

CANDIDATE
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COMBINED SCIENCE

0653/63

Paper 6 Alternative to Practical

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.

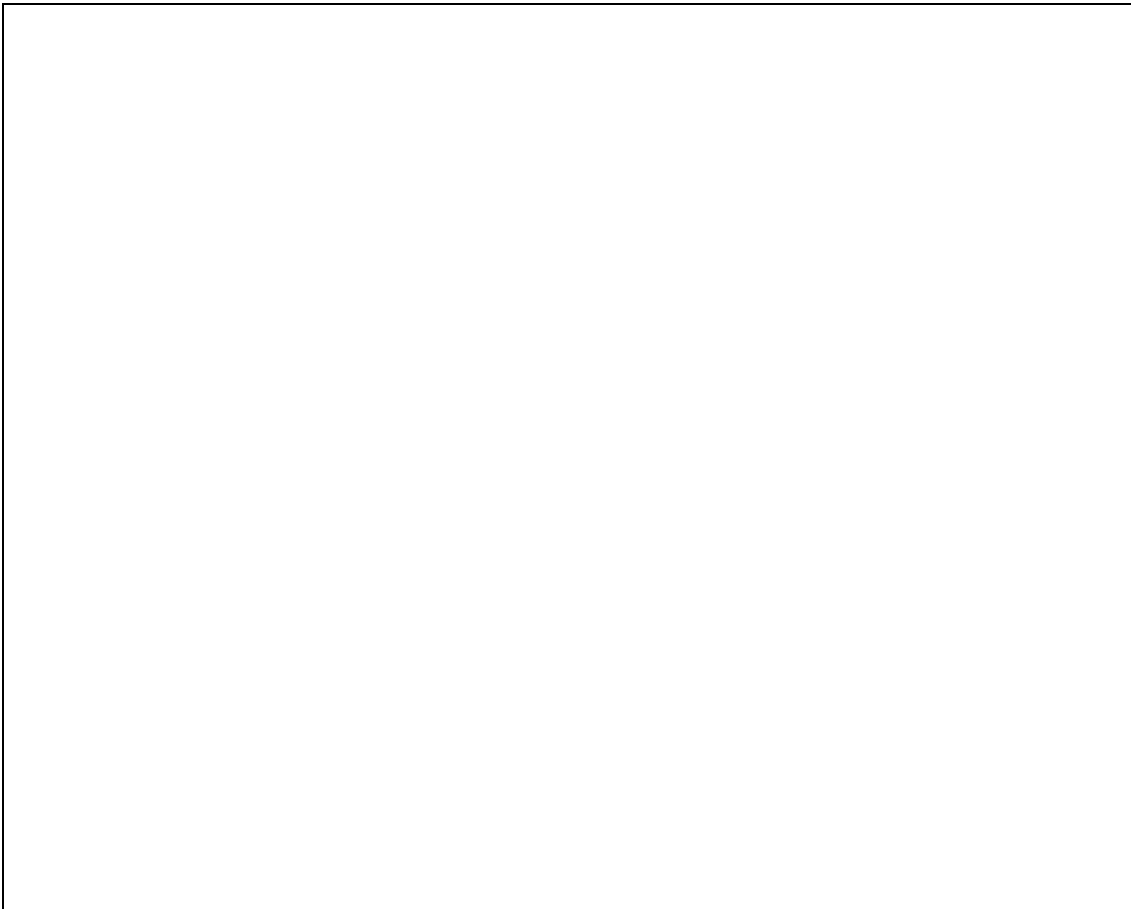
This document consists of **20** printed pages.

1 Fig. 1.1 is a photograph of a flower in section.

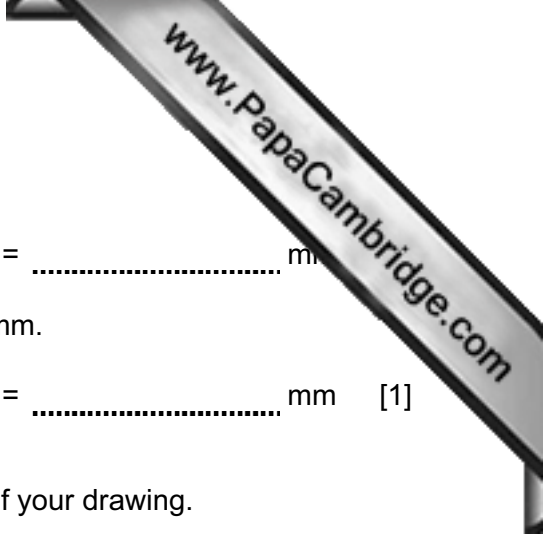


Fig. 1.1

(a) (i) In the box below make a pencil drawing of this flower to show the male and female parts and the petals. [2]



