Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7134617494

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.

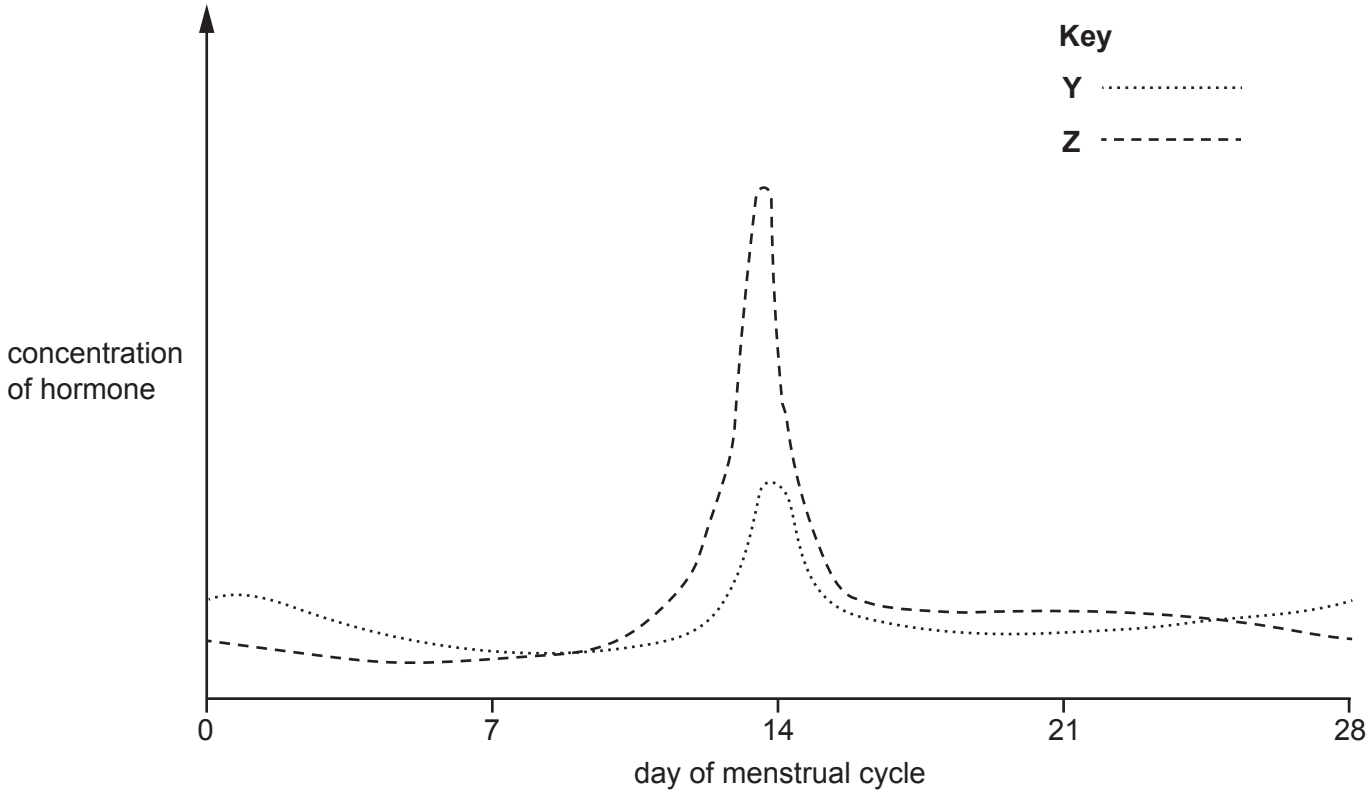


Fig. 1.1

(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]

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

..... [1]

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

..... [1]

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

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.

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

1 .....

2 .....

