, when respiration is inhibited in cells bathed in pure water, substances, especially ions, are released from the cells.

in pure water the diffusion gradient is from the more concentrated cell contents to the pure water;

this situation is maintained by active ion uptake;

using energy from respiration / ATP;

if respiration is inhibited active uptake is reduced and substances diffuse out of the cell into the surrounding water;

if respiration inhibited completely, membrane breaks down and all cell contents are released into the surrounding water; *(3)*

Total 8

Question 4

Study the diagrams below of different stages in mitosis and answer the following questions.

a) Write the letters in the correct order to match the sequence in which these stages occur in mitosis.

Y, Z, X *(1)*

b) Describe what is occurring with respect to the chromosomes / chromatids in each of the stages shown in diagrams Y and Z.

Y - the chromosomes (each of two chromatids) are just formed;

and moving towards the equator of the nuclear spindle apparatus;

Z - the chromosomes (each of two chromatids) are arranged on the equator;

by means of the kinetochore centromere) attached to fibres of the spindle apparatus; *(4)*

c) Explain the shape of the chromosomes in diagram X.

the kinetochores centromeres) are the centres of movement of the chromosomes;

they lead the way along the spindle fibres towards the centrioles at the poles of the spindle;

the 'arms' of the chromosomes trail behind; *(3)*

Total 8

Question 5

The diagram shows a representation of the 'dipolar nature' of water.

a) Explain how the 'dipolar nature' of water accounts for the following characteristics of water :

i) the high latent heat of vaporization.

H bonds between the opposite charged 'poles';

hold water molecules together;

so much energy is needed to separate them for vaporisation; *(2)*

ii) surface tension

electrostatic attraction between the opposite charged 'poles' hold water molecules together which at the surface results in the formation of a surface tension; *(1)*

b) Describe the importance to living organisms of the fact that water has its highest density at 4ºC.

ice floats allowing life to survive beneath it; *(1)*

Total 4

Question 6

The diagrams below show two plant cells, each bathed in a different external solution.

a) **i)** Identify the cell which is in a solution more dilute than the cell contents.

cell A; *(1)*

ii) Describe the appearance of the cell which is in a solution more concentrated than the cell contents.

the cell membrane is withdrawn from the cell wall;

the central vacuole is smaller than in cell A; *(2)*

b) In the space below make an accurate drawing, enlarged x 1.5, of the cells. Do not label your drawing.

correct size / magnification;

correct proportions;

correct number of cells

cell wall thickness appropriate;

accurate detail of cell contents;

(5)

Total 8

Question 7

The graph shows the effect of changing temperature on the rate of an enzyme controlled reaction.

a) i) identify the optimum temperature for this enzyme.

37ºC; *(1)*

ii) Identify the temperature at which this enzyme is completely denatured.

60ºC *(1)*

b) i) Explain why the rate of reaction slows at temperatures below the optimum.

rate of collisions of reacting molecules temperature dependent;

the lower the temperature the lower the rate of collisions;

lowers the rate of all chemical reactions including enzyme catalysed; *(3)*

ii) Explain why the rate of reaction slows at temperatures above the optimum.

enzyme molecules progressively denatured / disrupted;

cannot form enzyme substrate complexes;

rate of reaction slows despite increased rate of collision; *(2)*

c) A graph of rate of enzyme reaction against pH would have a similar shape as the one above, but there is an important difference between the state of the enzyme at the lowest temperature and the state of the enzyme at the lowest pH. Explain what this difference is.

at lowest temperature enzyme not denatured;

reversible;

at lowest pH enzyme denatured;

irreversible; *(3)*

Total 10

Question 8

a) The genetic code consists of a sequence of bases on a strand of DNA, and can be represented by a series of letters on a line as shown below

T A C C G T T C T A C C

i) Describe what the letters represent, and give their names.

nitrogenous bases;

thymine, adenine, guanine, and cytosine; *(2)*

ii) Draw a similar line with letters to represent the complementary strand of DNA.

A T G G C A A G A T G G *(1)*

iii) Draw a similar line with letters to represent the complementary strand of mRNA to the original DNA strand shown at the start of the question.

A U G G C A A G A U G G *(1)*

b) The table below shows the genetic code on a strand of mRNA for selected amino acids.

Amino acid	mRNA codons
alanine	GCA, GCC, GCG, GCU
argenine	AGA, AGG, CGA, CGC, CGG, CGU
tryptophan	UGG
lysine	AAA, AAG
methionine	AUG (also acts as the 'start' codon so that every polypeptide chain initially starts with methionine)

Using the information in the table answer the following:

i) write out the sequence of amino acids coded for by the original strand of DNA shown above in part (a) of the question

methionine-alanine-argenine-tryptophan; *(2)*

ii) explain what is meant by describing the genetic code as 'degenerate';

most amino acids are coded for by more than one triplet codon;

changes in the triplet codons (mutations) do not necessarily result in a change of the amino acid coded for; *(2)*

iii) explain what is meant by describing the genetic code as 'non-overlapping';

gene always starts from AUG;

determines bases in each subsequent triplet codon;

until 'stop' codon;

cannot 'overlap' by having bases contribute to more than one codon;

therefore a specific length of DNA a gene) always codes for the same polypeptide;

(4)

Total 12

Question 9

Give an account of the structure and functions of fibrous and globular proteins as illustrated by collagen and insulin.

both composed of long chains of amino acids joined by peptide bonds;

polypeptide chains - their primary structure;

shaping of final structure as a result of formation of bonds between parts of chains;

ionic, hydrogen and disulphide bonds;

giving secondary, tertiary, and quaternary structures;

two broad groupings - fibrous which are structural and metabolically inert e.g. collagen;

collagen tough fibrous protein forms major structural protein of the body;

found in tendons, bone, areolar connective tissue (membranes);

three polypeptide chains held together by hydrogen bonds;

a triple helix;

and globular which are metabolically active e.g. hormone insulin;

two polypeptide chains held together by disulphide bonds;

Total 10

Examination Style Question Papers

EDEXCEL Specification AS Biology and Biology (Human)

Name:

Units 2B and 2H - Exchange, Transport and Reproduction

Year Set 2

Time allowed 1 hour 20 minutes

Instructions:

- Answer NINE questions in the spaces provided.

Information

- The questions will score from four to twelve marks.
- You must answer Section 1 and

  EITHER Section B: Biology

  OR Section H: Biology (Human)
- The short questions will test mainly knowledge and understanding of the content of the unit.
- The longer questions will present students with stimulus material related to the specification content. These questions will also test skills of interpretation of data or information related to the content of the unit.
- At least one question requires an answer written in continuous prose
- Mark allocations are shown in brackets.
- The maximum mark for this paper is 70.
- This type of paper would carry 33.3 per cent of the total marks for AS level.
- Quality of Written Communication will be assessed.
- Scientific terminology should be used where appropriate.
- A calculator may be used.

You must answer Section 1 and
EITHER Section B: Biology OR Section H: Biology (Human)

Section 1

Answer ALL FOUR questions in this section.

Question 1

Air that is breathed in (inspired air) contains about 21% by volume of oxygen, and 0.04% by volume of carbon dioxide, and air that is breathed out (expired air) contains about 16% by volume of oxygen

a) i) Name two other main components of inspired air.

_____

_____ *(2)*

ii) Give figures for the percentage by volume of carbon dioxide in expired air.

_____

_____ *(1)*

b) Explain the relationship between the figures for inspired air, and the figures for expired air

_____

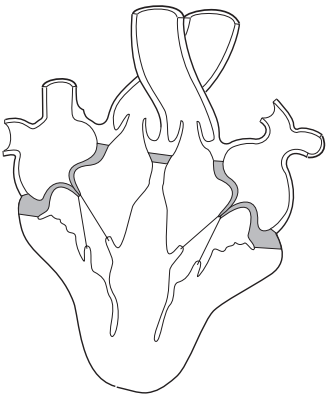
_____

_____ *(2)*

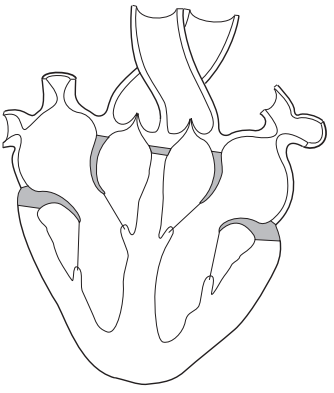
Total 5

Question 2

Study the diagrams below showing the state of the heart at two stages in the cardiac cycle, and answer the questions that follow.



X



Y

a) Identify the diagram in which the ventricles are relaxed.

_____ *(1)*

b) Describe what causes the pocket valves to shut at the stage of the cardiac cycle shown in diagram Y.

_____

_____

_____

_____ *(3)*

c) Explain how the tricuspid and bicuspid valves between the atria and the ventricles are prevented from opening in the wrong direction.

_____

_____

_____

_____ *(3)*

Total 7

Question 3

Study the following table relating to the composition of human faeces and answer the following questions.

Water	65 0 %
Solid material	35.0 %
of which bacteria	7.5 %
of 100 g Cellulose ingested	100 g lost in faeces
of 100 g fat ingested	6.0 g lost in faeces
mineral ions	
epithelial cells	
bile pigments	

a) **i)** Comment on the significance of the figures for the ingestion and egestion (loss) of cellulose.

(2)

ii) Comment on the efficiency of the digestion and absorption of fats.

(1)

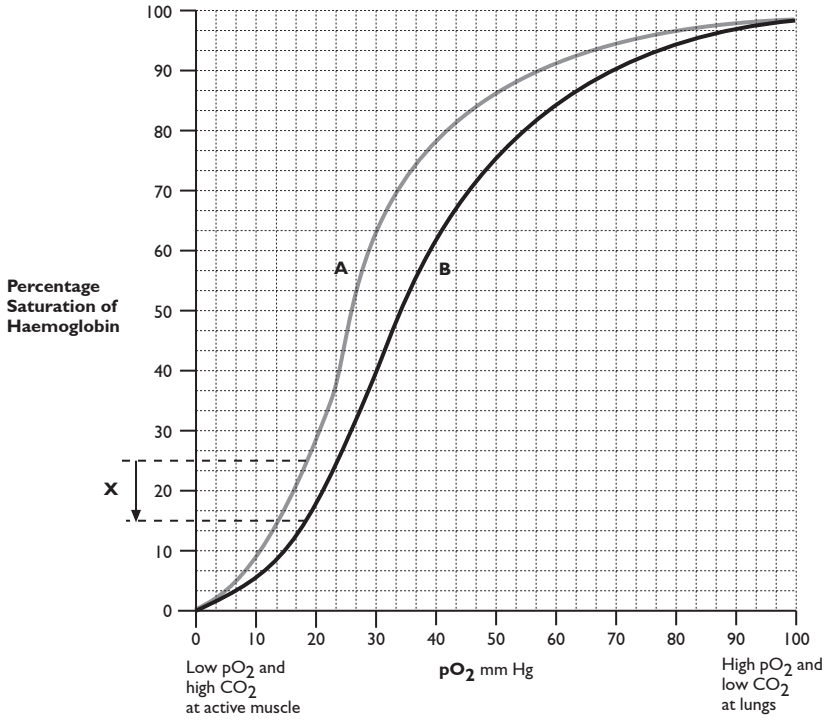
b) Explain the high percentage of bacteria in the faeces.

(4)

Total 7

Question 4

Study the graph below showing the association of haemoglobin with oxygen at different partial pressures of oxygen, and answer the following questions.



a) **i)** The two curves represent the percentage saturation of haemoglobin with oxygen at two different carbon dioxide concentrations, identify the curve on the diagram which is at the higher carbon dioxide concentration.

_____ *(1)*

ii) What effect would an increase in temperature and a decrease in pH have on the position of these curves, and what would this represent in terms of the association of oxygen with haemoglobin.

_____

_____

_____ *(2)*

Question continued...

iii) With reference to the vertical arrow labelled X explain the significance of the differences between the two curves in respect to the delivery of oxygen to the tissues.

(3)

b) Explain how the difference between the two conditions of the two curves could be increased by the activity of the body.