(ii) On your drawing, **label** a carpel and a stamen. [2]



(b) (i) Measure the line X – Y on Fig. 1.1 in mm.

length = mm

(ii) Measure the length of the same part on your drawing in mm.

length = mm [1]

(c) Use these two measurements to calculate the magnification of your drawing.

Show your working in the space below.

magnification = [1]

(d) On your drawing, mark with a **Z** the structure that receives pollen during pollination. [1]

(e) Describe the procedure you would use if you wanted to examine a sample of pollen from this flower.

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

- 2 A student is given three solutions labelled **A**, **B** and **C**. He knows they are copper(II) sulfate, sodium carbonate and zinc sulfate, but does not know which is which.

A second student has three more solutions, **D**, **E** and **F**. She knows they are barium chloride, hydrochloric acid and sodium hydroxide, but does not know which is which.

They place 2 cm³ solution **A** into a test-tube. Then they slowly add 2 cm³ solution **D**. They record their observations in Table 2.1.

They repeat this procedure with the other combinations and their results are shown in Table 2.1.

Table 2.1

	solution A	solution B	solution C
solution D	white precipitate	white precipitate	no reaction
solution E	no reaction	white precipitate	blue precipitate
solution F	bubbles given off	no reaction	no reaction

- (a) (i) Using the results in Table 2.1, deduce which two solutions are sodium carbonate and hydrochloric acid.

Sodium carbonate and hydrochloric acid are solutions

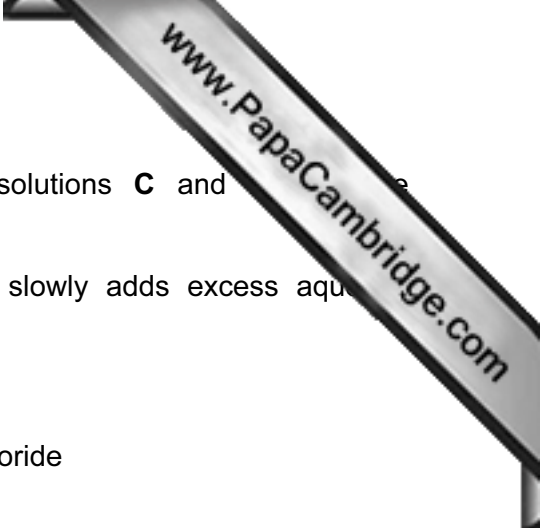
and [1]

- (ii) To identify which solution is which, the students add a little dilute sulfuric acid to separate samples of the solutions named in (a)(i).

Describe the observations when sulfuric acid is added to

sodium carbonate,

hydrochloric acid. [2]



(b) The students study Table 2.1 again and deduce that solutions C and D are copper(II) chloride and sodium hydroxide.

To identify which solution is which, one of the students slowly adds excess aqueous ammonia, to separate samples of the solutions.

State the expected observations of both solutions.

observations of excess aqueous ammonia with copper(II) chloride

.....
.....

observations of excess aqueous ammonia with sodium hydroxide

.....
.....

[3]

(c) The other two solutions must be zinc sulfate and barium chloride.

One student suggests using hydrochloric acid to distinguish between zinc sulfate and barium chloride.

(i) Explain why this would not distinguish between zinc sulfate and barium chloride.

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

(ii) Name another acid that would distinguish between zinc sulfate and barium chloride.

Record the expected observations for each solution.

acid used

observation with zinc sulfate

.....

observation with barium chloride

.....

[3]

- 3 A student is finding out how the rate of cooling of hot water depends upon the temperature of the water.

He has a beaker of hot water and a thermometer as shown in Fig. 3.1.