3 .....
[3]

[Total: 13]

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

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

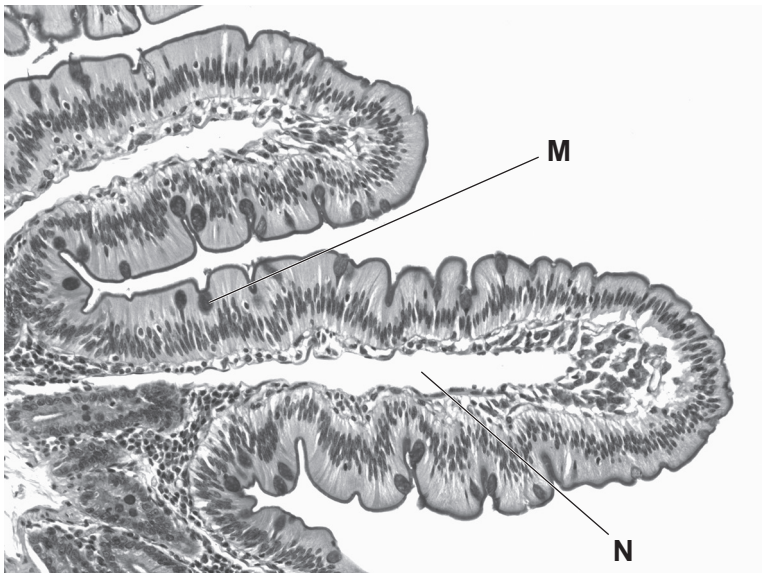


Fig. 2.1

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

..... [1]

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

State the name of cell **M**.

..... [1]

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

..... [1]

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

.....

.....

.....

.....

.....

.....

.....

.....

..... [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.

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.

