## Respiration – 2021/20 GCE Biology A Component 01

**1.** Nov/2021/Paper_H420/1/No.13

NAD, FAD and Coenzyme A (CoA) are molecules that are involved in cellular respiration.

Which of the following statements about these molecules is/are correct?

1 NAD and FAD are examples of coenzymes.
2 NAD is reduced by accepting hydrogen atoms.
3 CoA delivers the three carbon atoms of pyruvate to the Krebs cycle in the form of an acetyl group.

**A** 1, 2 and 3 are correct

**B** only 1 and 2 are correct

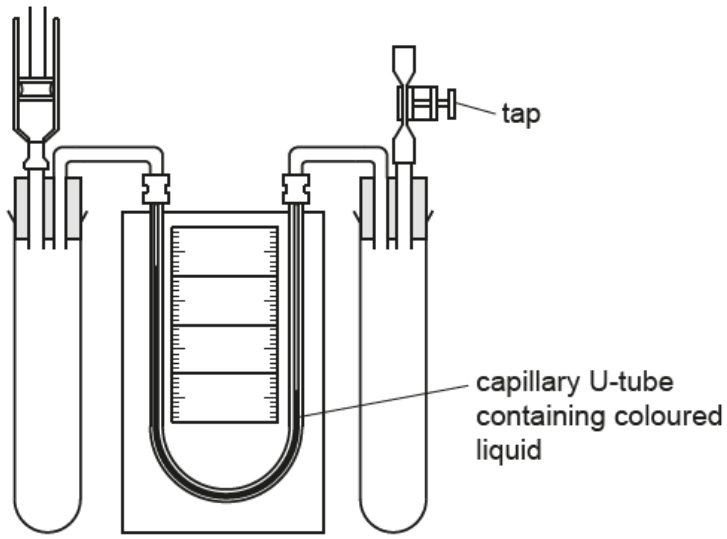
**C** only 2 and 3 are correct

**D** only 1 is correct

Your answer ☐ **[1]**

**2.** Nov/2021/Paper_H420/1/No.14

A respirometer, shown below, can be used to investigate respiration.




A student placed 5 $cm^3$ of potassium hydroxide solution in the left-hand tube of the respirometer. The student suspended a basket above the liquid and placed 10 g of respiring seeds in the basket.

Which of the following statements about this investigation is **not** correct?

**A** The level of the liquid in the left-hand arm of the capillary tube would decrease (move downwards) with time.

**B** The potassium hydroxide solution absorbs carbon dioxide.

**C** The rate of movement of the liquid in the capillary tube is a measure of the rate of respiration.

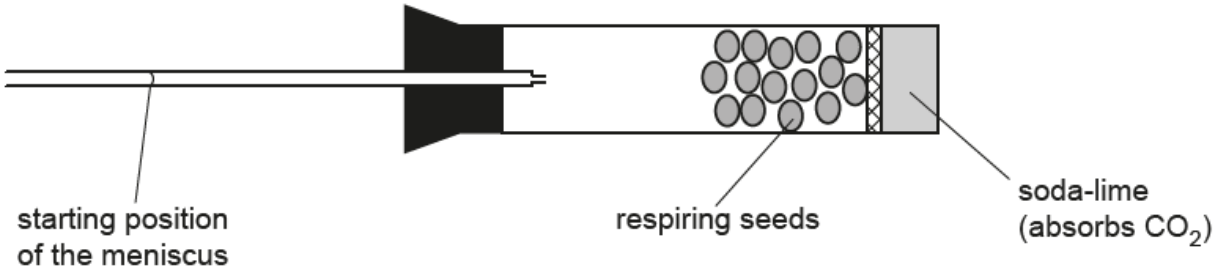
**D** The tap can be opened to equalise the pressure in each tube.

Your answer ☐ **[1]**

**3.** Nov/2020/Paper_H420/1/No.11

Questions **11** and **12** refer to the investigation described below.

The diagram shows a respirometer used to compare respiration in two types of germinating seeds.




A student set up the respirometer to measure oxygen consumption.

- The narrow tube contained coloured water.
- The position of the meniscus was noted at the beginning of the experiment.
- The tube was left for 20 minutes.
- The new position of the meniscus was noted.
- The experiment was repeated with the other type of seed.

Which of the following would be necessary to ensure valid results?

1 Keeping the respirometer in the dark during the experiment.
2 Keeping the respirometer at the same temperature during the experiment.
3 Using the same dry mass of seeds each time.

**A** 1, 2 and 3

**B** only 1 and 2

**C** only 2 and 3

**D** only 1

Your answer ☐ **[1]**

**4.** Nov/2020/Paper_H420/1/No.12

The student investigated two types of seed, pea and sunflower:

- pea seeds store mainly starch
- sunflower seeds store mainly lipid.

