1. Nov/2023/Paper_9700/41/No.5

(a) The respiratory quotient (RQ) values for different respiratory substrates can be calculated.

Table 5.1 shows:

- the formulae of four respiratory substrates
- the number of oxygen molecules (O_2) needed to completely respire each substrate to carbon dioxide and water.

Table 5.1

respiratory substrate	formula	number of oxygen molecules needed for respiration
beta-hydroxybutyric acid	$C_4H_8O_3$	4.5
glucose	$C_6H_{12}O_6$	6.0
malic acid	$C_4H_6O_5$	3.0
oleic acid	$C_{18}H_{34}O_2$	25.5

Using Table 5.1, name the respiratory substrate with the highest RQ and the respiratory substrate with the lowest RQ.

respiratory substrate with the **highest** RQ .....

respiratory substrate with the **lowest** RQ .....

[2]

(b) In anaerobic conditions, the production of ATP in mammals and yeast involves glycolysis and fermentation.

Describe the similarities **and** differences between fermentation in mammals and in yeast.

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..... [5]

[Total: 7]

(a) Some organisms carry out respiration in anaerobic conditions when oxygen is not available or when there is a low concentration of oxygen. In yeast and some plants, this is called ethanol fermentation. In mammals, it is called lactate fermentation.

Fig. 1.1 outlines ethanol fermentation and lactate fermentation.

