CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

**CO-ORDINATED SCIENCES** 0654/63

Paper 6 Alternative to Practical **May/June 2015**

**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 is investigating respiration in yeast cells.

She uses the indicator methylene blue to measure the rate of respiration. A solution of methylene blue is decolourised when oxygen is removed by respiration.

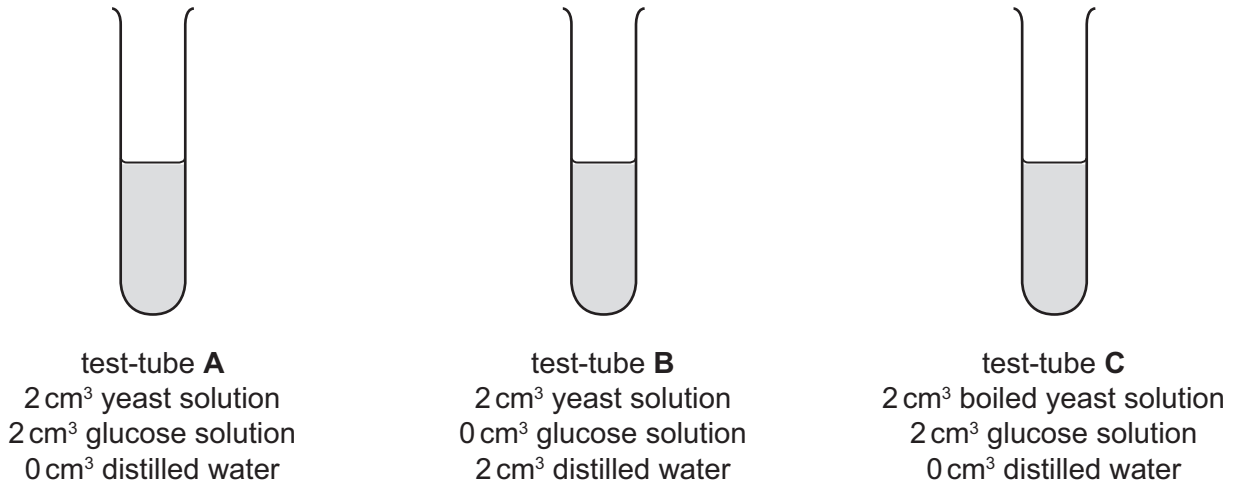She sets up three test-tubes labelled **A**, **B** and **C** as shown in Fig. 1.1.



test-tube **A**
2 cm³ yeast solution
2 cm³ glucose solution
0 cm³ distilled water

test-tube **B**
2 cm³ yeast solution
0 cm³ glucose solution
2 cm³ distilled water

test-tube **C**
2 cm³ boiled yeast solution
2 cm³ glucose solution
0 cm³ distilled water

**Fig. 1.1**

- She places the three test-tubes in a water bath at 35 °C for 5 minutes.

- She adds 2 cm³ methylene blue indicator to each test-tube.

- She starts a stopclock.

- She observes the colour of each test-tube each minute for 6 minutes.

**Results**

The indicator in test-tube **A** decolourised at 2 minutes.
The indicator in test-tube **B** decolourised at 5 minutes.
There is no change in test-tube **C**.

**(a)** Explain why there is no change in test-tube **C**.

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**(b)** Use all the information given above to complete the heading for column 1 and the observations in Table 1.1 on page 3.

**Table 1.1**

|  | colour in test-tube **A** | colour in test-tube **B** | colour in test-tube **C** |
|---|---|---|---|
| 1 | blue | blue | blue |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |

[4]

**(c) (i)** Explain why distilled water is added to test-tube **B**.

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**(ii)** Describe and explain the difference in results for test-tubes **A** and **B**.

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**(d)** She removes test-tube **A** from the water bath and shakes it vigorously until it froths.

Describe and explain what you would expect to observe.

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**2** A student is given a sample of a solid **D**.

She is told that it contains the three ions $Fe^{2+}$, $NH_4^+$ and $SO_4^{2-}$.

**(a)** Describe a procedure that she can carry out to show that solid **D** contains $Fe^{2+}$ ions.

Name any chemicals used and state the observations expected.

