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CO-ORDINATED SCIENCES

0654/63

Paper 6 Alternative to Practical

October/November 2017

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 an enzyme-catalysed reaction.

Hydrogen peroxide is broken down by catalase, an enzyme found in living cells such as potato cells. Oxygen gas is released during the reaction.

- The student cuts two cubes without any skin from the same potato of dimensions $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$.
- She places one cube of potato into a test-tube.
- She adds 5 cm^3 of hydrogen peroxide and then starts a stopclock.
- After 2 minutes 30 seconds she measures the distance d from the surface of the liquid to the top of the foam produced, as shown in Fig. 1.1.
- She records this distance, in centimetres, in Table 1.1.
- She repeats the procedure using smaller pieces cut from the second cube of dimensions shown in Table 1.1.

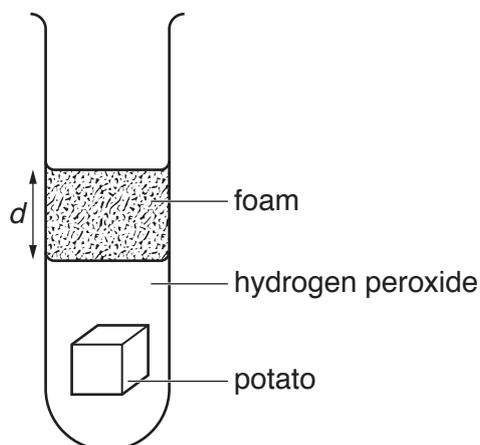


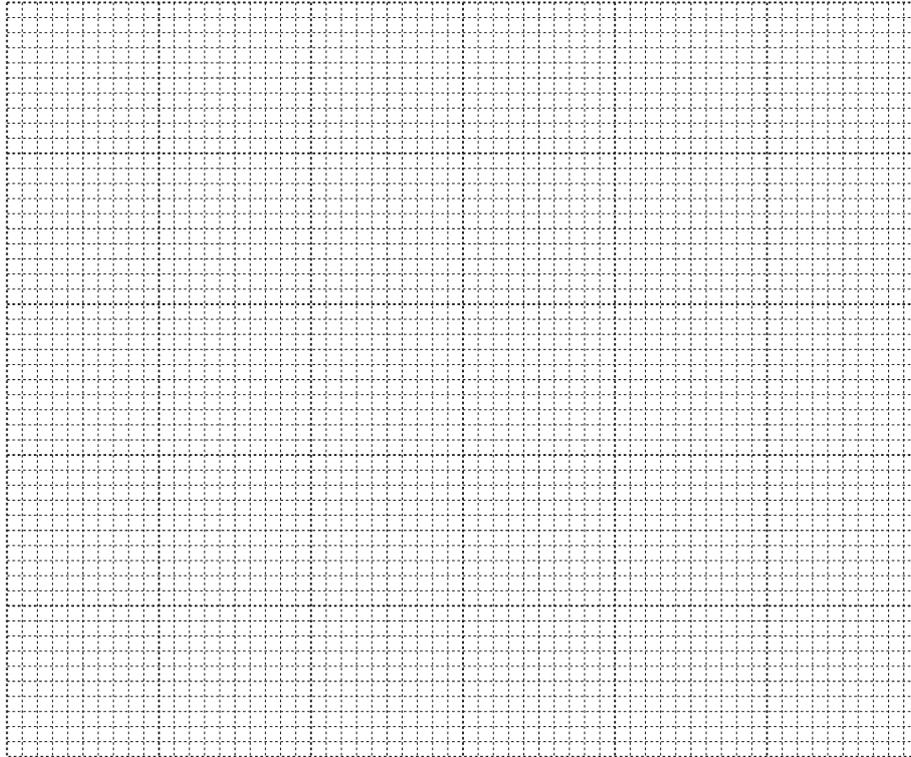
Fig. 1.1

Table 1.1

| dimensions of potato piece /cm | surface area of potato piece /cm ² | distance d /cm |
|-----------------------------------|--|---------------------|
| $1 \times 1 \times 1$ | 6.0 | 1.8 |
| $1 \times 1 \times 0.5$ | 4.0 | 1.1 |
| $1 \times 0.5 \times 0.5$ | 2.5 | 0.8 |
| $0.5 \times 0.5 \times 0.5$ | 1.5 | 0.5 |

- (a) (i) On the grid provided, plot a graph of distance d (vertical axis) against surface area of potato piece.