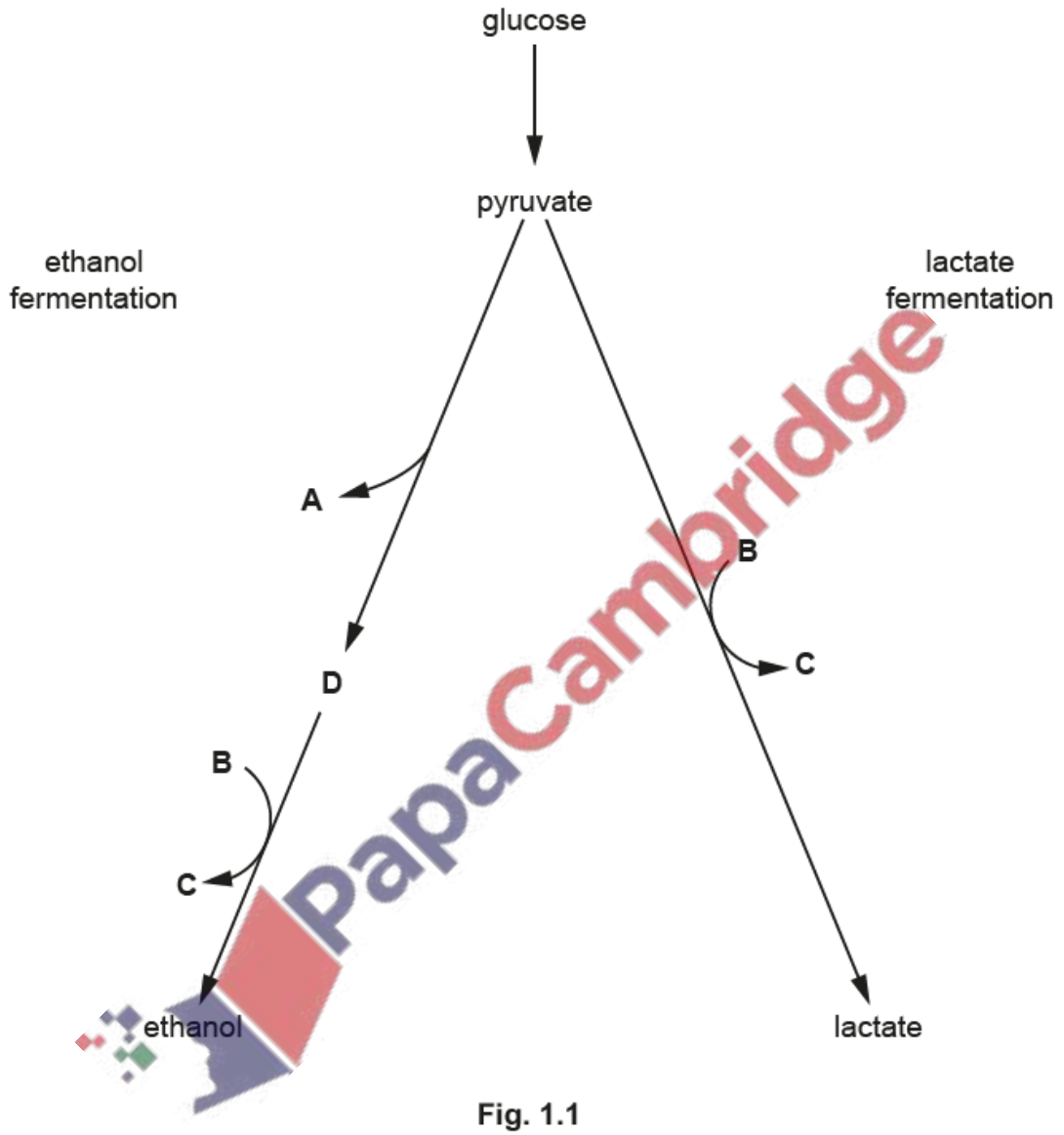

Fig. 1.1

Identify substances **A**–**D**.

A .....

B .....

C .....

D .....

[3]

(b) Explain how processes such as ethanol fermentation and lactate fermentation allow cells to continue to function in the absence of oxygen.

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(c) The cereal crop rice, *Oryza sativa*, grows in fields that are flooded with water. The roots of the rice plants are submerged in water that contains very little oxygen.

Describe **and** explain how rice plants are adapted to grow in flooded fields.

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[Total: 9]

3. Nov/2023/Paper_9700/42/No.7

(a) There are many mitochondria located in the presynaptic knobs of neuromuscular junctions and in the sarcomeres of muscle fibres of striated muscle.

Explain the need for many mitochondria in the presynaptic knobs and in the sarcomeres.

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(b) Fig. 7.1 is a diagram of synapses between a postsynaptic neurone and two presynaptic neurones, **X** and **Y**.

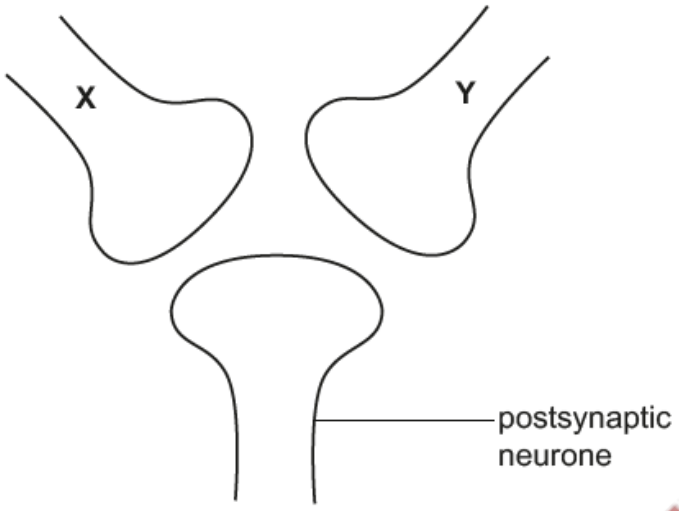

Fig. 7.1

- Neurone **X** releases the neurotransmitter acetylcholine.
- Neurone **Y** releases the neurotransmitter glutamate.
- Both neurotransmitters bind to channel proteins in the membrane of the postsynaptic neurone.
- Acetylcholine binding results in an influx (entry) of sodium ions.
- Glutamate binding results in an influx of chloride ions.