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**(b)** The student is given pieces of red and blue litmus paper.

Describe how she can use these pieces of litmus paper to show that solid **D** contains the $NH_4^+$ ion.

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**(c)** Describe a procedure that the student can carry out to show that solid **D** contains the $SO_4^{2-}$ ion.

Name any chemicals used and state the expected observations.

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**Please turn over for Question 3.**

 **[Turn over**

**3** A student is investigating the resistance of lamps arranged in different ways in electrical circuits.
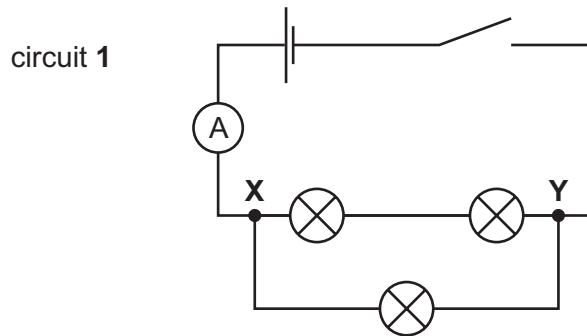
She sets up circuit **1** as shown in Fig. 3.1.

circuit **1**

**Fig. 3.1**

**(a)** On Fig. 3.1, draw the symbol for a voltmeter correctly connected to measure the potential difference between point **X** and point **Y**. [2]

- The student connects the voltmeter into the circuit to measure the potential difference between point **X** and point **Y**.

- She closes the switch.

- She measures, and records in Table 3.1, the potential difference $V$ and the current $I$.

- She opens the switch.

She reconnects the lamps between point **X** and point **Y**, in circuit **2** as shown in Fig. 3.2. The voltmeter is connected in the same place.

She records the new $V$ and $I$ in the next row of Table 3.1.
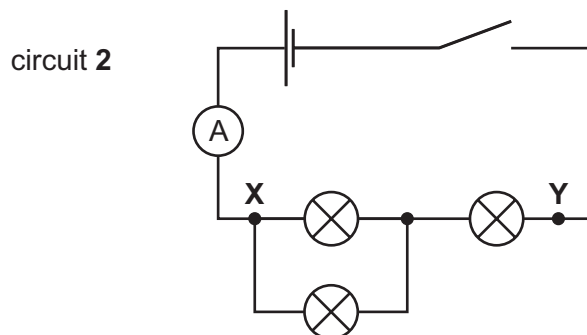
circuit **2**

**Fig. 3.2**

She reconnects the lamps between **X** and **Y** to make circuit **3** as shown in Fig. 3.3.
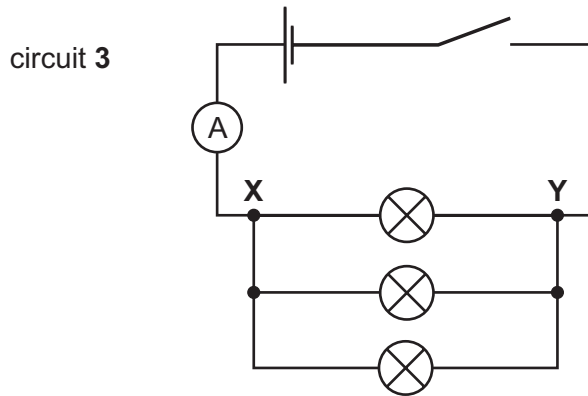
circuit **3**



**Fig. 3.3**

**(b) (i)** Read and record in the last row of Table 3.1 the values of $V$ and $I$ shown in Fig. 3.4.   [2]
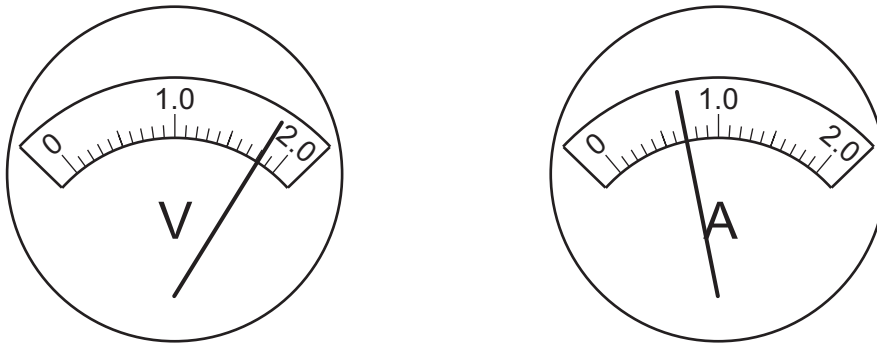


