Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **0610/41**

Paper 4 Theory (Extended) **October/November 2023**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

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1 **(a)** Fig. 1.1 shows the changes in the concentration of two hormones involved in the menstrual cycle.

View solution

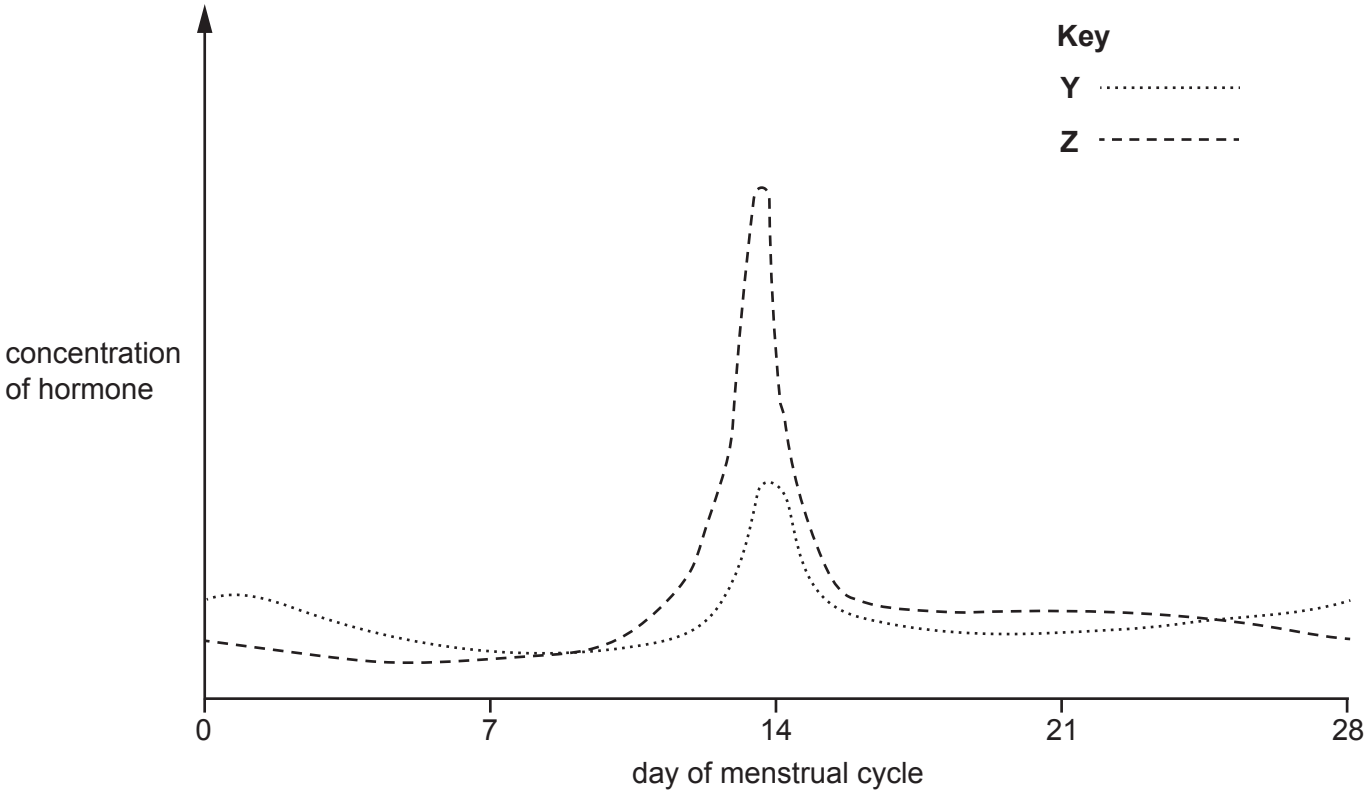

Fig. 1.1

(i) State the names of the hormones **Y** and **Z** in Fig. 1.1.

Y .....

Z .....
[2]

(ii) **On Fig. 1.1**, sketch a line to show the levels of progesterone through the 28-day menstrual cycle. [2]

View solution

(iii) State the day in the 28-day menstrual cycle when the egg is most likely to be released from a follicle.

View solution

..... [1]

(iv) State the main site of progesterone production during pregnancy.

View solution

..... [1]

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(b) Egg cells are contained in follicles in the ovary.

View solution

At the start of the menstrual cycle, a follicle has an average diameter of 29 μm.

