



**Edexcel B A-Level Biology**

# Topic 1

## Biological Molecules

# EXAM QUESTIONS BOOKLET

# 1.

Use this booklet to revise for exams and improve exam technique.

Ensure you identify areas of strength and weakness near exam time to make your revision effective, and use the revision notes to fill in any gaps

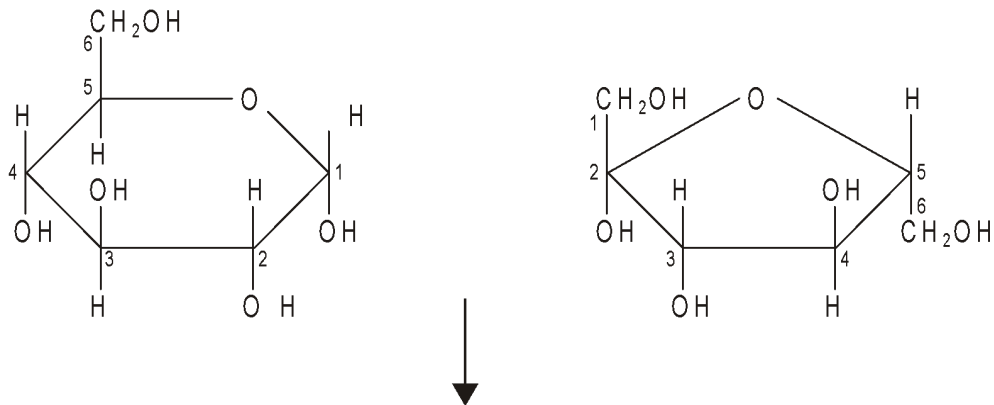
1. Maltose and sucrose are disaccharide sugars in which a bond joins two monosaccharide molecules. Sucrose is formed by the formation of a bond between carbon 1 of a glucose molecule and carbon 2 of a fructose molecule.

(i) Name the bond that joins the two molecules to form a disaccharide.

.....

[1]

(ii) Complete the diagram below to show what happens when the glucose and fructose molecules join together.



[2]

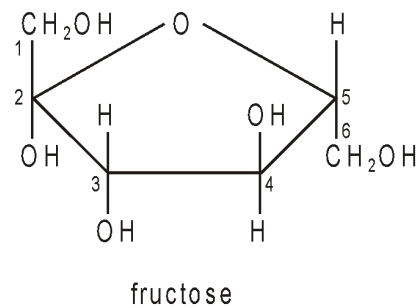
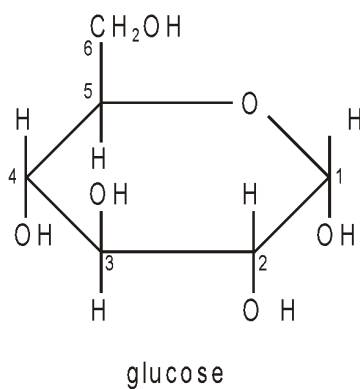
[Total 3 marks]

2.

Glucose:

- Is a carbohydrate
- Is a hexose (six-carbon sugar)
- Has the formula  $C_6H_{12}O_6$
- Has a six-membered ring structure.

The diagram below shows the molecular structures of two monosaccharide sugars, glucose and fructose.



State one way, visible in the diagram above, in which the structure of fructose is:

Similar to glucose;

.....  
.....

Different from glucose.

.....  
.....

[Total 2 marks]

3. A student was carrying out tests to determine which biological molecules were present in a food sample.

(a) (i) Describe a test that the student could carry out to discover whether this sample contained a lipid.

.....  
.....  
.....  
.....

[2]

(ii) State what would be seen if a lipid was present.

.....

[1]

(b) Describe how the structure of a phospholipid differs from that of a triglyceride.

You may use the space below for a diagram to help your answer.

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.....  
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[3]

(c) (i) Describe a test that the student could carry out to discover whether the food sample contained protein.

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[1]

(ii) State what would be seen if protein was present.

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[1]

[Total 8 marks]

4. Explain what is meant by the primary and secondary structure of a protein.

Primary structure:

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.....

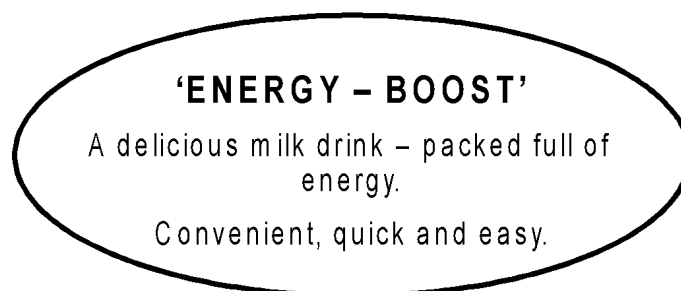
Secondary structure:

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[Total 5 marks]

5. 'Health – Milk' and 'Energy – Boost' are flavoured milk drinks.

The manufacturers make the following claims:



The two different flavoured milk drinks and a sample of fresh milk were all tested for the presence of some biological molecules.

The methods used and the results obtained are shown in the table below.

Colour change observed for			
Method used	Fresh milk	'Health – Milk'	'Energy – Boost'
A few drops of iodine solution added	remains yellow	remains yellow	remains yellow
5 cm <sup>3</sup> biuret solution added	blue to lilac	blue to lilac	blue to lilac
5 cm <sup>3</sup> Benedict's reagent added and solution boiled	blue to green	blue to green to yellow	blue to green to yellow to orange
<ul style="list-style-type: none"> <li>Sample that has been tested with Benedict's reagent is filtered.</li> <li>The filtrate (solution) is boiled with 5 cm<sup>3</sup> dilute acid, cooled and neutralised.</li> <li>Then 5 cm<sup>3</sup> Benedict's reagent is added and the solution is boiled.</li> </ul>	remains blue	blue to green to yellow to orange	blue to green to yellow to orange to red

(a) Using only the information in the table, state the biological molecules present in:

(i) Fresh milk;

.....  
 .....

[2]

(ii) 'Health – Milk'.

.....  
 .....

[3]

(b) What differences between 'Health – Milk' and 'Energy – Boost' are identified by the information in the table?

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[2]

(a) Explain why the claims made by the manufacturer for 'Health – Milk' could be misleading.

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[3]

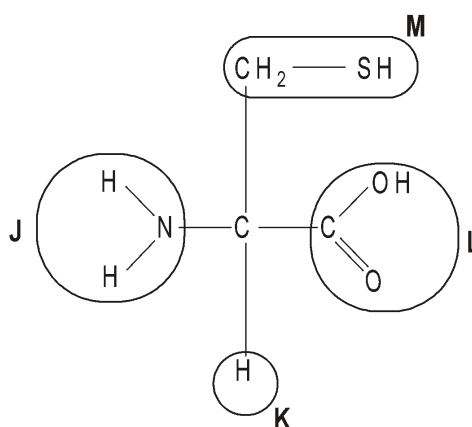
(d) Suggest why it would not be appropriate to test milk for lipids using the emulsion test.

.....  
.....

[1]

[Total 11 marks]

6. (a) Amino acids are the basic building blocks for proteins. The figure below shows the amino acid cysteine.





- (i) Complete the table by selecting the letter, J, K, L or M, that represents the following groups in cysteine.

Group	Letter
Carboxyl	
R group	
Amine group	

[3]

- (ii) The primary structure of a protein consists of a chain of amino acids.

Describe how a second amino acid would bond to cysteine in forming the primary structure of a protein.

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[3]

- (b) Each amino acid has a different R group.

Describe how these R groups can interact to determine the tertiary structure of a protein.

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[4]

[Total 10 marks]

7. Water is important in many biological reactions.

Complete the table below by writing an appropriate term next to each description.

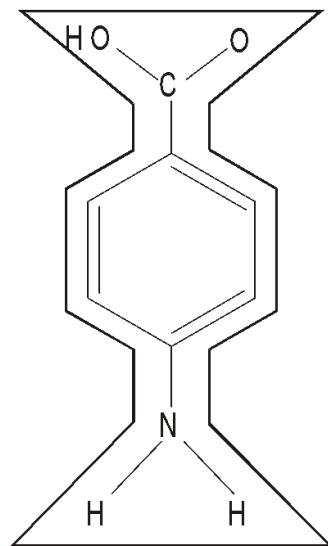
Description	Term
The type of reaction that occurs when water is added to break a bond in a molecule.	
The phosphate group of a phospholipid that readily attracts water molecules.	

[Total 2 marks]

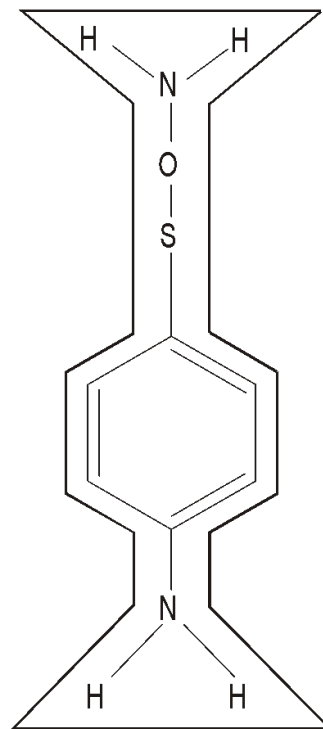
8. The enzyme DHPS is involved in the production of folic acid in bacteria.

- The substrate for DHPS is a molecule known as PABA.
- The enzyme DHPS is inhibited by the drug sulfonamide.

The figure below shows the structure of PABA and that of sulfonamide.

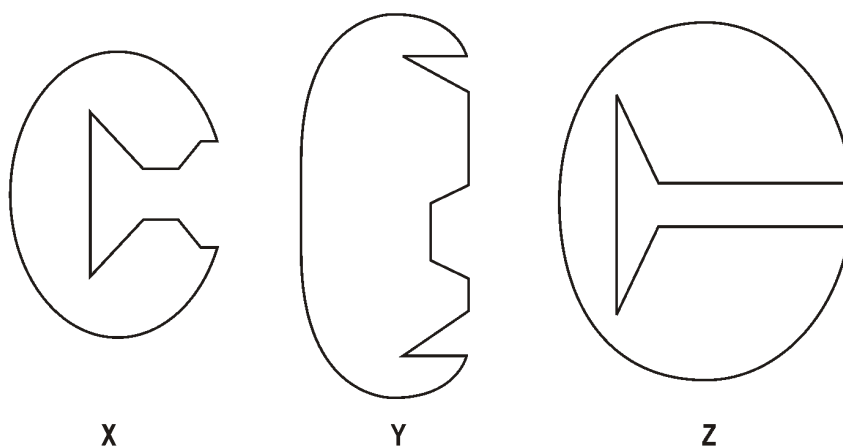


**PABA**



**sulfonamide**

- (i) Diagrams X, Y and Z represent these enzyme molecules and their active sites.



State the letter, X, Y or Z, that most accurately represents the enzyme DHPS.

.....

[1]

(ii) Using the information in the figure above, explain why sulfonamide acts as a competitive inhibitor of DHPS.

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.....

.....

.....

.....

[3]

[Total 4 marks]

9. Ponds provide a very stable environment for aquatic organisms. Three properties of water that contribute to this stability are as follows:

- The density of water decreases as the temperature falls below 4°C, so ice floats on the top of the pond.
- It acts as a solvent for ions such as nitrates (NO<sub>3</sub><sup>-</sup>).
- A large quantity of energy is required to raise the temperature of water by 1°C.

Explain how these three properties help organisms survive in the pond.



*In your answer you should make clear the links between the behaviour of the water molecules and the survival of the organisms.*

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[Total 8 marks]

10. Fungi such as *Fusarium venenatum* are grown in huge batch cultures to manufacture protein for food products.

Explain why these cultures are often maintained at the optimum temperature for protein production and not at a temperature above the optimum.



*In your answer you should make clear how the structure and activity of enzymes relates to the effects described.*

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[Total 8 marks]

11. (a) Part of the DNA base sequence coding for a protein is shown below.

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

- (i) State the corresponding base sequence of mRNA.

.....

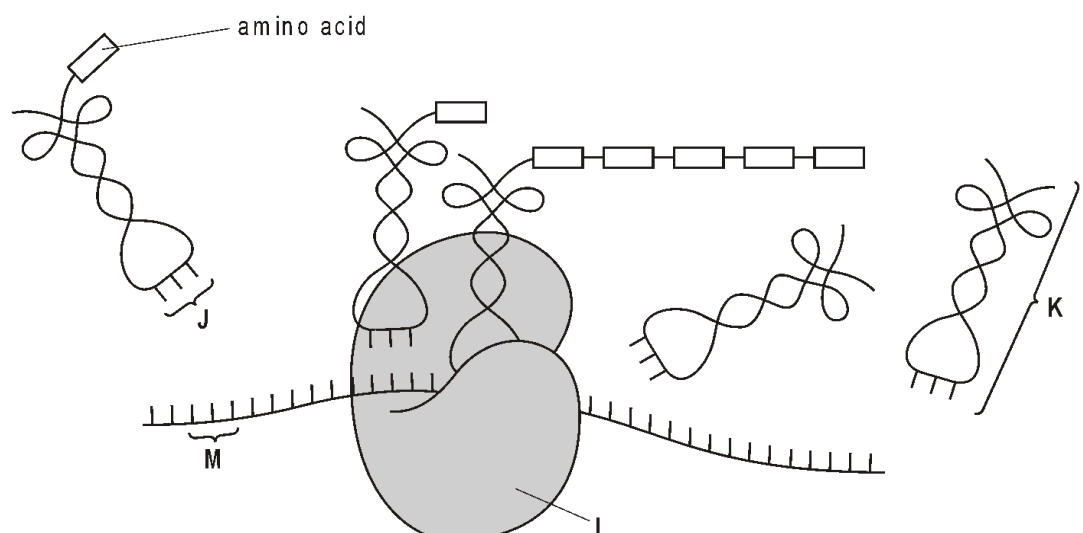
[2]

- (ii) Name the process by which the DNA code is transferred to mRNA.