**Fig. 3.4**

**(ii)** Complete the column headings in Table 3.1 to show the units.   [1]

**Table 3.1**

| circuit | $V$/................. | $I$/................. | $R$/................. |
|---------|-----------|-----------|-----------|
| **1** | 1.72 | 0.44 | |
| **2** | 1.76 | 0.22 | |
| **3** | | | |

**(iii)** Calculate, and record in Table 3.1, the total resistance $R$ of the lamps in each of the circuits. Use the equation

$$R = \frac{V}{I}$$

[2]

**(c)** The teacher makes the following suggestion.

"If each lamp has the same resistance, the total resistance of the lamps in circuit **1** should be twice the total resistance of the lamps in circuit **3**."

State whether the results in Table 3.1 support the teacher's suggestion.

Justify your statement by using the values of $R$ you have calculated.

statement ...................................................................................................................................

justification ...............................................................................................................................

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[2]

**(d)** A student observes that the lamps in circuit **1** have different brightness.

Suggest how this might have affected the results of this experiment.

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**4** A student carries out an experiment to investigate the effect of temperature on the activity of the enzyme pepsin.

Pepsin breaks down protein in the stomach.

The activity of pepsin can be measured by timing how long it takes to break down a cloudy protein solution into a clear solution.

- The student places $5.0\,cm^3$ of the protein solution into a test-tube and adds $1.0\,cm^3$ hydrochloric acid.

- He places $1.0\,cm^3$ of pepsin solution into another test-tube.

- He places both test-tubes into a water-bath at 35 °C for five minutes.

- He then pours the pepsin solution into the protein solution and times how long it takes for the contents of the tube to go clear.

- He records this time in Table 4.1.

- He repeats this procedure for the different temperatures as shown in Table 4.1.

The thermometer reading for the last temperature used is shown in Fig. 4.1.
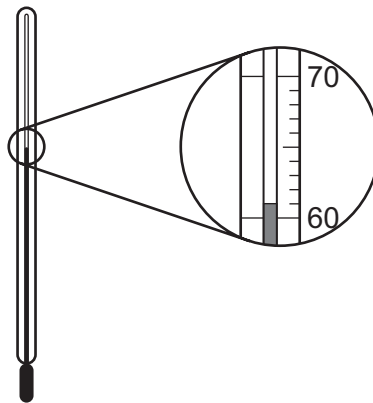


**Fig. 4.1**

**(a) (i)** Read the thermometer in Fig. 4.1 and record the value in the last row of Table 4.1 on page 10. [1]

The stopwatch reading for the final temperature used is shown in Fig. 4.2.



**Fig. 4.2**

**Table 4.1**

| temperature / °C | time taken for solution to go clear / s | rate of reaction in $\frac{1}{s}$ |
|---|---|---|
| 35 | 400 | 0.0025 |
| 41 | 175 | 0.0057 |
| 46 | 80 | 0.0125 |
| 52 | 30 | 0.0333 |
| 56 | 120 | 0.0083 |
| | | |

**(ii)** Read the stopwatch and record in Table 4.1 the time shown **in seconds**.

[1]

**(iii)** Complete Table 4.1 by calculating the rate of reaction, $\frac{1}{s}$, for the final temperature.

[1]

**(b) (i)** On the grid provided, plot a graph of rate of reaction against temperature. [2]

Draw the best-fit **curve**.



