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SURNAME:

FIRST NAME:

PREP SCHOOL:

Malvern College Academic Scholarship Examinations 2024

SCIENCE

Please read this information before the examination starts:

- This booklet contains the test papers for Biology, Chemistry and Physics
- You have 60-minutes
- It is recommended you spend 20-minutes on each paper

BIOLOGY

- It is recommended you spend 20-minutes on this section.
- There are 20 marks for each section.

Questions

Q1.

Many cells contain an enzyme called catalase.

Catalase breaks down hydrogen peroxide into water and oxygen.

A scientist investigated the effect of hydrogen peroxide concentration on the time taken to produce 20 cm^3 of oxygen.

Figure 12 shows the equipment used.

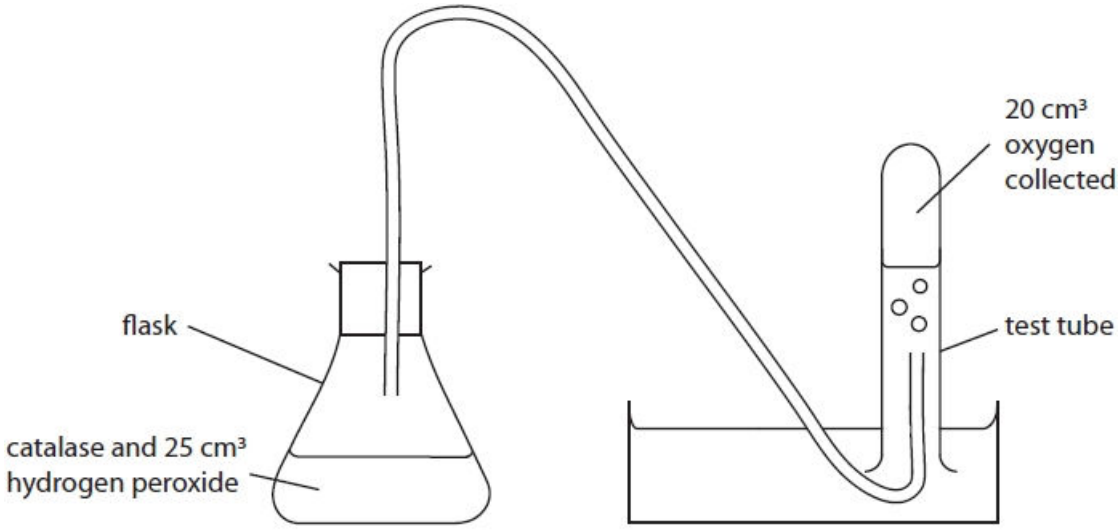

Figure 12

(i) State how the scientist could control the temperature of the flask.

[1]

.....

.....

(ii) Explain why the temperature should be controlled in this investigation.

[3]

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(iii) This investigation used five different concentrations of hydrogen peroxide.