.....

[1]

- (b) The figure below is a diagram that shows the stage in protein synthesis when amino acids are joined in the correct sequence to make the primary structure of the protein.



(i) Name J to M.

The group of bases at J .....

K .....

L .....

The group of bases at M .....

[4]

[Total 7 marks]

12.

- DNA is found in the nucleus of a cell.
- During interphase DNA replicates.
- DNA is involved in the transcription stage of protein synthesis.

The following statements, A to H, refer to events that may take place during:

- DNA replication only
- transcription only
- both DNA replication and transcription
- neither DNA replication nor transcription.

Complete the table by marking the appropriate boxes with a tick ( ✓ ) if the event takes place or a cross ( ✗ ) if it does not take place.

		DNA replication	transcription
<b>A</b>	Nucleotides line up along an exposed DNA strand.		
<b>B</b>	The whole of the double helix 'unzips'.		
<b>C</b>	Uracil pairs with adenine.		
<b>D</b>	A tRNA triplet pairs with an exposed codon.		
<b>E</b>	Both DNA polynucleotide chains act as templates.		
<b>F</b>	Adjacent nucleotides bond, forming a sugar-phosphate backbone.		
<b>G</b>	The original DNA molecule is unchanged after the process.		
<b>H</b>	Adenine pairs with thymine.		

[Total 8 marks]

13.

Inorganic ions are necessary for cellular activity in plants and animals. Phosphate ions  $\text{PO}_4^{3-}$  are considered to be one of the most important inorganic ions in mammals as they have so many different roles.

a)

i) Identify three uses of inorganic ions in the human body. (3 marks)

ii) Name two uses of calcium in the body. (2 marks)

b) The image below shows a plant with discoloured leaves.



i) Which two ions could the plant have a deficiency in? (2 marks)

ii) Why is nitrogen essential in plant development? (2 mark)

[Total 9 marks]





**Edexcel B A-Level Biology**

## **Topic 2**

# **Cells, Viruses and Reproduction of Living Things**

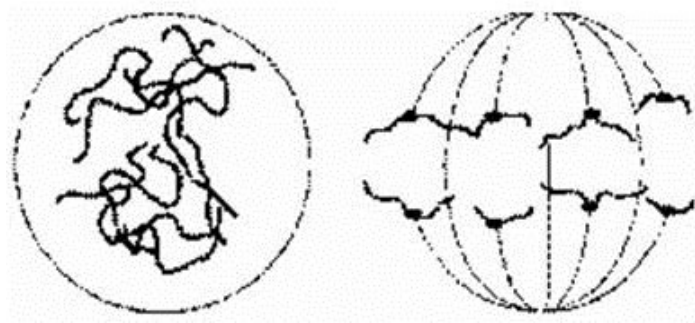
## **EXAM QUESTIONS BOOKLET**

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1. (a) The photographs show two stages in mitosis of a plant cell.



A

B

Name stages A and B. In each case describe what is happening to the chromosomes.

- (i) Stage A .....

.....  
.....  
.....

(2)

- (ii) Stage B .....

.....  
.....  
.....

(2)

- (b) Describe two events during interphase which prepare a cell for mitosis.

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.....  
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(2)

(Total 6 marks)

2. (a) Mitosis is important in the life of an organism. Give two reasons why.

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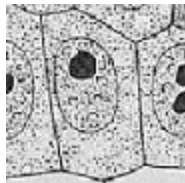


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(2)

A biologist used a microscope to investigate plant tissue, where some of the cells were dividing by mitosis. She examined 200 cells and counted the number of cells in interphase and in each stage of mitosis.

The table shows some of the cells she saw, and the percentage of cells in interphase and in two stages of mitosis, A and B.

Stage of cell cycle		Percentage of cells
Interphase		90
Stage A		3
Stage B		1

*Images by Edmund Beecher Wilson [Public domain], via Wikimedia Commons*

- (b) (i) Explain why the biologist chose to examine 200 cells.

.....  
.....  
.....

(1)

- (ii) Name Stage A and Stage B. Give the evidence from the photograph that you used to identify the stage.

Name of Stage A

.....

Evidence

.....  
.....

Name of Stage B

.....

Evidence

.....  
.....

(4)

- (c) In this tissue, one complete cell cycle took 20 hours.

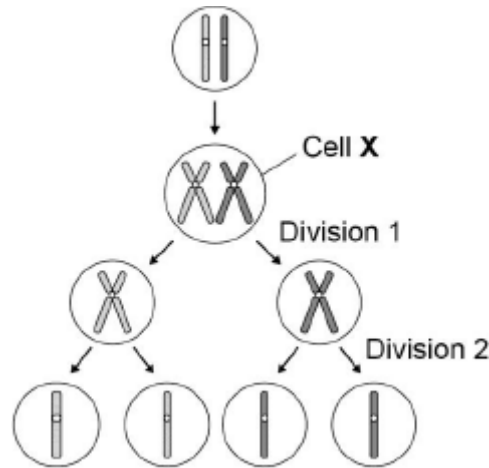
Using information from the table, calculate the mean time for these cells to complete mitosis. Show your working.

Answer .....

(2)

(Total 9 marks)

3. The figure below summarises the process of meiosis. The circles represent cells and the structures within each cell represent chromosomes.



- (a) Describe and explain the appearance of one of the chromosomes in cell X.

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.....

(Extra space)

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.....

(3)

- (b) Describe what has happened during division 1 in the figure above.

.....

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.....  
.....  
.....

(2)

(c) Identify one event that occurred during division 2 but not during division 1.

.....

(1)

(d) Name two ways in which meiosis produces genetic variation.

1.....

2.....

(2)

(Total 8 marks)

4. Division of the nucleus by meiosis produces haploid cells from a diploid cell. Nuclei produced by mitosis have the same number of chromosomes as the parent nucleus.

(a) What is the biological importance of reducing the chromosome number when the cell divides by meiosis?

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.....  
.....  
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(2)

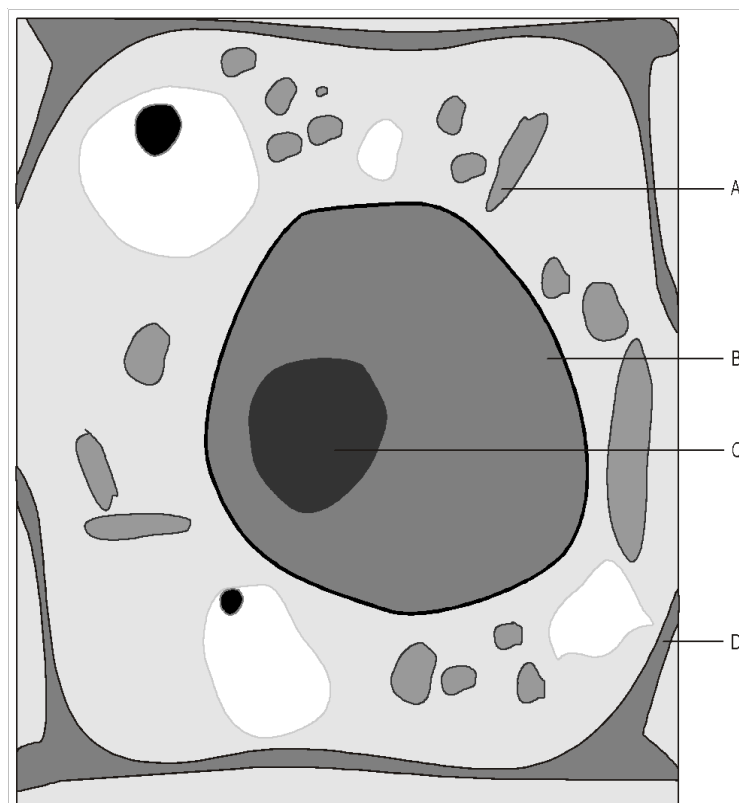
b) The table gives one difference between meiosis and mitosis. Complete the table by giving three further differences.

		<b>Meiosis</b>	<b>Mitosis</b>
	1	Reduces the chromosome number.	Maintains the same chromosome number as in the parent nucleus.
	2		
	3		
	4		

(3)

(Total 5 marks)

5. The diagram below is of a plant cell.





Name the parts of the cell labelled A to D.

A .....

B .....

C .....

D .....

[Total 4 marks]

6. (a) The table shows some features of cells. Complete the table with ticks to show those features which are present in an epithelial cell from the small intestine and those features which may be present in a prokaryotic cell.

Feature	Epithelial cell from small intestine	Prokaryotic cell
Golgi apparatus		
Mitochondrion		
Nuclear envelope		
Plasmid		
Ribosome		

(2)

(b) (i) Explain why it is possible to see the detailed structure of a prokaryotic cell with an electron microscope but not with a light microscope.

.....  
.....  
.....  
.....

(2)

(ii) Care must be taken in interpreting electron micrographs. Some features visible in an electron micrograph may not be present in the living cell. Explain why.

.....  
.....

(1)

(Total 5 marks)

7. The table below compares features of typical eukaryotic and prokaryotic cells.

(i) Complete the table by placing one of the following, as appropriate, in each empty box of the table.

- a tick ( ✓ )
- a cross ( ✕ )
- the words 'sometimes present'

Some of the boxes have been completed for you.

	eukaryotic cell	prokaryotic cell
cell wall	sometimes present	✓
nuclear envelope	✓	
Golgi apparatus		✕
ribosomes		✓
flagellum	sometimes present	

(ii) Outline the roles of the Golgi apparatus and the ribosomes.

Golgi apparatus.....  
.....  
.....

[4]

Ribosomes.....  
.....

[2]

[Total 6 marks]

8. State the maximum magnification that can be achieved by a light microscope and a transmission electron microscope.

Select your answers from the list below.

10x      40x      100x      400x      1500x      25 000x

50 000x      500 000x

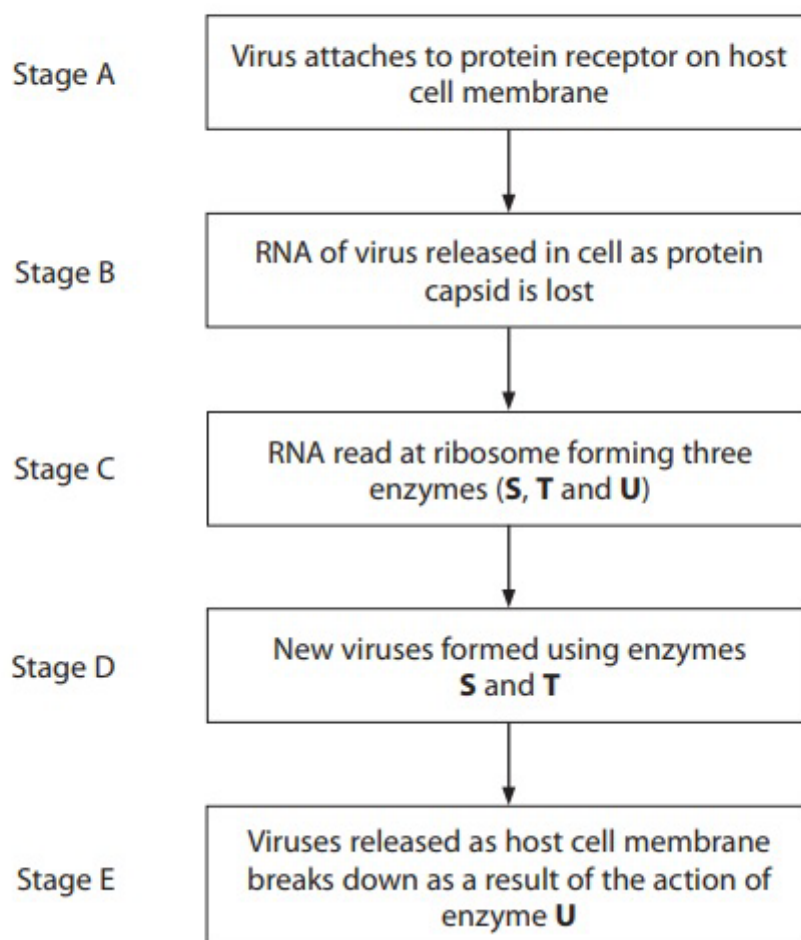
light microscope ..... x

transmission electron microscope ..... x

[Total 2 marks]

9. The common cold is a disease caused by a variety of viruses.

The flow diagram below describes how common cold viruses attack the cells on the inside of the nose.



(a) Common cold viruses infect only the cells inside the nose.

(i) Suggest why common cold viruses cannot infect cells if they land on unbroken skin

.....

.....

.....

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.....

[2]

(ii) Suggest why common cold viruses cannot infect cells if they enter the blood through a cut in the skin.

.....

.....

.....

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[2]

(b) Compare the action of the RNA in the common cold virus with that found in HIV.

.....

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.....

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.....

[2]

(c) At Stage C, three enzymes are formed.

(i) Suggest why two of these enzymes, S and T, are needed at Stage D.

.....

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.....

[2]

(ii) Suggest how enzyme U might catalyse the breakdown of the host cell membrane at Stage E.