rate of reaction $\frac{1}{s}$
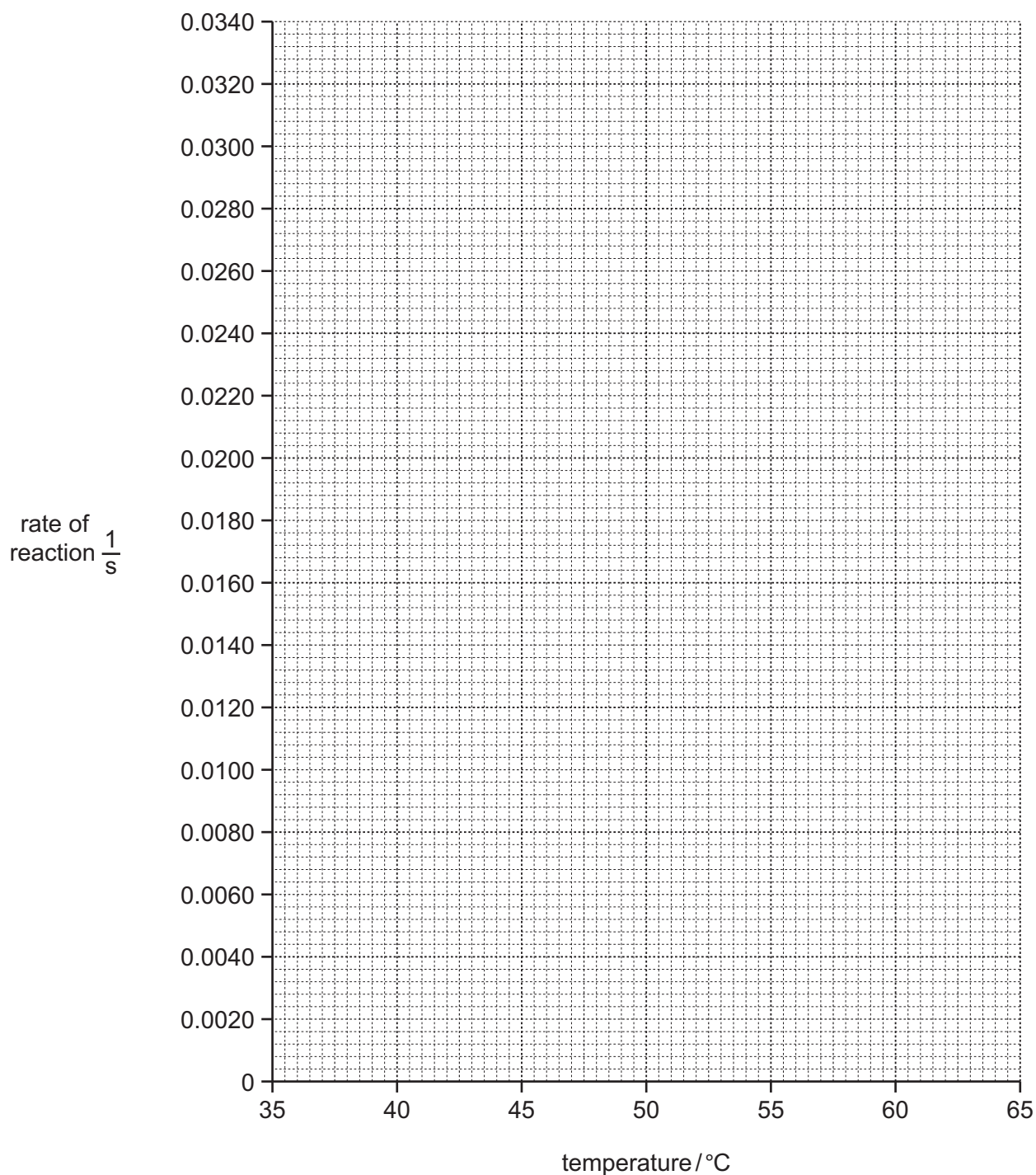
temperature / °C

**(ii)** Use the graph to estimate the optimum temperature for the activity of pepsin.

optimum temperature = ........................................ °C [1]

(iii) Explain why you cannot be sure that this is an accurate optimum temperature.

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(c) Describe an experiment to show that acid is required for pepsin to break down protein.