(3)

c) Explain the physiological significance of the relative affinity (combining tendency) of:

i) adult haemoglobin and fetal haemoglobin,

(3)

ii) adult haemoglobin and myoglobin

(3)

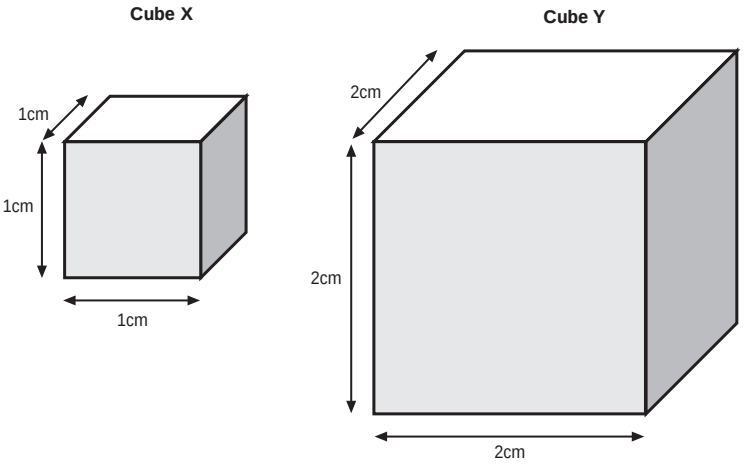
Total 15

Section B : Biology

Answer ALL FIVE questions in this section.

Question B5

The diagram shows two cubes and their dimensions in centimetres.



a) Calculate the surface area to volume ratio for each of the two cubes shown above.

(2)

b) **i)** Explain the significance of the surface area to volume ratio in relation to the exchange of substances and heat between organisms and their environment.

(4)

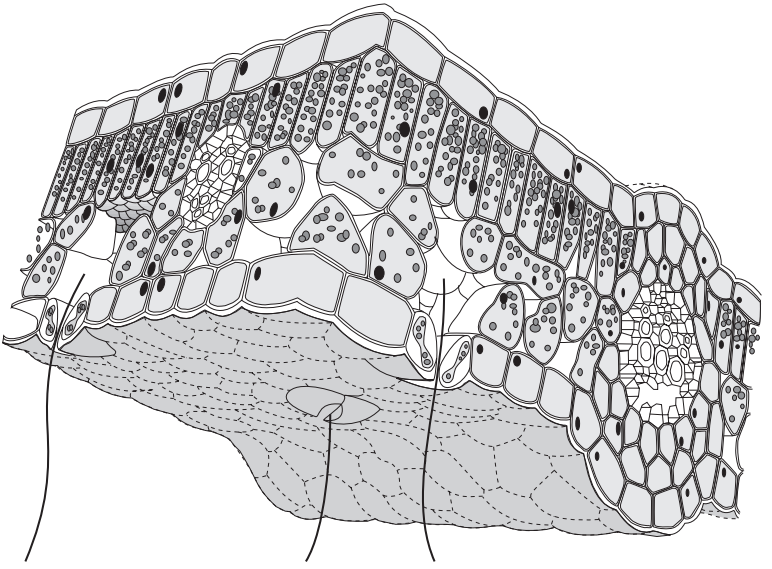
ii) Name a structure in the typical flowering plant which is specialised to present a large surface area for exchanges.

(1)

Total 7

Question B6

The diagram below is of a section through a typical leaf of a flowering plant a mesophyte).



P Oxygen **Q** Carbon dioxide **R** Water Vapour

a) i) Place arrow heads on the lines P, Q, and R on the diagram passing through the stomata to show the overall direction of the diffusion of oxygen, carbon dioxide, and water respectively, at noon in conditions of average humidity *(3)*

ii) Give the name of a cell from which water is actually evaporating prior to diffusing out of the leaf.

_____ *(1)*

iii) Name the tissue in which most of the carbon dioxide that enters the leaf will be used.

_____ *(1)*

b) With decreasing diameter of the stomata the passage of water vapour is restricted more than that of carbon dioxide. Explain the advantage of this to the plant in terms of gaseous exchanges with the environment.

_____

_____

_____

_____ *(3)*

Total 8

Question B7

a) Describe the effect on transpiration of plants living:

i) completely submerged in water;

_____

_____ *(1)*

ii) rooted in mud at the bottom of water with floating leaves.

_____

_____ *(1)*

b) Describe and explain the effect of both these modes of life on the degree of development of the xylem tissue.

_____

_____

_____ *(2)*

c) One characteristic of many plants such as those above (hydrophytes) is the presence of large air spaces, especially in submerged parts. Explain the function of these.

_____

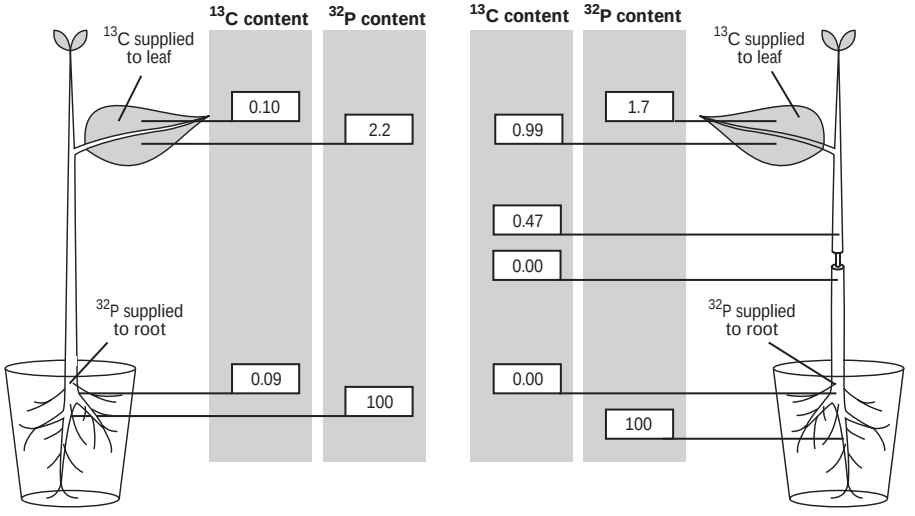
_____

_____ *(2)*

Total 6

Question B8

The diagrams below represent the results of ringing experiments on plants, leaves of which were exposed to radioactive ^{13}C labelled carbon dioxide and roots of which were exposed to radioactive ^{32}P labelled phosphate ions.



a) By reference to the diagrams explain how this experiment demonstrates the role of phloem in the translocation of sugars.

(3)

b) Studies with radioactive tracers have indicated rates of flow of sugars in the phloem of 1 metre per hour in grasses, and as high as 50 metres per hour in soya plants. Explain how this could be used as evidence against the mass flow hypothesis of translocation of sugars in the phloem.

(2)

Total 5

Question B9

Give a detailed account of how gas exchange is achieved in a free living single celled organism like *Amoeba*

Total 10

Section H : Biology (Human)

Answer ALL FIVE questions in this section.

Question H5

a) Explain the dangers of inhaling carbon monoxide.

(3)

b) **i)** Explain how the unborn child of a non-smoking woman can become poisoned by carbon monoxide, nicotine and cancer causing chemicals from tobacco smoke.

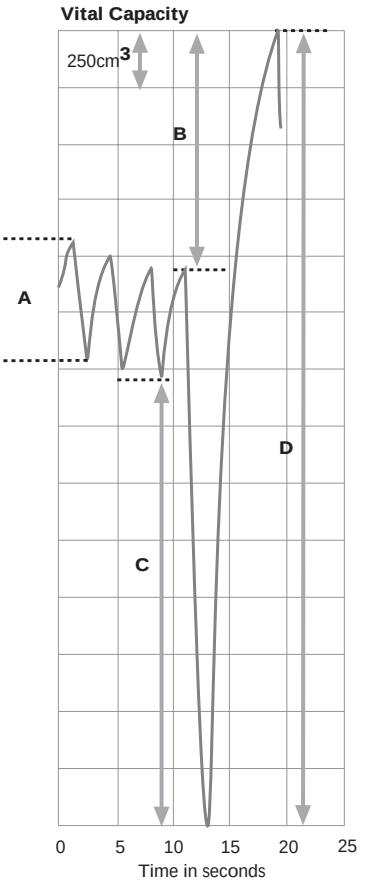
(2)

ii) Explain the effect of tobacco smoking on the blood vessels and relate this to the lower birth weight of babies born to mothers who smoke.

(2)

Total 7

Question H6



The diagram above is of a trace from a spirometer measuring a person's breathing.

a) Use the letters on the diagram to identify the following:

i) tidal volume, _____ *(1)*

ii) inspiratory and expiratory reserve volumes, _____ *(1)*

iii) vital capacity _____ *(1)*

b) Explain why the tidal volume can never equal the vital capacity.

_____

_____ *(2)*

Total 5

Question H7

The human placenta is of the type where there is extensive breakdown of both maternal and fetal tissues so that in some areas the maternal and fetal circulations are only separated by the thickness of a capillary wall.

a) Explain the advantages of this arrangement.

_____

_____

_____ *(2)*

b) Explain the disadvantages of this arrangement.

_____

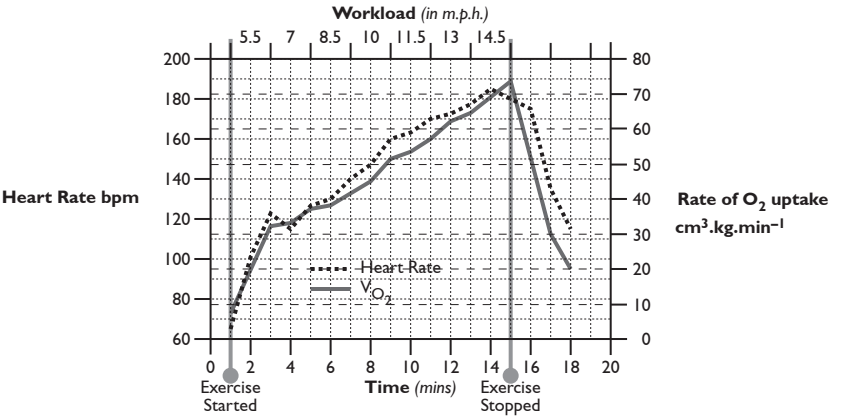
_____

_____ *(2)*

Total 4

Question H8

Study the graph showing the heart rate and oxygen uptake of a middle distance runner performing a maximal treadmill test, and answer the following questions.



a) Identify the periods over which:

i) the greatest increase in rate of heart rate and oxygen uptake occurs;

(1)

ii) the oxygen uptake continues to increase and the heart rate decreases.

(1)

b) For the individual above identify the

i) resting heart rate;

(1)

ii) maximum heart rate.

(1)

c) Explain why the curves do not return to normal immediately after exercise stops.

(3)

d) Explain why the heart rate and oxygen uptake follow each other so closely throughout this investigation.

(3)

Total 10

Question H9

Give an account of the effects of ageing on the skeletal system.

Total 10

Assessment Grid

EDEXCEL Specification
AS Biology and Biology (Human)

Units 2B and 2H - Exchange, Transport and Reproduction
Year Set 2

BIOLOGY	Question Number									
Specification Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
2B.1 Exchanges & Environment	**5**		**7**		**7**	**8**			**10**	**37**
2B.2 Transport systems		**7**		**15**			**6**	**5**		**33**
2B.3 Adaptations & Environment										
2B.4 Sexual reproduction										

Total 70

BIOLOGY	Question Number									
Assessment Objective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
AO1										
Knowledge with Understanding	**5**	**7**	**4**	**6**	**3**	**5**	**4**	**5**	**6**	**45**
AO2										
Application/Analysis/Evaluation			**3**	**9**	**4**	**3**	**2**		**4**	**25**

Total 70

HUMAN BIOLOGY	Question Number									
Specification Section					**5**	**6**	**7**	**8**	**9**	**Total**
2H.1 Exchanges & Environment					**7**	**5**				**12**
2H.2 Transport of materials								**10**		**10**
2H.3 Human ecology										
2H.4 Human reproduction							**4**		**10**	**14**

Total 36

HUMAN BIOLOGY	Question Number									
Assessment Objective					**5**	**6**	**7**	**8**	**9**	**Total**
AO1										
Knowledge with Understanding					**3**	**3**	**4**	**4**	**1**	**15**
AO2										
Application/Analysis/Evaluation					**4**	**2**		**6**	**6**	**18**

Total 33

Mark Schemes for Question Paper

EDEXCEL Specification
AS Biology and Biology (Human)

Units 2B and 2H - Exchange, Transport and Reproduction

Year Set 2

Instructions

; = 1 mark / = alternative response

Section 1

Answer ALL FOUR questions in this section.

Question 1

Air that is breathed in inspired air) contains about 21% by volume of oxygen, and 0.04% by volume of carbon dioxide, and air that is breathed out (expired air) contains about 16% by volume of oxygen

a) i) Name two other main components of inspired air.

nitrogen;

water vapour; *(2)*

ii) Give figures for the percentage by volume of carbon dioxide in expired air.

4 - 5%; *(1)*

b) Explain the relationship between the figures for inspired air, and the figures for expired air

the volume of carbon dioxide breathed out has been generated by oxidation;

of substrates by the roughly the same volume of oxygen; *(2)*

Total 5

Question 2

Study the diagrams below showing the state of the heart at two stages in the cardiac cycle, and answer the following questions.