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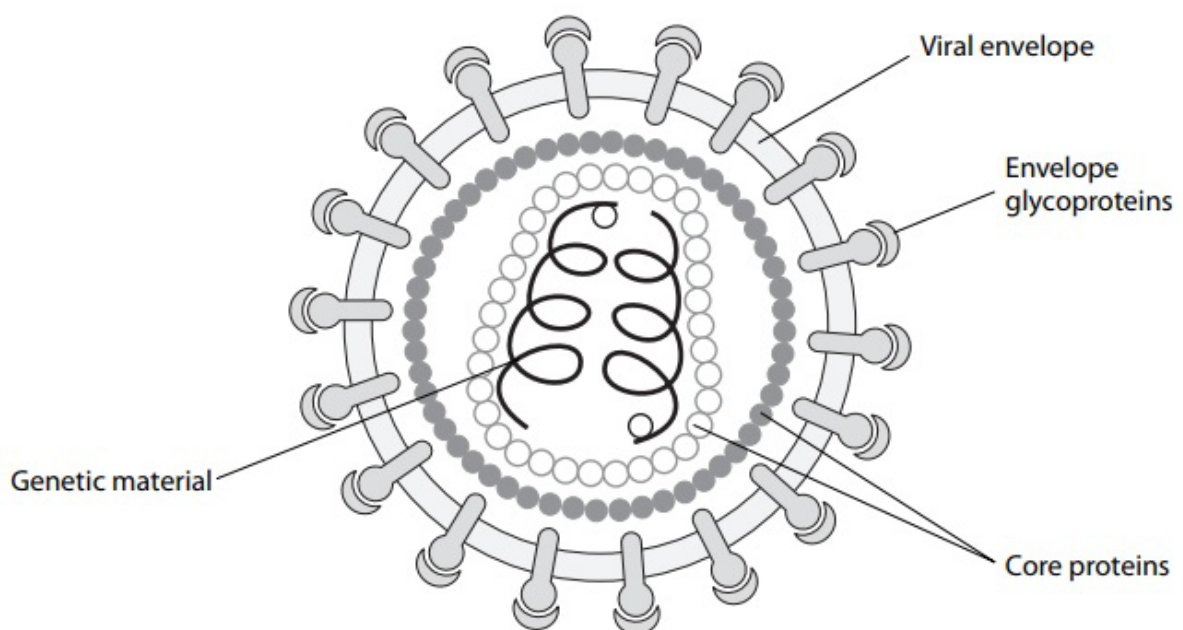
.....

.....

[3]

(Total 11 marks)

10. The diagram below shows the structure of Human Immunodeficiency Virus (HIV).



State how the genetic material in HIV differs from the genetic material in the bacterium *Mycobacterium tuberculosis* that causes TB.

.....

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.....

.....

(Total 2 marks)

11. Meiosis is involved in producing gametes such as sperm cells and egg cells.

(a) Describe three structural differences between a human sperm cell and a human egg cell.

1.....

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.....

2.....

.....

.....

3.....

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.....

[3]

(b) When a sperm cell reaches an egg cell, enzymes are released from the head of the sperm.

Explain the reasons for the release of these enzymes.

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.....  
[2]

(c) Describe what happens in the egg cell once the sperm cell nucleus has entered it.

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.....  
.....  
.....  
.....  
[2]

(d) In plants, a double fertilisation occurs.

(i) One fertilisation involves a male gamete nucleus fusing with the egg cell nucleus.  
Give two functions of this fertilisation.

- 1.....  
.....  
2.....  
.....

[2]

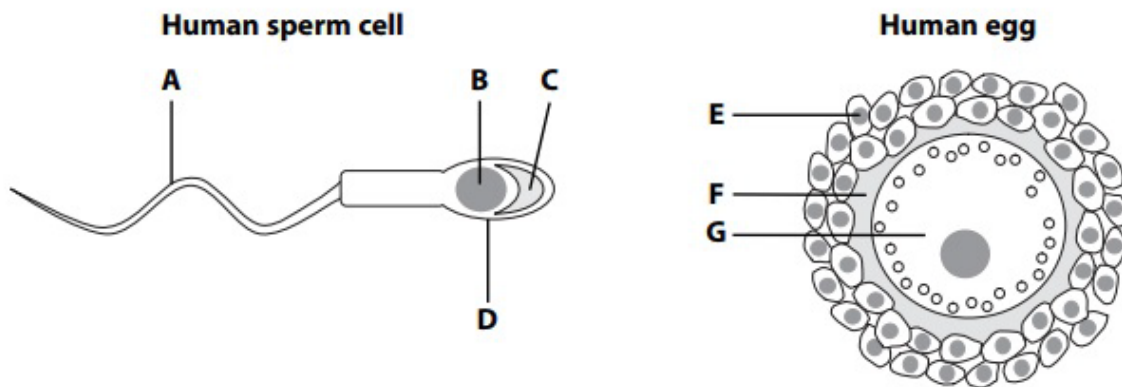
(ii) In the second fertilisation, the other male gamete nucleus fuses with two polar nuclei forming a triploid structure. Name the triploid structure formed.

.....  
[1]

(Total 10 marks)

12.

The diagrams below show a human sperm cell and a human egg.



- (i) The table below describes four sites.  
Place a cross ☒ in the box below the letter that correctly links the statement to one of the labels on the diagrams above.

(4)

Statement	A	B	C	D	E	F	G
Site containing acrosin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Site where acrosin works	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Site containing the haploid number of chromosomes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Site containing mitochondria	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

- (ii) Describe how the acrosin is released from the acrosome.

.....

.....

.....

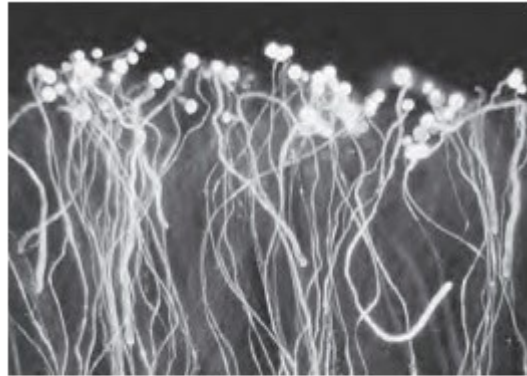
.....

[2]

[Total 6 marks]



13. The photograph below shows pollen germinating on the stigma of a tomato flower.



Magnification  $\times 100$

(a) Explain how the pollen tubes grow through the style of the flower.

.....

.....

.....

.....

[2]

(b) Place a cross ☒ in the box next to the correct word or words to complete each of the following statements.

(i) The tip of the pollen tube breaks through the micropyle to enter the

- ☒ **A** egg cell
- ☒ **B** embryo sac
- ☒ **C** ovary
- ☒ **D** style

[1]

(ii) During fertilisation, nuclei from the pollen tube fuse with

(1)

- ☐ **A** the antipodal cells
- ☐ **B** the egg cell and the antipodal cells
- ☐ **C** the egg cell and the polar nuclei
- ☐ **D** the polar nuclei and the antipodal cells

(iii) During fertilisation, the following structures are produced

(1)

- ☐ **A** diploid zygote and diploid endosperm
- ☐ **B** diploid zygote and triploid endosperm
- ☐ **C** triploid zygote and diploid endosperm
- ☐ **D** triploid zygote and triploid endosperm

(c) Describe how the structure of a pollen grain differs from that of a sperm cell.

(2)

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[Total 7 marks]



**Edexcel B A-Level Biology**

## **Topic 3**

# **Classification and Biodiversity**

## **EXAM QUESTIONS BOOKLET**

# 1.

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1.



Fig. 8.1

Fig. 8.1, above, shows an electron micrograph of an invertebrate known as a 'water bear'.

(a) Complete the following passage about the classification of water bears using the most appropriate terms.

The water bear, *Echiniscus trisetosus* is a member of the genus .....  
and the family Echiniscidae. This family belongs to the .....  
Echiniscoidea, which forms part of the class Heterotardigrada.

Water bears, also known as tardigrades, are classified into a  
..... of their own called the Tardigrada. Tardigrades form part  
of the kingdom ..... within the domain .....

[5]

(b) State the meaning of the term phylogeny and explain how phylogeny is related to classification.

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.....  
.....

.....

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.....

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.....

.....

[3]

(c) Water bears are extremely common in many habitats, including household gardens. However, they were not discovered until approximately 300 years ago.

Suggest reasons why they were not known before this time.

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.....

.....

[2]

[Total 10 marks]

2. In an investigation, the tolerance to copper ions of the grass *Agrostis tenuis* was determined.

Samples were taken of plants growing in waste from a copper mine and from nearby areas just outside the mine. The mean copper tolerance of plants from the mine waste was found to be four times higher than that of plants in the surrounding area.

(a) Explain how natural selection could produce a copper-tolerant population in the mine waste.

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(4)

(b) Copper-tolerant *Agrostis tenuis* plants flower at a different time from those which are not copper-tolerant. Explain how this might eventually lead to the production of a new species of *Agrostis*.

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(4)

(Total 8 marks)

3. Lake Malawi in East Africa contains around 400 different species of cichlids which are small, brightly coloured fish. All these species have evolved from a common ancestor.

(a) Describe one way in which scientists could find out whether cichlids from two different populations belong to the same species.

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.....

.....

.....

(2)

(b) During the last 700 000 years there have been long periods when the water level was much lower and Lake Malawi split up into many smaller lakes. Explain how speciation of the cichlids may have occurred following the formation of separate, smaller lakes.

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(4)

(Total 6 marks)

4. Table 1 shows how a bird called the bluethroat (*Luscinia svecica*) is classified by biologists.

Table 1

	<b>Taxon</b>	<b>Name of taxon</b>
	Domain	Eukaryota
		Animalia
		Chordata
		Aves
		Passeriformes
		Muscicapidae
	Genus	
	Species	



(a) Complete Table 1 by filling the seven blank spaces with the correct terms.

(2)

A group of scientists investigated genetic diversity in different species of bird. For each species, the scientists:

- Collected feathers from a large number of birds.
- Extracted DNA from cells attached to each feather.
- Analysed the samples of DNA to find genetic diversity.

Table 2 summarises their results.

Table 2

	Species of bird	Number of genes examined	Number of genes examined that showed genetic diversity
	Willow flycatcher	708	197
	House finch	269	80
	Bluethroat	232	81

(b) In this investigation, what is meant by genetic diversity?

.....  
.....

(1)

(c) The scientists concluded that the bluethroat showed greater genetic diversity than the willow flycatcher. Explain why they reached this conclusion. Use calculations to support your answer.

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.....  
.....

.....

(2)

(Total 5 marks)

5. (a) What two measurements are needed to calculate an index of diversity?

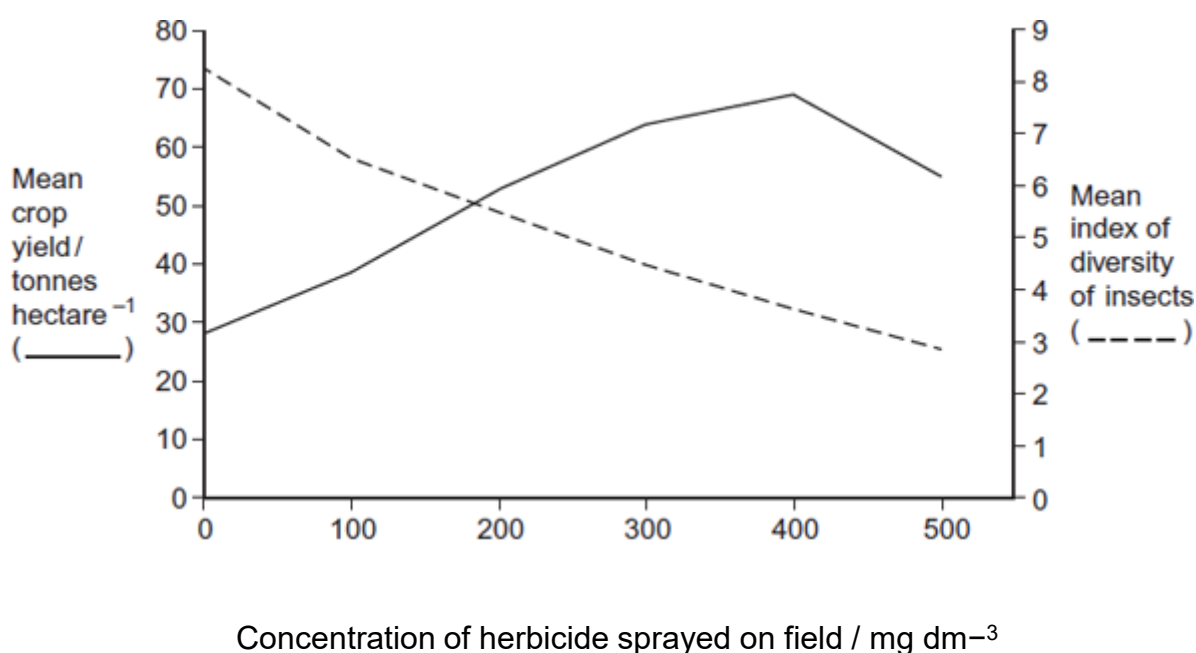
1.....

2.....

(2)

(b) A herbicide is a chemical used to kill weeds. Ecologists investigated the effect of a herbicide on crop yield and the diversity of insects. They sprayed different fields with the same volume of different concentrations of the herbicide. At harvest, the ecologists determined the mean crop yield and the mean index of diversity of insects for fields that had received the same concentration of the herbicide.

The figure below shows their results.



(i) Some fields acted as controls. They were sprayed with a solution that did not contain the herbicide. Explain the purpose of these control fields.

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(1)

(ii) Suggest an explanation for the relationship between the concentration of herbicide and the mean crop yield.

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(2)

(iii) Explain the relationship between the concentration of herbicide and the mean index of diversity of insects.

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(Extra space)

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(3)

(Total 8 marks)

6. Evolutionary relationships between different primates can be found by comparing their proteins and DNA.

(a) All primates produce a species-specific type of haemoglobin. An antibody against human haemoglobin could be used to compare the evolutionary relationships between different primates. Describe and explain how.