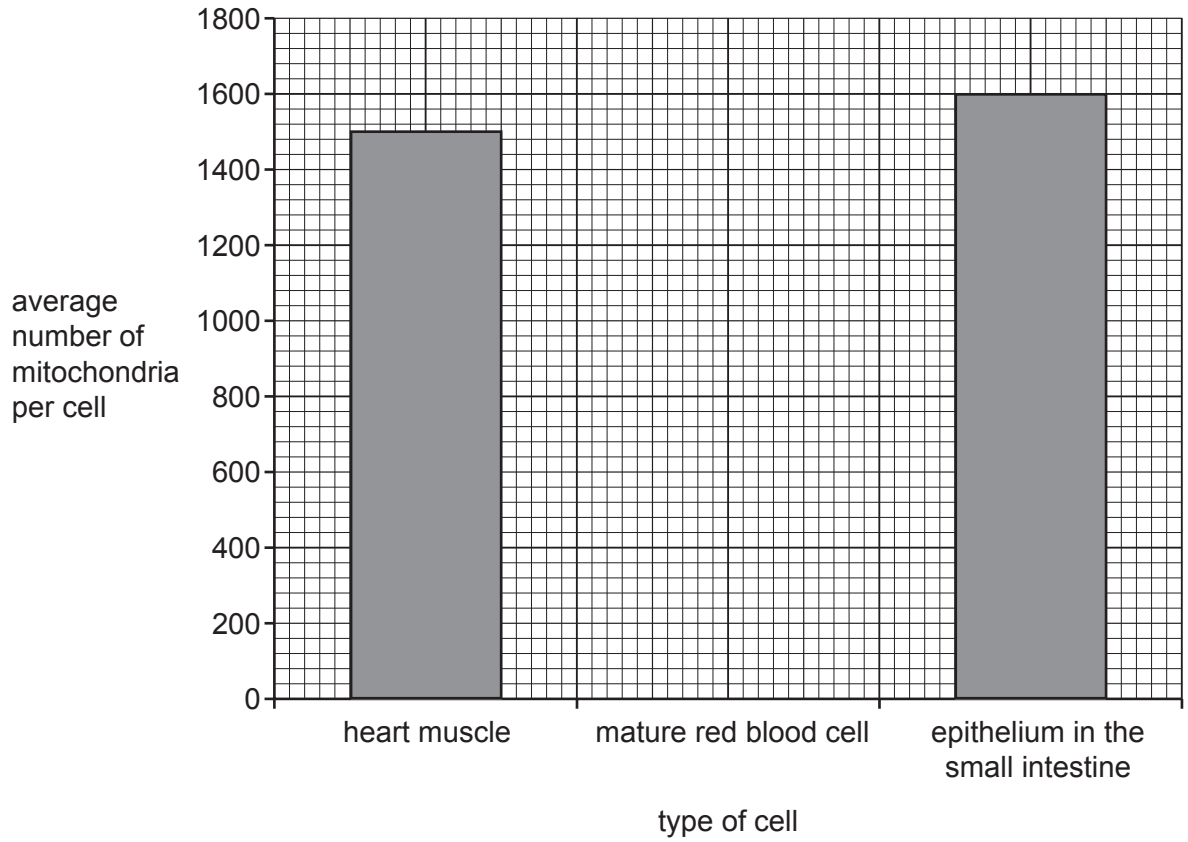


Fig. 2.2

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 15]

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

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.

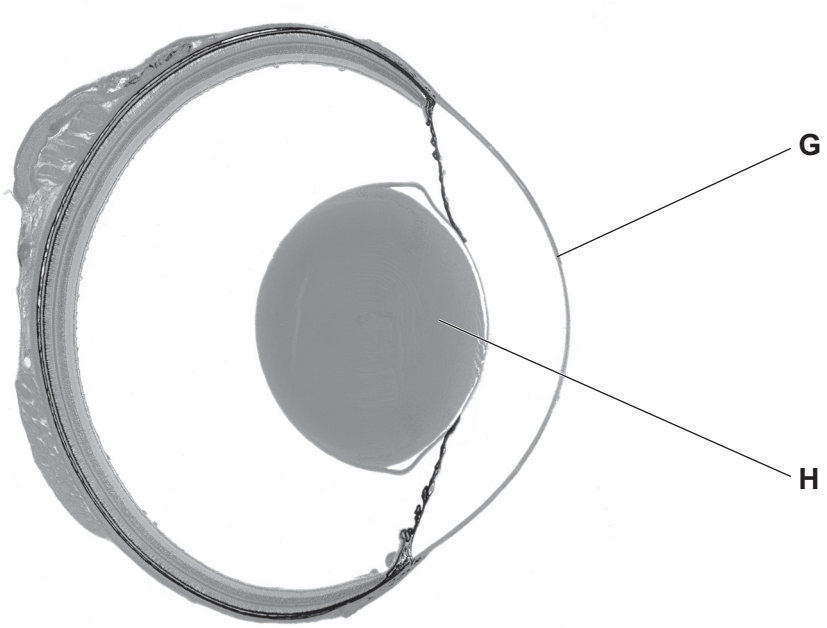


Fig. 3.1

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.

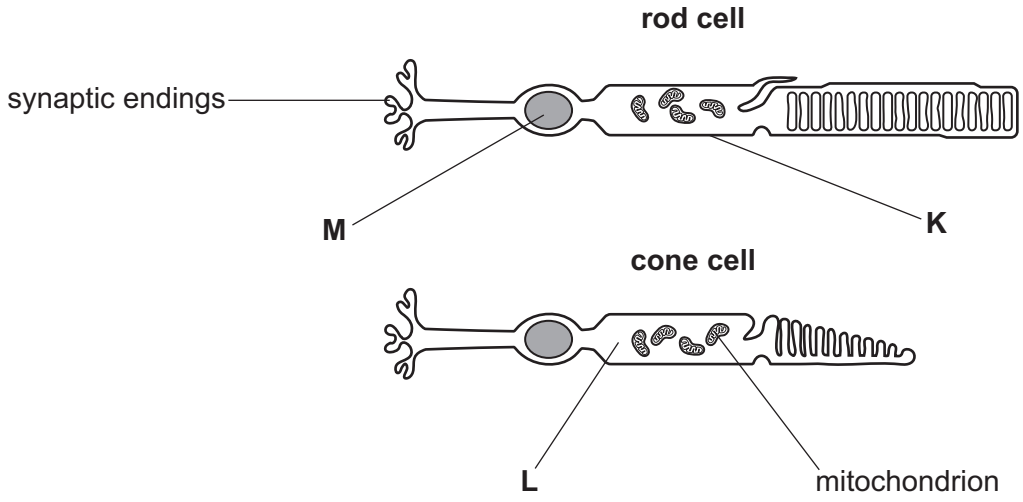


Fig. 3.2

(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.

