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0654/62

May/June 2014

1 hour

Candidates answer on the Question paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **18** printed pages and **2** blank pages.

- 1 A student investigates the movement of acid into different sized blocks of agar. The agar contains the indicator phenolphthalein. This indicator is purple in a pH of greater than 8 and colourless in a pH of less than 8.

Two agar blocks of dimensions $2\text{ cm} \times 2\text{ cm} \times 2\text{ cm}$ and $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ are labelled **A** and **B** respectively and placed in separate beakers as shown in Fig. 1.1.

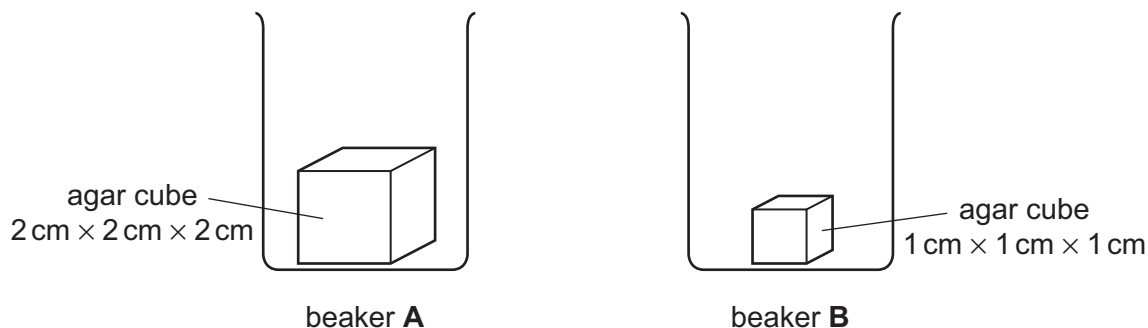


Fig. 1.1

- (a) At the beginning of the experiment the colour of the indicator in the agar was purple.

Explain what this colour indicates.

..... [1]

The student adds 10 cm^3 hydrochloric acid to each of the beakers to cover the blocks and then starts the stopclock. She records the time taken for the blocks to become colourless.

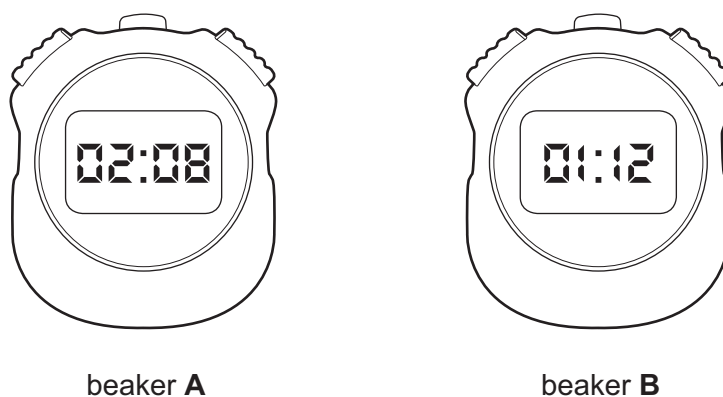


Fig. 1.2

- (b) In the space below, use a ruler to construct a table for the results.

Your table should show the dimensions of each block and the time taken, **in seconds**, for each block to go colourless.

Read the stopclocks shown in Fig. 1.2. Record the time taken, in seconds to complete your table.

[3]

- (c) (i) Name the process by which the acid moves into the agar from the solution.

..... [1]

- (ii) Explain the colour change of the agar.

.....
 [1]

- (d) (i) Explain the difference between the times taken for the colour changes in blocks **A** and **B**.

.....

 [1]

- (ii) Suggest the significance of this for gas exchange in the lungs.

.....
 [1]

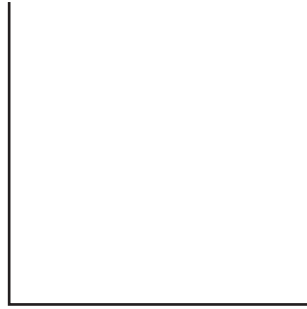
(e) The teacher says that the experiment should be extended to allow a more confident explanation of the results.