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(3)

(b) Scientists used DNA hybridisation to determine the evolutionary relationships between five species of primate. The temperature at which a molecule of double-stranded DNA separates into two single strands is the separation temperature.

The scientists recorded the mean separation temperature of DNA in which both strands were from the same species. The scientists then recorded the mean decrease in separation temperature of DNA in which one of the strands was from another species.

Their results are shown in the table.

	Primate	Mean decrease in separation temperature / °C				
		Human	Chimpanzee	Gorilla	Orangutan	Gibbon
	Human					
	Chimpanzee	1.7				
	Gorilla	2.3	2.3			
	Orangutan	3.6	3.6	3.5		
	Gibbon	4.8	4.8	4.7	4.9	

(i) These data suggest that gibbons are the most distantly related to humans. Explain how.

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(2)

(ii) There were differences in separation temperature of DNA formed from single-stranded DNA of the same species of primate. Suggest why.

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(1)

(iii) The scientists assumed that the decreases in separation temperatures are directly proportional to the time since the evolutionary lines of these primates separated.

Gorillas are thought to have separated from orangutans 20 million years ago.

Use this information to calculate how long ago the evolutionary lines of humans and chimpanzees separated. Show your working.

..... million years

(Total 8 marks)

7. A student investigated the distribution of plants in a heathland.

The table below shows the number of plants he found in a sample area of 1m<sup>2</sup>.

	Species of plant	Number counted in 1m <sup>2</sup>
	Common heather	2
	Red fescue	14
	Vetch	2
	White clover	8

(a) What is the species richness of this sample?

(1)

(b) Calculate the index of diversity of this sample. Show your working.

Use the following formula to calculate the index of diversity.

$$d = \frac{N(N - 1)}{\sum n(n - 1)}$$

Where N is the total number of organisms of all species

and n is the total number of organisms of each species.

Index of diversity = .....

(2)

(c) Suggest how this student would obtain data to give a more precise value for the index of diversity of this habitat.

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(2)

(Total 5 marks)

8. Scientists investigated the species of insects found in a wood and in a nearby wheat field. The scientists collected insects by placing traps at sites chosen at random, both in the wood and in the wheat field.

The table shows the data collected in the wood and in the wheat field.

Species of insect	Number of organisms of each species	
	Wood	Wheat field
Bird-cherry oat aphid	0	216
Beech aphid	563	0
Large white butterfly	20	0
Lacewing	12	3
Seven-spot ladybird	36	0
Two-spot ladybird	9	1
<b>Total number of organisms of all species</b>	<b>640</b>	<b>220</b>

(a) The scientists collected insects at sites chosen at random. Explain the importance of the sites being chosen at random.

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(1)

- (b) (i) Use the formula

$$d = \frac{N(N-1)}{\sum n(n-1)}$$

to calculate the index of diversity for the insects caught in the wood,  
where

d = index of diversity N = total number of organisms of all species n =  
total number of organisms of each species.

Show your working.

Answer .....

(2)

- (ii) Without carrying out any further calculations, estimate whether the  
index of diversity for the wheat field would be higher or lower than the  
index of diversity for the wood.

Explain how you arrived at your answer.

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(2)

- (c) A journalist concluded that this investigation showed that farming reduces  
species diversity. Evaluate this conclusion.

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(2)

(d) Farmers were offered grants by the government to plant hedges around their fields.

Explain the effect planting hedges could have on the index of diversity for animals.

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(2)

(Total 9 marks)

9. (a) Explain why it is sometimes necessary to conserve a plant species, such as *N.thermarum*, outside its natural habitat (ex situ).

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[3]

(b) The Royal Botanic Gardens also manages the Millennium Seed Bank, which aims to store seeds from one quarter of all plant species.

Give three advantages of conserving plant species as seeds and not as adult plants.

- 1.....  
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2.....  
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3.....  
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[3]

[Total 6 marks]

10. Sardinia is an island in the Mediterranean Sea. Many of the plants and animals on islands, such as Sardinia, show distinct physical and behavioural features that are different from those found in closely-related mainland populations. The Sardinian wild boar is an example of this, shown in the photograph below.



Magnification  $\times 0.1$

(a) Explain what is meant by each of the following terms.

- (i) Gene pool

.....  
.....

[1]

(ii) Allele frequency

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[1]

[Total 2 marks]

11.

Organisms are adapted to their environment which increases their chances of survival.

- (a) Read through the following passage about adaptations to the environment. Write on the dotted lines the most appropriate word or words to complete the passage.

(3)

The process of ..... selection can lead to adaptation, survival and .....

There are three types of adaptations to the environment: physiological, anatomical and .....

- (b) The table below describes some adaptations in humans. Complete the table by stating whether the adaptation is physiological or anatomical.

(3)

Description	Adaptation
Hearing becoming temporarily less sensitive after listening to loud music for a few hours	
Heart beats faster when the hormone adrenaline is released	
People living in a cold climate have a shorter neck than people living in a hot, dry climate	

[Total 6 marks]

12. Nuthatches are small, colourful birds belonging to the genus, *Sitta*. Many varieties of the species *Sitta europaea* (European nuthatch) can be found throughout mainland Europe. These varieties form overlapping populations in different regions. These birds eat small invertebrates, living in tree bark, throughout the year.



European nuthatch. Magnification x0.5  
Leslie J Borg/Science Photo Library

However, in the colder mountain forests on the island of Corsica, a small population of approximately 2500 pairs of nuthatches can be found. These birds are classified as the species *Sitta whiteheadi* (Corsican nuthatch). For most of the year, they feed on pine seeds. During the summer breeding season they also feed on small invertebrates. Members of the two species, *S. europaea* and *S. whiteheadi*, are so similar in appearance and behaviour that they can usually only be distinguished by expert observation and research.

(a) Place a cross ☒ in the box next to the best definition of a species.

- ☐ **A** individuals can interbreed to produce fertile offspring
- ☐ **B** individuals can interbreed to produce hybrid offspring
- ☐ **C** individuals can interbreed to produce sterile offspring
- ☐ **D** individuals can interbreed to produce viable offspring

[1]

(b) In mountainous regions of mainland Europe, only *S. europaea* is found. Suggest how a distinct species of nuthatch, *S. whiteheadi*, has evolved in the mountainous regions of the island of Corsica.

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[5]

- (c) (i) Suggest how environmental changes, such as those caused by global warming, are more likely to cause extinction of *S. whiteheadi* than *S. europaea*.

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[3]

- (ii) Suggest why *S. whiteheadi* might be able to survive an environmental change such as global warming.

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[2]

(d) Explain how the work of zoos could be important to the survival of *S. whiteheadi*.

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[2]

[Total 13 marks]

13. There are wolves in many European countries. Scientists investigated the genetic diversity of these wolves. They collected samples of DNA from the mitochondria of wolves from different countries. For each sample, they identified which haplotypes were present in the DNA. A haplotype is a particular sequence of bases on DNA. Mutations can produce new haplotypes.

	Country	Number of wolves sampled	Number of different haplotypes in mitochondrial DNA
	Spain	84	3
	Portugal	19	2
	Italy	101	1
	France	7	1
	Bulgaria	29	6
	Sweden	93	1

The scientists wanted to find out whether one of the haplotypes in the Portuguese wolves was the same as one of those in the Spanish wolves. They used a restriction endonuclease, electrophoresis and a labelled DNA probe.

(a) For what purpose did they use:

(i) The restriction endonuclease?

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(1)

(ii) Electrophoresis?

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.....

(1)

(b) Explain why the labelled DNA probe could be used to find out whether the haplotypes were the same.

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(2)

(c) The scientists analysed the DNA on the Y chromosome and the DNA in the mitochondria of the Swedish wolves. They concluded that the Swedish wolf population descended from one male wolf from Finland and one female wolf from Russia.

(i) Explain why DNA on the Y chromosome helped them to reach this conclusion.

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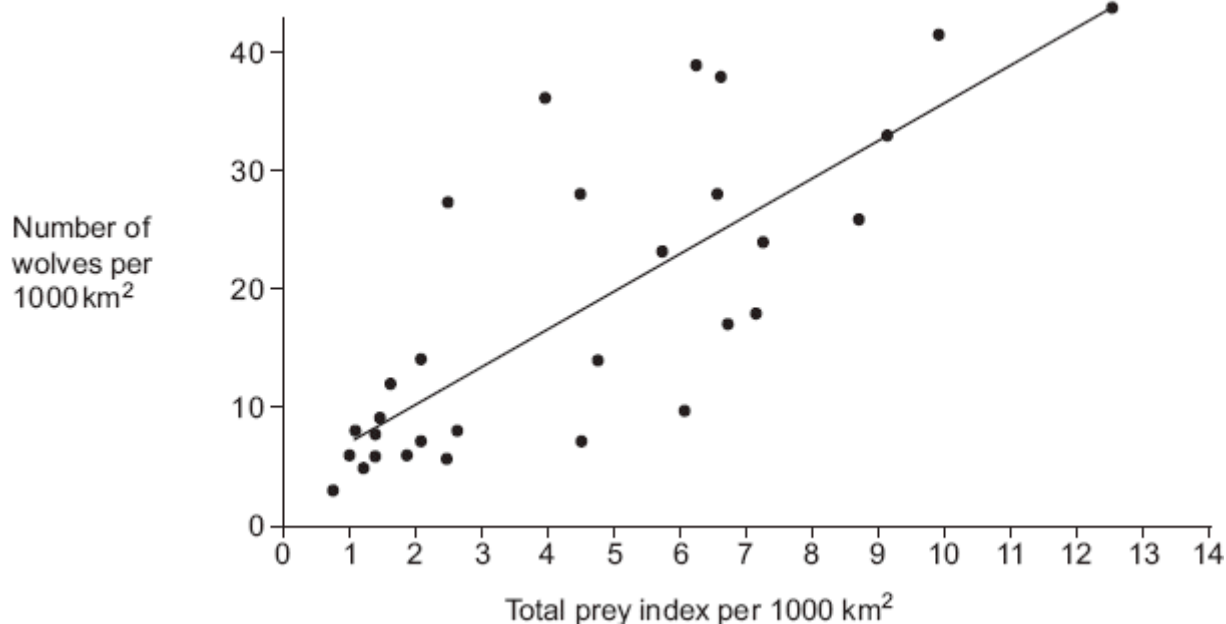
(1)

(ii) Suggest why DNA in the mitochondria helped them to reach this conclusion.



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(1)

Wolves eat different mammals. An ecologist investigated factors that affect wolf numbers in North America. He collected data from different field studies carried out in different places. The graph shows his results.



- (d) (i) The wolf numbers are given per unit area. Explain why.

.....  
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.....

(2)

- (ii) The ecologist calculated the total prey index for each of the places that had been studied. In order to do this, he gave each prey species a value based on how much food was available to wolves from the prey animal concerned. He called this value the prey index.

The ecologist considered that the prey index gave a better idea of the food available than the prey biomass in kg. Suggest why the prey index gives a better idea of food available.



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(2)

(e) The ecologist calculated the total prey index by combining the prey indices and the total number of animals of each species present in 1000 km<sup>2</sup>. He plotted this information on the graph. What does the graph suggest about the factors that determine wolf numbers in North America? Explain your answer.

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(2)

(Total 12 marks)



**Edexcel B A-Level Biology**

# **Topic 4**

## **Exchange and Transport**

### **EXAM QUESTIONS BOOKLET**

# 1.

Use this booklet to revise for exams and improve exam technique.

Ensure you identify areas of strength and weakness near exam time to make your revision effective, and use the revision notes to fill in any gaps

1. (a) Describe the part played by the inner membrane of a mitochondrion in producing ATP.

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(3)

(b) A scientist investigated ATP production in a preparation of isolated mitochondria. He suspended the mitochondria in an isotonic solution and added a suitable respiratory substrate together with ADP and phosphate. He bubbled oxygen through the preparation.

(i) Why was the solution in which the mitochondria were suspended isotonic?

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.....

(1)

(ii) Explain why the scientist did not use glucose as the respiratory substrate.

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(2)

(iii) Explain why the oxygen concentration would change during this investigation.

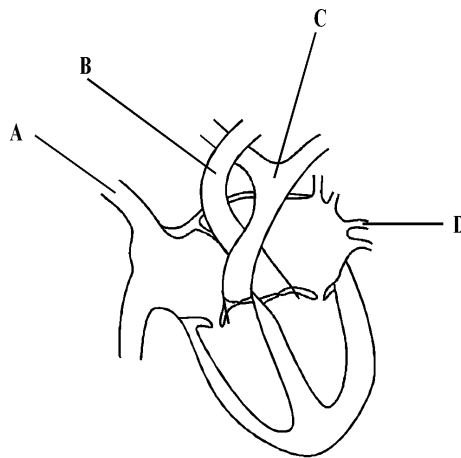
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(1)

(Total 7 marks)

2. The diagram shows a section through a human heart.



(a) Which of the blood vessels labelled A to D

(i) Takes blood from the heart to the muscles of the arms and legs;

.....  
(1)

(ii) Is a vein which contains oxygenated blood?

.....  
(1)

(b) Is the right ventricle filling with blood or emptying? Give two pieces of evidence from the diagram to support your answer.