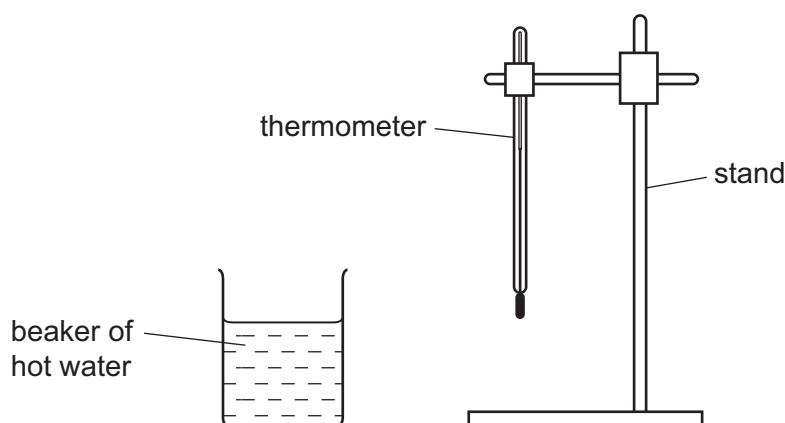


Fig. 3.1

- (a) He carefully places the thermometer into the hot water and measures the temperature, T , of the hot water. He records this value of T in Table 3.1 at time $t = 0$ s and starts the stopwatch.

He records in Table 3.1 the temperature of the water every 60 s until he has a total of nine values, up to a time of 480 s.

Table 3.1

time t/s	temperature $T/^\circ\text{C}$
0	87.0
60	83.0
120	78.0
180	
240	
300	69.0
360	65.5
420	63.0
480	60.5

Read the thermometers in Fig. 3.2 on page 7, which show the temperatures of the water at $t = 180$ s and $t = 240$ s, and record the values in Table 3.1. [2]

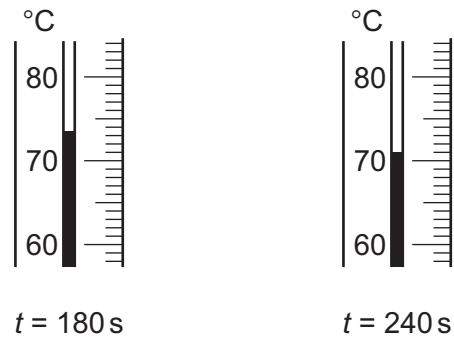
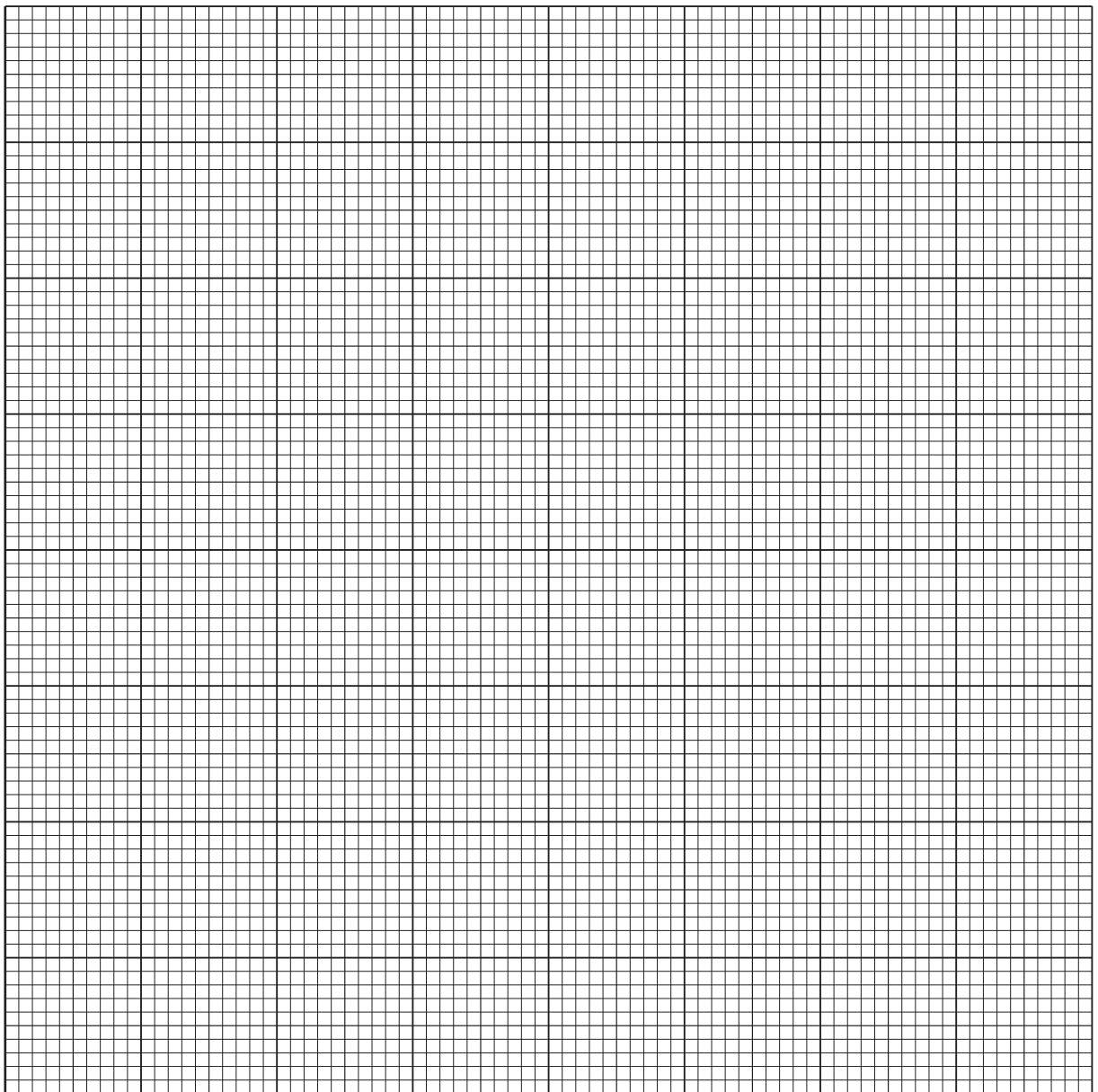