Which of the following, **A** to **D**, describes the results you would expect with each type of seed?

**A** The meniscus would move to the left with pea seeds and further to the left with sunflower seeds.

**B** The meniscus would move to the left with sunflower seeds and to the right with pea seeds.

**C** The meniscus would move to the right with pea seeds and further to the right with sunflower seeds.

**D** The meniscus would not move.

Your answer ☐ **[1]**

**5.** Nov/2020/Paper_H420/1/No.13

Which of the following statements, **A** to **D**, describes and explains the relative yield of ATP in anaerobic and aerobic respiration?

**A** Anaerobic respiration produces less ATP per molecule of glucose because lactate is converted to pyruvate.

**B** Anaerobic respiration produces less ATP per molecule of glucose because NAD is not regenerated in oxidative phosphorylation.

**C** Anaerobic respiration produces more ATP per molecule of glucose because NAD is regenerated in oxidative phosphorylation.

**D** Anaerobic respiration produces more ATP per molecule of glucose because pyruvate is converted to lactate.

Your answer ☐ **[1]**

**6.** Nov/2020/Paper_H420/1/No.16

**(a)** Fig. 16.1 shows the structure of ATP.

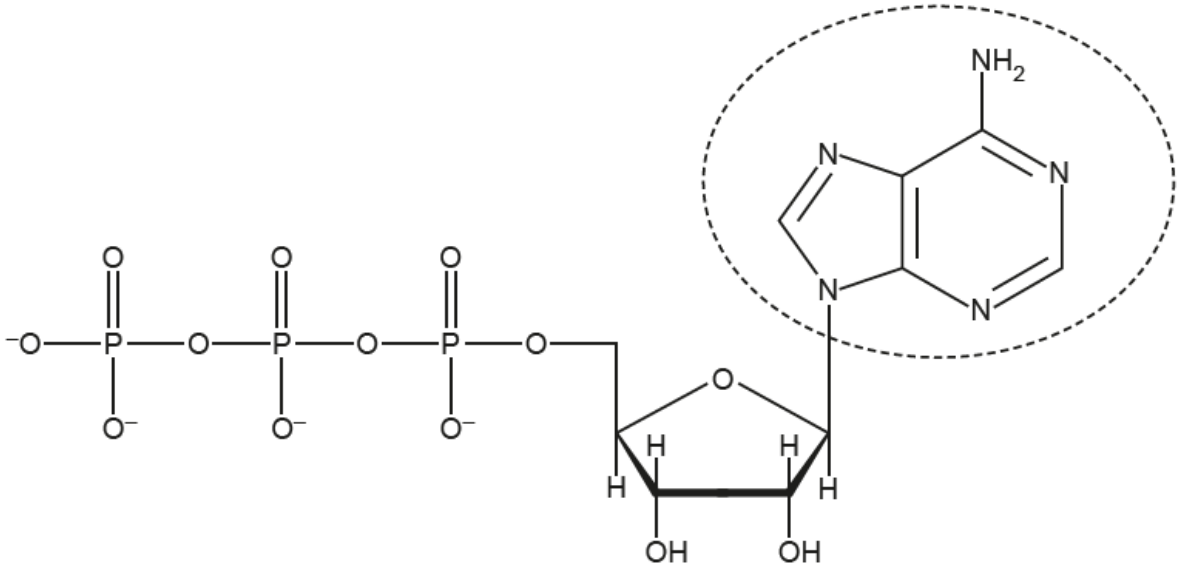



**Fig. 16.1**

**(i)** Name the circled component in Fig. 16.1.

..... **[1]**

**(ii)** Name the type of reaction that occurs when ATP is converted to ADP.

..... **[1]**

**(iii)** A teacher told his students that the human body makes the equivalent of its own mass in ATP every day.

Explain why, at the end of the day, only a small proportion of the students' mass was ATP.

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

**(b)** A student investigated the uptake of two different substances in cultured cells.

The rate of uptake was measured at different concentrations of each substance in the medium surrounding the cells.

The results are shown in Fig. 16.2.