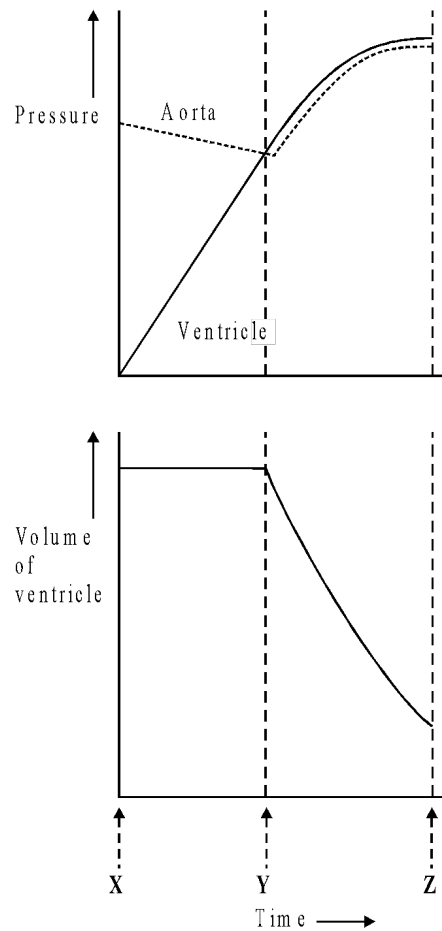
Filling or emptying? .....

Evidence

1.....  
.....  
2.....  
.....

(2)

The graphs show some changes in pressure and volume during part of a cardiac cycle.



(c) Describe what the graphs show about the pressure and volume in the ventricle between times X and Y.

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(1)

(d) At point Y, the valve between the aorta and the ventricle opens. Use the information about pressure on the graph to explain why.

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(1)

- (e) Explain the changes in the volume of the ventricle between times X and Z.

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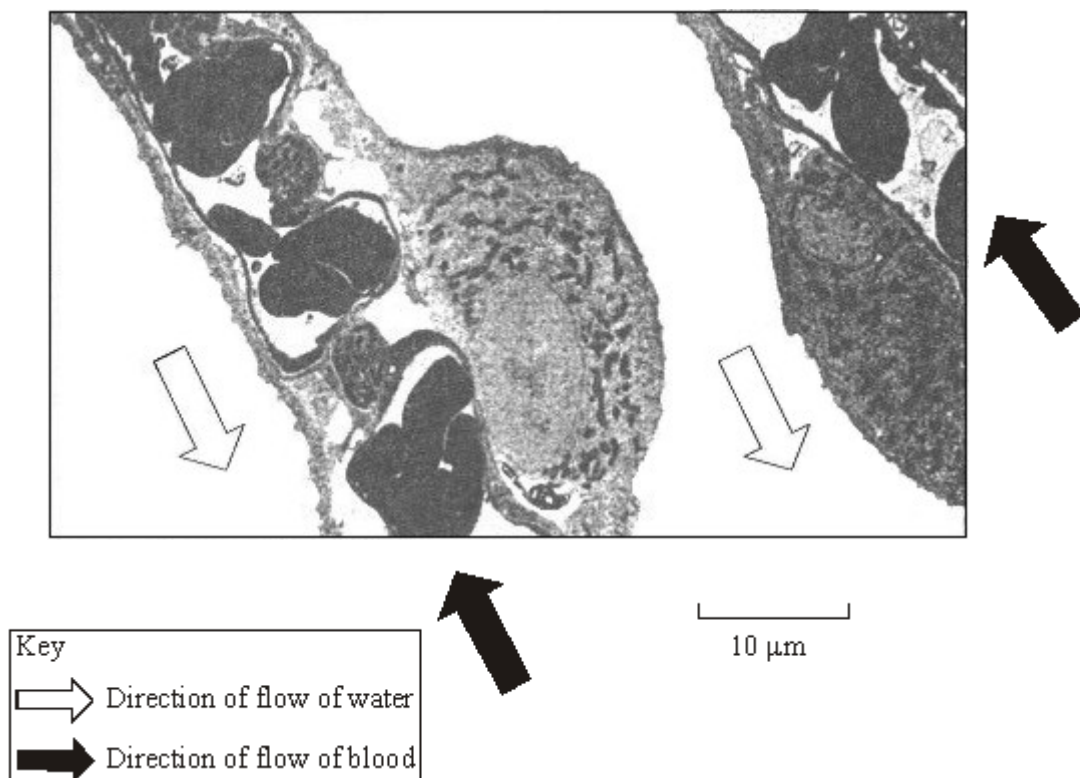
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(3)

(Total 9 marks)

3. The electron micrograph on the following page shows a section through a fish gill. The directions of flow of water and of blood are indicated by arrows.



(a) Calculate the minimum distance that a molecule of oxygen would have to travel from the water to a red blood cell. Give your answer in micrometres and show your working.

Answer .....  $\mu\text{m}$ .

(2)

(b) Explain how the relationship between the direction of flow of water and of blood shown in the micrograph is useful to a fish.

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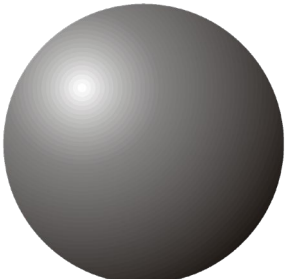
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(3)

(Total 5 marks)

4. A student investigated how the surface area of a single-celled organism is related to its volume. The student used two spheres, A and B, as models of two organisms. The surface area and volume of each sphere was calculated.

The results are shown in the table below.

	Sphere A	Sphere B
		
Diameter / cm	1	3
Surface area / $\text{cm}^2$	3.14	28.27
Volume / $\text{cm}^3$	0.52	14.14



- (i) The student calculated the surface area: volume ratio of sphere B as 2:1.  
Calculate the surface area: volume ratio of sphere A. Show your working.

.....

[2]

- (ii) How does the surface area: volume ratio of sphere B differ from that of sphere A?

.....

[1]

- (iii) Single-celled organisms generally have a surface-area to volume ratio more like that of sphere A than sphere B.

Explain why.

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[2]

[Total 5 marks]

5. The lungs in the mammalian body are well developed to allow effective exchange of gases.

Describe the features of the lungs that make them effective organs for the exchange of gases.

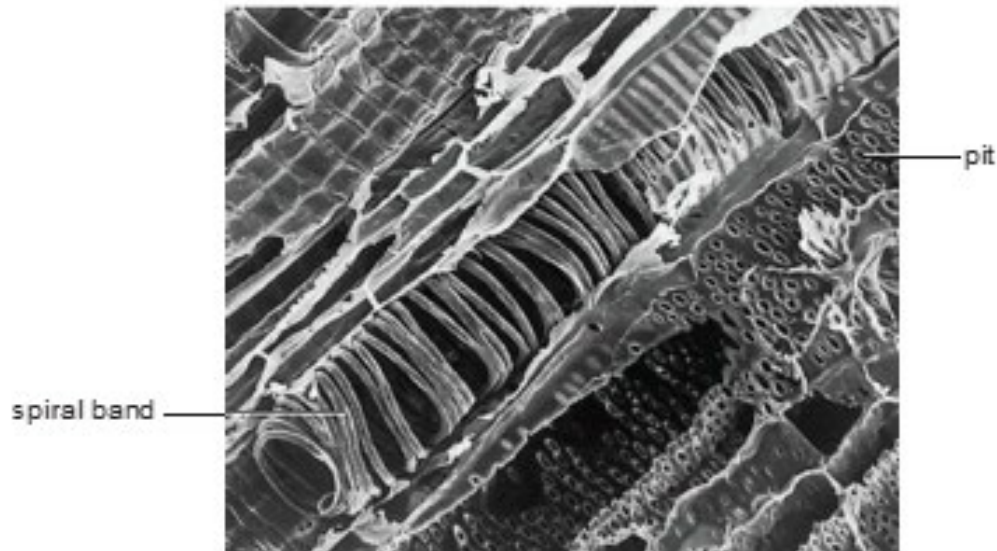


*In your answer, you should use appropriate technical terms, spelled correctly.*

*(Allow one lined page).*

[Total 5 marks]

6. The figure below is an electron micrograph of xylem tissue in the stem of a plant.



- (i) State one function of xylem tissue.

.....

.....

[1]

- (ii) The spiral band in the xylem vessel shown in the figure above contains a substance called lignin.

State the function of this spiral band of lignin and explain why it is important that the xylem vessel becomes lignified in this way.

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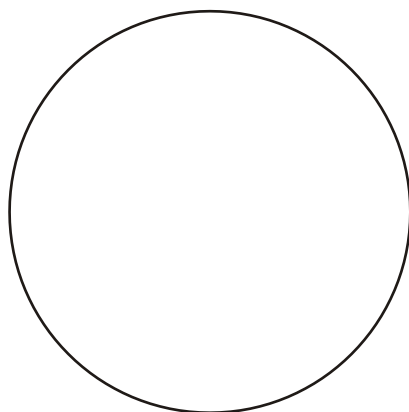
[3]

[Total 4 marks]

7. Translocation is the movement of the products of photosynthesis within a plant.

Translocation occurs in the phloem and involves sources and sinks.

Using the outline below, draw in the position of the phloem in the root of a dicotyledonous plant.



[Total 1 mark]

8. The table below contains some terms or names of structures related to the mammalian heart and circulatory system.

Complete the table by selecting the statement from the list A to I below that best matches the term or structure in the table.

The first one has been done for you.

You may use each letter once, more than once or not at all.

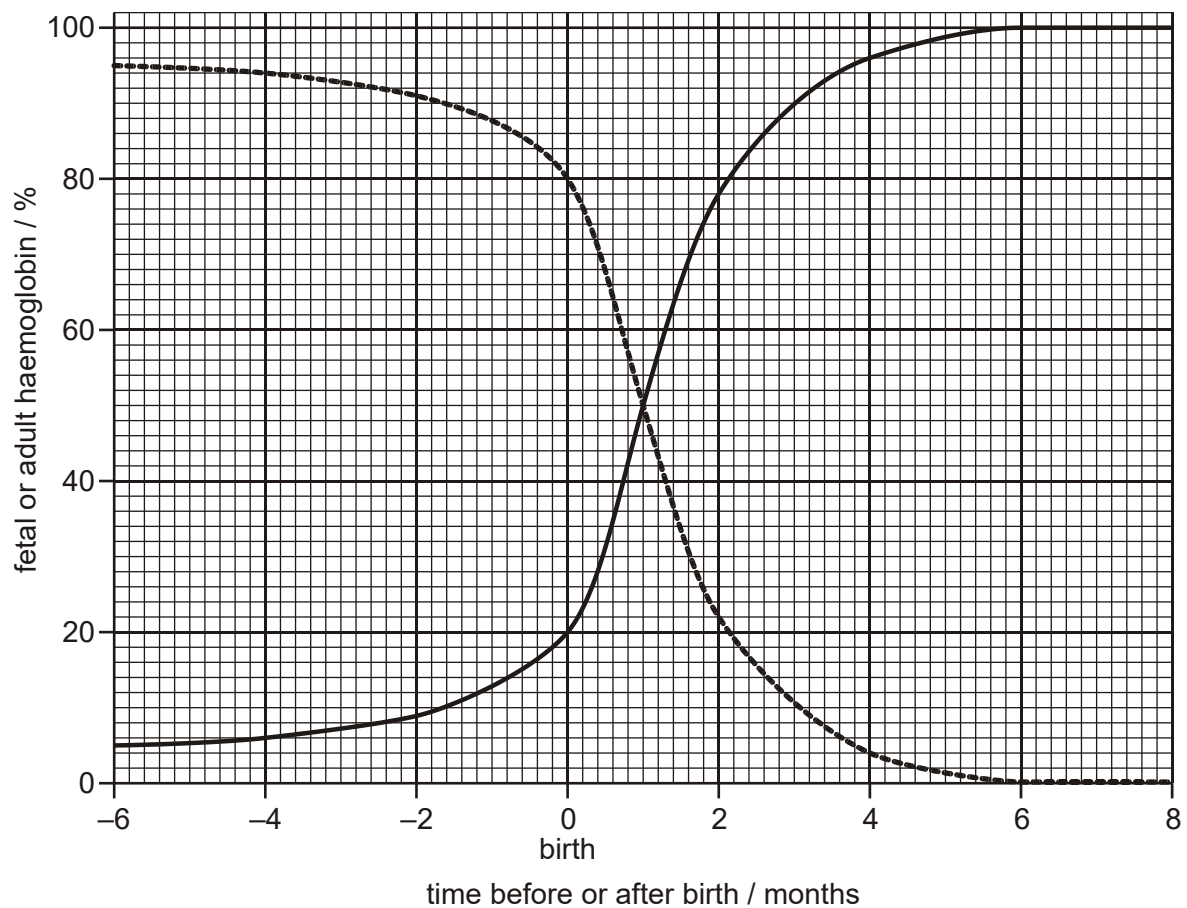
term or structure	statement
a closed system	<b>A</b>
a double circulation	
Purkyne tissue	
fibrous tissue between the atria and the ventricles	
atrioventricular node (AVN)	
sinoatrial node (SAN)	
coronary artery	

- A the blood flows in vessels
- B the left and right side of the heart contract at different times
- C transmits waves of excitation to the base of the heart
- D initiates the cardiac cycle
- E is unable to conduct waves of excitation
- F carries oxygen to the heart muscle
- G conducts waves of excitation over the walls of the ventricles
- H blood passes twice through the heart for one complete circuit of the body
- I delays transmission of the waves of excitation by about 0.1 s

[Total 6 marks]

9. (a) Two slightly different types of haemoglobin are found in mammals. Fetal haemoglobin is found in the developing fetus, but is replaced by adult haemoglobin. In humans, this replacement is completed by the time a baby is six months old.

The diagram below shows the change in the percentage of each type of haemoglobin for six months before birth and for eight months after birth.



State the percentage of adult haemoglobin present when the baby is two months old.

Answer = .....%

[1]

- (b) (i) Explain why it is essential that the fetus has a different type of haemoglobin from the adult.

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- (ii) Explain why the change from fetal to adult haemoglobin seen in the diagram above is essential after birth.