A student made three statements:

1. When only neurone **X** is stimulated, an action potential **will** occur in the postsynaptic neurone.
2. When only neurone **Y** is stimulated, an action potential **will** occur in the postsynaptic neurone.
3. When neurone **X** and neurone **Y** are stimulated at the same time, an action potential **will not** occur in the postsynaptic neurone.

Explain whether or not you agree with these statements.

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(c) Multiple sclerosis is a condition in which the myelin sheath breaks down in some neurones.

Suggest the effect of multiple sclerosis on the transmission of action potentials in the affected neurones.

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[Total: 9]

4. Nov/2023/Paper_9700/42/No.8

(a) Non-cyclic photophosphorylation occurs in the light-dependent stage of photosynthesis.

Outline the main features of non-cyclic photophosphorylation.

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..... [4]

(b) Some Calvin cycle intermediates are used to produce other molecules that are **not** part of the Calvin cycle.

Name **two** of these intermediates.

For each intermediate, state **one** example of the type of molecule that is produced.

intermediate .....

molecule produced .....

intermediate .....

molecule produced .....

[2]

(c) Fig. 8.1 shows how the rate of uptake of carbon dioxide by a plant varies with temperature, at an optimum intensity of light on a clear day.

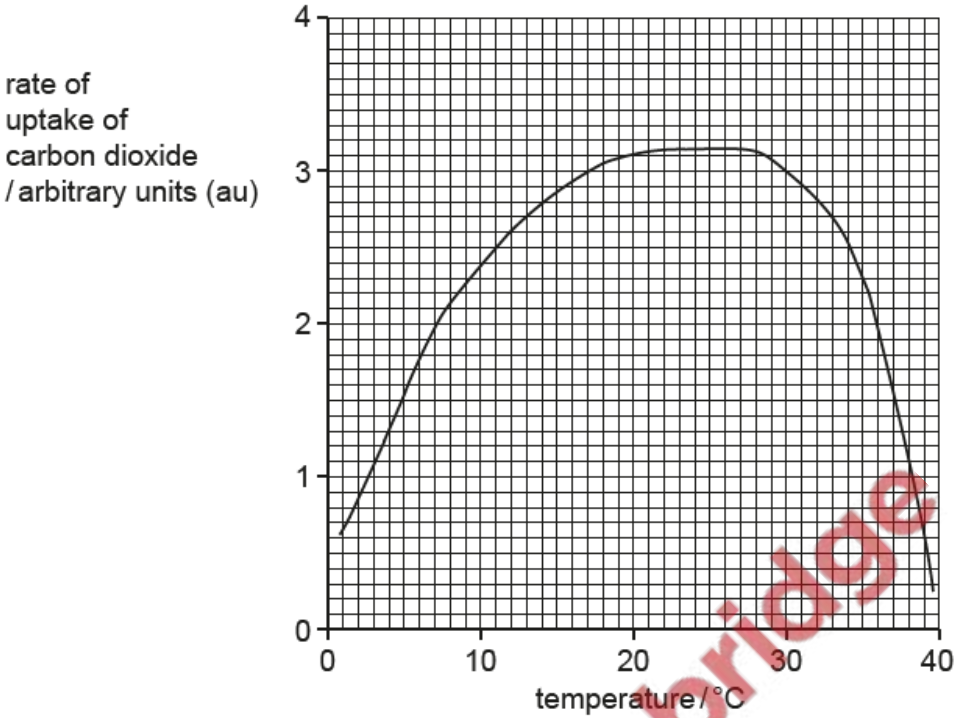

Fig. 8.1

(i) Calculate the mean increase in rate of uptake of carbon dioxide as the temperature increases from 5 °C to 20 °C.

Show your working.

Give your answer to **two** decimal places.

..... au °C^{-1} [2]

(ii) Suggest why the rate of carbon dioxide uptake levels off and then decreases after 20 °C.

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(iii) On Fig. 8.1, draw a curve to show the uptake of carbon dioxide on a cloudy day. [1]

[Total: 12]