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.

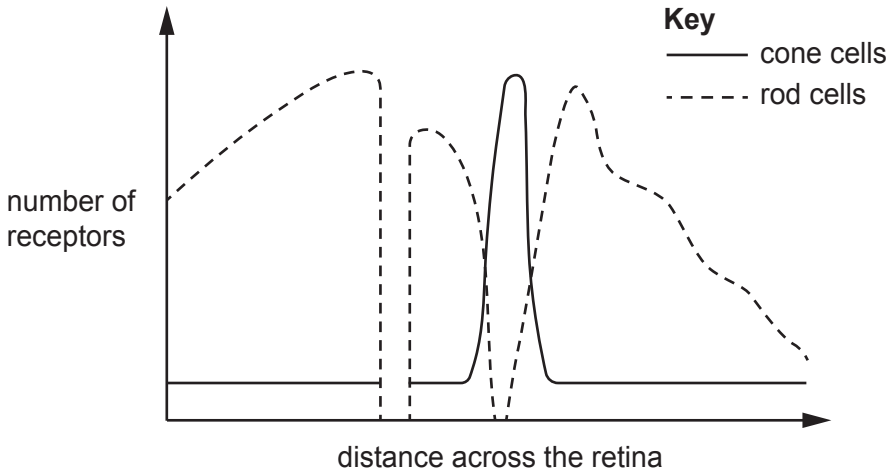


Fig. 3.3

(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.

.....

.....

.....

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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]

4 Mitosis and meiosis are both important processes for life.

(a) Complete the sentences about mitosis and meiosis.

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.

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

.....

.....

..... [2]

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

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.