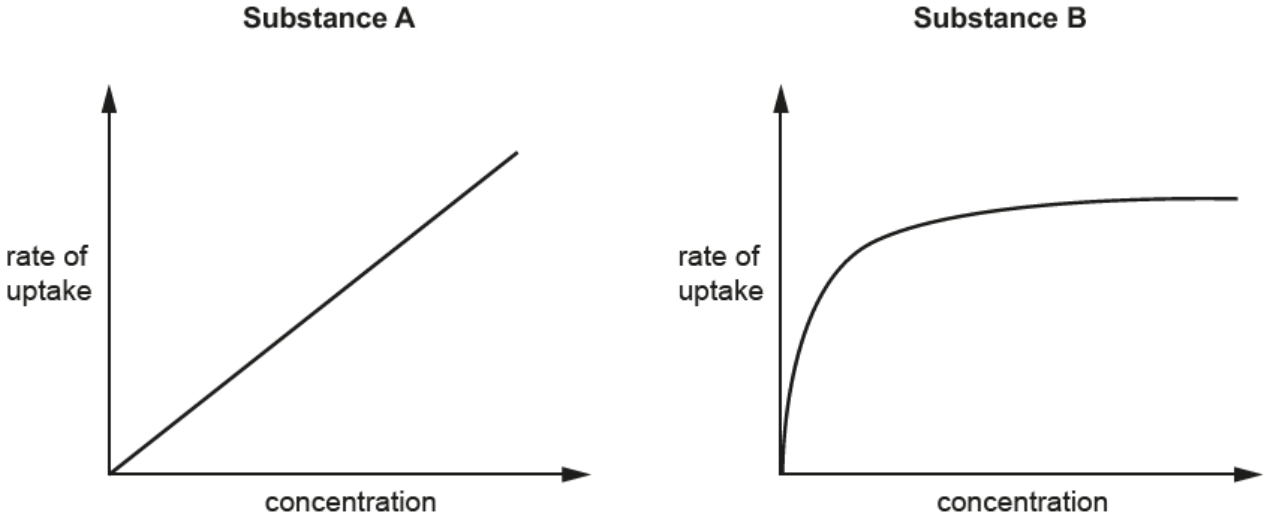


**Fig. 16.2**

**(i)** The student concluded that one substance entered the cells by simple diffusion and the other by active transport.

Evaluate the student's conclusion.

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..... **[4]**

**(ii)** The student then added 2,4-dinitrophenol (DNP) to the cells. DNP inhibits respiration.

Predict the effect of DNP on the uptake of each substance and explain your prediction.

**Substance A**

effect .....

explanation .....

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**Substance B**

effect .....

explanation .....

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**[4]**

**(c)** The student used a colorimeter to measure the concentration of each substance in the liquid surrounding the cells.

The colorimeter had an analogue display. The reading was indicated by a needle moving across a scale. The smallest divisions on the scale corresponded to 0.1 absorbance unit.

After the investigation the student suggested some improvements.

Draw a line between each of the improvements to the corresponding justification.

| **Improvement** | **Justification** |
|---|---|
| Use a colorimeter with a digital display showing absorbance units to 3 decimal places. | To assess repeatability |
| Check the zero value of the colorimeter with purified water before use. | To assess reproducibility |
| For each concentration, repeat the measurement of the rate of reaction three times and calculate a mean. | To reduce systematic error |
| Ask students in several schools to carry out the same investigation. | To reduce random error (uncertainty) |
| | To increase resolution |

**[4]**

**7.** Nov/2020/Paper_H420/1/No.20

A student investigated the effect of different sugars on the respiration rate in yeast using the following procedure.

- Prepare a stock solution of yeast containing 10 g of dried yeast in 250 $cm^3$ of pH5 buffer.
- Prepare solutions of each sugar containing 5 g of sugar in 250 $cm^3$ of distilled water.
- Keep the yeast and sugar solutions in a water bath at 35 °C until required.
- Set up the apparatus with a 250 $cm^3$ conical flask connected by a rubber tube to a 100 $cm^3$ gas syringe.
- Add 25 $cm^3$ of yeast solution and 25 $cm^3$ of sugar solution to the flask, immediately connect the flask to the gas syringe and start the clock.
- Record the volume of gas produced after 30 s and then every 30 s for 7 min.
- Repeat the experiment 5 times for each different sugar.
- Prepare a fresh yeast solution for each set of sugars.

**(a) (i)** Describe **two** precautions the student should take between each experiment to ensure repeatable results.

1 .....

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2 .....

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**[2]**

**(ii)** The student's procedure did not include a negative control.

Describe **one** negative control that the student could have used.