Just before an egg is released from the follicle, the follicle has an average diameter of 22 mm.

Calculate the percentage increase in the average diameter of the follicle from the start of the menstrual cycle, until just before an egg is released.

Step 1 Convert the average starting diameter of a follicle to millimetres (mm).

..... mm

Step 2 Calculate the percentage increase.

..... %

Step 3 Give your answer to **three** significant figures.

..... %

[4]

(c) Once an egg cell has been released from a follicle it can be fertilised by a sperm cell.

View solution

State **three** adaptive features of a sperm cell.

1 .....

2 .....

3 .....

[3]

[Total: 13]

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2 **(a)** The small intestine is lined with many villi and is adapted to absorb glucose.

View solution

Fig. 2.1 shows two villi from the lining of the small intestine.

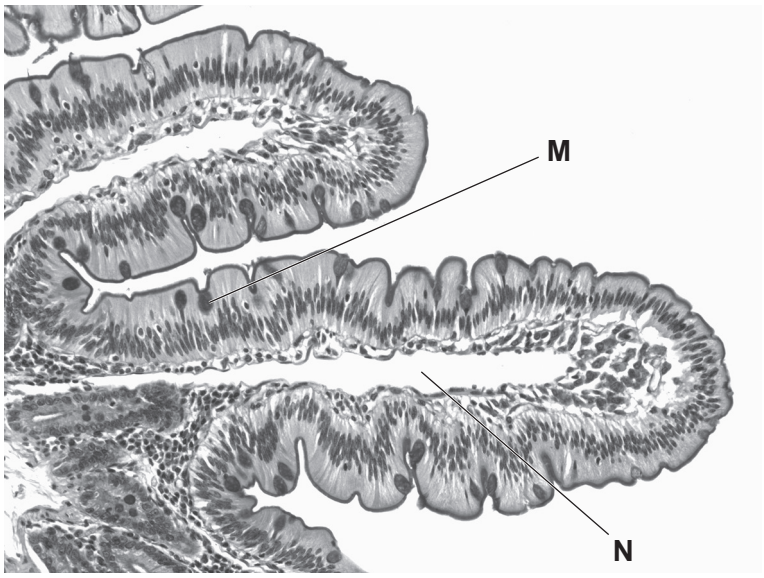

Fig. 2.1

(i) State the name of structure **N** in Fig. 2.1.

..... [1]

(ii) Cell **M** in Fig. 2.1 secretes mucus.

View solution

State the name of cell **M**.

..... [1]

(iii) State **one** other place in the body where mucus secreting cells are found.

..... [1]

View solution

(iv) Describe and explain how the structure of a villus is adapted for its function.

View solution

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) State the name of the main blood vessel that takes blood from the small intestine to the liver.

..... [1]

(c) All cells develop from stem cells.

View solution

Describe what is meant by the term stem cell.

.....

.....

..... [2]

(d) Some cells in the small intestine have many mitochondria.

Fig. 2.2 shows the variation in the average number of mitochondria found in three different types of cell.