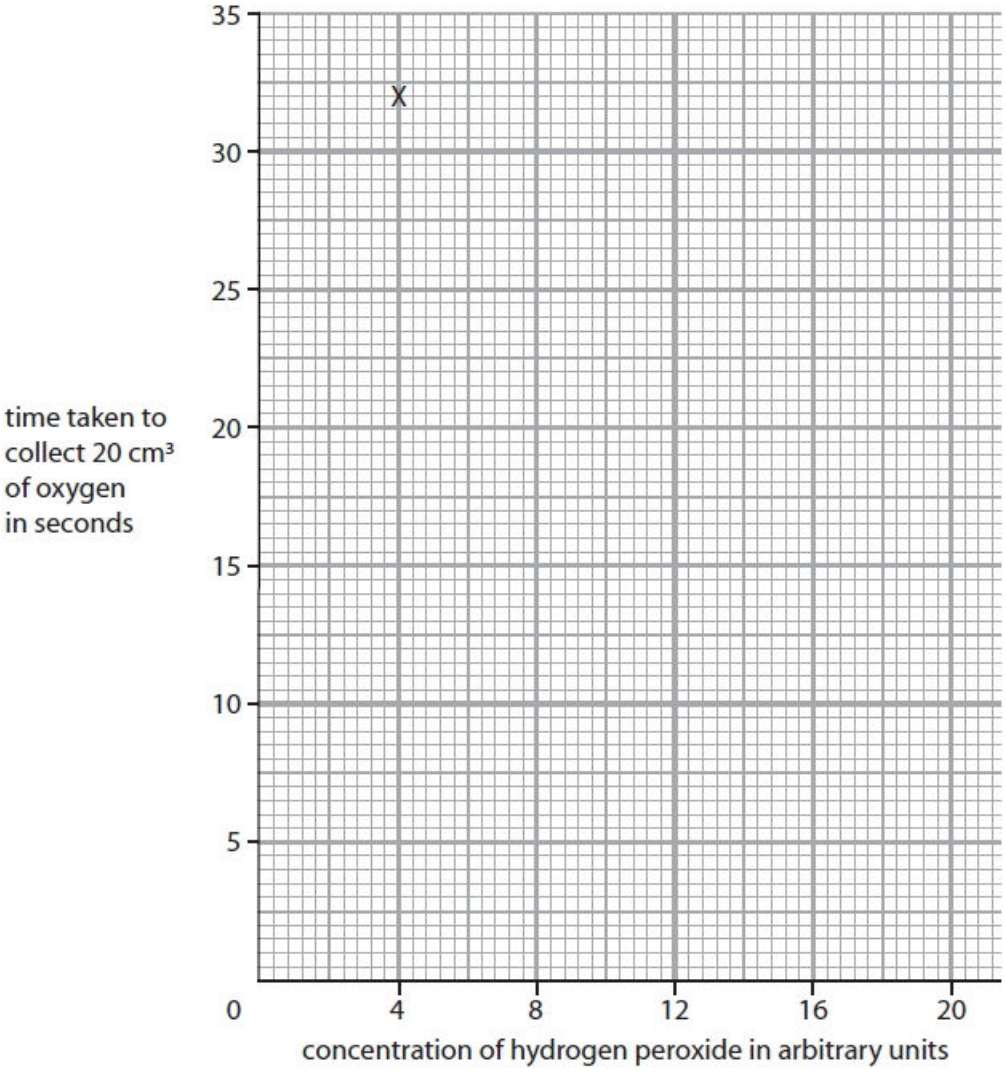
Figure 13 shows the results of this investigation.

concentration of hydrogen peroxide in arbitrary units	time taken to collect 20 cm^3 of oxygen in seconds
4	32
8	14
12	9
16	7
20	6

Figure 13

Complete the graph by plotting the points and drawing a line to show the trend in the data.
The first point has been plotted for you.

[2]



(iv) Describe the trend shown in the graph.

Use data from the table in Figure 13 to support your answer.

[3]

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.....

(Total for question = 9 marks)

Q2.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Birds are classified in the domain Eukarya.

(i) Why are the cells from birds described as eukaryotic?

[1]

☒ **A** they have membrane-bound organelles

☒ **B** they do not have nuclei

☒ **C** they have a rigid cell wall

☒ **D** they have a cell membrane

(ii) Give **one** reason why the three domain classification system was proposed.

[1]

.....

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.....

(Total for question = 2 marks)

Q3.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Body mass index (BMI) is calculated using the equation:

$$\text{BMI} = \frac{\text{mass (kg)}}{(\text{height (m)})^2}$$

(i) Person A is 1.8 m tall and has a mass of 64.8 kg.

Calculate the BMI of person A.

[2]

BMI = ...

(ii) Figure 9 shows some information about BMI.

BMI	BMI category
less than 18.5	underweight
18.5 to 24.9	healthy weight
25 to 29.9	overweight
more than 29.9	obese

Figure 9

Person B has a BMI of 18.5.
Which category is correct for person B?

[1]

☒ **A** underweight
☒ **B** healthy weight
☒ **C** overweight
☒ **D** obese

(iii) Person C has a BMI of 28.5.

Explain **one** way person C could change their lifestyle to reach a healthy weight.

[2]

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(Total for question = 5 marks)

Q4.

The human immune system helps defend the body against disease.

Figure 1 shows a bacterial cell that can cause disease.