Draw the best-fit straight line through the origin.



[4]

- (ii) Use your graph to state the relationship between the amount of enzyme and the rate of reaction.

.....[1]

- (iii) Use your graph to predict the distance d for a piece of potato with a surface area of 3.0 cm^2 .

Mark on the graph how you did this.

$d =$ cm [2]

(b) Name **two** variables that should be kept constant in this experiment to make the results as reliable as possible.

variable 1

variable 2

[2]

(c) Describe how you could confirm that the gas produced in this reaction is oxygen.

test

observation

[1]

2 A student carries out reactions with compounds **H** and **J**.

- (a) She connects a hard glass test-tube containing a sample of solid **H** to a sample of limewater. She heats the test-tube containing solid **H** strongly with a Bunsen burner. She disconnects the apparatus before she stops heating.

Her observations are shown.

***H** changes from a white powder to yellow when hot and white again when cool.*

The limewater becomes milky and then colourless.

- (i) Draw a labelled diagram of the apparatus she uses.

[2]

- (ii) Suggest why she disconnects the apparatus before she stops heating.

.....
 [1]

- (iii) State what the student can deduce about the gas produced.

.....
 [1]

- (iv) State what the student can deduce about the anion in **H**.

.....
 [1]

- (v) The student recognises the colour changes of the powder as being a property of zinc oxide.

Suggest the identity of **H**.

H is[1]

- (b) To confirm the identity of the cation in solid **H** as zinc, Zn^{2+} , the student reacts **H** with dilute hydrochloric acid until there is a solution with no solid remaining.

- (i) She splits the solution into two portions.

- To one portion she slowly adds sodium hydroxide solution until it is in excess.
- To the other portion she slowly adds ammonia solution until it is in excess.
- In both cases, a precipitate is seen and this precipitate then dissolves.

State the colour of the precipitate.

.....[1]

- (ii) State the expected observation if the student adds dilute hydrochloric acid slowly to the final solutions in (b)(i).

.....
[1]

- (c) **J** is a potassium salt which is **not** a nitrate.

- (i) Draw a suitable table **and** record the observations the student makes when mixing a solution of **J** with the acidified reagents shown.

- barium nitrate solution giving no visible reaction
- silver nitrate solution giving a yellow precipitate.

- (ii) She places a small volume of a solution of **J** in a test-tube and adds an equal amount of chlorine water.

She then adds a few drops of starch solution.

Her observations are shown.

brown on adding the chlorine water

blue-black colour on adding the starch

Use the observations in (c)(i) and (ii) to make **one** conclusion about the anion in **J**.

conclusion about the anion in **J**

.....[1]

3 A student measures the focal length of a convex lens.

She sets up the apparatus as shown in Fig. 3.1. A metre rule is used for the distances.