Diagrams of heart at ventricular diastole (Y) and systole (X)

a) Identify the diagram in which the ventricles are relaxed.

diagram Y; *(1)*

b) Describe what causes the pocket valves to close at the stage of the cardiac cycle shown in diagram Y.

by blood falling back down the blood vessels exiting the right and left ventricles aorta and pulmonary arteries);

as a result of the lower pressure in the empty ventricles;

blood fills 'pockets';

'pockets' block and shut the blood vessels; *(3)*

c) Explain how the tricuspid and bicuspid valves between the atria and the ventricles are prevented from opening in the wrong direction.

tendons / cords attached to lower surface of valves and to walls of ventricles;

when ventricles contract, upward force of blood forces valves up;

prevented from opening the wrong way by tendon cords becoming taut;

aided by muscles of ventricular wall exerting a downward pull on tendon cords; *(3)*

Total 7

Question 3

Study the following table relating to the composition of human faeces and answer the following questions.

Water 65 0 %
Solid material 35.0 %
of which bacteria 7.5 %
of 100 g Cellulose ingested 100.0 g lost in faeces
of 100 g fat ingested 6.0 g lost in faeces
mineral ions
epithelial cells
bile pigments

a) **i)** Comment on the significance of the figures for the ingestion and egestion (loss) of cellulose.

no digestion or absorption;
purely mechanical role in aiding peristalsis; *(2)*

ii) Comment on the efficiency of the digestion and absorption of fats.

6 % lost ie 94 % digested and absorbed; *(1)*

b) Explain the high percentage of bacteria in the faeces.

enter with the food;
bypass the sterilising effect of stomach acid;
multiply in the colon;
some lost on a daily basis and replenished by continuing multiplication in the colon; *(4)*

Total 7

Question 4

Study the graph showing the association of haemoglobin with oxygen and answer the following questions.

a) i) The two curves represent the percentage saturation of haemoglobin with oxygen at two different carbon dioxide concentrations, label the curve on the diagram which is at the higher carbon dioxide concentration.

right hand curve / curve B; *(1)*

ii) What effect would an increase in temperature and a decrease in pH have on the position of these curves, and what would this represent in terms of the association of oxygen with haemoglobin?

move both to the right;

represents a decrease in affinity for oxygen; *(2)*

iii) With reference to the vertical arrow labelled X explain the significance of the difference between the two curves in respect of the delivery of oxygen to the tissues.

arrow X indicates difference in saturation;

at one particular oxygen level;

more oxygen released to tissues;

when right hand curve operating (high carbon dioxide); *(3)*

b) Explain how the difference between the two conditions of the two curves could be increased by the activity of the body.

difference depends on different levels of carbon dioxide;

levels of carbon dioxide increased by increased respiration;

eg as a result of increased exercise; *(3)*

c) Explain the physiological significance of the relative affinity (combining tendency) of:

i) adult haemoglobin and foetal haemoglobin,

fetal haemoglobin has greater affinity;

ensures foetal haemoglobin can load with oxygen;

from adult oyxhaemoglobin in the placental artery; *(3)*

ii) adult haemoglobin and myoglobin

myoglobin has greater affinity;

ensures myoglobin can load with oxygen;

from adult oyxhaemoglobin in the muscles; *(3)*

Total 15

Section B : Biology

Answer ALL FIVE questions in this section.

Question B

The diagram shows two cubes and their dimensions in centimetres.

a) Calculate the surface area to volume ratio for each of the two cubes shown above.

Cube X: S.A. = 6cm^2. V = 1cm^3. SA/V = 6

Cube X: S.A. = 24cm^2. V = 8cm^3. SA/V = 3 *(2)*

b) **i)** Explain the significance of the surface area to volume ratio in relation to the exchange of substances and of heat between organisms and their environment.

substances exchanged with the environment over the surface area of organisms;

to and from the volume of the organism;

therefore the larger the SA/Vol ratio;

the more exchange capacity per unit volume; *(4)*

ii) Name a structure in the typical flowering plant which is specialised to present a large surface area for exchanges.

leaf / root hair; *(1)*

Total 7

Question B6

The diagram is of a section through a typical leaf of a flowering plant a (mesophyte).

a) **i)** Place arrow heads on the lines P, Q, and R on the diagram passing through the stomata to show the overall direction of the diffusion of oxygen, carbon dioxide, and water respectively, at noon in conditions of average humidity *(3)*

ii) Give the name of a cell from which water is actually evaporating before diffusing from the stomata.

spongy mesophyll; *(1)*

iii) Name the tissue in which most of the carbon dioxide that enters the leaf will be used.

palisade mesophyll; *(1)*

b) With decreasing diameter of the stomata the passage of water vapour is restricted more than that of carbon dioxide. Explain the advantage of this to the plant in terms of gaseous exchanges with the environment.

primary role of open stomata is the uptake of carbon dioxide in the light for photosynthesis;

water loss an unavoidable and potentially harmful consequence;

therefore decreasing size of stomata limits the danger at less cost to the advantage; *(3)*

Total 8

Question B7

a) Describe the effect on transpiration of plants living:

i) completely submerged in water;

no transpiration; *(1)*

ii) rooted in mud at the bottom of water with floating leaves.

normal but reduced transpiration only from upper surface of leaves; *(1)*

b) Describe and explain the effect of both these modes of life on the degree of development of the xylem tissue.

poorly developed;

as xylem is the water transporting tissue; *(2)*

c) One characteristic of many plants such as those above (hydrophytes) is the presence of large air spaces, especially in submerged parts. Explain the function of these.

to allow the circulation of air to all parts;

to offset low oxygen content of water as compared to air; *(2)*

Total 6

Question B8

The diagrams below represent the results of ringing experiments on plants, leaves of which were exposed to radioactive ^{13}C labelled carbon dioxide and roots of which were exposed to radioactive ^{32}P.labelled phosphate ions.

a) By reference to the figures explain how this experiment demonstrates the role of phloem in the translocation of sugars and that of the xylem in the transport of inorganic ions from the roots.

in ringed plant ^{13}C compounds accumulate in the leaf from 0.10 to 0.99;

in ringed plant ^{13}C compounds do not reach roots, unringed 0.09, ringed 0.00;

in ringed plant small effect on transport of ^{32}P to the leaf from 2.2 to 1.7; *(3)*

b) Studies with radioactive tracers have indicated rates of flow of sugars in the phloem of 1 metre per hour in grasses, and as high as 50 metres per hour in soya plants. Explain how this could be used as evidence against the mass flow hypothesis of translocation of sugars in the phloem.

only living phloem involved in translocation;

cytoplasm and membranes of sieve tube elements present high resistance to mass flow;

cross section dimensions of sieve tube elements do not seem large enough for mass flow at this rate; *(2)*

Total 5

Question B9

Give a detailed account of how gas exchange is achieved in a free living freshwater single celled organism like *Amoeba*.

small size;

therefore large surface area to volume ratio;

gas exchange over the surface sufficient to serve requirements of volume of cytoplasm;

oxygen uptake and carbon dioxide loss;

passively down diffusion gradients;

across cell surface membrane / plasmalemma;

free living organism like amoeba carry out phagocytosis by pseudopodia;

food vacuole has a surface area over which oxygen may be taken up;

and exocytosis of egested particles;

water expelled with particles carries carbon dioxide in solution;

water entering by osmosis contains oxygen in solution;

fresh water amoeba carries out extensive osmoregulation by contractile vacuole;

water expelled contains carbon dioxide in solution;

Total 10

Section H : Biology (Human)

Answer ALL FIVE questions in this section.

Question H5

a) Explain the dangers of inhaling carbon monoxide.

combines irreversibly with haemoglobin;

competing with the transport of oxygen as oxyhaemoglobin;

reducing oxygen supply to tissues; *(3)*

b) **i)** Explain how the unborn child of a non-smoking woman can become poisoned by carbon monoxide, nicotine and cancer causing chemicals from tobacco smoke.

by passive smoking / breathing smoker's smoke;

carbon monoxide etc absorbed into blood stream and reaches embryo across placenta; *(2)*

ii) Explain the effect of tobacco smoking on the blood vessels and relate this to the lower birth weight of babies born to mothers who smoke.

nicotine constricts blood vessels;

reducing supply to placenta and embryo; *(2)*

Total 7

Question H6

The diagram below is of a trace from a spirometer, measuring a person's breathing.

a) Use the letters on the diagram to identify the following:

i) tidal volume,

A *(1)*

ii) inspiratory and expiratory reserve volumes,

B & C (1)

iii) vital capacity

D (1)

b) Explain why the tidal volume can never equal the vital capacity.

impossible to move vital capacity;

repeatedly in normal breathing cycle; *(2)*

Total 5

Question H7

The human placenta is of the type where there is extensive breakdown of both maternal and fetal tissues so that in some areas the maternal and fetal circulations are only separated by the thickness of a capillary wall.

a) Explain the advantages of this arrangement.

reduces diffusion distance between the two to a minimum;

increasing efficiency of exchanges; *(2)*

b) Explain the disadvantages of this arrangement.

danger of passage of unwanted substances;

and of mixing of two circulations as a result of leaks;

loss of structural attachment; *(2)*

Total 4

Question H8

Study the graph of heart rate and oxygen uptake of a middle distance runner performing a maximal treadmill test, and answer the following questions.

a) Identify the periods over which:

i) the greatest increase in heart rate and oxygen uptake occurs;

1 - 2 minutes / first minute of exercise; *(1)*

ii) the oxygen uptake continues to increase and the heart rate decreases.

14 - 15 minutes / 13 - 14 minutes after the start of exercise; *(1)*

b) For the individual above identify the

i) resting heart rate;

65 - 70 bpm; *(1)*

ii) maximum heart rate.

180 - 185 bpm; *(1)*

c) Explain why the curves do not return to normal immediately after exercise stops.

metabolic demands still high;

oxygen debt;

both continue at higher rate to meet these declining demands; *(3)*

d) Explain why the heart rate and oxygen uptake follow each other so closely throughout this investigation.

tissues (muscles) demand oxygen for aerobic respiration;

demand for oxygen met by increase in blood supply;

increase in blood supply achieved by increase in cardiac output which involves an increase in heart rate; *(3)*

Total 10

Question H9

Give an account of the effects of ageing on the skeletal system.

osteoporosis or loss of bone;
removal of calcium salts at a greater rate than replacement;
'brittle bones' leading to increased risk of fracture;
may be secondary to effect of increasing inactivity rather than ageing as such;
made worse by inactivity as stressing of bones promotes bone deposition;
weakening of musculature reduces stress on skeleton;
commonest in post-menopausal women;
linked to drop in oestrogen levels;
large genetic component in susceptibility;
osteoarthritis or degenerative joint disease;
inflammation of the synovial membrane or systemic symptoms;
loss of articular cartilage;
autoimmune rheumatoid arthritis also increases in occurrence with age;

Total 10

Examination Style Question Papers

EDEXCEL Specification AS Biology and Biology (Human)

Name:

Unit 3 - Energy and the environment

Year Set 2

Time allowed 1 hour

Instructions:

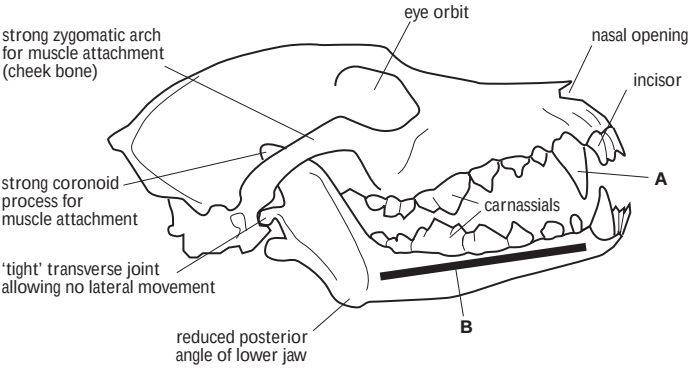
- Answer ALL THREE questions in the spaces provided.

Information

- Mark allocations are shown in brackets.
- The maximum mark for this paper is 38
- The short questions will test mainly knowledge and understanding of the content of the unit.
- The longer questions will present students with stimulus material related to the specification content. These questions will also test skills of interpretation of data or information related to the content of the unit.
- Quality of Written Communication will be assessed.
- Scientific terminology should be used where appropriate.
- A calculator may be used.

Question 1

The diagram below shows the skull of a dog.



a) Describe one major problem and one major advantage associated with a carnivorous diet.

(2)

b) For each of the structures labelled A and B briefly explain how they are adapted to a carnivorous diet.