Fig. 3.2

(b) On the grid provided, plot a graph of T (vertical axis) against t .

The vertical axis does not need to start from 0. Draw the best fit curve.



[3]

- (c) (i) Use your graph to calculate the average rate of cooling of the water during the **first** 90 s of cooling. Give your answer to an appropriate number of significant figures.

Use the equation

$$\text{average rate of cooling} = \frac{\text{temperature fall}}{\text{time taken}}$$

average rate of cooling during the **first** 90 s = °C/s [2]

- (ii) Use your graph to calculate the average rate of cooling of the water during the **last** 90 s of cooling. Use the same equation that you used in (c)(i). Give your answer to an appropriate number of significant figures.

average rate of cooling during the **last** 90 s = °C/s [1]

- (d) Suggest **two** factors, other than a different initial temperature, which would change the rate of cooling of the water in the experiment.

factor 1

.....

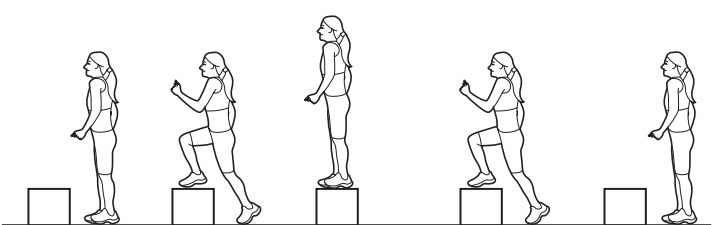
factor 2

..... [2]

Please turn over for Question 4.

- 4 A teacher asked the class to investigate the effect of exercise on pulse rate. Their instructions are shown in Fig. 4.1.

The Step Test



- 1 Do "step exercise" continuously for 4 mins.
- 2 Rest for 1 min and measure your pulse rate for 15 sec.
- 3 Rest for 45 secs and measure your pulse rate for 15 secs.
- 4 Rest for 45 secs and measure your pulse rate for 15 secs.
- 5 Calculate your **total number of beats** for the 3 mins.
- 6 Calculate your Aerobic fitness rating.

Fig. 4.1

- (a) What is the effect of exercise on heart rate?

..... [1]

- (b) A student filled in her results in Table 4.1.

Table 4.1

time after exercise / min	number of beats in 15 seconds	pulse rate / beats per min
1	26	
2	20	
3	18	

- (i) For each pulse measurement, calculate the pulse rate in beats per minute and record these values in Table 4.1. [2]

- (ii) The pulse rate calculation can be used to estimate the 'total beats' over the three minute period. This is done by adding together the values in the final column of Table 4.1.