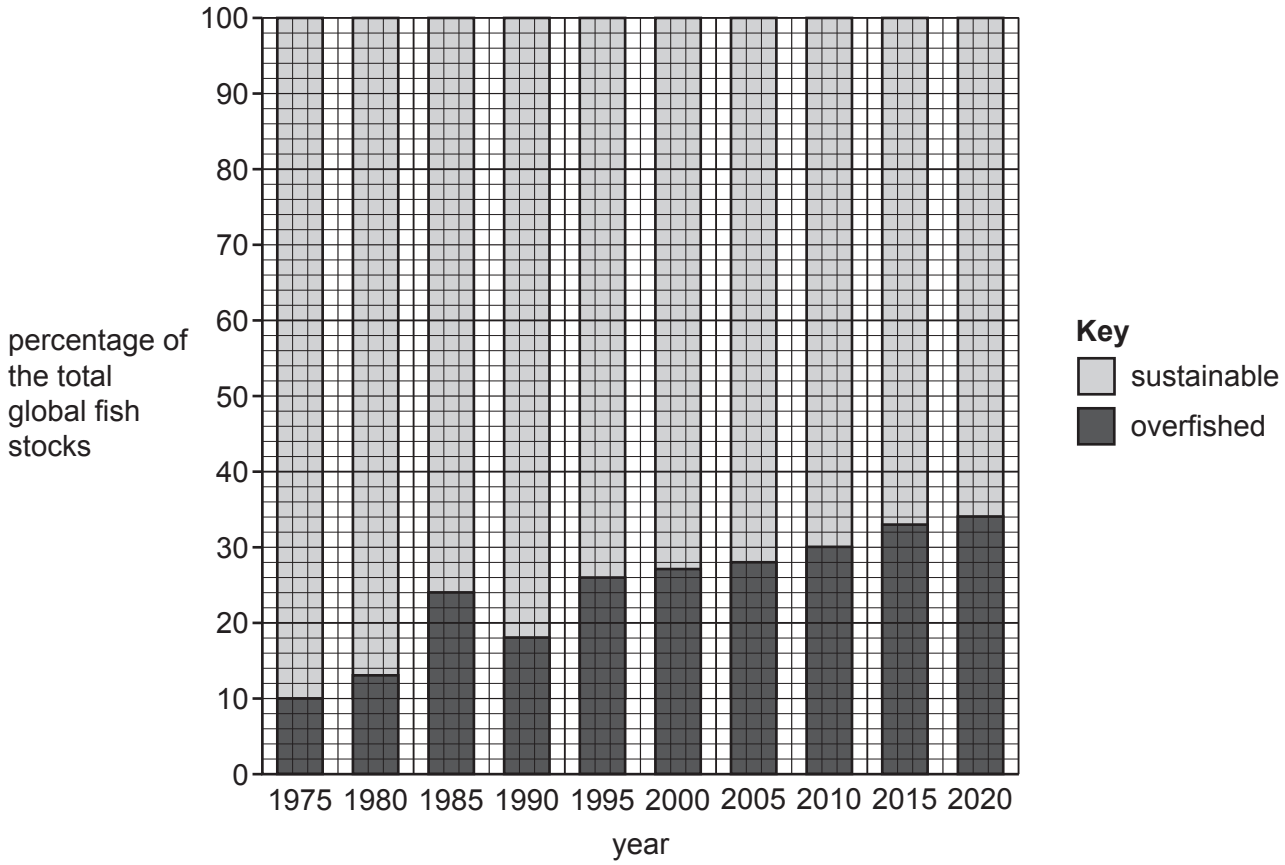


Fig. 5.1

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

(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]

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

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]

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

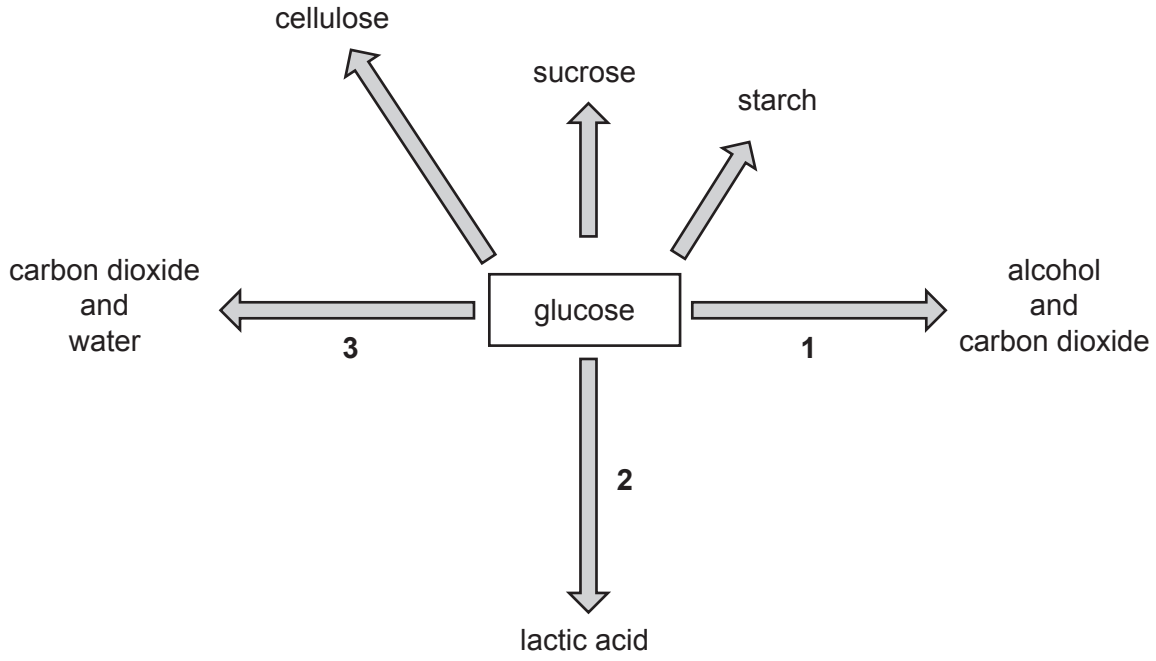


Fig. 6.1

(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]

(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.

(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.

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]

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