A

B *(2)*

c) Describe how the gut of a carnivore differs from that of a ruminant.

(2)

Total 6

Question 2

About 6 000 000 tonnes of sulphur oxides are released into the atmosphere from burning fossil fuels each year. However, once released sulphur dioxide has a relative short 'residence' time of about four days in the atmosphere.

a) Explain how the released sulphur dioxide is removed from the atmosphere.

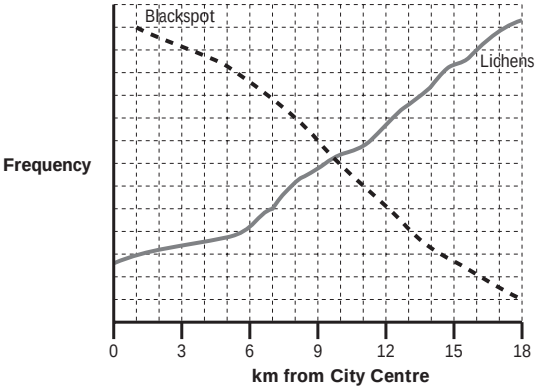
(3)

b) 'Clean' rain has a pH of about 5.6, and 'acid' rain can commonly have a range of pH from 4 to 6. Explain why pH figures could be misleading to the general public when attempting to describe the nature of the problem of 'acid' rain.

(2)

Question continued...

The graph below shows the number of species of Lichens, and the occurrence of the disease 'Black Spot' on roses, at different distances from the centre of a major town (lichens are sensitive indicators of the amount of air pollution in general and 'acid' rain in particular, the lichens also become 'bushier' with increasingly clean air.)



c) i) Describe and explain the appearance of the curve for lichens.

(2)

ii) Describe and explain the shape of the curve for 'Black Spot'.

(2)

'Acid' rain causes inorganic ions to be washed (leached) out of the soil into rivers and lakes where they reach toxic levels.

d) i) Give one effect of aluminium ions on aquatic animals.

(1)

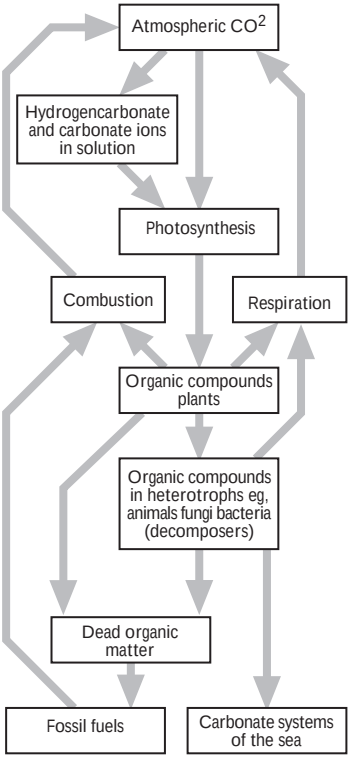
ii) Explain why streams running off heathlands growing on acid soils have red deposits on the pebbles and are crystal clear with very few water plants.

(2)

Total 12

Question 3

A representation of the carbon cycle is shown in the diagram below.



In the carbon cycle carbon dioxide is continually feeding into and out of the atmosphere and into solution in the oceans) from the rapidly cycling pool of carbon compounds associated with organisms.

a) i) Give two simple chemical equations representing the two major processes by which carbon dioxide is continually feeding into and out of the atmosphere from the rapidly cycling pool of carbon compounds associated with organisms.

(2)

ii) Explain how carbon compounds pass directly between organisms in the rapidly cycling pool of carbon compounds.

(2)

The carbonate system of the sea and the earth's green belts are both 'sinks' which are very efficient at removing carbon dioxide from the air.

Question continued...

b) Explain the following terms:

i) carbonate system of the sea,

_____

_____ *(1)*

ii) 'sink' in the context of the carbon cycle,

_____

_____ *(1)*

iii) Name one sink which is now being massively exploited by humans,

_____ *(1)*

iv) Name one sink which is relatively permanent;

_____ *(1)*

Estimates of the amounts of carbon in the 3 major physical compartments are:

atmosphere 2300 x 10^9 tons;

oceans 130 000 x 10^9 tons;

fossil fuels 40 000 x 10^9 tons;

c) **i)** With reference to the figures above explain why the increasing rate of combustion of fossil fuels is a threat to the atmosphere.

_____

_____

_____

_____ *(3)*

In 1980 it was estimated that the combustion of fossil fuels was releasing 5 x 109 tons of carbon dioxide per year, adding 2-3 ppm each year to the air which at that date had a level of 320 ppm.

d) Evaluate the accuracy of these estimates by calculating what figure they would give for atmospheric levels of carbon dioxide today which are now 0.04 %.

_____

_____

_____ *(2)*

Question continued...

Modern agriculture speeds up release of carbon dioxide from the soil and reduces the acidity of water, which in turn reduces the weathering of minerals in sediment based cycles

e) **i)** Explain how modern agriculture speeds up the release of carbon dioxide from the soil.

(2)

ii) Explain how modern agriculture reduces the acidity of water thus reducing the weathering of minerals in sediment based cycles.

(3)

Each year 6 000 000 tonnes of carbon dioxide are released into the atmosphere by combustion of fossil fuels, and about a third of this is absorbed by forests. Recently international agreements have been reached on the increased planting of forests to act as 'sinks' to offset the continuing high levels of carbon dioxide emissions from fossil fuels. However, this policy has been criticised on the basis that as global warming increases these forest 'sinks' will in fact become net carbon exporters.

f) **i)** Explain what is meant by the term net carbon exporters,

(1)

ii) Explain the process by which they will become net carbon exporters,

(1)

Total 20

Assessment Grid

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 3 - Energy and the Environment

Year Set 2

	Question Number									
Specification Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
3.1 Modes of nutrition	**6**									**6**
3.2 Ecosystems										
3.3 Energy flow										
3.4 Recycling of nutrients			**20**							**20**
3.5 Energy resources										
3.6 Human influences		**12**								**12**

Total 38

	Question Number									
Assessment Objective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**0**	**0**	**Total**
AO1										
Knowledge with Understanding	**2**	**4**	**8**							**14**
AO2										
Application/Analysis/Evaluation	**4**	**8**	**12**							**24**

Total 38

Mark Schemes for Question Paper

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 3 - Energy and the Environment
Year Set 2

Instructions

; = 1 mark / = alternative response

Question 1

The diagram below shows a skull of a dog.

a) Describe one major problem and one major advantage associated with a carnivorous diet.

problem - piercing and tearing skin, tendon and bone;

advantage - meat highly nutritious and easily digested; *(2)*

b) For each of the structures labelled A and B briefly explain how they are adapted to a carnivorous diet.

A - canines for holding, killing and tearing meat from bone;

B - carnassials sharp with scissor like action for shearing meat from bone / no chewing; *(2)*

c) Describe how the gut of a carnivore differs from that of a ruminant.

shorter, vestigial caecum and appendix;

less complex; *(2)*

Total 6

Question 2

About 6 000 000 tonnes of sulphur oxides are released into the atmosphere from burning fossil fuels each year. However, once released sulphur dioxide has a relative short 'residence' time of about four days in the atmosphere.

a) Explain how the released sulphur dioxide is removed from the atmosphere.

sulphur dioxide to form sulphuric acid in air;

catalysed by ozone and unburnt hydrocarbons;

sulphuric acid combines with ammonia to form ammonium sulphate (a natural fertiliser); *(3)*

Clean' rain has a pH less than 7, and 'acid' rain can commonly have a range of pH from 4 to 6.

b) Explain why pH figures could be misleading to the general public when attempting to describe the nature of the problem of 'acid' rain.

pH scale is logarithmic;

pH4 is 100 x more acidic than pH 6; *(2)*

The graph below shows the numbers of species of Lichens and the occurrence of the disease of 'Black Spot' on roses at different distances from the centre of a major town (lichens are sensitive indicators of the amount of air pollution in general and 'acid' rain in particular, the lichens also become 'bushier' with increasingly clean air.)

c) i) Describe and explain the appearance of the curve for lichens.

more species of lichens with increasing distance from centre;

correlated with decreasing air pollution from traffic and industry; *(2)*

ii) Describe and explain the shape of the curve for 'Black Spot'.

increasing disease of 'Black Spot' on roses at increasing distances from the centre of a major town;

pollution decreases occurrence of the disease of 'Black Spot' on roses;

black spot on roses prevented by 100 $\mu g.m^{-3}$ of sulphur dioxide; *(2)*

'Acid' rain causes inorganic ions to be washed (leached) out of the soil into rivers and lakes where they reach toxic levels.

d) i) Give one effect of aluminium ions on aquatic animals.

sticky mucus develops on gills impairs respiration; *(1)*

ii) Explain why streams running off heathlands growing on acid soils have red deposits on the pebbles and are crystal clear with very few water plants.

red deposits of iron salts at toxic levels leached off acid soils;

high iron toxic to plants / low organic matter therefore water clear; *(2)*

Total 12

Question 3

A representation of the carbon cycle is shown in the diagram below.

In the carbon cycle carbon dioxide is continually feeding into and out of the atmosphere and into solution in the oceans) from the rapidly cycling pool of carbon compounds associated with organisms.

a) i) Give two simple chemical equations representing the two major processes by which carbon dioxide is continually feeding into and out of the atmosphere from the rapidly cycling pool of carbon compounds associated with organisms.

photosynthesis - $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

respiration - $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ *(2)*

ii) Explain how carbon compounds pass directly between organisms in the rapidly cycling pool of carbon compounds.

by feeding, digestion, absorption and assimilation;

along food chains; *(2)*

The carbonate system of the sea and the earths green belts are both 'sinks' which are very efficient at removing carbon dioxide from the air.

b) Explain the following terms:

i) carbonate system of the sea,

hydrogen carbonate in solution and calcium carbonate in shells; *(1)*

ii) 'sink' in the context of the carbon cycle),

a reservoir of carbon into which carbon dioxide is absorbed;

thus effectively removing it from the atmosphere or in solution for varying periods of time; *(1)*

iii) Name one sink which is now being massively exploited by humans,

fossil fuels / forests; *(1)*

iv) Name one sink which is relatively permanent;

carbonate sediments e.g. limestone; *(1)*

c) i) With reference to the figures explain why the increasing rate of use of fossil fuels is a threat to the atmosphere.

atmosphere small pool relative to fossil fuels;

carbon in fossil fuels accumulated from atmosphere and oceans over billions of years;

being returned back in decades; *(3)*

In 1980 it was estimated that the combustion of fossil fuels was releasing 5 x 109 tons of carbon dioxide per year, adding 2-3 ppm each year to the air which then had a level of 320 ppm.

Question continued...

d) Evaluate the accuracy of these estimates by calculating what figure they would give for atmospheric levels of carbon dioxide today which are now 0.04 %.

lower figure would give 360 ppm ie 0.036%;

higher figure would give 380 ppm ie 0.038%; *(2)*

Modern agriculture speeds up release of carbon dioxide from the soil and reduces acidity of water thus reducing weathering of minerals in sediment based cycles

(e) i) Explain how modern agriculture speeds up release of carbon dioxide from the soil.

carbon dioxide fixed by the crops does not compensate for rapid oxidation of humus by microorganisms;

as a result of increased aeration by ploughing; *(2)*

ii) Explain how modern agriculture reduces acidity of water thus reducing the weathering of minerals in sediment based cycles.

carbon dioxide is acid in solution carbonic acid);

therefore its removal from the soil by agriculture reduces soil acidity;

which is normally responsible for increasing solubility of soil minerals; *(3)*

Each year 6 000 000 tonnes of carbon dioxide are released into the atmosphere by combustion of fossil fuels, and about a third of this is absorbed by forests. Recently international agreements have been reached on the increased planting of forests to act as 'sinks' to offset the continuing high levels of carbon dioxide emissions from fossil fuels. However, this policy has been criticised on the basis that as global warming increases these forest 'sinks' will in fact become net carbon exporters.

f) i) Explain what is meant by the term net carbon exporters,

the forests will release more carbon dioxide than they will absorb; *(1)*

ii) Explain the process by which the forests will become net carbon exporters,

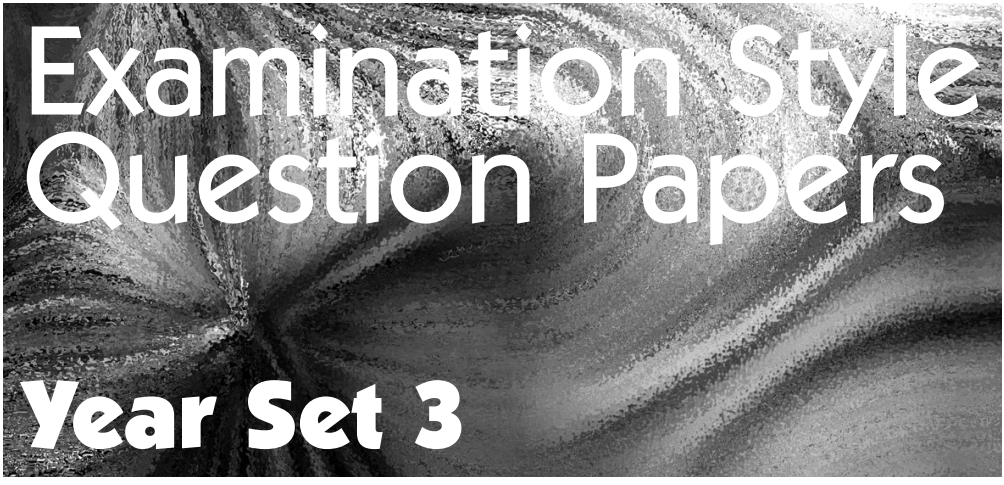
the rate of respiration of these forests and their associated soil microorganisms will increase above that of photosynthesis; *(1)*

Total 20

For **Edexcel** Specifications

Advanced Subsidiary

Biology or Biology (Human)



AS Unit 1 - Molecules & cells
AS Unit 2B - Exchange, transport & reproduction
AS Unit 2H - Exchange, transport & reproduction in humans
AS Unit 3 - Energy & the Environment

Complete with Assessment Grids & Mark Schemes

FELTHAM PRESS

Examination Style Question Papers

Name:

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 1 - Molecules and cells
Year Set 3

Time allowed 1 hour 20 minutes

Instructions:

- Answer ALL NINE questions in the spaces provided.