View solution

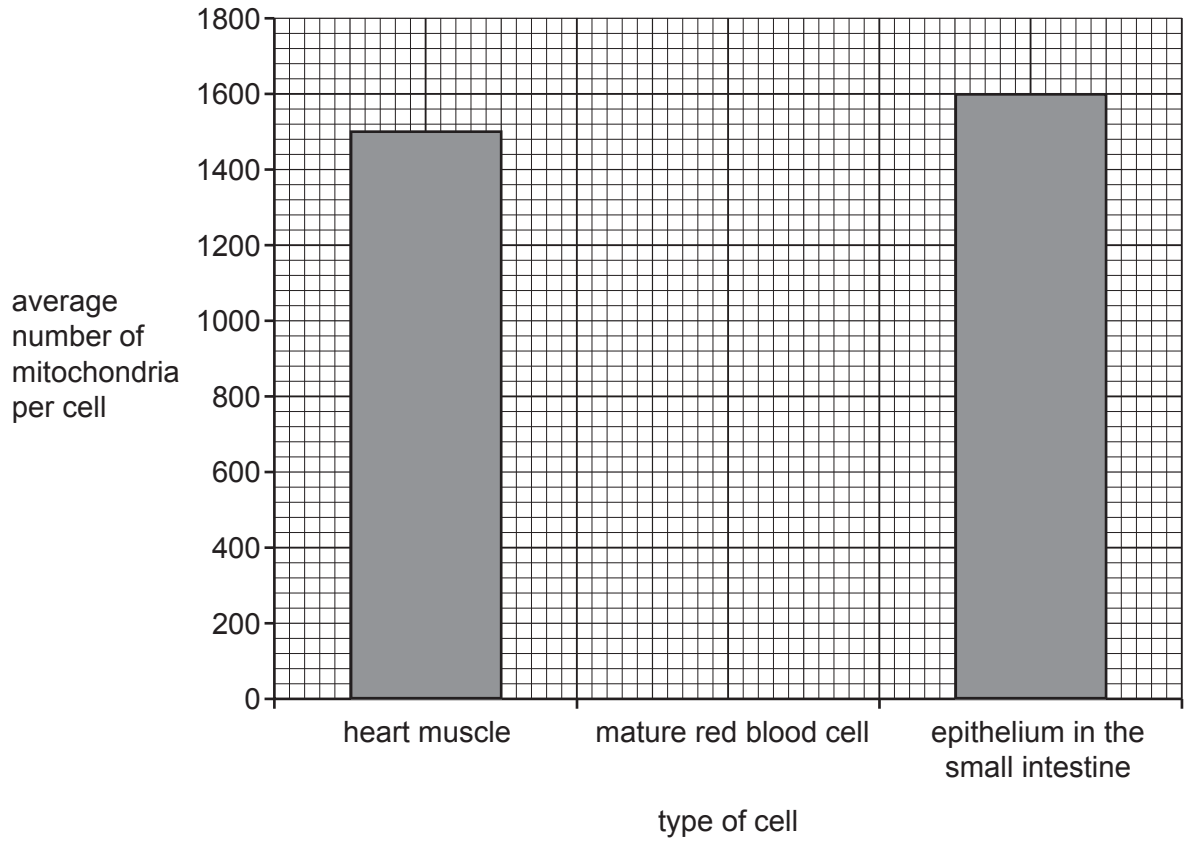

Fig. 2.2

Explain the differences in the average number of mitochondria in each type of cell.

.....

.....

.....

.....

.....

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.....

.....

.....

.....

..... [5]

[Total: 15]

3 (a) (i) Frogs are classified as amphibians.

View solution

State **two** features of amphibians that distinguish them from all other vertebrates.

1 .....

2 .....

[2]

(ii) Fig. 3.1 is a photograph of a cross-section of a frog's eye.

View solution

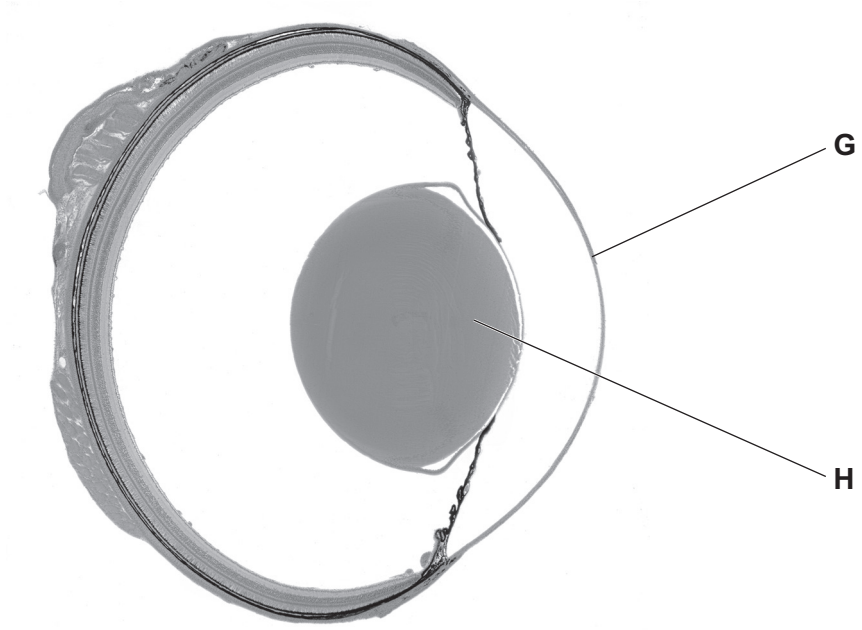

Fig. 3.1

Identify the structures labelled **G** and **H** in Fig. 3.1.