Estimate the 'total beats' in this student's experiments.

estimated 'total beats' = [1]

(c) The aerobic fitness, **F**, of a person can be determined using the formula below

$$F = \frac{24000}{\text{'total beats'}}$$

Fitness ratings are linked to values of **F**, as shown in Table 4.2.

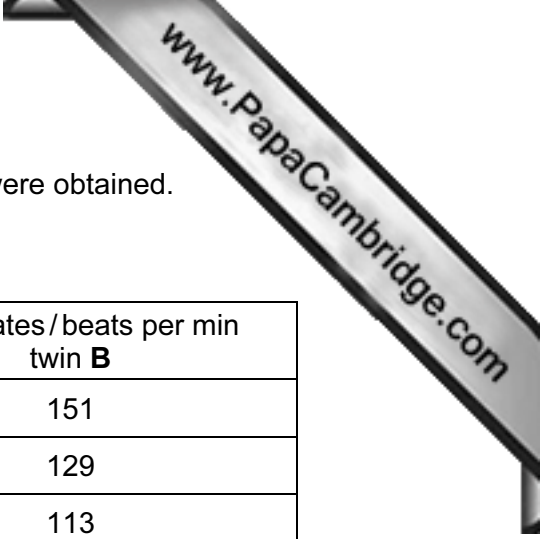
Table 4.2

F	fitness rating
60 or less	poor
61 to 70	average
71 to 80	very good
greater than 81	excellent

Use the formula to calculate **F** for this student and hence give her a fitness rating.

$$F = \dots\dots\dots$$

$$\text{fitness rating} = \dots\dots\dots [2]$$



(d) In an experiment with identical twins the results in Table 4.3 were obtained.

Table 4.3

	pulse rates / beats per min twin A	pulse rates / beats per min twin B
1 min	157	151
2 min	126	129
3 min	117	113

(i) Calculate the ‘total number of beats’ for each twin over the three minutes.

‘total number of beats’ for twin **A** =

‘total number of beats’ for twin **B** = [1]

(ii) Using your values for the ‘total number of beats’ and the equation for **F** from part (c), deduce the fitness rating for each of the twins.

fitness rating for twin **A** =

fitness rating for twin **B** = [1]

(iii) Twin **B** says to twin **A** ‘I’m fitter than you’.

Twin **A** replies ‘You’re not really fitter than I am’.

Comment on these statements.

.....

 [2]

Please turn over for Question 5.

5 A student is investigating the solubility of potassium nitrate.

- She places 100 cm³ water into a beaker.
- She measures out a number of 20 g portions of potassium nitrate.
- She places one 20 g portion of potassium nitrate into the water and stirs.
- She looks carefully and sees that all the potassium nitrate has dissolved.
- She adds another 20 g portion of potassium nitrate and stirs. Not all the potassium nitrate dissolves, so she gently warms the beaker.
- When all the potassium nitrate has dissolved, she stops heating and allows the beaker to cool. She measures the temperature when the first crystals appear and records this temperature in Table 5.1.
- She adds another 20 g portion of potassium nitrate to the beaker, stirs and warms until it has all dissolved. She stops heating and allows it to cool, recording, in Table 5.1, the temperature when the first crystals appear.