(i) Suggest a suitable extension.

.....

..... [1]

(ii) Label the axes to show how you would represent the results of this extended experiment.



[1]

Please turn over for Question 2.

- 2 Solid **X** is a mixture of two salts which have the same anion. A student carries out a series of tests to identify the two salts.

(a) Identification of the anion

A student dissolves a sample of solid **X** in distilled water. He divides the resulting solution into three test-tubes.

- (i) Into the first test-tube the student adds some nitric acid. There is no reaction.

State which anion is **not** present in solid **X**.

..... [1]

- (ii) In the second test-tube the student tests for the presence of chloride ions. The result is negative.

Name the reagents used in this test.

reagent 1

reagent 2 [2]

- (iii) To the third test-tube the student adds barium chloride solution and observes a white precipitate.

This proves a sulfate is present.

The student observes that this test-tube gets hot.

State the term for this type of reaction.

..... [1]

(b) Identification of the two cations

The student dissolves another sample of solid **X** in distilled water. To this he adds an excess of ammonia solution. A precipitate forms.

He separates the precipitate from the solution and records the colours in Table 2.1.

Table 2.1

	colour	cation present
solution	dark blue	
precipitate	green	

- (i) Complete Table 2.1 to show the cation present in the solution and the cation present in the precipitate. [2]

- (ii) Draw a labelled diagram to show how the student can separate the precipitate and solution.

[2]

- (iii) After standing in air for a short time the student notices that the colour of the precipitate has changed.

Describe the colour change and the process that is occurring.

colour change

process [2]

- 3 A student is finding out how the potential difference (p.d.) across a lamp and the power of the lamp vary with the length of resistance wire in series with it.

She sets up the circuit as shown in Fig. 3.1.

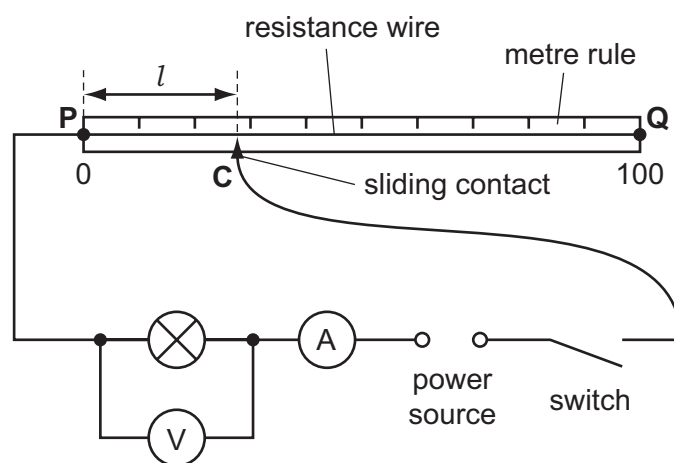


Fig. 3.1

- (a) She closes the switch and places the sliding contact **C** on the resistance wire at a distance, l of 10.0 cm from end **P**. She records in Table 3.1 the current, I , flowing through the lamp and the p.d. V , across it.

She moves the contact **C** on the resistance wire until distance l is 20.0 cm. She records in Table 3.1 the new values of I and V .

She continues with further values of l as shown in Table 3.1.

Table 3.1

length l /cm	current I /A	p.d. V /V	power P /W
10.0	0.21	1.81	
20.0	0.17	1.72	
40.0	0.15	1.52	
60.0			
80.0	0.13	1.17	

- (i) Fig. 3.2 shows the ammeter and voltmeter readings when the length, l , equals 60.0 cm.

Record, in Table 3.1, the values of I and V .