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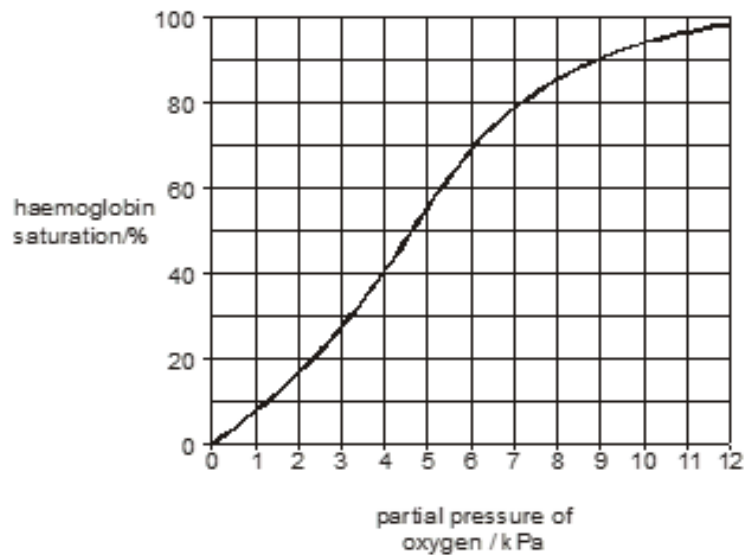
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[5]

[Total 6 marks]

10. Haemoglobin is a pigment which can combine with oxygen and is found in red blood cells.

The graph below shows the sigmoid (S-shaped) dissociation curve for maternal haemoglobin.



*Data from 'Exchange and Transport', Fig. 158, p.85, by ABAL.*

*Published by Cambridge University Press, 1984 (ISBN 0 521 2882 3).*

(i) Using the graph, state the likely partial pressure of oxygen in the pulmonary vein leaving the lungs and in a vein leaving a muscle during strenuous exercise.

pulmonary vein ..... kPa

vein leaving a muscle during strenuous exercise ..... kPa

[2]

(ii) On the graph, sketch the curve for fetal haemoglobin.

[2]

(iii) Using the graph, explain why it is important that fetal haemoglobin and maternal haemoglobin are different.

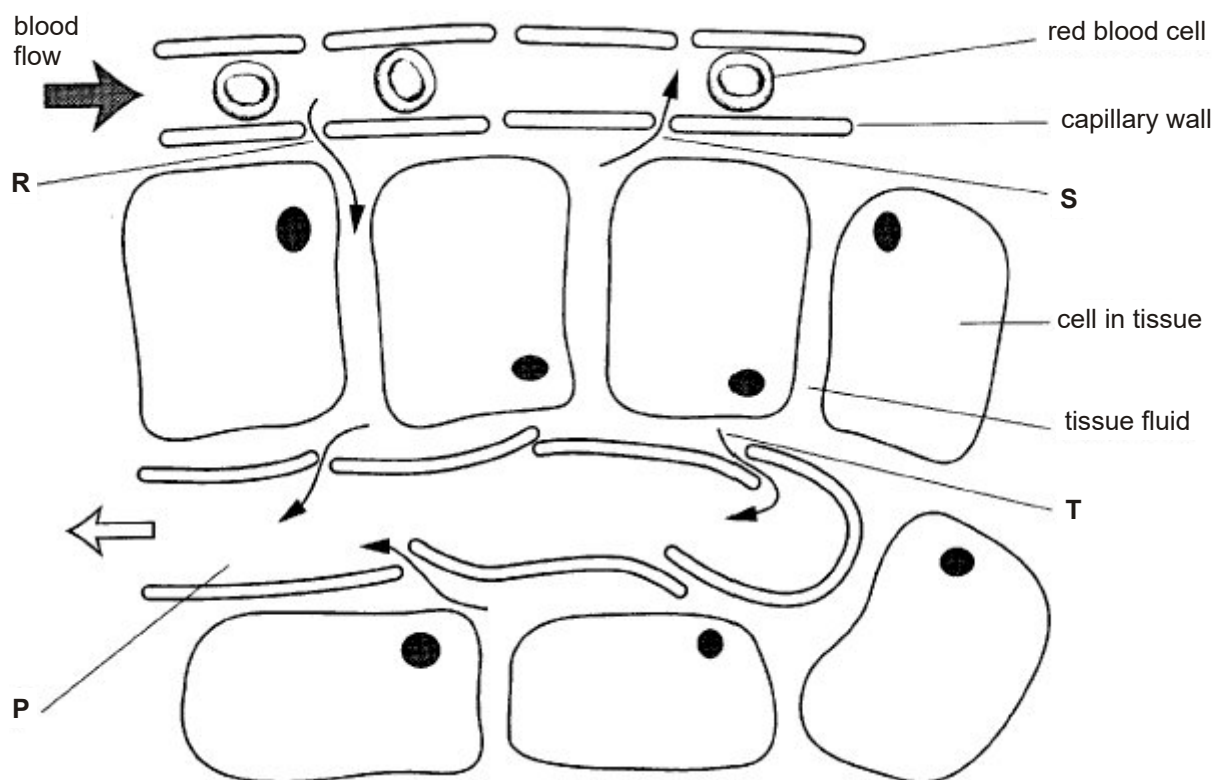
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[3]

[Total 7 marks]

11. The diagram below shows the formation and drainage of tissue fluid in a mammal.





- (a) (i) Complete the table to give three differences between tissue fluid and blood.

tissue fluid	blood

[3]

- (ii) Name the type of vessel labelled P in the diagram.

.....

[1]

- (b) In this question, one mark is available for the quality of written communication.

Describe how tissue fluid is formed at R and drained at S and T.

Credit will be given if you use information from the diagram.

[6]

Quality of Written Communication [1]

- (c) Suggest what could happen in the tissues of a person if the drainage at S and T was inefficient.

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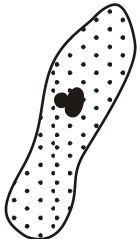
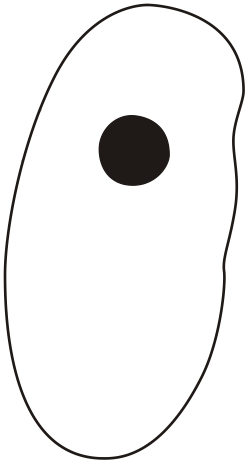
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[2]

[Total 13 marks]

12. A student was studying the surface area to volume ratio of three unicellular organisms, A, B and C, from the same habitat. The diagram below shows the three organisms and some of the calculations the student made.

	A	B	C
scale:  0.075 mm			
surface area / mm <sup>2</sup>	0.28	3.1	23
volume / mm <sup>3</sup>	0.02	0.59	11.3
surface area to volume ratio	14:1		2:1

*Adapted data © M Jones and G Jones, Advanced Biology, 1997, Cambridge University Press*

- (a) (i) Calculate the surface area to volume ratio for organism B to the nearest whole number.

Write your answer in the shaded box in the table.

[1]

(ii) By how many times does the surface area to volume ratio for organism C differ from that for organism A?

.....  
[1]

(b) The student determined the rate of oxygen uptake for the three organisms in  $\text{cm}^3$  of oxygen  $\text{g}^{-1} \text{h}^{-1}$ . The student found that the results were:

$1.0 \text{ cm}^3 \text{ g}^{-1} \text{ h}^{-1}$

$0.5 \text{ cm}^3 \text{ g}^{-1} \text{ h}^{-1}$

$7.0 \text{ cm}^3 \text{ g}^{-1} \text{ h}^{-1}$

State which of the three figures is most likely to be the value for the rate of oxygen uptake for organism C.

.....  
[1]

(c) None of the organisms A, B or C has a transport system.

Explain why organisms larger than organism C need to have transport systems.

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[3]

[Total 6 marks]

13. Contrast the processes of facilitated diffusion and active transport.

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(Extra space)

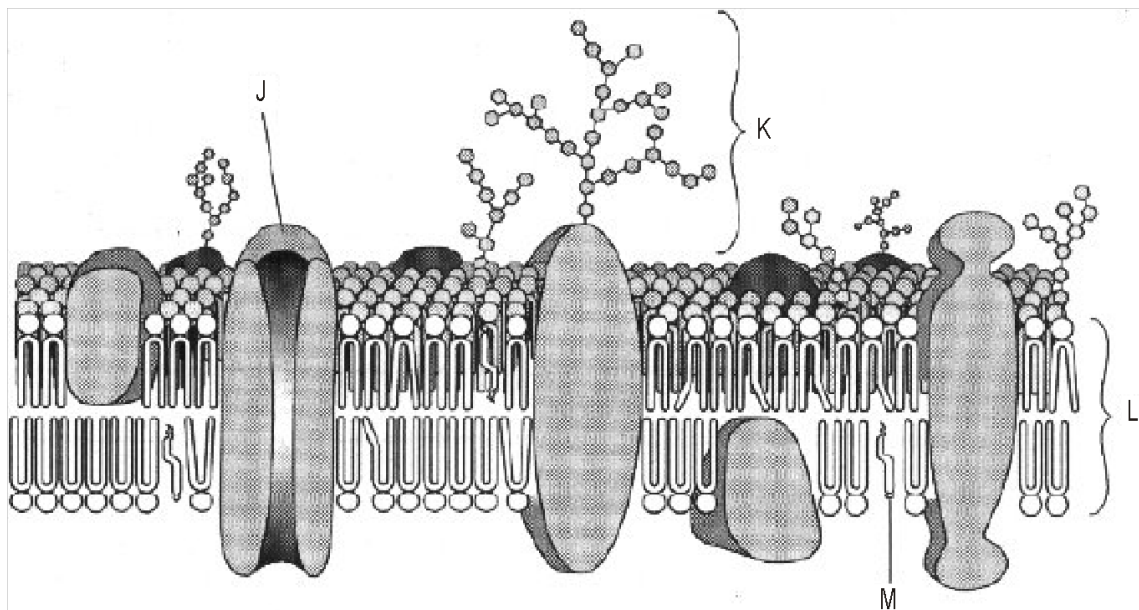
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(Total 3 marks)

14. The diagram below represents the structure of the plasma (cell surface) membrane.



(i) State one function of the parts labelled J to M.

J.....

.....  
K.....

.....  
L.....

.....  
M.....

[4]

(ii) Circle the most appropriate measurement for the actual width of this membrane.

0.07  $\mu\text{m}$     7 nm    0.0007 mm    7  $\mu\text{m}$

[1]

[Total 5 marks]



**Edexcel B A-Level Biology**

# **Topic 5**

## **Energy for Biological Processes**

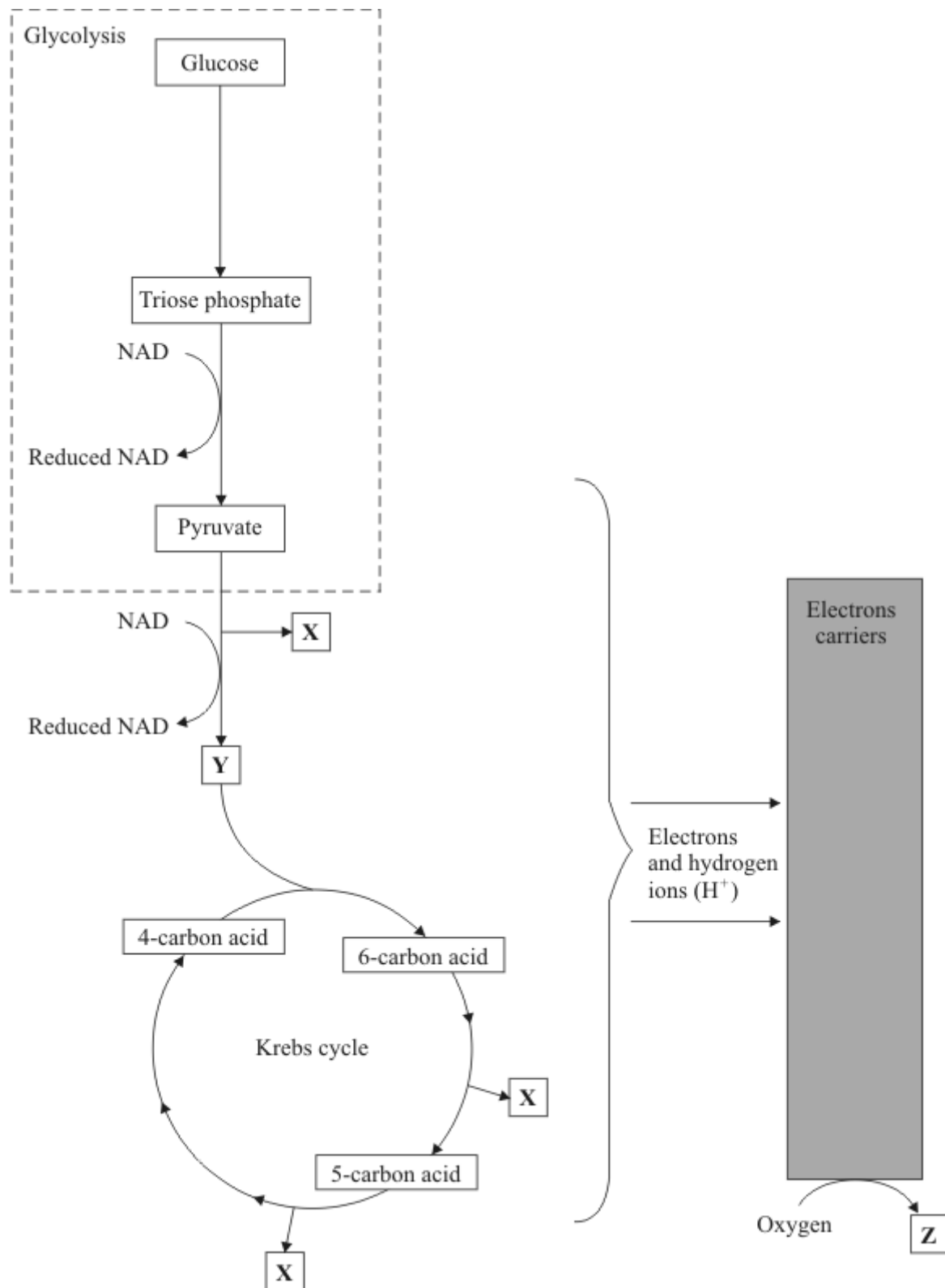
### **EXAM QUESTIONS BOOKLET**

# 1.

Use this booklet to revise for exams and improve exam technique.