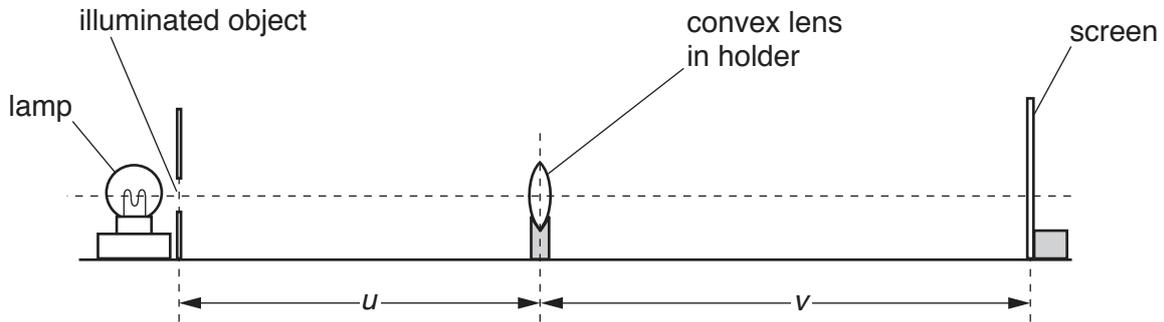


Fig. 3.1

- She switches on the lamp and places the lens a distance $u = 30.0$ cm from the illuminated object.
- She adjusts the position of the screen by moving it backwards and forwards along the bench until a sharp triangular image of the illuminated object is formed on the screen.
- She measures the image distance v from the screen to the lens.

The student repeats this procedure for values of $u = 35.0$ cm, 40.0 cm, 45.0 cm and 50.0 cm.

(a) (i) Fig. 3.2 shows the rule and the positions of the lens and the screen when $u = 30.0$ cm.

Read the scale of the rule and write down the position of the screen in the space provided.

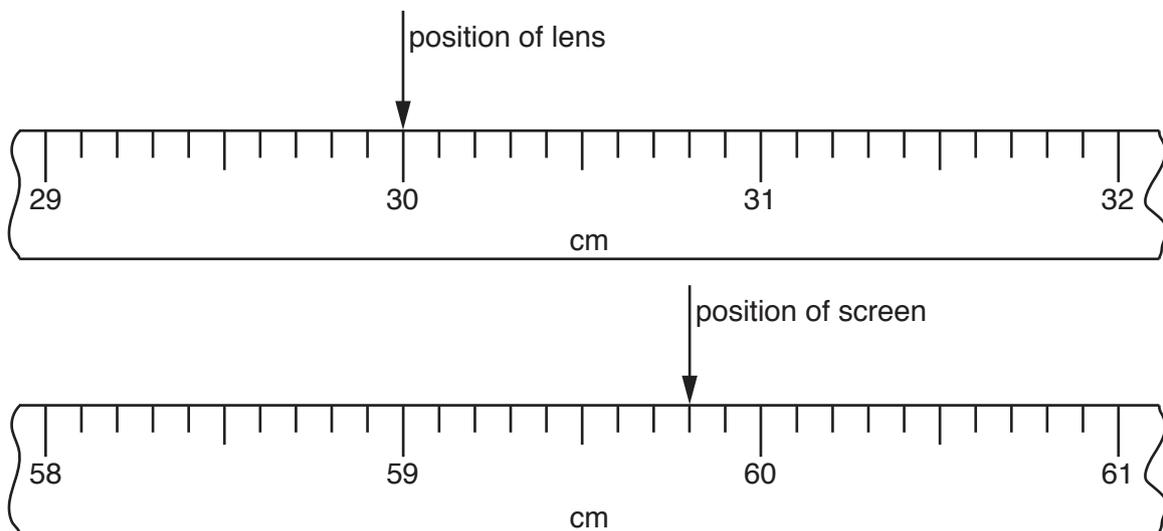


Fig. 3.2

position of lens = 30.0 cm

position of screen = cm [1]

(ii) Use your answer from (a)(i) to calculate the image distance v .