[2]

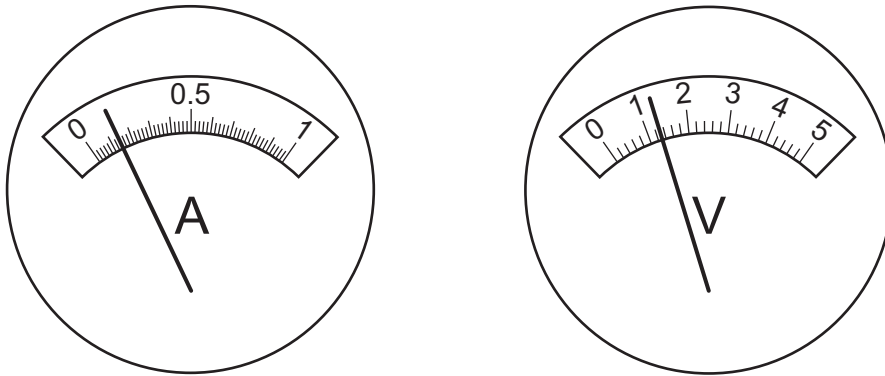


Fig. 3.2

- (ii) Calculate the power, P , produced by the lamp for each length of wire, using the equation

$$P = V \times I$$

Record your values of P in Table 3.1 to an appropriate number of significant figures. [2]

- (iii) What observation of the apparatus shows that the power produced by the lamp decreases as the length of resistance wire increases?

.....
 [1]

- (b) The teacher makes the following suggestion.

‘The potential difference across the lamp is directly proportional to the length of the resistance wire in the circuit.’

- (i) In Table 3.2, transfer the values of V that are recorded in Table 3.1. For each pair of readings of l and V , calculate the ratio $\frac{V}{l}$. Record your results in Table 3.2. [2]

Table 3.2

length l /cm	<i>p.d.</i> V /V	$\frac{V}{l}$ in V/cm
10.0		
20.0		
40.0		
60.0		
80.0		

- (ii) On Fig. 3.3 sketch the graph you would expect to obtain if the teacher's suggestion is correct.

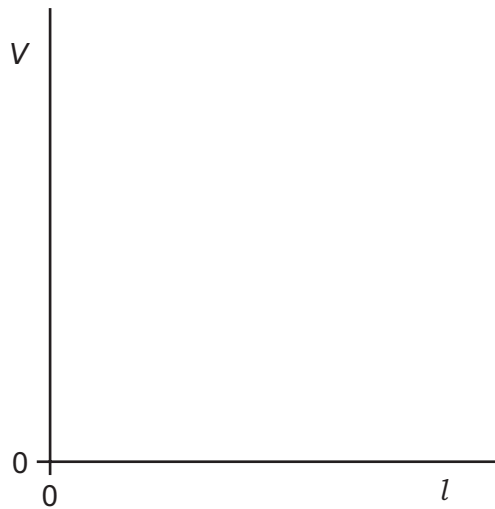


Fig. 3.3

[2]

- (iii) Use your values of $\frac{V}{l}$ from Table 3.2 to state whether you agree with the suggestion made by the teacher.

.....

Justify your statement by referring to the values you have calculated.

.....

..... [1]

Please turn over for Question 4.

- 4 A student investigates water uptake by a plant. The apparatus, called a potometer, is set up as shown in Fig. 4.1.