G .....

H .....

[2]

(b) Fig. 3.2 is a diagram of a rod cell and a cone cell from a human eye.

View solution

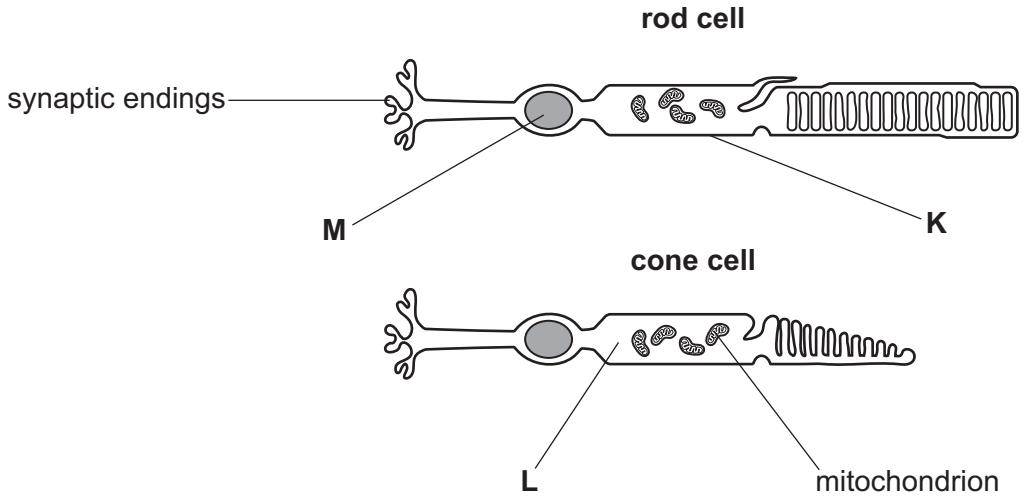

Fig. 3.2

(i) Identify cell structures **K**, **L** and **M** in Fig. 3.2.

K .....

L .....

M .....

[3]

(ii) State the names of the **two** parts of the mammalian central nervous system.

View solution

1 .....

2 .....

[1]

(c) Fig. 3.3 is a graph showing the distribution of rod cells and cone cells across the retina in a human eye.

View solution

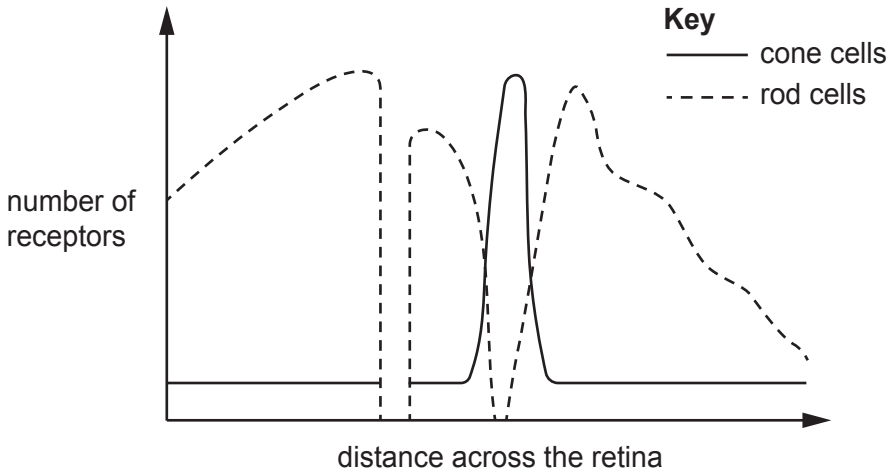

Fig. 3.3

(i) **On Fig. 3.3** draw:

- the letter **P** to show the location of the fovea
- the letter **Q** to show the location of the blind spot.

[2]

(ii) Describe and explain the distribution of rod cells and cone cells shown in Fig. 3.3.

View solution

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..... [5]

(iii) Some mammals are nocturnal which means they are active at night and sleep during the day.

Suggest how the number and distribution of rod cells and cone cells across the retina of a nocturnal mammal would differ from a human retina.

.....

.....

..... [2]

[Total: 17]

View solution

4 Mitosis and meiosis are both important processes for life.

(a) Complete the sentences about mitosis and meiosis.

View solution

Mitosis is a type of nuclear division which produces genetically identical cells.

It is important for growth, ... of tissues and

..... reproduction.