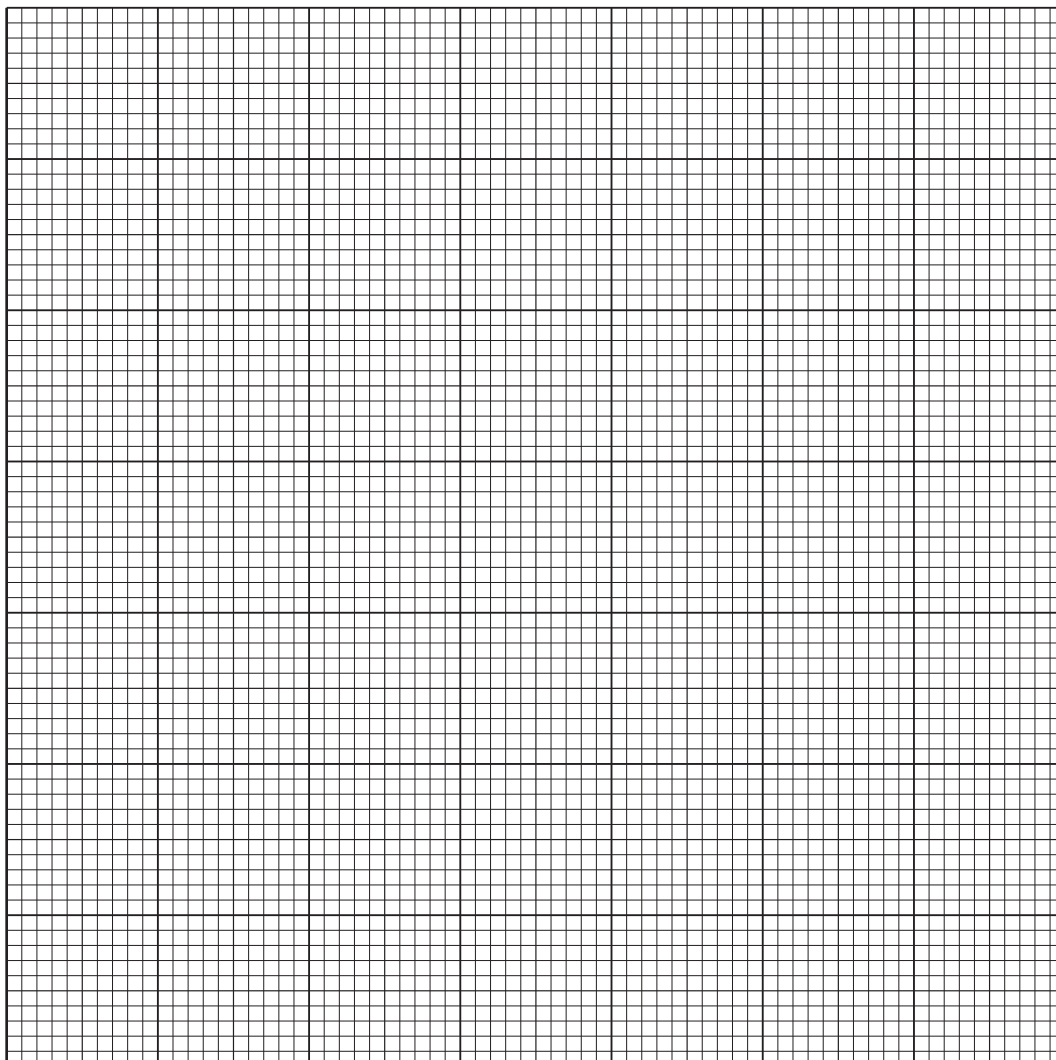
Table 5.1

mass of potassium nitrate added / g per 100 cm ³ water	temperature when first crystals appear / °C
40	24
60	37
80	48
100	55
120	62
140	67

- (a) (i) Use the grid provided to plot a graph of **mass of potassium nitrate dissolved** (vertical axis) against **temperature**.

Start both axes at zero.

Draw the best fit curve.

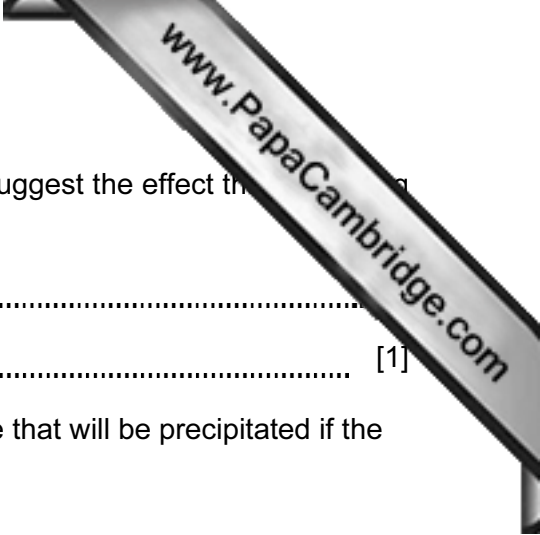


[4]

- (ii) Extend your curve until it cuts the vertical axis and predict how much potassium nitrate would remain dissolved in 100 cm^3 water when it is cooled to 0°C .

Show how you do this on the graph.

..... g [2]



(iii) The solution of potassium nitrate at 0 °C is still a liquid. Suggest the effect that potassium nitrate has on the freezing point of water.

