GCE Biology

S21-A400U10-1

Assessment Resource 8

Energy for Life Resource H

1. RuBisCO is the most abundant enzyme on Earth. Each RuBisCO molecule is made of eight **identical** long chain polypeptides and eight **identical** short chain polypeptides.

(a) (i) RuBisCO shows all four levels of protein structure. Briefly describe what is meant by the following terms: [2]

Primary structure .....

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Secondary structure .....

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Tertiary structure .....

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Quaternary structure .....

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The genetic code for the long chain polypeptides is found in the chloroplast genome and the genetic code for the short chain polypeptides is found in the nucleus.

(ii) State **two** features of the genetic code. [2]

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(iii) State how many genes code for the polypeptides found in a RuBisCO molecule. [1]

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(b) RuBisCO is responsible for carbon fixation in the Calvin cycle.

(i) State the names of the **two** substrates that form an enzyme-substrate complex with RuBisCO. [2]

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(ii) State the names of the following molecules:

I. the first 3-carbon phosphorylated **sugar** produced by the Calvin cycle; [1]

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II. **one** organic molecule formed from the product of the Calvin cycle with the addition of nitrogen **and** phosphorus; [1]

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III. **one** organic molecule formed from the product of the Calvin cycle with the addition of nitrogen **and** sulphur. [1]

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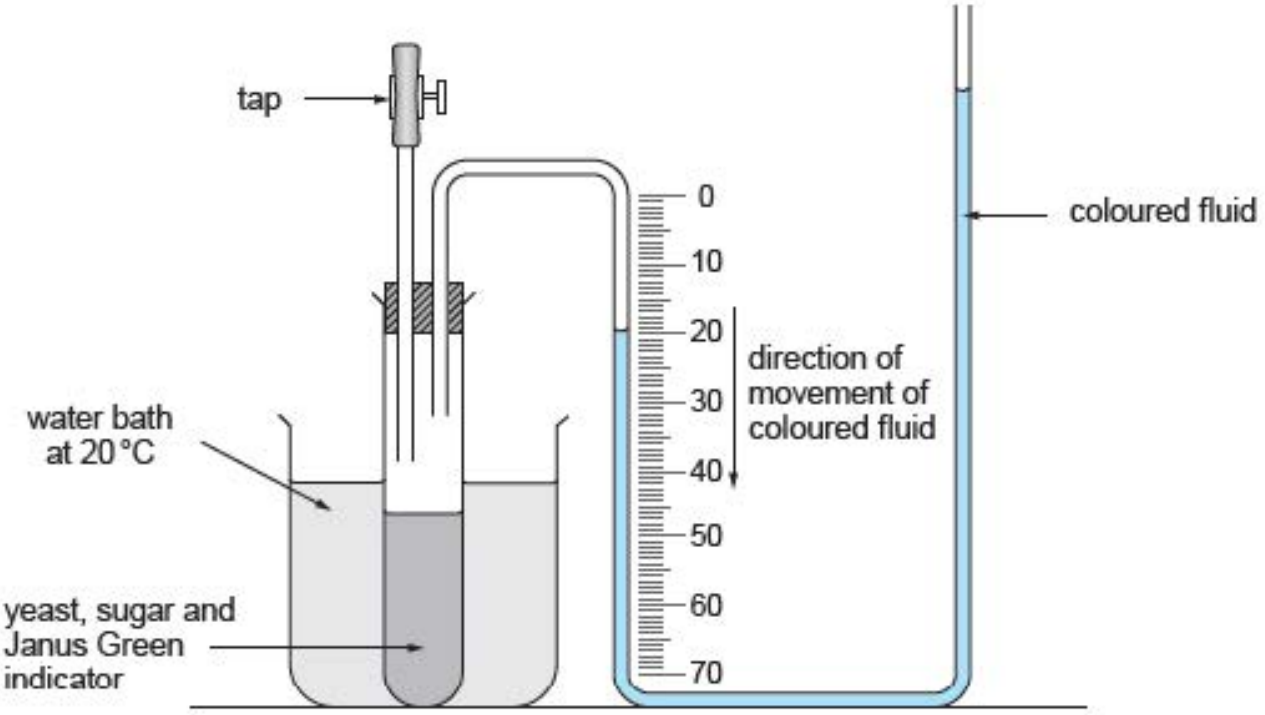
2. **Image 6.1** shows the apparatus which can be used to measure the production or absorption of gases during respiration. The apparatus relies on changes in pressure to move the coloured fluid along the tube.

Image 6.1



A student used this apparatus to compare the rate of **anaerobic** respiration in yeast using different sugars as the respiratory substrate.

Janus Green indicator is blue if oxygen is present and pink if no oxygen is present.

- Janus Green indicator is added to the yeast and sugar in a test tube as shown above.
- The apparatus is left with the tap open for 5 minutes.
- After this time the tap is closed.
- Once the solution turns pink, the time for the meniscus to move 10 mm is recorded.
- The time for the meniscus to travel 10 mm is repeated a further four times.
- All controlled variables are the same for each sugar and for each repeat.

(a) Explain the following:

(i) The tap is open when the apparatus is assembled. [1]

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(ii) The tap is not closed until 5 minutes after setting up. [1]

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(iii) No readings are taken before the Janus Green indicator changes to pink. [1]

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(b) Explain why you would expect the meniscus to move in the direction of the arrow. [2]

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(c) Suggest a suitable control experiment **and** explain why a control is necessary. [3]

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(d) (i) The results when glucose was used as the substrate are shown in the table below. Use the table and formula to calculate the standard deviation for the glucose results. [3]

Time for meniscus to travel 10 mm /seconds	Deviation from mean $x - \bar{x}$	Deviation from mean squared $(x - \bar{x})^2$
254		
246		
255		
253		
252		
Mean = 252		$\sum(x - \bar{x})^2$ =

The formula for standard deviation is:

$$\sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

where

x = individual result $\bar{x}$ = mean result

n = number of trials $\sum$ = sum of

Standard deviation = ...

(ii) **Complete the following table** which shows the results of the experiment for all three sugars. [3]

.....	.....						
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Mean	Standard deviation
glucose	254	246	255	253	252	252	.....
fructose	170	208	214	265	270	225	42.0
sucrose	370	376	388	379	390	381	8.4

(iii) State what standard deviation indicates about data **and** comment on the values for the three sugars in this experiment. [3]

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(e) Explain why the respiratory rate is much slower when yeast uses sucrose as the respiratory substrate. [2]

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(f) Predict what would happen to the position of the meniscus if the yeast was only carrying out **aerobic** respiration. Explain your answer. [2]

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