Just before mitosis the chromosomes are replicated and then the chromosomes

..... so that the chromosome number is maintained in each daughter cell.

Meiosis is another type of nuclear division that is involved in the production of gametes. The chromosome number is halved from ..... to haploid resulting in genetically different cells. The fusion of the nuclei of two gametes formed by meiosis forms a ..... . This process is known as

..... .

[6]

(b) Mutations are a source of genetic variation in a population.

View solution

(i) Describe what is meant by a gene mutation.

.....

.....

..... [2]

(ii) State **two** examples of how mutation rates can be increased.

View solution

1 .....

2 .....

[2]

[Total: 10]

5 Fig. 5.1 shows the changes in the percentage of the total global fish stocks that are overfished and those that are sustainable.

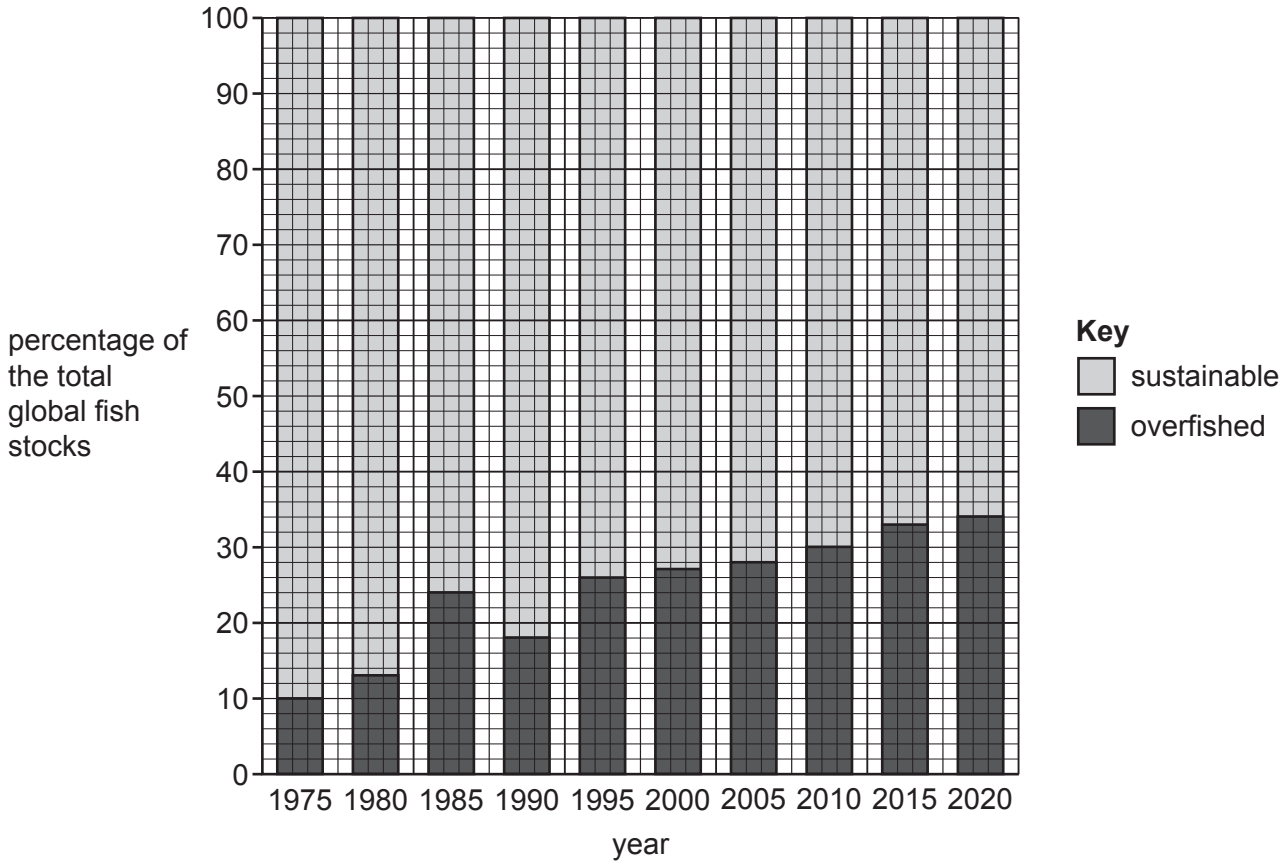

Fig. 5.1

(a) Use the information in Fig. 5.1 to:

View solution

(i) State the percentage of fish stocks that were sustainable in 2020.