Information

- The questions will score from four to twelve marks.
- The short questions will test mainly knowledge and understanding of the content of the unit.
- The longer questions will present stimulus material related to the specification content. These questions will also test skills of interpretation of data or information related to the content of the unit.
- At least one question requires an answer written in continuous prose
- Mark allocations are shown in brackets.
- The maximum mark for this paper is 70.
- This type of paper would carry 33.3 per cent of the total marks for AS level.
- Quality of Written Communication will be assessed.
- Scientific terminology should be used where appropriate.
- A calculator may be used.

Question 1

a) Plant and animal cells are both described as eukaryotic cells, describe the main features of eukaryotic cells.

(4)

b) Name a type of organism which has a prokaryotic cell. State two differences between this prokaryotic cell and a eukaryotic animal cell.

(3)

Total 7

Question 2

a) In the table below list three differences between the light (optical) and electron microscopes

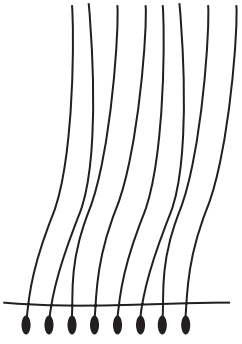
Light (optical) microscope	Electron microscope

(3)

b) Explain the main difference between the principles of the transmission and scanning electron microscopes.

(2)

c) Drawing X represents cilia. Drawing Y represents the appearance of a section of cilia.



X

Y

Interpret and explain the difference in appearance between the two drawings.

(3)

Total 8

Question 3

a) i) What is the water potential of pure water at standard temperature and pressure?

_____ *(1)*

ii) Name two factors to which the rate of osmosis is proportional.

_____

_____ *(2)*

b) If a plant cell is placed in pure water it eventually becomes fully turgid, the cellulose cell wall can expand no further, and so no more water enters the cell. Explain this process in terms of the effect of pressure on water potential.

_____

_____

_____

_____

_____ *(4)*

Total 7

Question 4

A solution of unknown composition is tested with Benedict's solution and a positive result is obtained.

a) Describe a positive result with the Benedict's test.

_____

_____

_____ *(2)*

b) Explain why it would be wrong to deduce that glucose was present in the test solution from the positive Benedict's result.

_____

_____

_____

_____ *(3)*

c) Explain why it would not be correct to deduce from the positive Benedict's test result that there were no disaccharides present in the solution.

_____

_____

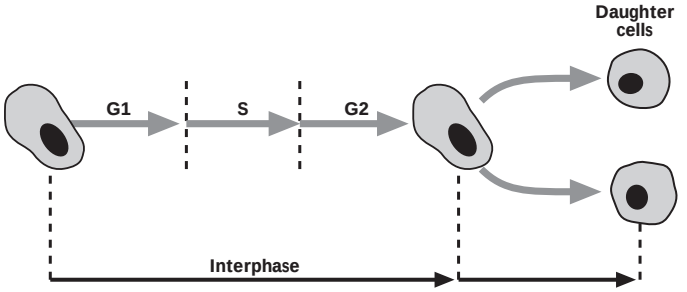
_____

_____ *(3)*

Total 8

Question 5

Study the diagram of the cell cycle of a body cell of a multicellular organism and answer the following questions.



a) Match the letters on the diagram with each of the following.

i) The period in which mitosis occurs

_____ *(1)*

ii) The period in which the amount of DNA doubles (replicates).

_____ *(1)*

iii) The point past which the cell will complete the cycle and enter division.

_____ *(1)*

b) Explain why it is necessary for the amount of DNA to double during this cell cycle;

_____

_____

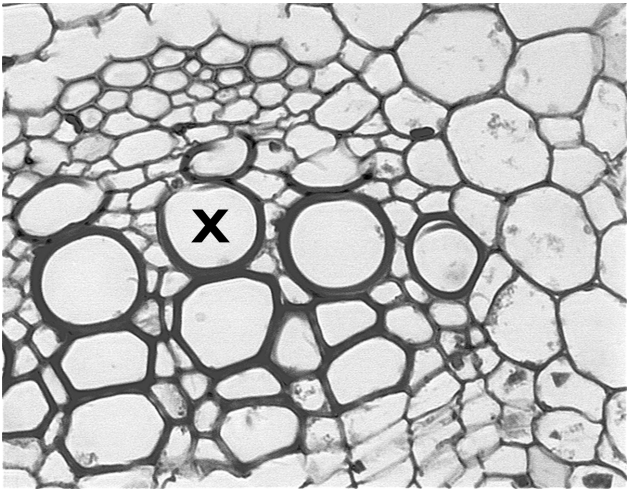
_____

_____ *(3)*

Total 6

Question 6

The photomicrograph below shows some cells from a plant in cross section.



a) Name the tissue marked X in the photomicrograph and describe its functions.

_____

_____

_____

_____ *(3)*

Question continued...

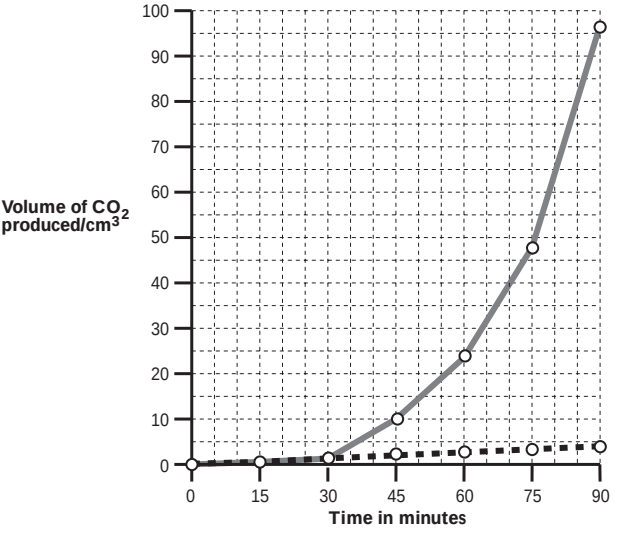
b) In the space below make an accurate drawing, enlarged x 1.5, of 3 cells from tissue X.
Do not label your drawing.

(5)

Total 8

Question 7

The graph below shows the rates of fermentation of two sugars by yeast (S. cerevisiae) as measured by the volumes of carbon dioxide produced.



a) The term enzyme means 'in yeast' and was derived from the first experiments with yeast fermentation. Comment on the results illustrated in the graph in terms of:

i) enzyme specificity,

_____

_____

_____ *(2)*

ii) enzymes as catalysts,

_____

_____

_____ *(2)*

b) Yeast cannot ferment sucrose directly but must first digest it to glucose and fructose, which can subsequently enter the yeast cells and be fermented.

explain why sucrose could not enter the yeast cells as easily as glucose.

_____

_____

_____ *(2)*

Total 6

Question 8

Read the following passage and answer the questions that follow.

Neither the light microscope nor the electron microscope reveals much of the structure of the cell membrane. Models of membrane structure are constructed on the basis of the membrane's behaviour under certain conditions; in other words, it is impossible to separate structure and function since our knowledge of the structure derives from our knowledge of function.

Early investigations were based on studies of the rate of penetration of various materials into the cell, e.g. urea, sugars, alcohols, etc. It was found that fat-soluble substances penetrated more easily than others.

Lipids were extracted from red blood cell membranes, and the surface area that this lipid would have if it formed a layer one molecule thick was measured and found to be twice the surface area of the red blood cells.

a) What does the fact that fat soluble substances enter the cell more rapidly than non-fat soluble substances, suggest about the nature of the membrane?

(1)

b) What does the finding that the surface area of lipid extracted from the red cell membranes would have formed a layer one molecule thick with twice the surface area of the red blood cells, tell us about the arrangement of lipids in the red blood cell membrane?

(2)

c) Further work indicated that 'smaller' molecules penetrated the membrane faster than would have been expected on the basis of their fat solubility alone.

What does the fact that smaller molecules penetrated the membrane faster than would have been expected on the basis of their fat solubility alone suggest about membrane structure?

(2)

d) It has been claimed that all membranes have this common structure. Explain why the wide variety of functions shown by various membranes seems to argue against this.

(2)

e) Why do neither the light microscope nor the electron microscope reveal much of the structure of the cell membrane.

(3)

Total 10

Question 9

Describe how you would set up and use a light microscope to view slides of suitable tissues. Explain the reasons for each of your actions.

Total 10

Assessment Grid

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 1 - Molecules and cells
Year Set 3

	Question Number									
Specification Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
1.1 Molecules				**8**						**8**
1.2 Enzymes							**6**			**6**
1.3 Cellular organisation	**7**	**8**	**7**			**8**		**10**	**10**	**50**
1.4 Cell cycle					**6**					**6**

Total 70

	Question Number									
Assessment Objective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
AO1										
Knowledge with Understanding	**7**	**5**	**7**	**5**	**6**	**8**	**1**	**3**	**3**	**45**
AO2										
Application/Analysis/Evaluation		**3**		**3**			**5**	**7**	**7**	**25**

Total 70

Mark Schemes for Question Paper

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 1 - Molecules and cells
Year Set 3

Instructions

; = 1 mark / = alternative response

Question 1

a) Plant and animal cells are both described as eukaryotic cells, describe the main features of eukaryotic cells.

presence of a membrane bound nucleus at some stage in the cell cycle;

with chromosomes;

mitochondria;

chloroplastids in plant cells;

endoplasmic reticulum;

Golgi apparatus;

cellulose cell wall in plants; *(4)*

b) Name a type of organism which has a prokaryotic cell. State two differences between this prokaryotic cell and a eukaryotic animal cell.

bacterium;

no membrane bound nucleus at any stage in the cell cycle;

no chromosomes, strand of DNA only;

plasmids;

mesosomes;

cell wall;

(3)

Total 7

Question 2

a) In the table below list three differences between the light (optical) and electron microscopes

Light (optical) microscope	Electron microscope
Light (optical) microscope	Electron microscope
Uses light	Uses a stream of electrons
Objects observed directly	Objects observed via fluorescent screen
Light focussed by lenses	Electrons focussed by magnets

(3)

b) Explain the main difference between the principles of the transmission and scanning electron microscopes.

Transmission electron microscope - electrons pass through thin sections of specimen

Scanning electron microscope - electrons reflected from surface of specimen *(2)*

c) Drawing X represents cilia. Drawing Y represents the appearance of a section of cilia. Interpret and explain the difference in appearance between the two drawings.

cilia elongated cylindrical relatively long structures;

thin sections along their length only cut small lengths;

and rarely 'catch' the connection to the cell;

giving appearance of unattached oval segments; *(3)*

Total 8

Question 3

a) **i)** What is the water potential of pure water at standard temperature and pressure?