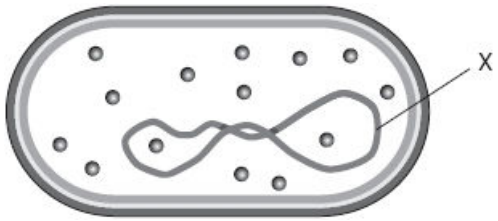


Figure 1

What is the part of the cell labelled X?

[1]

☒ **A** cytoplasm

☒ **B** nucleus

☒ **C** chromosome

☒ **D** plasmid

(Total for question = 1 mark)

Questions continue over the page

Q5.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 4 shows three cells.

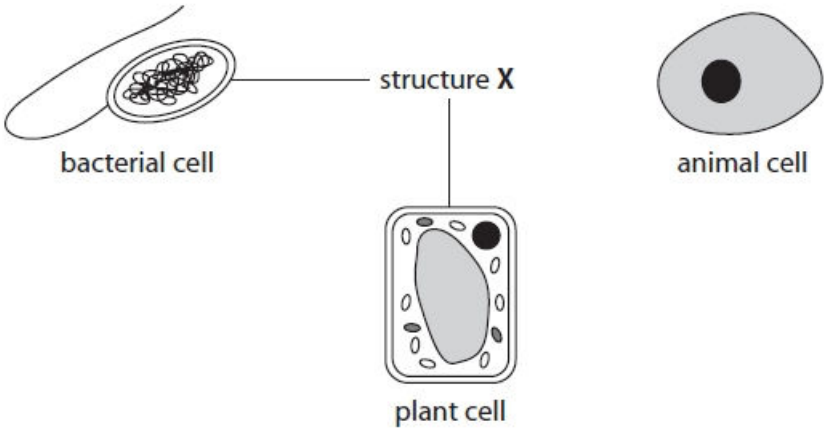


Figure 4

(i) What is structure **X**?

[1]

☒ **A** cell membrane

☒ **B** cell wall

☒ **C** cytoplasm

☒ **D** nucleus

(ii) The bacterial cell in Figure 4 has a flagellum.

State the function of a flagellum.

[1]

.....

.....

(iii) Give **one** other difference between the bacterial cell and the animal cell shown in Figure 4.

[1]

.....

.....

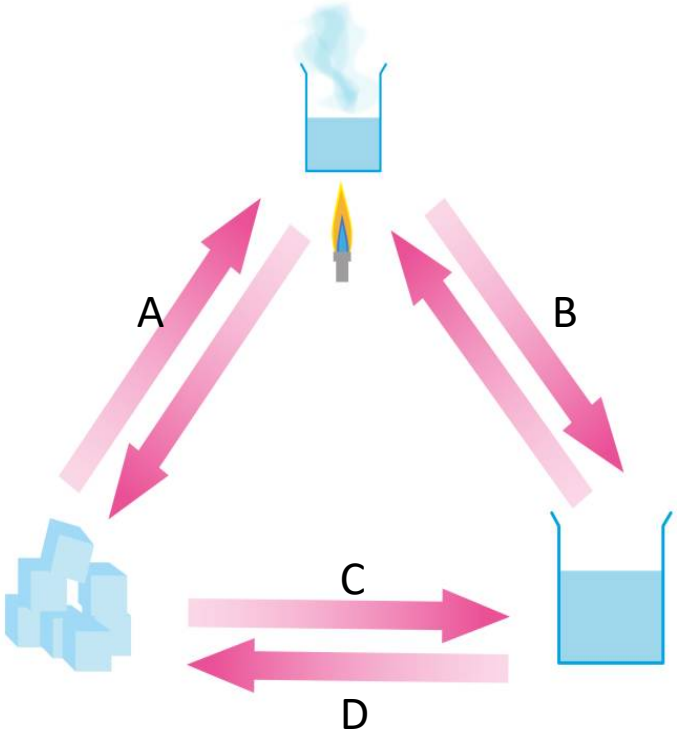
(Total for question = 3 marks)

Chemistry and Physics questions continue over page.

CHEMISTRY

- It is recommended you spend 20-minutes on this section.
- There are 20 marks for each section.