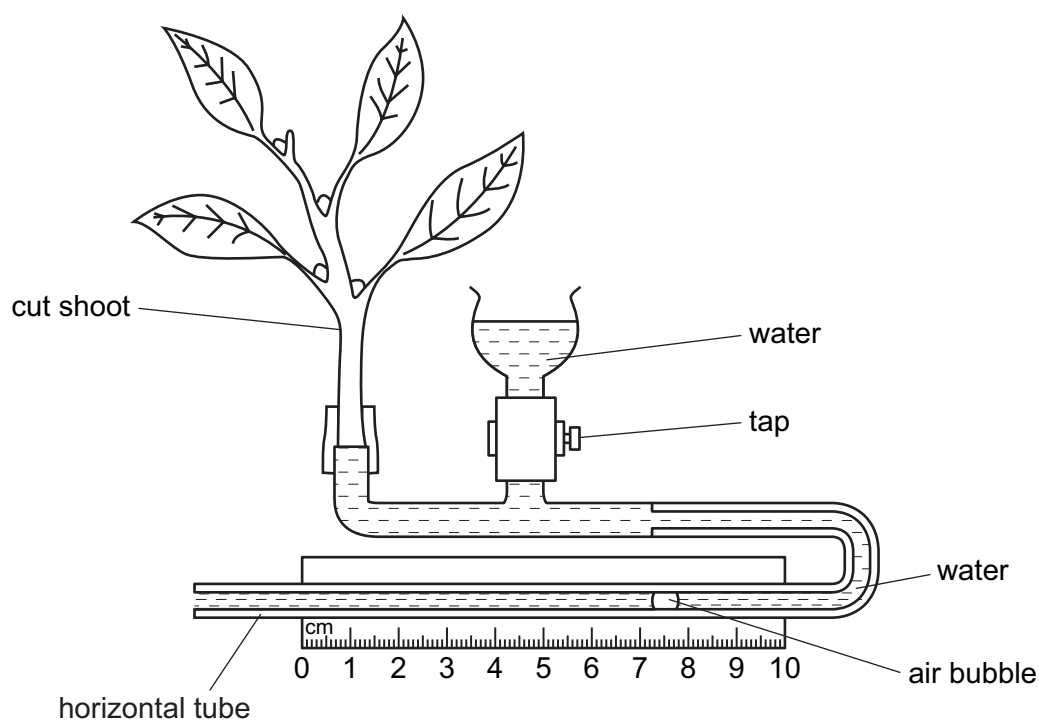


Fig. 4.1

The potometer is filled with water and an air bubble is introduced. The scale is used to measure the distance the bubble moves in a set time period.

- (a) Name and explain the process, in the leaves, causing the bubble in the horizontal tube to move from left to right.

process

explanation

..... [2]

- (b) Describe how the student can use the potometer to investigate the effect of wind on the rate of water uptake.

.....

.....

.....

.....

..... [4]

The student investigates the effect of light intensity on the rate of water uptake.

Table 4.1 shows the results he obtained with the shoot in high light intensity:

Table 4.1

light intensity	start point (cm)	end point (cm)	distance moved (cm)
high	2.5	7.0	
low			

- (c) (i) Using Fig. 4.2, read the positions of the air bubble in low light intensity and record the values in Table 4.1. [1]

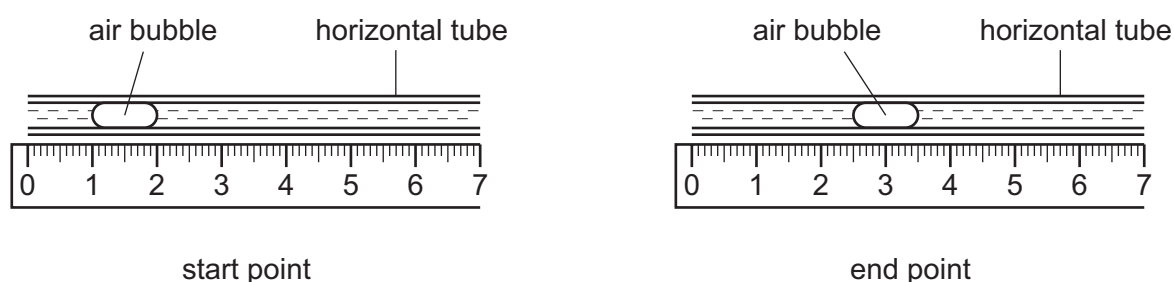


Fig. 4.2

- (ii) Calculate the distances moved by the air bubbles for both light intensity conditions. Record these values in the final column of Table 4.1.