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**Please turn over for Question 5.**

 **[Turn over**

5   A student investigates the electrolysis of brine (salt water).
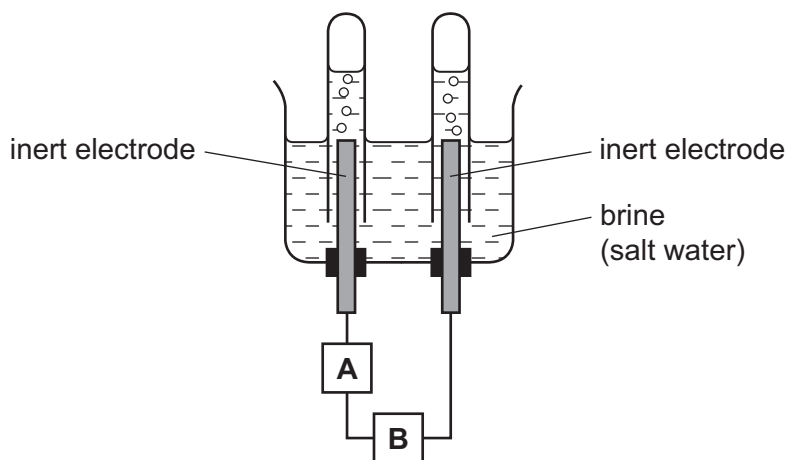
He sets up the apparatus as shown in Fig. 5.1.



**Fig. 5.1**

(a) (i)   Box **A** on Fig. 5.1 represents a piece of apparatus that shows when a current is flowing.

Name this piece of apparatus.

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   (ii)   Box **B** on Fig. 5.1 represents a piece of apparatus that supplies the energy for the experiment.

Draw the **symbol** for this piece of apparatus in the **space below**.

[1]

   (iii)   The electrodes are inert.

Explain what this means and name a material that can be used to make these electrodes.

explanation ...............................................................................................................

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

The ions present in the brine are $Na^+$, $Cl^-$, $H^+$ and $OH^-$.

Gases are produced at both electrodes.

The gas produced at the cathode is colourless.
The gas produced at the anode is a pale yellow/green colour.

The solution that remains is sodium hydroxide.

**(b) (i)** Suggest how the student can use iron(III) sulfate solution to show that the remaining solution is sodium hydroxide.

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

**(ii)** The gas produced at the anode is chlorine.

State the test and result to identify chlorine.

test .......................................................................................................................

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

**(iii)** Use the above information to name the colourless gas and state the test and result you would use to identify it.

name ....................................................................................................

test ....................................................................................................

result .............................................................................................. [3]

6  A student investigates the thermal conduction of five metal rods.

The rods are alloys of aluminium and magnesium. Each rod contains a different percentage of magnesium.

He sets up the apparatus as shown in Fig. 6.1. The student fills the container with hot water and starts the stopclock.

He measures the time taken for the drawing pins to fall off the rods due to the wax melting.

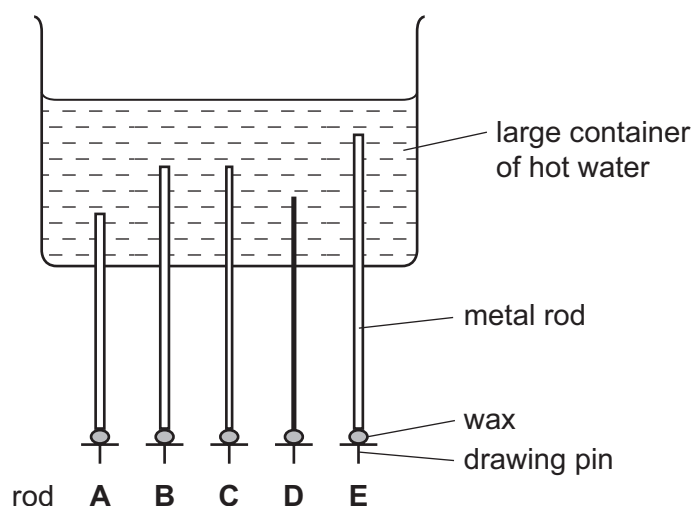He records the times in Table 6.1.