Q1. The diagram below shows the changes of state between solid, liquid and gas (the top picture).



a) State the name of the changes A-D

A _____

B _____

C _____

D _____

[2]

b) The reverse process to B can be called either evaporation or boiling. Explain the difference between the two and give a real world example to demonstrate the difference.

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.....

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.....

.....

[3]

Q2

A student is given a beaker of a colourless liquid and is asked to determine whether the liquid is pure water. The student adds anhydrous copper sulphate.

a) What is the expected colour change when anhydrous copper sulphate is added to water

.....

[1]

b) The student sees the expected colour change and concludes that the colourless liquid must be pure water. Explain why the student's conclusion is incorrect.

.....

.....

[1]

c) Suggest a more appropriate test to prove that the water is pure or not and the expected result.

.....

[1]

d) The solution is in fact a mixture of water and salt. State the name of a technique that could be used to obtain pure water from this mixture.

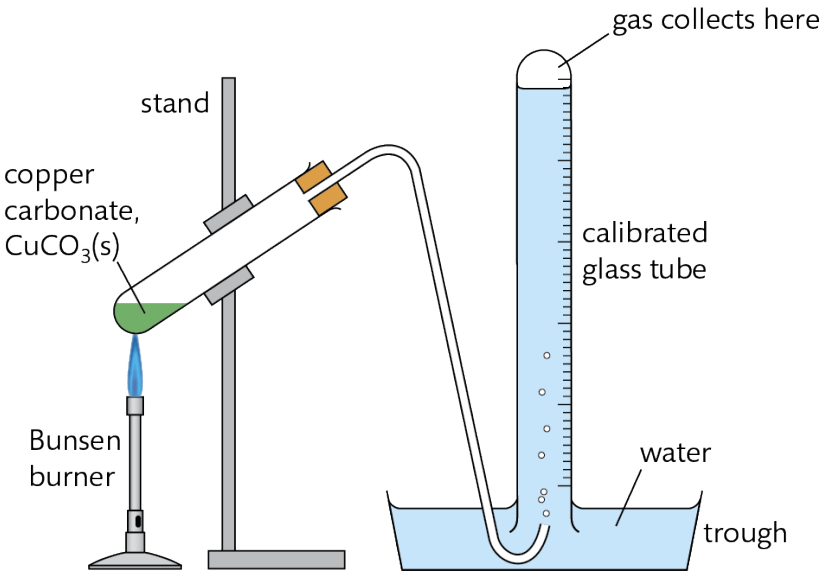
.....

[1]

Questions continue over the page

Q3

A student used the equipment shown in the picture below to investigate the decomposition of copper carbonate, $CuCO_3$. The process produces carbon dioxide and one other product.



a) State the number of (i) elements and (ii) atoms in copper carbonate

(i) _____

(ii) _____

[2]

b) Describe a test and the expected result to show that the gas produced is carbon dioxide

.....

.....

[2]

c) Deduce the name and formula of the other product

.....

.....

[2]

Questions continue over the page

d) The set-up shown is not an accurate method to determine the volume of gas that is produced as carbon dioxide can dissolve in water to form carbonic acid, which is a weak acid. Suggest a pH and the colour of universal indicator in a solution of carbonic acid.

pH = Colour of universal indicator =

[2]

e) The carbonic acid can be reacted with sodium and sodium hydroxide. Sodium is a metal and sodium hydroxide is an alkali. Complete the word equations for the two reaction

Carbonic acid + sodium → sodium carbonate + _____

Carbonic acid + sodium hydroxide → sodium carbonate + _____

[2]

f) Describe what happens to the pH of the solution as sodium hydroxide is added to the solution of carbonic acid.

.....

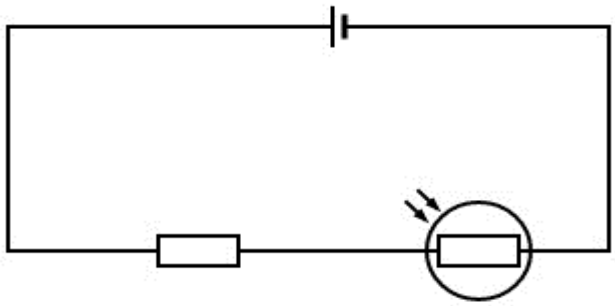
.....