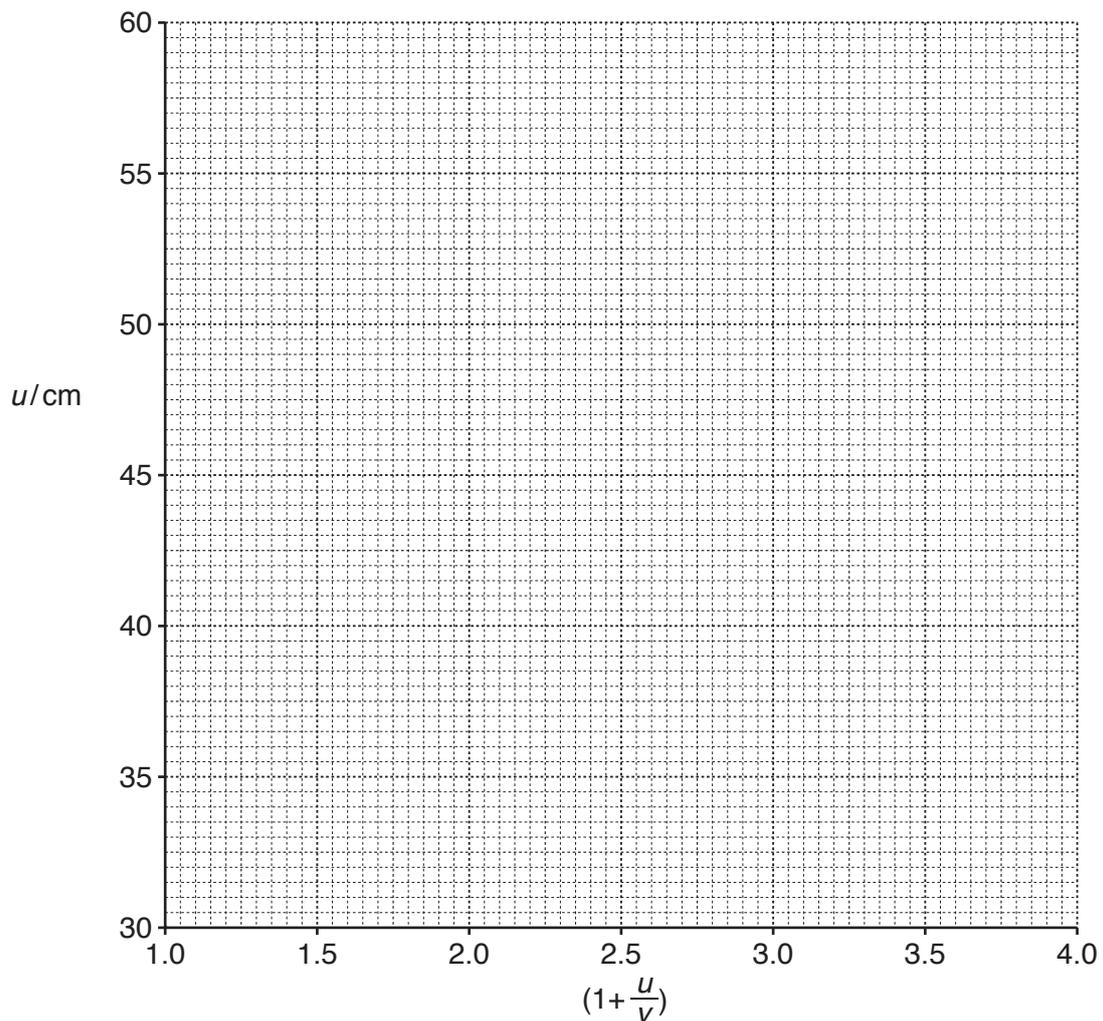
Record your answer in the space provided in Table 3.1.

[1]

Table 3.1

| u/cm | v/cm | $\frac{u}{v}$ | $(1 + \frac{u}{v})$ |
|---------------|---------------|---------------|---------------------|
| 30.0 | | | |
| 35.0 | 26.4 | 1.3 | 2.3 |
| 40.0 | 24.1 | | |
| 45.0 | 22.4 | 2.0 | 3.0 |
| 50.0 | 21.5 | 2.3 | 3.3 |

- (iii) Calculate the missing ratios $\frac{u}{v}$ **and** record these in Table 3.1. [1]
- (iv) Calculate the missing values of $(1 + \frac{u}{v})$ **and** record these in Table 3.1. [1]
- (b) (i) On the grid provided, plot a graph of u (vertical axis) against $(1 + \frac{u}{v})$.
Draw the best-fit straight line.



[2]

(ii) Calculate the gradient of your line.