..... % [1]

(ii) State which five-year period had the greatest increase in sustainable fish populations.

..... [1]

View solution

(b) Overfishing is one reason why populations of fish decline.

View solution

Explain the risks to a species if its population size decreases.

.....

.....

.....

.....

.....

.....

..... [3]

(c) Describe **and** explain how fish stocks can be managed sustainably and how overfishing can be prevented through conservation.

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..... [6]

[Total: 11]

View solution

6 **(a)** Fig. 6.1 is a diagram showing how glucose is used by different organisms.

View solution

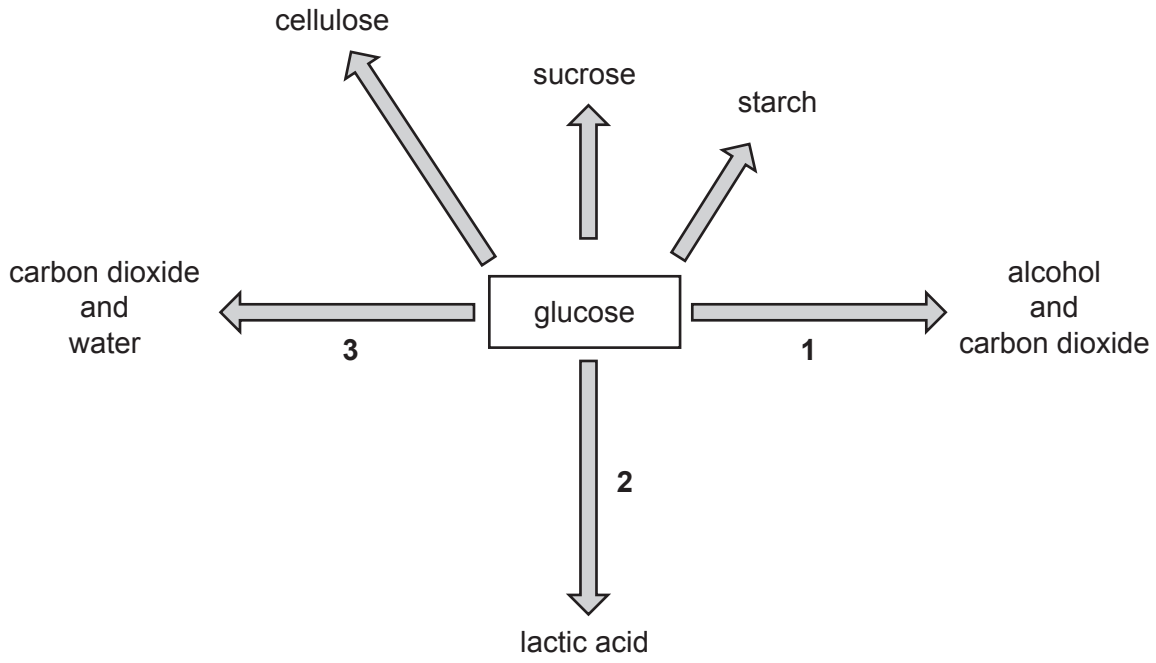

Fig. 6.1

(i) State the number or numbers from Fig. 6.1 that identify the processes that:

- release the most energy per glucose molecule .....
- take place in yeast cells. .....

[2]

(ii) State the balanced chemical equation for anaerobic respiration in a yeast cell.

..... [2]

(iii) State the names of **two** enzymes that are needed to break down starch into glucose in humans.

1 .....

2 .....

[2]

(iv) State the main use of the molecule cellulose in a plant.

..... [1]

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(v) Sucrose and amino acids are transported around a plant.

State the name of:

- the process by which sucrose is transported around a plant
- the tissue that transports sucrose and amino acids around a plant
- the mineral ion that is used to make amino acids.

process .....

tissue .....

mineral ion .....

[3]

(b) In humans, the build-up of lactic acid creates an oxygen debt.

View solution

(i) State the body tissue that produces the most lactic acid during vigorous exercise.

..... [1]

(ii) The oxygen debt needs to be removed after exercise.

View solution

State how the breathing **and** circulatory systems act to remove the oxygen debt.

.....

.....

.....

.....

..... [2]

(iii) State the name of the organ which breaks down lactic acid.

..... [1]

[Total: 14]

View solution

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