[1]

PHYSICS

- It is recommended you spend 20-minutes on this section.
- There are 20 marks for each section.

Q1. A Light dependant resistor is placed in a series circuit with a normal resistor as shown:



a) Another way of connecting the resistor and the LDR together would have been in parallel, in the space below draw the LDR and the resistor connected in parallel

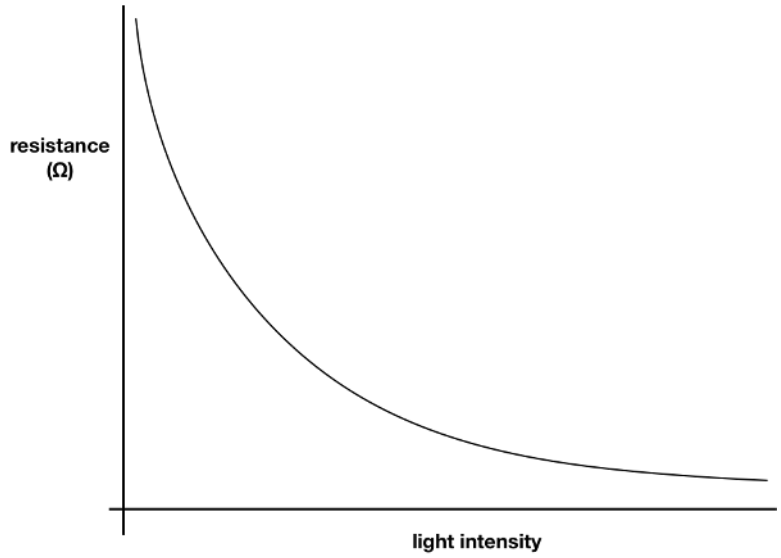
[2]

b) What is the function of the resistor in the circuit? [1]

.....

Questions continue over the page

In the original series circuit the resistance in the light dependant resistor depends on the light intensity in the room as shown below:



c) Describe what happens to the resistance of the light dependant resistor as the amount of light shining on it increases. [1]

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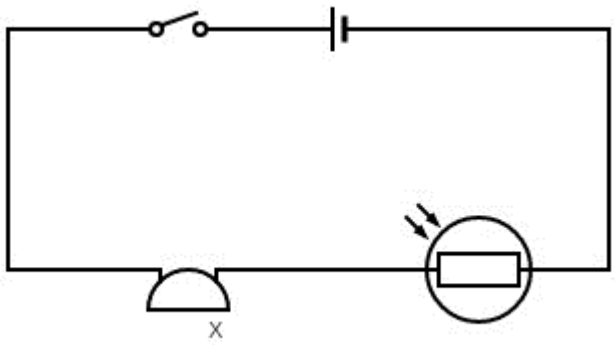
.....

Questions continue over the page

The resistor is replaced with a new component – labelled X.



d) Identify component X and explain what will happen when the switch is pushed. [2]

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……

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e) This circuit is then taken to a dark room and the switch is pushed. Explain what will happen. [3]

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f) Can you think of an example of where this circuit would be useful, and explain how it would be used. [2]

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……

Questions continue over the page

Q2. This question is about the Earth and space flight.

a) The Earth rotates on its axis every 24 hours. The radius of the Earth is 6.4 x 10^6m.

(i) Determine the circumference of the Earth using, C=2πr [1]

……

(ii) Determine the number of seconds in 1 day [1]

……..

(iii) Calculate the speed of a person standing on the equator in m/s [1]

……

b) A space rocket needs a fast launch speed to reach orbit above the Earth's atmosphere. Explain why rockets tend to be launched from the equator rather than from the poles of the Earth. [2]

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c) The old Space shuttles were fitted with heat resistant tiles for re-entry to the Earth. Explain why the space shuttle became hot when it re-entered the Earth's atmosphere. [3]

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d) Satellites are being used to look for life on other planets. Explain why they would probably not expect to find life on Neptune. [2]

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