[2]

- (d) State **one** environmental condition, other than wind or light intensity, that will affect the rate of water uptake of a plant.

..... [1]

- 5 (a) A student has three solutions, labelled **A**, **B** and **C**. These are barium chloride, hydrochloric acid and sodium carbonate.

The teacher says that:

A is hydrochloric acid

B is sodium carbonate and

C is barium chloride.

Using only solutions **A**, **B** and **C** and no other reagents explain how the student could show that the teacher is correct.

State clearly what she can do and the observations expected.

.....

.....

.....

.....

..... [3]

- (b) (i) Which **two** solutions from **A**, **B** and **C** could the student add together to make sodium chloride solution, without a precipitate being formed.

solution and solution [1]

- (ii) Sodium chloride solution needs to be heated gently to produce sodium chloride crystals.

Name the process that must take place for crystallisation to occur.

..... [1]

- (iii) Draw a labelled diagram of how she would carry out the procedure described in (b)(ii).

[2]

- (c) The teacher provides the student with another solution, labelled **D**.

Describe a test and state the result that shows it contains a zinc cation.

.....

.....

.....

..... [3]

- 6 (a) A student wishes to find the efficiency of a heating element.

He sets up the circuit as shown in Fig. 6.1.

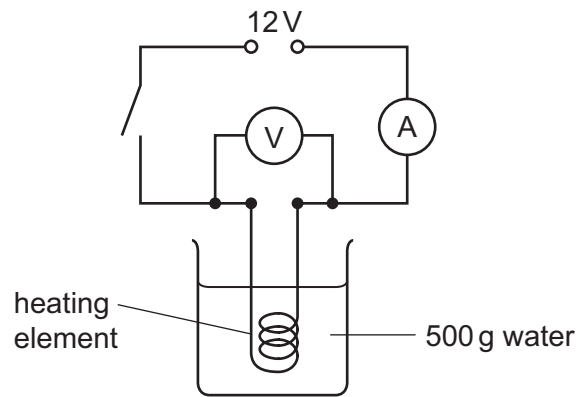


Fig. 6.1

He closes the switch and leaves it for one hour. The ammeter reading is shown in Fig. 6.2.

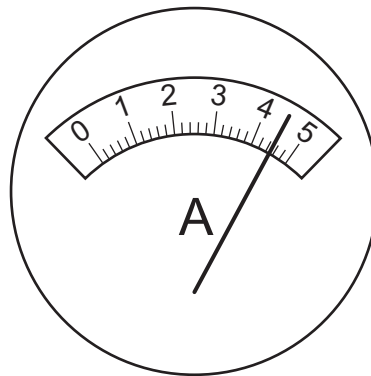


Fig. 6.2

- (i) Read the ammeter and record the value in Table 6.1.

Table 6.1

ammeter reading / A	voltmeter reading / V	time / s
	12	

[1]

- (ii) Complete the final column of Table 6.1 by calculating the number of seconds the switch was closed.

[1]

- (iii) Calculate the **energy input** using the equation,

$$\text{energy input} = I \times V \times t$$

where I = ammeter reading, V = voltmeter reading and t = time in seconds.

energy input = J [2]

- (b) The student calculates the amount of energy used to heat the water.

- (i) The original temperature of the water was 20 °C.

Read the thermometer shown in Fig. 6.3 to find the final temperature of the water after heating and calculate the temperature rise.

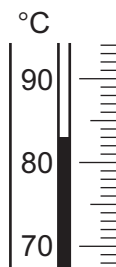


Fig. 6.3

thermometer reading = °C

temperature rise = °C [2]

- (ii) Calculate the **useful energy** transferred to heat the water using the equation,

$$\text{useful energy} = m \times 4200 \times t$$

where m = mass of water in kg and t = temperature rise in °C.

useful energy = J [2]

- (c) Use your values from (a)(iii) and (b)(ii) to calculate the efficiency of the heater.

Show clearly the formula you use.

efficiency = % [2]

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