0 (nought / zero); *(1)*

ii) Name two factors to which the rate of osmosis is proportional.

temperature;

surface area over which it is occurring;

water potential gradient; *(2)*

b) If a plant cell is placed in pure water, it eventually becomes fully turgid, the cellulose cell wall can expand no further, and so no more water enters the cell. Explain this process in terms of the effect of pressure on water potential.

the pressure inside the cell is raised above that in a non-turgid cell;

an increase in pressure increases the water potential;

reducing the water potential gradient to zero;

so no more water enters the cell; *(4)*

Total 7

Question 4

A solution of unknown composition is tested with Benedict's solution and a positive result is obtained.

a) Describe a positive result with the Benedict's test.

green /yellow / red;

precipitate; *(2)*

b) Explain why it would be wrong to deduce that glucose was present in the test solution from the positive Benedict's result.

Benedict's test is a test for reducing sugars;

there are reducing sugars other than glucose;

e.g. fructose, maltose, and lactose; *(3)*

c) Explain why it would not be correct to deduce from the positive Benedict's result that there were no disaccharides present in the solution.

sucrose is a non-reducing sugar;

which only gives a positive result with the Benedict's after acid hydrolysis;

positive result with reducing sugars present is an independent event; *(3)*

Total 8

Question 5

Study the diagram of the cell cycle of a body cell of a multicellular organism and answer the following questions.

a) Match the letters on the diagram with each of the following:

i) the period in which mitosis occurs *(1)*

ii) the period in which the amount of DNA doubles (replicates);

S phase; *(1)*

iii) the point past which the cell will complete the cycle and enter division

Start of S phase; *(1)*

b) Explain why it is necessary for the amount of DNA to double during this cell cycle

two new daughter body cells are produced;

daughter body cells need to be genetically identical;

doubling (replication) of the DNA results in genetically identical daughter cells (nuclei); *(3)*

Total 6

Question 6

The photomicrograph below shows some cells from a plant in cross section.

a) Name a tissue X in the photomicrograph and describe its functions.

Xylem;

transport of water;

and inorganic ions in solution;

mechanical support; *(3)*

b) In the space below make an accurate drawing, enlarged x 1.5, of three cells from tissue X. Do not label your drawing.

correct size / magnification;

correct proportions;

minimum number of cells

cell wall thickness appropriate;

accurate middle lamella; *(5)*

Total 8

Question 7

The graph below shows the rates of fermentation of two sugars by yeast (*S. cerevisiae*) as measured by the volumes of carbon dioxide produced.

a) The term enzyme means 'in yeast' and was derived from the first experiments with yeast fermentation. Comment on the results illustrated in the graph in terms of:

i) enzyme specificity,

yeast has enzymes to ferment glucose;

but not lactose; *(2)*

ii) enzymes as catalysts,

glucose not fermented until enzymes present;

rapid fermentation once glucose within yeast cells; *(2)*

Yeast cannot ferment sucrose directly but must first digest it to glucose and fructose, which can subsequently enter the yeast cells and be fermented.

b) explain why sucrose could not enter the yeast cells as easily as glucose.

sucrose is a larger molecule

no specific carriers for sucrose; *(2)*

Total 6

Question 8

Neither the light microscope nor the electron microscope reveals much of the structure of the cell membrane. Models of membrane structure are constructed on the basis of the membrane's behaviour under certain conditions; in other words, it is impossible to separate structure and function since our knowledge of the structure derives from our knowledge of function.

a) Early investigations were based on studies of the rate of penetration of various materials into the cell, e.g. urea, sugars, alcohols, etc. It was found that fat-soluble substances penetrated more easily than others.

What does the fact that fat soluble substances enter the cell more rapidly than non-fat soluble substances suggest about the nature of the membrane?

the membrane is fatty in nature; *(1)*

b) Lipids were extracted from red blood cell membranes, and the surface area that this lipid would have if it formed a layer one molecule thick was measured and found to be twice the surface area of the red blood cells.

What does the finding that the surface area of lipid extracted from the red cell membranes would have formed a layer one molecule thick with twice the surface area of the red blood cells tell us about the arrangement of lipids in the red blood cell membrane?

with the fats forming a bilayer;

suggests that there were two layers of lipid in the membrane;

arranged as a bimolecular lipid membrane; *(2)*

c) Further work indicated that 'smaller' molecules penetrated the membrane faster than would have been expected on the basis of their fat solubility alone.

What does the fact that smaller molecules penetrated the membrane faster than would have been expected on the basis of their fat solubility alone suggest about membrane structure?

that the membrane is porous;

allowing smaller molecules to penetrate faster through pores of a certain diameter;

independent of their fat solubility therefore pores are 'aqueous'; *(2)*

e) It is claimed that all membranes showed this common structure. Explain why the wide variety of functions shown by various membranes seems to argue against this.

function to a large part determined by structure and vice versa;

some functions so different as to require different membrane structure; *(2)*

f) Why do neither the light microscope nor the electron microscope reveal much of the structure of the cell membrane.

the resolving power of the LM is insufficient;

the resolving power of the EM is insufficient;

preparation techniques for the EM are too drastic to leave the membrane unaltered;

molecular level too small to be revealed; *(3)*

Total 10

Question 9

Describe how you would set up and use a light microscope to view slides of suitable tissues. Explain the reasons for each of your actions.

check and clean all lenses and mirrors to ensure maximum light transmission;

if microscope does not have built in illumination adjust mirror for maximum light transmission;

adjust sub-stage condenser for uniform illumination of field of view;

ensure low power lens is in place;

ensure that slide is clean, and clean if necessary;

place slide on stage of microscope, cover slip uppermost, and secure with clips to prevent movement;

focus on slide using coarse adjustment;

move slide as necessary to obtain required view of specimen;

swing next highest objective lens into position and adjust with fine control;

use of fine focus necessary now as objective lens very close to specimen;

focus away from the specimen, and if focus missed, turn back down whilst observing objective lens from side to ensure it does not touch specimen, then focus away again;

Total 10

Examination Style Question Papers

Name:

EDEXCEL Specification AS Biology and Biology (Human)

Units 2B and 2H - Exchange, Transport and Reproduction

Year Set 3

Time allowed 1 hour 20 minutes

Instructions:

- Answer NINE questions in the spaces provided.

Information

- The questions will score from four to twelve marks.
- You must answer Section 1 and

  EITHER Section B: Biology

  OR Section H: Biology (Human)
- The short questions will test mainly knowledge and understanding of the content of the unit.
- The longer questions will present students with stimulus material related to the specification content. These questions will also test skills of interpretation of data or information related to the content of the unit.
- At least one question requires an answer written in continuous prose
- Mark allocations are shown in brackets.
- The maximum mark for this paper is 70.
- This type of paper would carry 33.3 per cent of the total marks for AS level.
- Quality of Written Communication will be assessed.
- Scientific terminology should be used where appropriate.
- A calculator may be used.

You must answer Section 1 and
EITHER Section B: Biology OR Section H: Biology (Human)

Section 1

Answer ALL FOUR questions in this section.

Question 1

a) State the name and describe the location of the nerve centre that controls breathing movements in humans.

(1)

b) This control centre receives sensory nervous input from receptors in various parts of the body.

i) Name and describe the location of such a receptor which is sensitive to mechanical stimuli.

(1)

ii) Name and describe the location of such a receptor which is sensitive to chemical stimuli.

(1)

c) i) Describe the ways in which the automatic breathing mechanisms can be overridden.

(2)

ii) Explain what major stimulus makes holding one's breath so difficult.

(1)

Total 6

Question 2

a) Give brief descriptive definitions of each of the following terms:

i) plasma

_____

_____

_____ *(2)*

ii) tissue fluid

_____

_____

_____ *(2)*

iii) lymph

_____

_____

_____ *(2)*

b) Describe how the lymph is moved through the lymphatic system back to the circulation.

_____

_____

_____

_____ *(3)*

Total 9

Question 3

Blood is a specialised tissue containing a number of different cell types.

a) Give a a function of each of the type of blood cell listed below in the defence of the body against infection.

i) lymphocyte

_____ *(1)*

ii) monocyte

_____ *(1)*

iii) neutrophils,

_____ *(1)*

iv) eosinophils.

_____ *(1)*

b) Describe how red blood cells or erythrocytes are adapted to their function of transporting oxygen.

_____

_____

_____

_____ *(3)*

Total 7

Question 4

Samples of intestinal contents can be obtained by transintestinal intubation in which a tube is inserted into the gut and samples are withdrawn from different regions.

When the tube is in position a test meal of 500 g of a homogenised (well mixed) mixture of fat as corn oil, carbohydrate as glucose and lactose, and protein as milk protein is swallowed.

The meal also contains a water soluble non-digestible, non-absorbable reference substance, polyethyleneglycol (PEG).

The percentage absorption of fat, carbohydrate and protein is calculated from the relation of the amount of these substances to the PEG concentration in the test meal, and their subsequent relationship in the collected samples.

a) i) Describe the main difference between the test meal and a normal meal.

(1)

ii) Explain how a normal meal is homogenised, and the importance of this process in digestion.

(3)

b) The pH of the stomach was 4-5 in the first hour, decreasing to 2 in the fourth hour, whilst the pH of the duodenum was constant at 6, increasing to 8 further down the small intestine.

Explain how the pH of the duodenum and the rest of the small intestine is higher than that of the stomach.

(3)

c) The test meal left the stomach over a 4 hour period mostly in the second hour. The meal was diluted 3-5 times in the duodenum, and the concentration of digestive enzymes decreased along the small intestine.

Explain how the meal was diluted 3-5 times in the duodenum.

(3)

In the test meal the milk protein was labelled and used as an indicator of food protein.

d) Explain why it was necessary to be able to specifically identify the food protein, when it was already known to be in the meal.

(2)

Total 12

Section B : Biology

Answer ALL FIVE questions in this section.

Question B5

a) Give the main function of each of the following elements of xylem in flowering plants.

i) vessels,

_____ *(1)*

ii) tracheids,

_____ *(1)*

iii) fibres,

_____ *(1)*

iv) xylem parenchyma,

_____ *(1)*

b) Name and describe the properties of the substance with which the walls of the xylem elements are thickened.

_____

_____

_____ *(2)*

Total 6

Question B6

Briefly describe the following pathways of the movement of water across the roots of plants.

a) Apoplast pathway.

_____

_____

_____ *(2)*

b) Symplast pathway

_____

_____

_____ *(2)*

Total 4

Question B7

a) **i)** Explain how protandry and protogyny favour cross pollination in flowering plants.

_____

_____

_____ *(2)*

ii) Explain how even if protandry and protogyny fail to ensure cross pollination, self pollination can still occur.

_____

_____ *(1)*

b) Describe an advantage of cross pollination to plants.

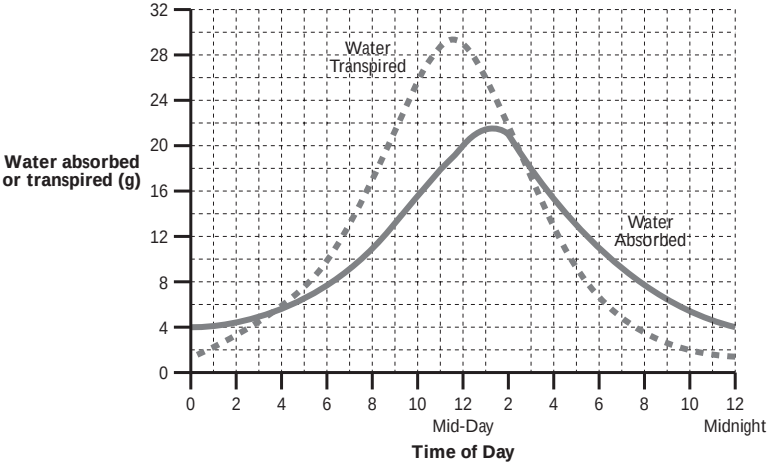
_____

_____ *(1)*

Total 4

Question B8

The relationship between the rate of water uptake by the roots of a plant and its transpiration rate over a 24 hour period, under natural conditions on a summer's day, is shown on the graph below.



a) i) Identify the times that transpiration and water uptake reach their peaks.

_____ *(1)*

ii) Give one environmental factor other than temperature which reaches a peak near the time of maximum transpiration.

_____ *(1)*

iii) Explain the cause and effect relationship between the environmental factor (other than temperature) peaking and the maximum transpiration rate.

_____

_____ *(2)*

b) Describe the environmental conditions under which transpiration could continue at a high level (at least for a short period) but water uptake is reduced to a minimum.

_____

_____ *(2)*

c) Describe how the curves of the graphs shown at the start of the question help to explain the cohesion-tension mechanism of moving water through the xylem.