Show all your working and indicate on your graph the values you chose to enable the gradient to be calculated.

gradient = cm [2]

(iii) The gradient of your graph is equal to the focal length f of the lens.

Write down the value of f to an appropriate number of significant figures.

$f =$ cm [1]

(c) State **one** precaution that you should take in this experiment to obtain accurate results.

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

4 A student investigates the effect of temperature on the growth of seedlings.
 She places five seedlings onto some cotton wool in each of three dishes, **A**, **B** and **C**.
 She keeps dish **A** at 5 °C, dish **B** at 15 °C and dish **C** at 25 °C.

(a) Describe how the student can germinate the seeds to form the seedlings for this experiment.

.....

 [2]

(b) Complete Fig. 4.1 to predict the appearance of the seedlings in each dish after five days.

Dish **B** has been completed for you.

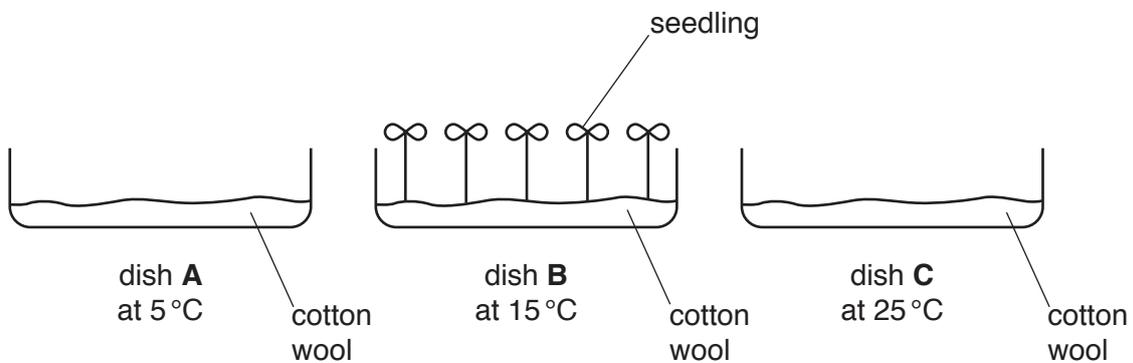


Fig. 4.1

[2]

(c) Describe how the student could test the seedlings for the presence of reducing sugar and state the observation for a positive result.

procedure

.....

observation

[3]

(d) Describe an experiment to show that these seedlings grow towards the light.

In your plan you should include:

- details of the lighting
- a suitable control
- how you would show your results are **not** due to chance.

.....

.....

.....

.....

.....

.....

..... [3]

5 A class is investigating the rusting of iron and steel. Steel is an alloy of iron.

- (a) The teacher places a small sheet of steel on the table. The steel has had any sign of rust removed. He then pours a small amount of water containing phenolphthalein indicator onto the steel. This forms a pool of colourless liquid.

Phenolphthalein is an acid-alkali indicator like litmus.

The colour changes for litmus and phenolphthalein are shown in Table 5.1.

Table 5.1

| indicator | colour in acid | colour in alkali |
|-----------------|----------------|------------------|
| litmus | red | blue |
| phenolphthalein | colourless | pink |

After a few minutes, a pink colour is observed at the edge of the pool of water containing phenolphthalein indicator.

Rusting has begun but at this point there is **no** sign of rust.

- (i) Suggest which type of substance is formed in the early stages of rusting.

.....[1]

- (ii) The teacher now adds water containing a different chemical to a piece of clean steel.

After a short time the teacher tells the class that Fe^{2+} ions have been made.

Suggest what would be seen if these Fe^{2+} ions react with the substance identified in (i).

.....[1]

- (iii) When the steel in (ii) is left for a day, it becomes covered with an orange-brown solid which is insoluble in the pool of water.

Describe how you could prove the presence of Fe^{3+} ions in the orange-brown solid.

.....

[3]

- (b) The students now set up the experiments **H**, **J**, **K** and **L** shown in Fig. 5.1 to investigate the effects of air and water on the rusting of iron.

The air contains water vapour.