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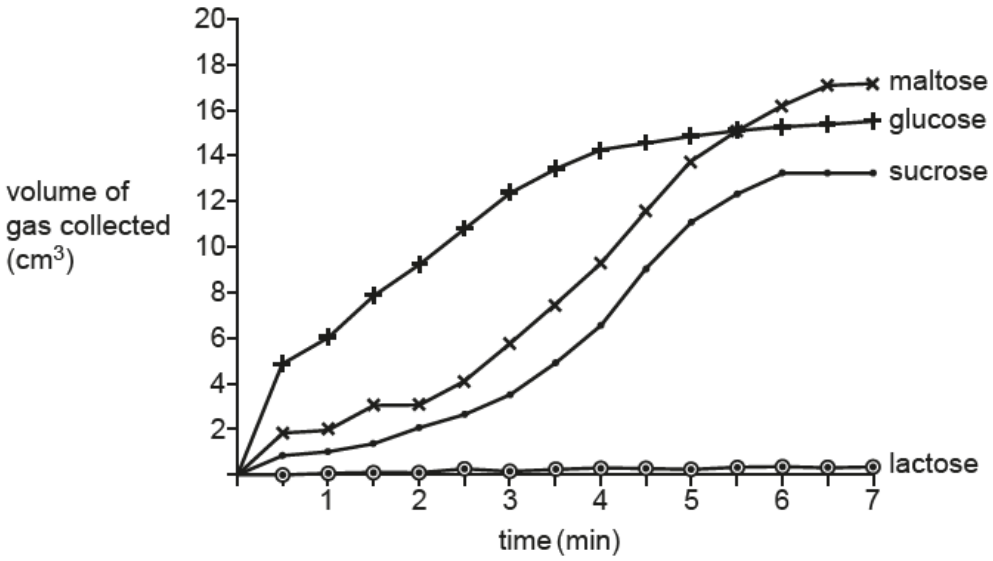
..... **[1]**

**(b)** The student calculated mean values for each sugar and plotted the results on a graph.

The graph is shown below.




**(i)** Describe how the student could use the graph to calculate the rate of respiration for each type of sugar.

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..... **[3]**

**(ii)*** The student concluded the following from the graph:

- The rates of respiration with glucose, maltose and sucrose were very similar.
- The yeast could not hydrolyse disaccharides.

Evaluate the student's conclusions.

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**(c)** The student wanted to study the effect of the different sugars on the rate of growth of a yeast population.

They used a colorimeter to measure the absorbance of a culture of yeast cells.

The absorbance of the yeast culture is proportional to the concentration of yeast cells.

As the yeast multiplied, it was necessary to dilute the sample to obtain a reading on the colorimeter.

**(i)** Describe how the student could use 1 $cm^3$ pipettes and 10 $cm^3$ measuring cylinders to dilute the sample so that it was 10 000 times less concentrated.

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..... **[3]**

**(ii)** A light microscope can be used to observe yeast cells.

State the equipment that would be needed, in addition to a microscope, to measure the average diameter of yeast cells.

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

**(iii)** The student prepared a starter culture using $2.5 \times 10^{-3}$ g yeast cells in 1 $dm^3$ nutrient broth.

The average mass of a yeast cell is $2.0 \times 10^{-11}$ g.

Calculate the number of cells in the starter culture.

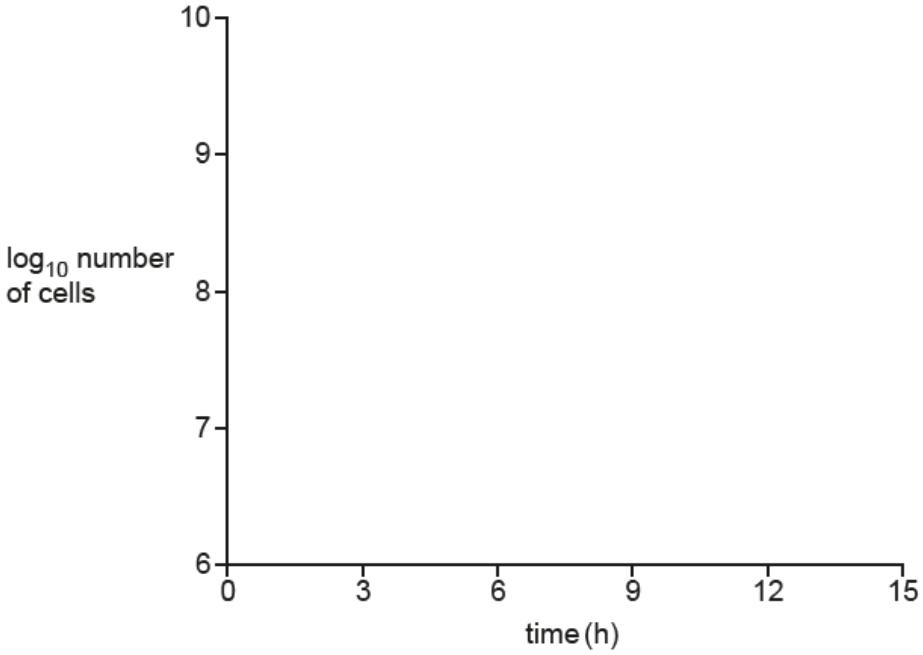
Give your answer in standard form.

number of cells = ..... **[2]**

**(iv)** The population of this yeast doubles every 90 minutes when growing under ideal conditions.

A different starter culture was prepared containing $1 \times 10^7$ cells.

Use the axes below to sketch the growth curve you would expect for the yeast culture over the first 15 h.




**[3]**