Ensure you identify areas of strength and weakness near exam time to make your revision effective, and use the revision notes to fill in any gaps

1. The diagram gives an outline of the process of aerobic respiration.





(a) Name substances X, Y and Z.

.....

.....

.....

(3)

(b) Give the location of each of the following in a liver cell.

(i) Glycolysis .....

(ii) The Krebs cycle .....

(2)

(c) (i) Write the letter A on the diagram to show one step where ATP is used.

(ii) Write the letter B on the diagram at two steps where ATP is produced.

(3)

(d) Apart from respiration, give three uses of ATP in a liver cell.

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(3)

(e) Human skeletal muscle can respire both aerobically and anaerobically.

Describe what happens to pyruvate in anaerobic conditions and explain why anaerobic respiration is advantageous to human skeletal muscle.

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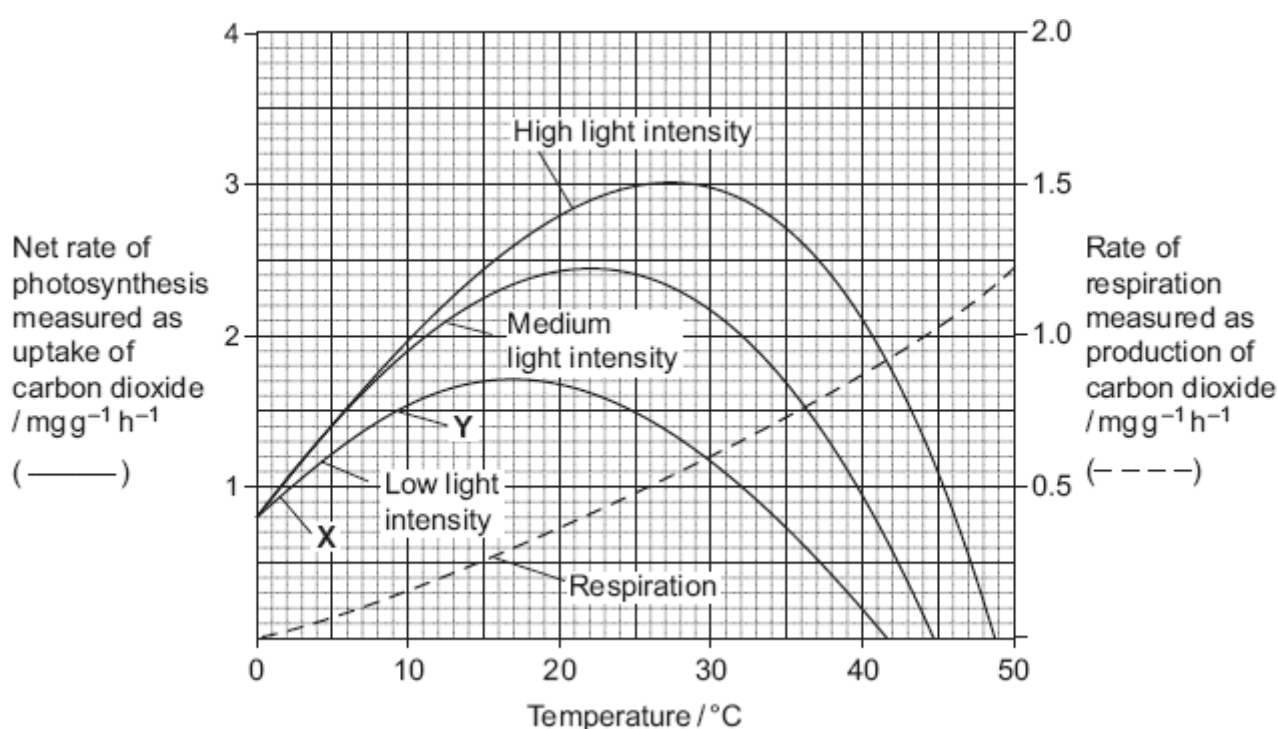
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(4)

(Total 15 marks)

2. Scientists investigated the effects of temperature and light intensity on the rate of photosynthesis in creeping azalea. They investigated the effect of temperature on the net rate of photosynthesis at three different light intensities. They also investigated the effect of temperature on the rate of respiration. The graph shows the results.



- (a) (i) Name the factors that limited the rate of photosynthesis between X and Y.

.....  
(1)

- (ii) Use information from the graph to explain your answer.

.....  
.....

(2)

(b) Use information from the graph to find the gross rate of photosynthesis at 20°C and medium light intensity.

Answer .....

(1)

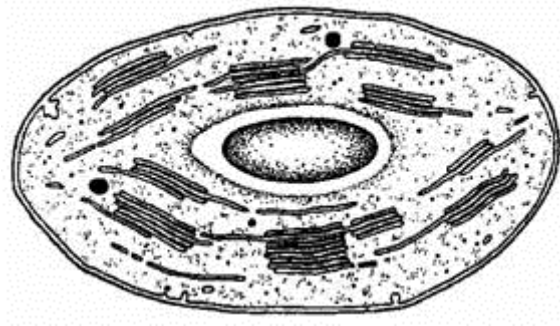
(c) Creeping azalea is a plant which grows on mountains. Scientists predict that in the area where this plant grows the mean summer temperature is likely to rise from 20 °C to 23 °C. It is also likely to become much cloudier. Describe and explain how these changes are likely to affect the growth of creeping azalea.

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(3)

(Total 7 marks)

3. The diagram shows the structure of a chloroplast.



- (a) Label the diagram with an X to show where the light-dependent reactions take place and with a Y to show where the light-independent reactions take place.

(1)

- (b) The photolysis of water is an important part of the process of photosynthesis. Describe what happens in the photolysis of water.

.....

.....

.....

.....

(2)

- (c) ATP and reduced NADP are two products of the light-dependent reactions. Describe one function of each of these substances in the light-independent reactions.

ATP .....

.....

Reduced NADP .....

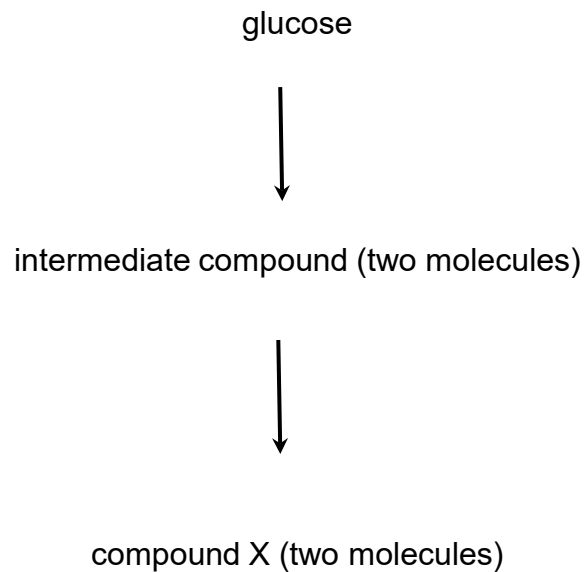
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(2)

(Total 5 marks)

4. All living cells must continuously synthesise ATP as an immediate source of chemical energy for vital functions. Energy needed to synthesise ATP can come from either aerobic or anaerobic respiration. A common pathway in both types of respiration is glycolysis.

The diagram below shows a simplified pathway for glycolysis.



(a) (i) Name compound X, which is the final product formed during glycolysis.

.....  
(1)

(ii) Before it can be split into two molecules, glucose must first be made more reactive. Explain how this activation of glucose occurs.

.....  
.....  
(2)

(iii) Describe the changes occurring during glycolysis in the conversion of the intermediate compound to compound X.

.....  
.....  
(2)

(a) During anaerobic respiration in muscle cells compound X is converted to lactate.

(i) Explain the importance of converting compound X into lactate in anaerobic respiration.

.....  
.....

(2)

(ii) Describe the fate of lactate after a period of anaerobic respiration in muscle cells.

.....  
.....

(2)

(iii) Suggest one reason why it is important to remove lactate quickly after a period of anaerobic respiration.

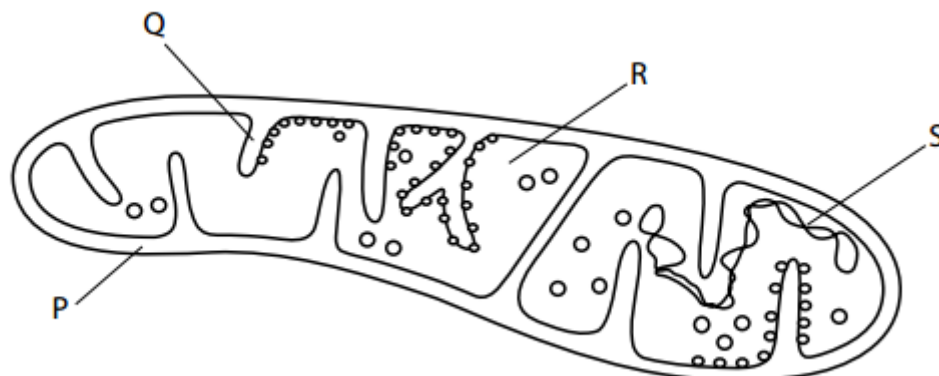
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(1)

(Total 10 marks)

5. Aerobic respiration is a series of reactions that occur in the cytoplasm and mitochondria of animal and plant cells.

(a) The diagram shows a mitochondrion.



Which row of the table shows where each process takes place in a mitochondrion?

	<b>Diffusion of hydrogen ions / production of ATP in chemiosmosis</b>	<b>Production of reduced NAD</b>
<input type="checkbox"/> <b>A</b>	P	Q
<input type="checkbox"/> <b>B</b>	Q	R
<input type="checkbox"/> <b>C</b>	R	S
<input type="checkbox"/> <b>D</b>	S	P

(1)

(b) The link reaction takes place in mitochondria. Which row of the table shows the correct substances produced by the link reaction?

	<b>Carbon dioxide</b>	<b>ATP</b>	<b>Reduced NAD</b>
<input type="checkbox"/> <b>A</b>	no	no	no
<input type="checkbox"/> <b>B</b>	no	yes	no
<input type="checkbox"/> <b>C</b>	yes	yes	yes
<input type="checkbox"/> <b>D</b>	yes	no	yes

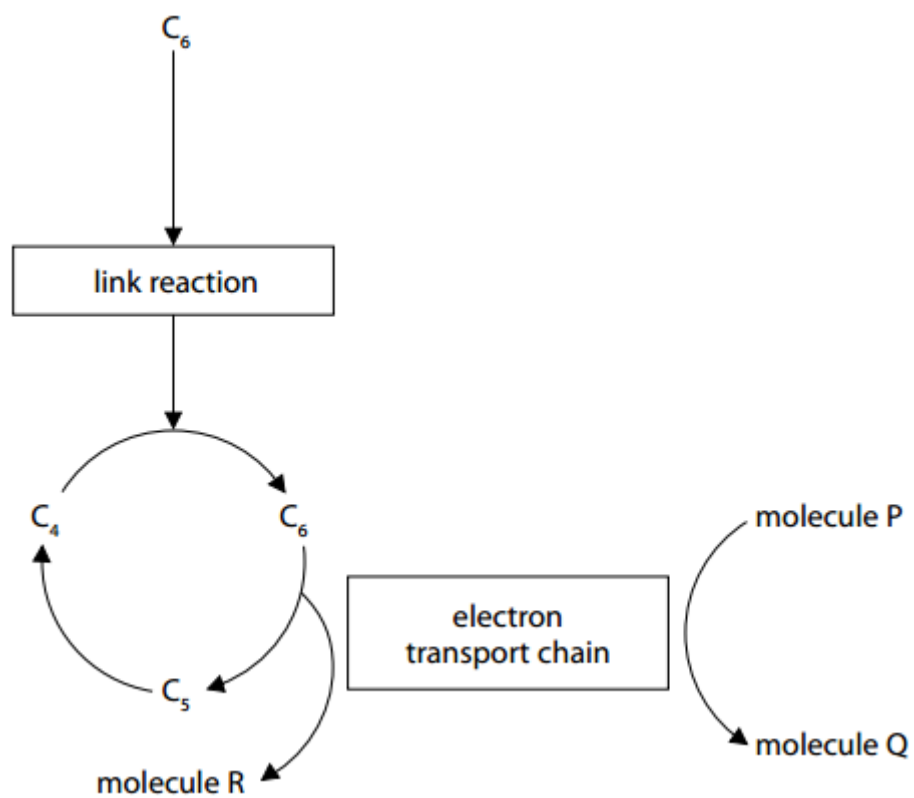
(1)

(c) The number of ATP molecules synthesised in mitochondria from one molecule of acetyl CoA is

- ☒ **A** 11
- ☒ **B** 12
- ☒ **C** 22
- ☒ **D** 24

(1)

(d) The diagram shows some of the stages of aerobic respiration.





(i) Which row of the table correctly describes molecule R and molecule Q?

(1)

	Molecule R	Molecule Q
<input type="checkbox"/> A	ATP	oxygen
<input type="checkbox"/> B	carbon dioxide	water
<input type="checkbox"/> C	reduced NAD	carbon dioxide
<input type="checkbox"/> D	ATP	reduced NAD

(Total 4 marks)

6. In the light-dependent reaction of photosynthesis, light energy generates ATP.

Describe how.