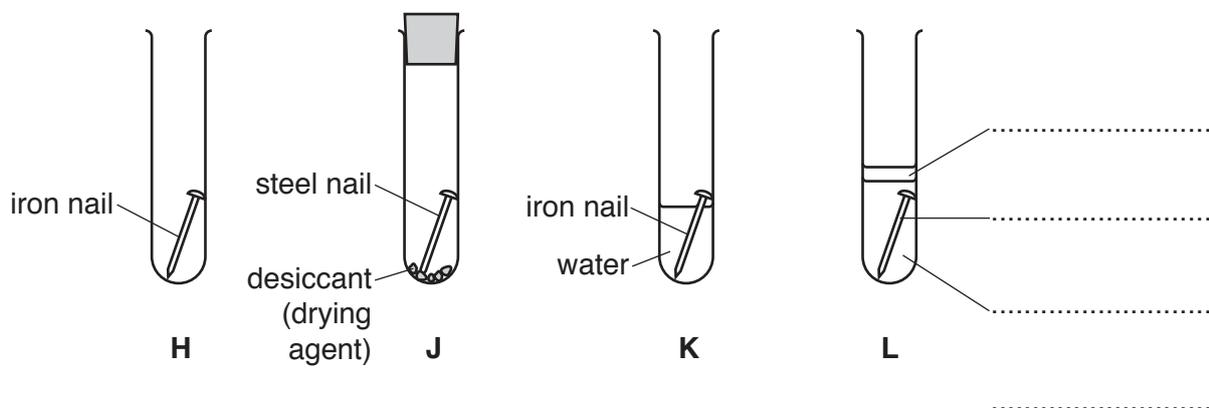


Fig. 5.1

- (i) Complete the labels for test-tube **L**, which is used for studying the effect of water only (no air) on iron. [2]
- (ii) Suggest **one** change to this experiment (test-tubes **H**, **J**, **K** and **L**) that would allow a fairer comparison of the conditions needed for the rusting of iron.

.....
 [1]

- (c) The experiment in Fig. 5.1 is left for a week.

- There is **no** sign of rust on the nails in test-tubes **J** and **L**.
- There is a small amount of rusting on the nail in test-tube **H**.
- There is very noticeable rusting of the nail in test-tube **K**, especially near the surface of the water.

Explain why the result for test-tube **K** is **not** enough to demonstrate that both air and water are required for iron to rust.

You must refer to the other test-tubes in your answer.

.....

 [2]

Please turn over for Question 6.

- 6 A student investigates the force needed to make objects move.

When the force **P** pulling an object is greater than the force **F** resisting the pull, the block moves as shown in Fig. 6.1.

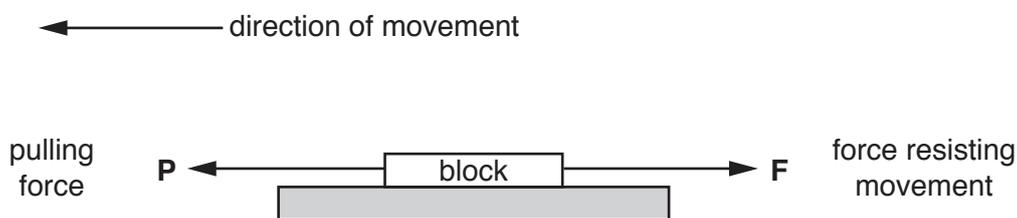


Fig. 6.1

- (a) The student places a block onto a surface, attaches a newton meter and measures the force needed to make the block just move, as shown in Fig. 6.2.

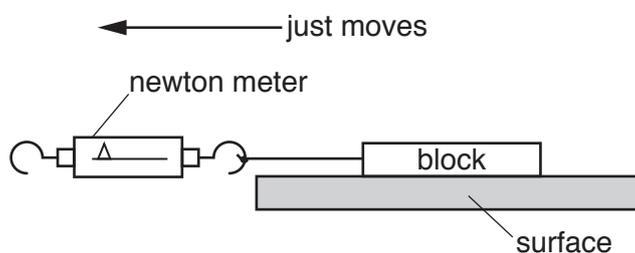


Fig. 6.2

She uses blocks of the same size.