**Fig. 6.1**

**Table 6.1**

| rod | A | B | C | D | E |
|---|---|---|---|---|---|
| percentage magnesium/% | 1 | 2 | 3 | 4 | 5 |
| time for pin to drop/s | 20.5 | 21.5 | 20.0 | | |

Fig. 6.2 shows stopclocks with the times for the pins to drop from rods **D** and **E**.



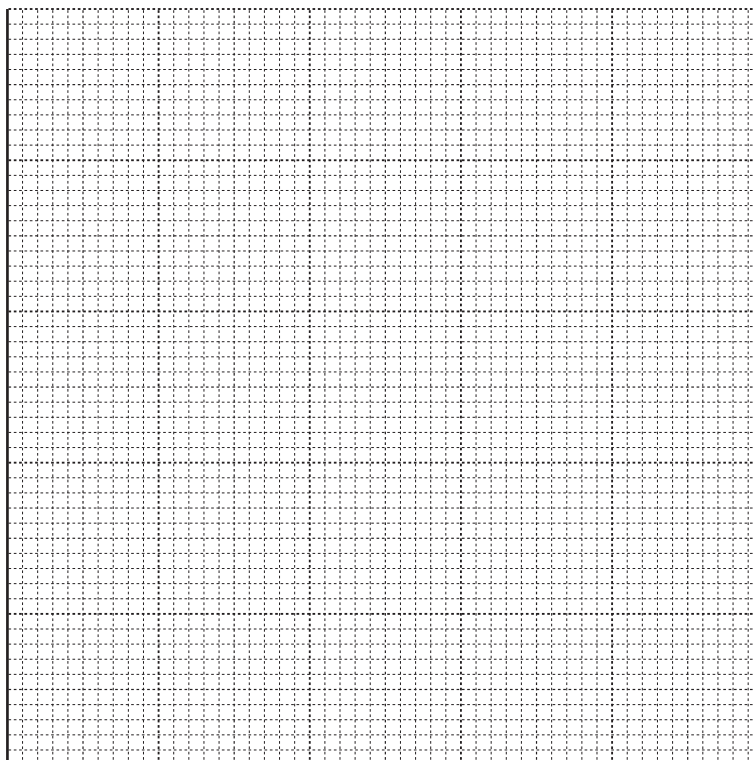rod **D**                              rod **E**
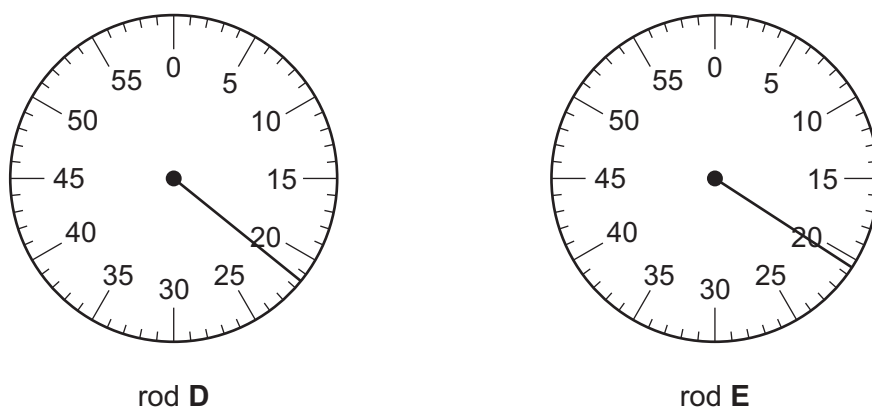
**Fig. 6.2**

**(a) (i)** Read the stopclocks and record the times in Table 6.1. [2]

**(ii)** On the grid provided plot a graph of time (vertical axis) against percentage magnesium in the alloy.

[3]

**(iii)** Use the graph to suggest and explain if there is a correlation between the percentage magnesium in the alloy and the time taken for the pins to fall off.

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**(b)** The teacher says that the results are not very reliable and not very accurate.

Suggest **three** changes the student can make to improve the method.

1 ......................................................................................................................................

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2 ......................................................................................................................................

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3 ......................................................................................................................................

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[3]

**(c)** Explain how **one** of the changes you have given in **(b)** affects the reliability or accuracy.

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

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