_____

_____

_____

_____ *(4)*

Total 10

Question B9

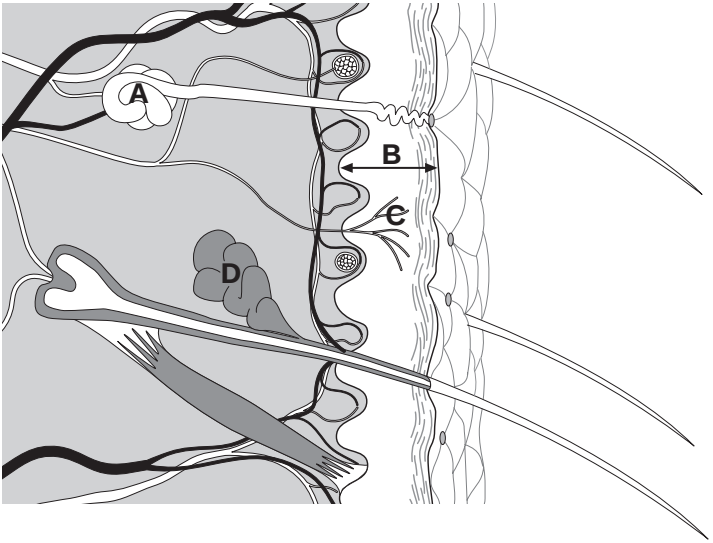
Give an account of the adaptations of flowers to insect and wind pollination.

Total 10

Section H : Biology (Human)

Answer ALL FIVE questions in this section.

Question H5



Study the diagram above of a section through human skin and answer the following questions.

a) Identify the following structures by matching each of them with the appropriate label letter on the diagram.

i) sweat gland,

_____ *(1)*

ii) epidermis,

_____ *(1)*

iii) sebaceous gland,

_____ *(1)*

b) With regard to the role of the skin in temperature regulation explain the function of the sweat gland.

_____

_____

_____ *(3)*

c) Explain how the epidermis aids water conservation.

_____

_____ *(2)*

Total 8

Question H6

a) With regard to lactation and the suckling of young humans describe the origin and the role of the following hormones:

i) prolactin,

_____

_____

_____ *(2)*

ii) oxytocin,

_____

_____

_____ *(2)*

b) Describe the importance of colostrum to the suckling infant.

_____

_____

_____ *(2)*

Total 6

Question H7

Endurance athletes make use of hypobaric (low pressure) chambers in their preparations for competition, often sleeping in them for long periods.

a) Explain the physiological reasoning behind this practice.

(3)

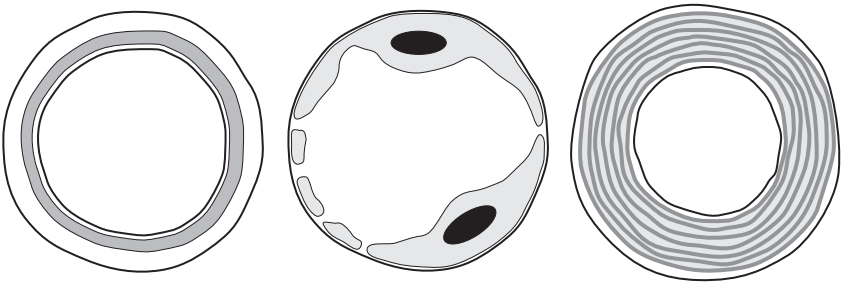
b) Describe what goal this technique has in common with altitude training or the misuse of the hormone erythropoietin (EPO).

(1)

Total 4

Question H8

The three diagrams below are of cross (transverse) sections of an artery, vein and capillary, not drawn to scale.



X Y Z

a) i) Identify the artery, vein and the capillary.

_____ *(1)*

ii) What is the diameter of an average capillary?

_____ *(1)*

b) Describe how the structure of the capillary shown above is adapted to its function.

_____

_____

_____

_____ *(3)*

c) Describe another distinguishing feature between arteries and veins that can only be seen in a longitudinal section.

_____

_____ *(1)*

Total 6

Question H9

Give an account of the effects of heat stress.

Total 10

Assessment Grid

EDEXCEL Specification
AS Biology and Biology (Human)

Units 2B and 2H - Exchange, Transport and Reproduction

Year Set 3

BIOLOGY	Question Number									
Specification Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
2B.1 Exchanges & Environment	6			12					10	28
2B.2 Transport systems		9	7		6	4		10		36
2B.3 Adaptations & Environ										
2B.4 Sexual reproduction							4		10	14
										Total 78

BIOLOGY	Question Number									
Assessment Objective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
AO1										
Knowledge with Understanding	6	6	7	4	6	4	4	2	4	43
AO2										
Application/Analysis/Evaluation		3		8				8	6	25
										Total 68

HUMAN BIOLOGY	Question Number									
Specification Section					**5**	**6**	**7**	**8**	**9**	**Total**
2H.1 Exchanges & Environment										
2H.2 Transport of materials								6		6
2H.3 Human ecology					8		4		10	22
2H.4 Human reproduction						6				6
										Total 34

HUMAN BIOLOGY	Question Number									
Assessment Objective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
AO1										
Knowledge with Understanding					3	6	1	6	3	19
AO2										
Application/Analysis/Evaluation					5		3		7	15
										Total 34

Mark Schemes for Question Paper

EDEXCEL Specification AS Biology and Biology (Human)

Units 2B and 2H - Exchange, Transport and Reproduction

Year Set 3

Instructions

; = 1 mark / = alternative response

Section 1

Answer ALL FOUR questions in this section.

Question 1

a) State the name and location of the nerve centre for the control of breathing movements in humans.

respiratory centre / inspiratory and expiratory centres in the medulla of the brain; *(1)*

b) This control centre receives sensory nervous input from receptors in various parts of the body.

i) Name and describe the location of such a receptor which is sensitive to mechanical stimuli.

stretch receptors in the alveoli; *(1)*

ii) Name and describe the location of such a receptor which is sensitive to chemical stimuli.

chemoreceptor in carotid / aortic body; *(1)*

c) **i)** Describe the ways in which the automatic breathing mechanisms can be overridden.

yawning;
coughing;
swallowing;
speaking; *(2)*

ii) Explain what major stimulus makes holding one's breath so difficult.

rise in blood carbon dioxide; *(1)*

Total 6

Question 2

a) Give brief descriptive definitions of each of the following terms:

i) plasma

the fluid part of the blood;
dilute clear - yellow aqueous solution;
containing soluble substances e.g. inorganic ions;
containing proteins;
eg anti-bodies / enzymes *(2)*

ii) tissue fluid

that part of the plasma exuded through the capillary walls;
as a result of blood pressure / water potential gradient;
minus plasma proteins;
bathes tissues directly; *(2)*

iii) lymph

tissue fluid absorbed into lymphatic capillaries;
contains lymphocytes;
may contain fatty droplets from lacteals in villi in small intestine; *(2)*

b) Describe how the lymph is moved through the lymphatic system back to the circulation.

contractions of surrounding skeletal musculature;
massage thin walled lymph vessels;
one way valves ensure one way flow; *(3)*

Total 9

Question 3

Blood is a specialised tissue containing a number of different cell types.

a) Give a a function for each of the type of blood cell listed below involved in the defence of the body against infection.

i) lymphocyte

B cells produce antibodies *(1)*

ii) monocyte

phagocytic *(1)*

iii) neutrophils,

phagocytic *(1)*

iv) eosinophils.

phagocytic in membranes / involved in allergic reactions; *(1)*

b) Describe how red blood cells or erythrocytes are adapted to their function of transporting oxygen.

no nucleus means that;

biconcave flattened shape increases their surface area to volume ratio;

packed with haemoglobin; *(3)*

Total 7

Question 4

Samples of intestinal contents can be obtained by transintestinal intubation in which a tube is inserted into the gut and samples are withdrawn from different regions.

When the tube is in position a test meal of 500 g of a homogenised (well mixed) mixture of fat as corn oil, carbohydrate as glucose and lactose, and protein as milk protein is swallowed.

The meal also contains a water soluble non-digestible, non-absorbable reference substance, polyethyleneglycol (PEG).

The percentage absorption of fat, carbohydrate and protein is calculated from the relation of the amount of these substances to the PEG concentration in the test meal, and their subsequent relationship in the collected samples.

a) i) Describe the main difference between the test meal and a normal meal.

test meal all 'pure' liquid 'chemicals' normal meal contains solids; *(1)*

ii) Explain how a normal meal is homogenised, and the importance of this process in digestion.

mastication;

to increase surface area of food for digestion by enzyme action;

churned in stomach and well mixed with gastric juice; *(3)*

The pH of the stomach was 4-5 in the first hour, decreasing to 2 in the fourth hour, whilst the pH of the duodenum was constant at 6, increasing to 8 down the small intestine.

b) Explain how the pH of the duodenum and the rest of the small intestine is higher than that of the stomach.

bile, pancreatic, and intestinal juice;

are alkaline fluids;

which neutralise stomach acid; *(3)*

c) The test meal left the stomach over a 4 hour period mostly in the second hour. The meal was diluted 3-5 times in the duodenum, and the concentration of digestive enzymes decreased along the small intestine.

Explain how the meal was diluted 3-5 times in the duodenum.

food / chyme has received range of secretions;

bile from gall bladder;

pancreatic juice from pancreas;

intestinal juice from gut wall; *(3)*

d) In the test meal the milk protein was labelled and used as an indicator of food protein.

Explain why it was necessary to be able to specifically identify the food protein, when it was known to be in the meal.

digestive enzymes are proteins;

their presence would raise level of protein in the gut above that due to food protein. *(2)*

Total 12

Section B : Biology

Answer ALL FIVE questions in this section.

Question B5

a) Give the main function of each of the following elements of xylem.

i) vessels,

water transport; *(1)*

ii) tracheids,

water transport *(1)*

iii) fibres,

support; *(1)*

iv) xylem parenchyma,

storage of food / waste products; *(1)*

b) Name and describe the properties of the substance with which the walls of the xylem elements are thickened.

lignin;

strong, tough, waterproof; *(2)*

Total 6

Question B6

Briefly describe the following pathways for the movement of water across the roots of plants.

a) Apoplast pathway.

in the pores and channels of the cellulose cell walls of cells;

outside of the cell surface membrane; *(2)*

b) Symplast pathway

passes through the cell surface membrane;

moves through cytoplasm but not vacuoles;

via plasmodesmata; *(2)*

Total 4

Question B7

a) i) Explain how protandry and protogyny favour cross pollination in flowering plants.

protandry stamens mature first releasing pollen before emergence of stigmas in same flower;

protogyny stigmas mature first before stamens; *(2)*

ii) Explain how even if protandry and protogyny fail to ensure cross pollination, self pollination can still occur.

overlap between maturations of stamens and stigma; *(1)*

b) Describe an advantage of cross pollination to plants.

increased genetic variation; *(1)*

Total 4

Question B8

The relationship between the rate of water uptake by the roots of a plant and its transpiration rate over a 24 hour period under natural conditions on a summer's day is shown below.

a) **i)** Identify the times that transpiration and water uptake reach their peaks.

transpiration around 12 pm and water uptake around 2 pm; *(1)*

ii) Give one environmental factor other than temperature which reaches a peak near the time of maximum transpiration.

light intensity; *(1)*

iii) Explain the cause and effect relationship between the peak environmental factor other than temperature and the maximum transpiration rate.

transpiration occurs mainly via the stomata stomata open in the light;

therefore the period of greatest stomatal opening and greatest transpiration is period of maximum light intensity *(2)*

b) Describe the environmental conditions under which transpiration could continue at a high level at least for a short period) but water uptake is reduced to a minimum.

dry hot conditions;

soil water at a minimum; *(2)*

c) Describe how the curves of the graphs shown at the start of the question help to explain the cohesion-tension mechanism of moving water through the xylem.

peak of transpiration occurs before that of water absorption;

ie water loss greater than water gain;

therefore water in xylem under negative tension;

as water pulled up by cohesion-tension; *(4)*

Total 10

Question B9

Give an account of the adaptations of flowers to insect and wind pollination.

insect pollinated flowers have well developed petals;
or petalloid structures;
typically highly coloured but also white and UV reflecting;
highly scented;
nectaries;
special landing areas and guides;
relatively small amounts of large spiny sticky pollen grains;
Stigma set to exploit insect movements;
insects can sometimes by-pass all this and 'rob' nectar;
also some flowers with these characteristics are self-pollinating in the bud;
wind pollinated flowers reduce petals and sepals to minimum;
exposing dangling stamens;
which produce large amounts of smooth light pollen;
typically before foliage emerges in the case of trees;
large feathery stigmas protrude out into air currents;

Total 10

Section H : Biology (Human)

Answer ALL FIVE questions in this section.