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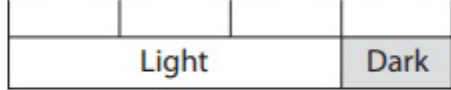
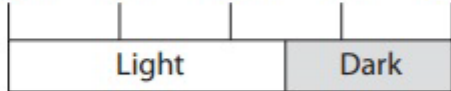


(Total 5 marks)

7.

Both plants and animals are able to respond to stimuli using photosensitive pigments.

- (a) The photosensitive pigment in plants can be involved in a range of responses to environmental cues. This includes flower production in response to day length.

The diagram below shows the results of a study on the effect of day length on flowering in one species of plant.

0 hr	6 hr	12 hr	18 hr	24 hr	Flowers are produced
					Yes
0 hr	6 hr	12 hr	18 hr	24 hr	
					Yes
0 hr	6 hr	12 hr	18 hr	24 hr	
					No
0 hr	6 hr	12 hr	18 hr	24 hr	
					No

- (i) Place a cross ☒ in the box to complete the conclusion made using these results.

The critical amount of daylight needed for the production of flowers is

(1)

- ☐ **A** between 15 and 18 hours
- ☐ **B** between 12 and 15 hours
- ☐ **C** between 9 and 12 hours
- ☐ **D** between 6 and 9 hours

(ii) The photosensitive pigment involved in making this plant species produce flowers is likely to be

(1)

- ☐ A IAA
- ☐ B chlorophyll
- ☐ C FAD
- ☐ D phytochrome

(iii) Suggest how the plants were grown to ensure this study was valid.

(2)

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(iv) Suggest how this study could be changed to produce a more accurate conclusion.

(1)

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(b) For some plant species, day length is not an environmental cue for the production of flowers.

Suggest **one** environmental cue, other than day length, that could stimulate plants of these species to produce flowers.

(1)

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[Total 6 marks]

8. (a) Describe how NADP is reduced in the light-dependent reaction of photosynthesis.

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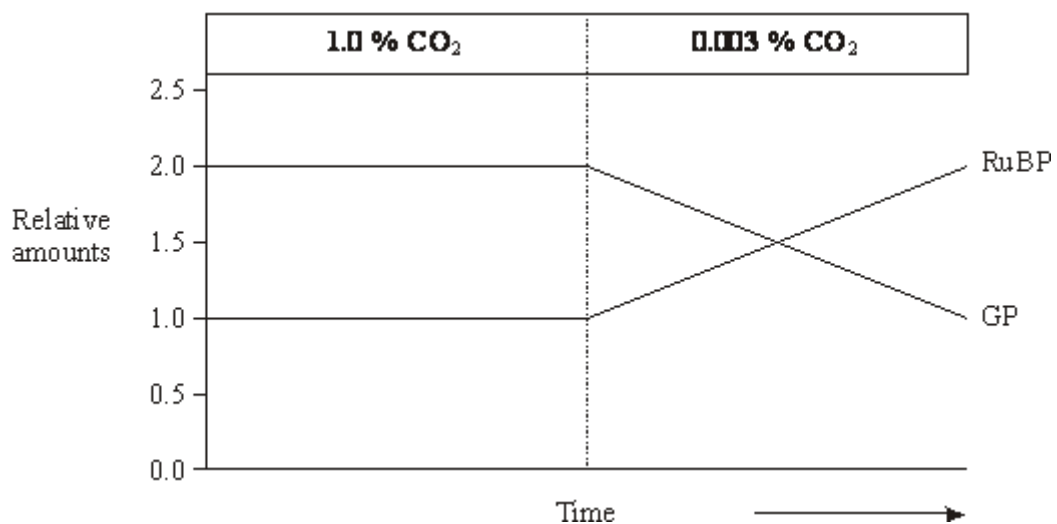
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[2]

(b) In an investigation of the light-independent reaction, the amounts of glycerate 3-phosphate (GP) and ribulose biphosphate (RuBP) in photosynthesising cells were measured under different environmental conditions.

Figure 1 shows the effect of reducing the carbon dioxide concentration on the amounts of glycerate 3-phosphate and ribulose biphosphate in photosynthesising cells.

Figure 1



(i) Explain why there is twice the amount of glycerate 3-phosphate as ribulose biphosphate when the carbon dioxide concentration is high.

.....

.....

[1]

(ii) Explain the rise in the amount of ribulose biphosphate after the carbon dioxide concentration is reduced.

.....

.....

[1]

(c) Figure 2 shows the results of an experiment in which photosynthesising cells were kept in the light and then in darkness.

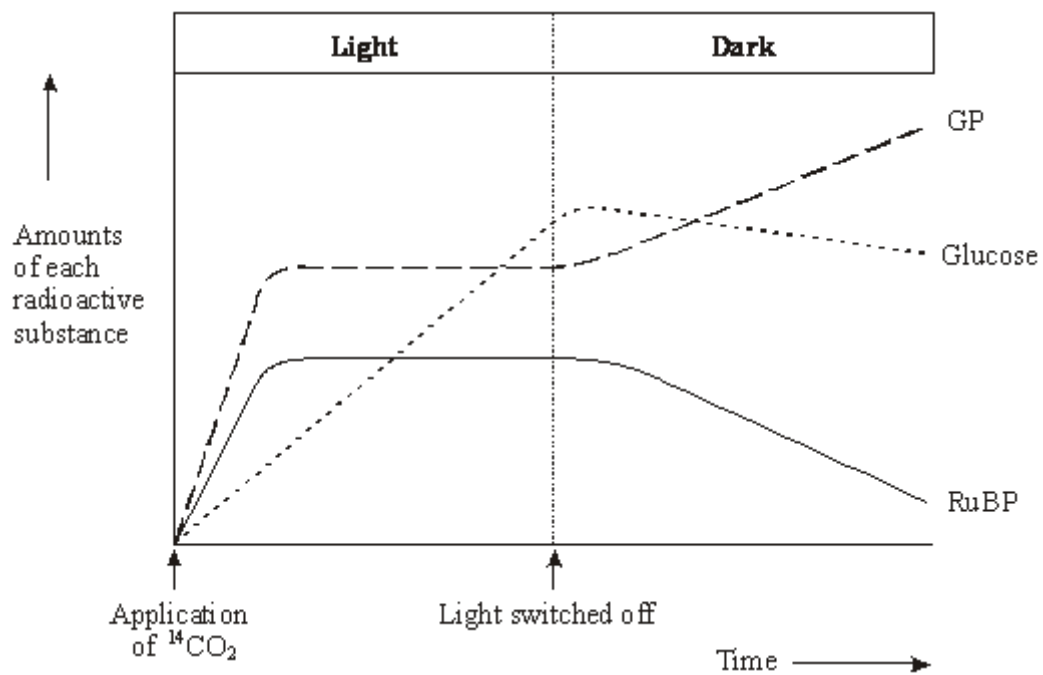


Figure 2

(i) In the experiment the cells were supplied with radioactively labelled  $^{14}\text{CO}_2$ . Explain why the carbon dioxide used was radioactively labelled.

.....

.....

[1]

(ii) Explain how lack of light caused the amount of radioactively labelled glycerate 3-phosphate to rise.

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[2]

(iii) Explain what caused the amount of radioactively labelled glucose to decrease after the light was switched off.

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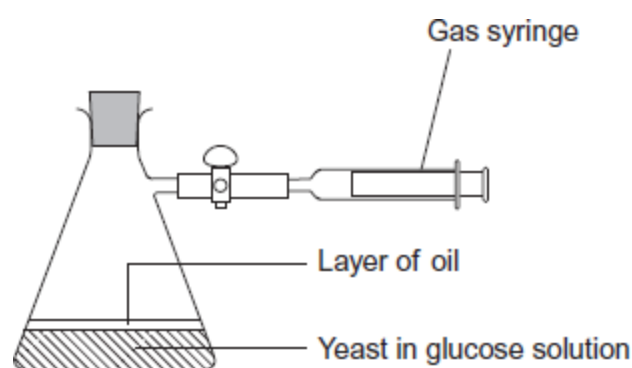
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[1]

[Total 8 marks]

9. A student investigated the rate of anaerobic respiration in yeast. She put 5 g of yeast into a glucose solution and placed this mixture in the apparatus shown in the figure below.

She then recorded the total volume of gas collected every 10 minutes for 1 hour.



(a) Explain why a layer of oil is required in this investigation.

.....

.....

(1)

(b) The student's results are shown in the following table.

	Time / minutes	Total volume of gas collected / cm <sup>3</sup>
	10	0.3
	20	0.9
	30	1.9
	40	3.1
	50	5.0
	60	5.2

(i) Calculate the rate of gas production in cm<sup>3</sup> g<sup>-1</sup> min<sup>-1</sup> during the first 40 minutes of this investigation. Show your working.

Answer = ..... cm<sup>3</sup> g<sup>-1</sup> min<sup>-1</sup>

(2)

(ii) Suggest why the rate of gas production decreased between 50 and 60 minutes.

.....  
.....

(1)

(iii) Yeast can also respire aerobically. The student repeated the investigation with a fresh sample of yeast in glucose solution, but without the oil. All other conditions remained the same.

Explain what would happen to the volume of gas in the syringe if the yeast were only respiring aerobically.

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.....  
.....

(2)

(c) Respiration produces more ATP per molecule of glucose in the presence of oxygen than it does when oxygen is absent. Explain why.

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.....  
.....

(2)

(Total 8 marks)

10. (a) Describe the part played by the inner membrane of a mitochondrion in producing ATP.

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.....  
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.....

(3)

(b) A scientist investigated ATP production in a preparation of isolated mitochondria. He suspended the mitochondria in an isotonic solution and added a suitable respiratory substrate together with ADP and phosphate. He bubbled oxygen through the preparation.

(i) Why was the solution in which the mitochondria were suspended isotonic?

.....  
.....

(1)



(ii) Explain why the scientist did not use glucose as the respiratory substrate.

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(2)

(iii) Explain why the oxygen concentration would change during this investigation.

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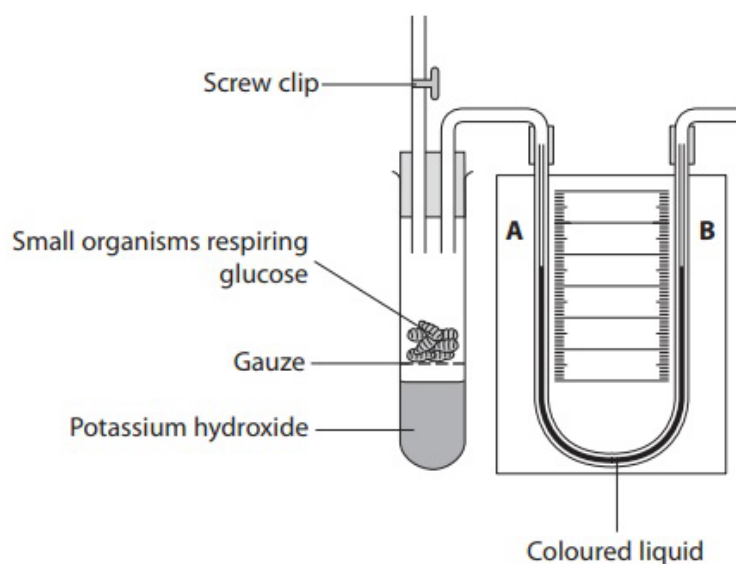
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(1)

(Total 7 marks)

11.

The diagram below shows a respirometer used to measure the rate of aerobic respiration in small organisms.



Potassium hydroxide absorbs carbon dioxide.  
The table below describes three different situations.  
Place a cross in the box ☐ that correctly shows the movement of the coloured liquid in the U-shaped tube for each situation.

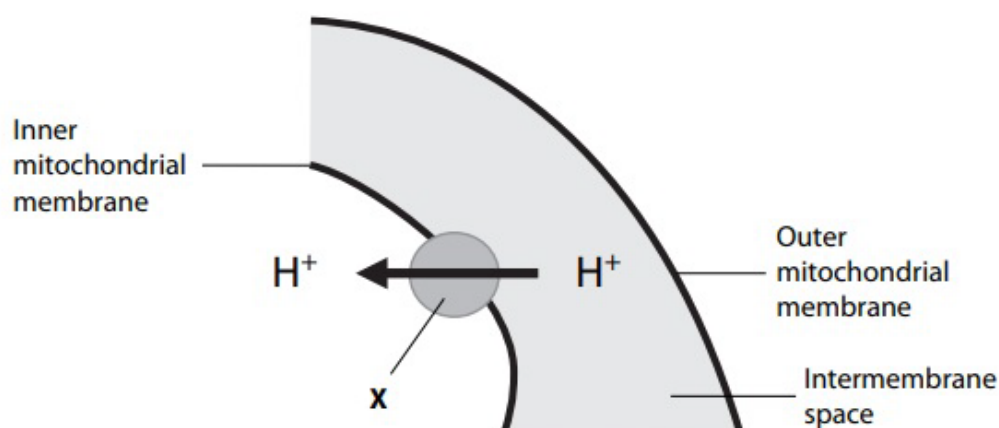
(3)

Situation	Movement of coloured liquid		
	towards A	towards B	does not move
(i) Screw clip is open	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
(ii) Screw clip is closed	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
(iii) Potassium hydroxide is replaced with water and screw clip is closed	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

[Total 3 marks]

12.

The diagram below shows part of the process of chemiosmosis in a mitochondrion.



(a) Name the enzyme labelled **X** involved in chemiosmosis.

(1)

(b) Explain how a high concentration of hydrogen ions ( $H^+$ ) is maintained in the intermembrane space.

(3)

[Total 4 marks]