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

(iv) Use your graph to calculate the mass of potassium nitrate that will be precipitated if the saturated solution was cooled from 65 °C to 25 °C.

Show your working on the graph.

..... g [2]

(b) In carrying out the experiment the student warmed the mixture to dissolve the potassium nitrate and recorded the temperature at which the first crystals appeared as it cooled down.

Suggest a reason why the student does not record the temperature at which the potassium nitrate dissolves as she warms the beaker up.

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

Please turn over for Question 6.

- 6 A student is using a variable resistor to see how the current and potential difference across a lamp and the brightness of a lamp changes when the resistance changes.

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

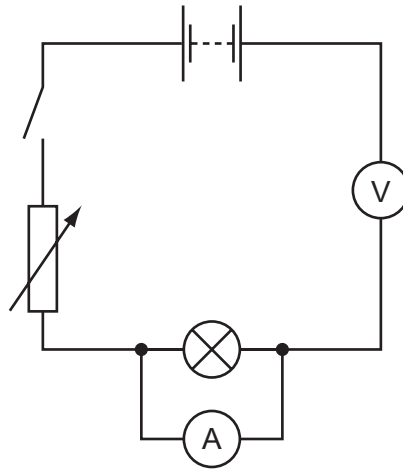


Fig. 6.1

The teacher points out that the student has made three mistakes in setting up the circuit and corrects the circuit for him.

- (a) (i) Draw the diagram showing the teacher's circuit.

[3]

- (ii) Using the correct circuit he turns the variable resistor to a medium setting. He closes the switch and reads the values on the ammeter and voltmeter.

Use the diagrams in Fig. 6.2 to read and record in Table 6.1 the current and potential difference shown. Record your answers to two decimal places.

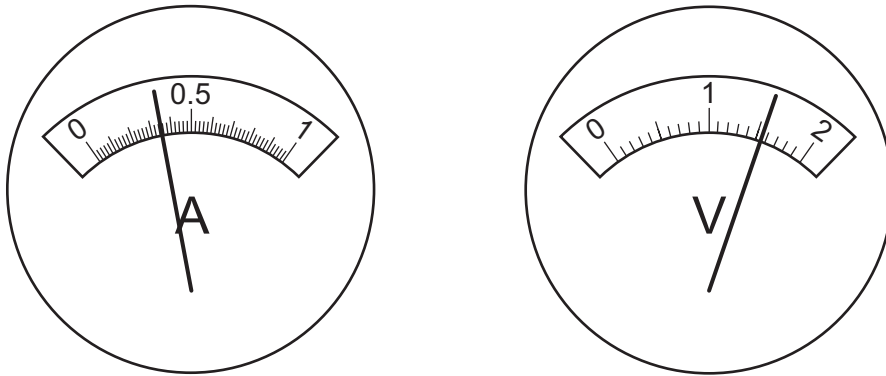


Fig. 6.2

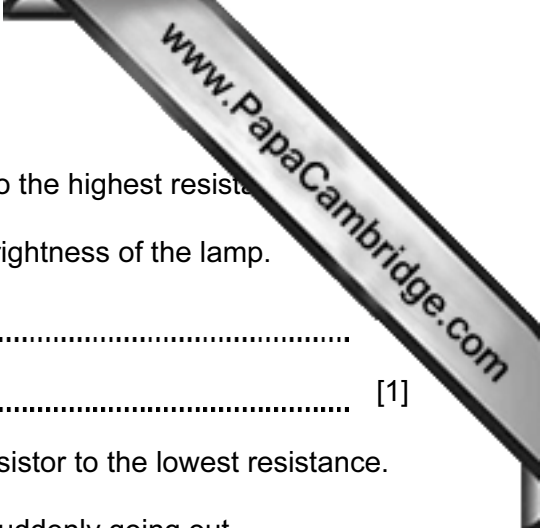
[2]

Table 6.1

ammeter reading / A	voltmeter reading / V

- (iii) Use your values in Table 6.1 to calculate the resistance of the lamp. State the correct unit.

resistance unit [2]



(b) (i) The student changes the setting on the variable resistor to the highest resistance.
State what will happen to the ammeter reading and the brightness of the lamp.

ammeter reading
brightness of the lamp [1]

(ii) The student slowly changes the setting on the variable resistor to the lowest resistance.
He sees the lamp getting brighter and brighter and then suddenly going out.
Suggest explanations for these observations.

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

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