Question H5

Study the diagram of a section through human skin and answer the following questions.

a) Identify the following structures by matching each of them with the appropriate label letter on the diagram.

i) sweat gland, A *(1)*

ii) epidermis, B *(1)*

iii) sebaceous gland, D *(1)*

b) With regard to the role of the skin in temperature regulation explain the function of the sweat gland.

secretes sweat onto surface of skin;

evaporates and absorbs the latent heat of vapourisation;

from the body thus cooling it; *(3)*

c) In contrast, explain how the epidermis aids water conservation.

dead keratinised layer;

waterproof; *(2)*

Total 8

Question H6

a) With regard to lactation and the suckling of the young human describe the origin and the role of the following hormones:

i) prolactin,

anterior pituitary;

stimulates milk production by the mammary glands; *(2)*

ii) oxytocin,

posterior pituitary;

stimulates reflex ejection of milk in suckling; *(2)*

b) Describe the importance of colostrum to the suckling infant.

contains essential nutrients;

antibodies;

mildly laxative; *(2)*

Total 6

Question H7

Endurance athletes make use of hypobaric (low pressure) chambers in their preparations for competition, often sleeping in them for long periods.

a) Explain the physiological reasoning behind this practice.

reduced air pressure reduces partial pressure of oxygen;

body stimulated to produce more EPO and therefore more red blood cells;

increasing supply of oxygen to tissues when competing at atmospheric pressure; *(3)*

b) Describe what goal this technique has in common with altitude training or the misuse of the hormone erythropoietin (EPO).

stimulation of production of more red blood cells; *(1)*

Total 4

Question H8

The three diagrams below are of cross (transverse) sections of an artery, vein and capillary, not drawn to scale.

a) i) Identify the artery, vein and the capillary.

X = vein; Y = capillary; Z = artery; *(1)*

ii) What is the diameter of an average capillary?

6 - 8 µm; *(1)*

b) Describe how the structure of the capillary is adapted to its function.

thin walled / wall one cell thick;

some also have pores in the wall / fenestrated;

diameter same as that of the red blood cells; *(3)*

c) Describe another distinguishing feature between arteries and veins that can only be seen in a longitudinal section.

pocket valves in veins; *(1)*

Total 6

Question H9

Give an account of the causes and effects of heat stress.

environmental factors include air temperature;
humidity;
wind speed;
amount of direct radiation;
above 30 - 32^{o}C radiation, conduction and convection cease to aid heat loss;
contribute to heat gain;
amount of muscular activity generates metabolic heat;
which if cannot dissipate contributes to heat stress;
excessive sweating;
1leading to heat cramps;
as result of mineral loss and dehydration;
heat exhaustion;
as a result of reduced blood volume;
and heat stroke;
life threatening rise in internal body temperature above 40^{o}C;
cessation of sweating;
circulatory disruption with high blood pressure;
unconsciousness and coma;

Total 10

Examination Style Question Papers

Name:

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 3 - Energy and the Environment
Year Set 3

Time allowed 1 hour

Instructions:

- Answer ALL THREE questions in the spaces provided.

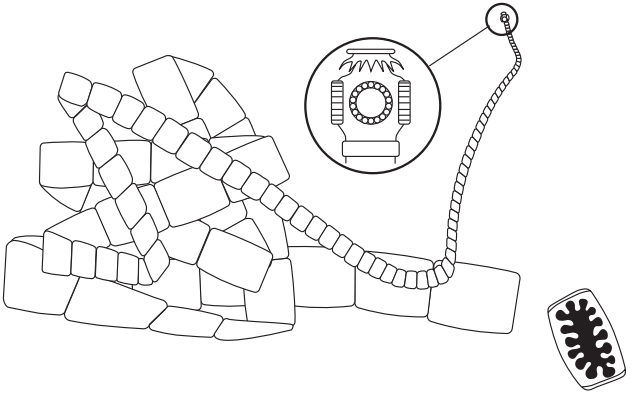
Information

- Mark allocations are shown in brackets.
- The maximum mark for this paper is 38
- The short questions will test mainly knowledge and understanding of the content of the unit.
- The longer questions will present students with stimulus material related to the specification content. These questions will also test skills of interpretation of data or information related to the content of the unit.
- Quality of Written Communication will be assessed.
- Scientific terminology should be used where appropriate.
- A calculator may be used.

Mark Scheme

Question 1

The diagram below is of Taenia solium the pork tapeworm.



a) Describe how the long flat tape shape is adapted to its mode of nutrition.

_____

_____

_____ *(2)*

b) Name a major structure which has been 'lost' by the tapeworm as a consequence of its mode of nutrition

_____

_____ *(1)*

c) One part of the definition of a parasite is that it does harm to its host, in this case man. Explain how the nutrition of tapeworm harms man.

_____

_____

_____

_____ *(3)*

Total 6

Question 2

a) Give definitions of the following terms.

i) Niche

_____ *(1)*

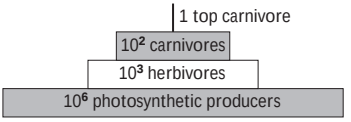
ii) Population

_____ *(1)*

iii) Community an interdependent collection of populations appropriate example e.g all

_____ *(1)*

b) The diagram below gives a simplified representation of a pyramid of numbers.



i) For this pyramid of numbers name an organism at each trophic level. All organisms must come from the same named habitat.

_____
_____
_____
_____
_____ *(4)*

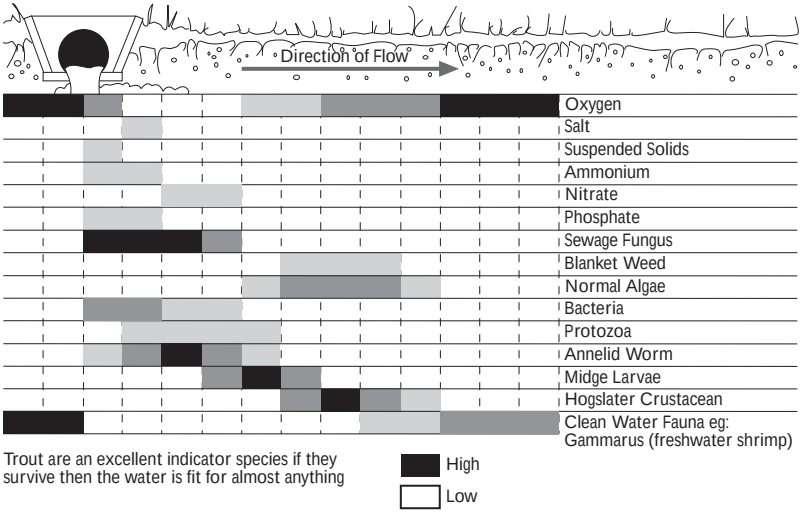
ii) Describe by reference to named organisms how a series of trophic levels in a food chain may not form a pyramid of numbers.

_____
_____
_____
_____
_____
_____ *(5)*

Total 12

Question 3

The diagram shows a representation of the effect of sewage effluent on river water and its animals (fauna).



a) Explain why presenting the data in this way is:

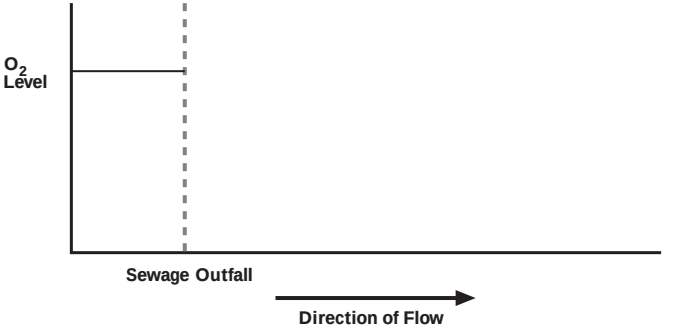
i) more realistic than drawing a smooth curve on a graph.

_____ *(1)*

ii) less realistic than drawing a smooth curve on a graph.

_____ *(1)*

iii) Convert the information about the levels of oxygen from the diagram into a smooth curve on the axes provided below.



(3)

Question continued...

b) **i)** By reference to the information about oxygen levels describe what is meant by "the oxygen sag" and explain its cause.

(3)

ii) With regard to the oxygen levels in water and the information in the original diagram, explain using examples what is meant by 'indicator species'

(3)

iii) Describe the methods by which oxygen levels recover further downstream.

(2)

c) Explain the appearance of nitrates slightly downstream of the sewage outfall.

(3)

d) Explain why the sayings of "the solution to pollution is dilution" and "running water purifies itself in ten miles" are not to be believed in our urban environment.

(2)

e) Explain how Biological Oxygen Demand (BOD) is a measure of organic pollution load.

(2)

Total 20

Assessment Grid

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 3 - Energy and the Environment
Year Set 3

	Question Number									
Specification Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
3.1 Modes of nutrition	**6**									**6**
3.2 Ecosystems										
3.3 Energy flow		**12**								**12**
3.4 Recycling of nutrients										
3.5 Energy resources										
3.6 Human influences			**20**							**20**

Total 38

	Question Number									
Assessment Objective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**0**	**0**	**Total**
AO1										
Knowledge with Understanding	**3**	**7**	**6**							**16**
AO2										
Application/Analysis/Evaluation	**3**	**5**	**14**							**22**

Total 38

Mark Schemes for Question Paper

EDEXCEL Specification
AS Biology and Biology (Human)

Unit 3 - Energy and the Environment
Year Set 3

Instructions

; = 1 mark / = alternative response

Question 1

The diagram below is of Taenia solium the pork tapeworm.

a) Describe how the long flat tape shape is adapted to its mode of nutrition.

large surface area to volume ratio;

for uptake of nutrients by diffusion; *(2)*

b) Name a major structure which has been 'lost' by the tapeworm as a consequence of its mode of nutrition

its gut; *(1)*

b) One part of the definition of a parasite is that it does harm to its host, in this case man. Explain how the nutrition of tapeworm harms man.

robs host of nutrients;

excretes waste products into gut of host;

irritates gut of host stimulating mucus secretion which decreases absorption of nutrients by host; *(3)*

Total 6

Question 2

a) Give definitions of the following terms.

i) Niche

an organisms role / 'occupation'; *(1)*

ii) Population

interbreeding members of the same species; *(1)*

iii) Community

an interdependent collection of populations; *(1)*

b) The diagram gives a simplified representation of a pyramid of numbers.

i) For this pyramid of numbers name an organism at each trophic level. All organisms must come from the same named habitat.

appropriate examples of:

producers e.g. heathers in a heathland community;

primary consumers e.g. caterpillars;

secondary consumers e.g. insectivorous birds;

tertiary consumers e.g. birds of prey; *(4)*

ii) Describe by reference to named examples of types of organisms how a series of trophic levels in a food chain may not form a pyramid of numbers.

any acceptable account e.g.:

single producer e.g. Beech tree;

supporting huge numbers of primary consumers;

e.g. insects and their larvae and detritivores on the leaf litter;

supporting a much smaller number of insectivorous birds;

which support larger numbers of parasites *(5)*

Total 12

Question 3

The diagram shows a representation of the effect of sewage effluent on river water and its animals (fauna).

a) Explain why presenting the data in this way is:

i) more realistic than drawing a smooth curve on a graph.

water is sampled at intervals; *(1)*

ii) less realistic than drawing a smooth curve on a graph.

the changes will be smoothed out by the flow of water; *(1)*

iii) Convert the information about the levels of oxygen from the diagram into a smooth curve on the axes provided below.

(3)

Question continued...

b) **i)** By reference to the information about oxygen levels describe what is meant by "the oxygen sag" and explain its cause.

oxygen levels drop after entry of sewage;

caused by microorganisms carrying out aerobic respiration;

having multiplied exponentially as a result of the large amounts of organic matter in the sewage as a food supply; *(3)*

ii) With regard to the oxygen levels in water and the information in the original diagram, explain using named examples what is meant by 'indicator species'

species which are characteristic of water with certain oxygen level;

e.g Gammarus (fresh water shrimp) is an excellent indicator species for pure water

Sewage 'fungus' indicates low oxygen and presence of organic matter; *(3)*

iii) Describe the methods by which oxygen levels recover further downstream.

diffusing into water at surface from air;

oxygenation by photosynthesis by algae; *(2)*

c) Explain the appearance of nitrates slightly downstream of the entry of the sewage outfall.

bacterial decomposition of nitrogen containing organic matter;

releases ammonium ions;

which aerobic bacteria convert to nitrate ions; *(3)*

d) Explain why the sayings of "the solution to pollution is dilution" and "running water purifies itself in ten miles" are not to be believed in our urban environment.

pollution load too great for dilution to be effective;

many pollutants undergo biological accumulation even though diluted; *(2)*

e) Explain how Biological Oxygen Demand bOD) is a measure of organic pollution load.

BOD is that amount of oxygen consumed by microorganisms in a water sample;

the more organic matter the more microorganisms the more BOD; *(2)*

Total 20