She varies the material of the block and the surface that it sits on.

She records her results in Table 6.1.

Table 6.1

| test number | block | surface | pulling force/N |
|-------------|-----------|---------|-----------------|
| 1 | brick | carpet | 20.8 |
| 2 | aluminium | glass | 3.8 |
| 3 | wood | wood | 5.8 |
| 4 | brick | glass | |
| 5 | aluminium | sand | |
| 6 | brick | wood | 17.5 |
| 7 | wood | sand | 15.6 |
| 8 | brick | sand | 21.6 |

(i) The newton meter readings for two of her tests are shown in Fig. 6.3.

Read the values and record them in Table 6.1.

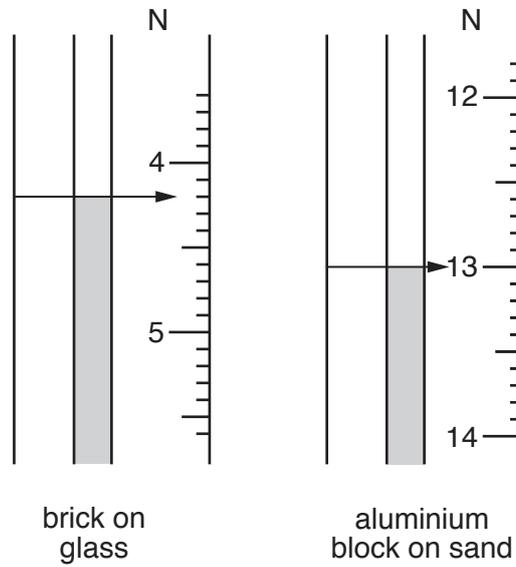


Fig. 6.3

[2]

(ii) The student wants to place all the surfaces she used in order of resistance to movement (friction).

Suggest which test results she should use and explain your choice.

test numbers

explanation

.....

[3]

(iii) Place the surfaces in order of resistance to movement (friction).

most resistant to movement

.....

.....

least resistant to movement

[1]

(b) Explain why each test should have been repeated three times **and** the average pulling force calculated.

.....

.....[1]

- (c) The student says that a road surface should be made of a material with a small resistance to movement so that a car uses less petrol.

The teacher says that this would be unsafe.

Explain the teacher's answer.

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

- (d) On some steep hills there are safety tracks (called escape lanes) at the side of the road, as shown in Fig. 6.4.

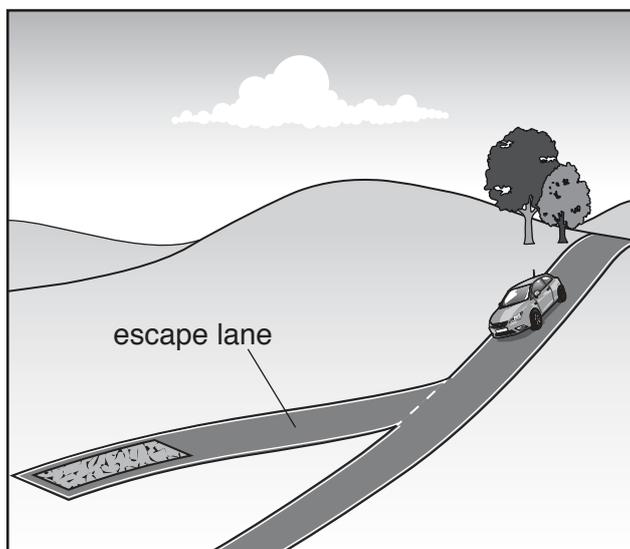


Fig. 6.4

If a car is going too fast and the driver cannot brake strongly enough to stop the car, then he can drive onto the escape lane. The escape lane slows down the car quickly and brings it to a stop.

Suggest a suitable material for the surface of the escape lane and explain your answer.

surface

explanation

.....

[2]

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