

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GCSE**

**TWENTY FIRST CENTURY SCIENCE**

**A182/01**

**PHYSICS A**

**Modules P4 P5 P6 (Foundation Tier)**

**THURSDAY 13 JUNE 2013: Morning**

**DURATION: 1 hour**

**plus your additional time allowance**

**MODIFIED ENLARGED 24pt**

|                               |  |                              |  |
|-------------------------------|--|------------------------------|--|
| <b>Candidate<br/>forename</b> |  | <b>Candidate<br/>surname</b> |  |
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|                          |  |  |  |  |  |                             |  |  |  |  |
|--------------------------|--|--|--|--|--|-----------------------------|--|--|--|--|
| <b>Centre<br/>number</b> |  |  |  |  |  | <b>Candidate<br/>number</b> |  |  |  |  |
|--------------------------|--|--|--|--|--|-----------------------------|--|--|--|--|

**Candidates answer on the Question Paper.  
A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**

**Insert for Question 3**

**OTHER MATERIALS REQUIRED:**

**Pencil**


**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. HB pencil may be used for graphs and diagrams only.**
- **Answer ALL the questions.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**

## **INFORMATION FOR CANDIDATES**

- **Your quality of written communication is assessed in questions marked with a pencil ().**
- **A list of useful relationships is printed on pages 4–6.**
- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **The total number of marks for this paper is 60.**
- **Any blank pages are indicated.**

# **TWENTY FIRST CENTURY SCIENCE EQUATIONS**

## **USEFUL RELATIONSHIPS**

### **THE EARTH IN THE UNIVERSE**

$$\text{distance} = \text{wave speed} \times \text{time}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

### **SUSTAINABLE ENERGY**

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

# EXPLAINING MOTION

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved in the direction of the force}$$

$$\text{amount of energy transferred} = \text{work done}$$

$$\text{change in gravitational potential energy} = \text{weight} \times \text{vertical height difference}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

## **ELECTRIC CIRCUITS**

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

## **RADIOACTIVE MATERIALS**

$$\text{energy} = \text{mass} \times [\text{speed of light in a vacuum}]^2$$

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## **Answer ALL the questions.**

### **1 Read the following article.**

**Some cancers are treated with a form of radiation therapy called brachytherapy. A small piece of material that is radioactive is placed inside a tumour. The radioactive material then decays, releasing ionising radiation that destroys the tumour.**

- (a) (i) Write down words or phrases FROM THE ARTICLE that mean the following:**

**breaks down over time**

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**produces ionising radiation**

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**[2]**

**(ii) The three types of ionising radiation from radioactive materials travel different distances.**

**Write ALPHA, BETA and GAMMA in the boxes opposite to show how far each type of ionising radiation travels through the body.**

**[1]**

| travels the SHORTEST distance |  | → travels the GREATEST distance |
|-------------------------------|--|---------------------------------|
|                               |  |                                 |

**(b) (i) Which two statements explain why the ionising radiation “destroys the tumour”?**

**Put ticks (✓) in the boxes next to the TWO best answers.**

**Ionising radiation**

**can break molecules into bits.**

☐

**gets stronger over time.**

☐

**is produced from the electrons in atoms.**

☐

**can be destroyed using acid.**

☐

**kills living cells.**

☐

**[2]**

**(ii) Which statement explains why the radioactive material decays at the same rate both inside and outside the body?**

**Put a tick (✓) in the box next to the correct answer.**

**The movement of the body speeds up the decay.** ☐

**The heat from the body increases the radioactivity.** ☐

**The decay is not affected by chemicals in the body.** ☐

**The body shields the radioactive material from light.** ☐

**[1]**

**(c) Which of the following is NOT another use for ionising radiation?**

**Put a tick (✓) in the box next to the correct answer.**

**to sterilise food**

☐

**as a tracer in the body**

☐

**to sterilise surgical  
instruments**

☐

**to send messages from  
mobile phones**

☐

**[1]**

**(d) For brachytherapy to be effective:**

**the radioactive material must remain in the tumour long enough for the tumour to be destroyed**

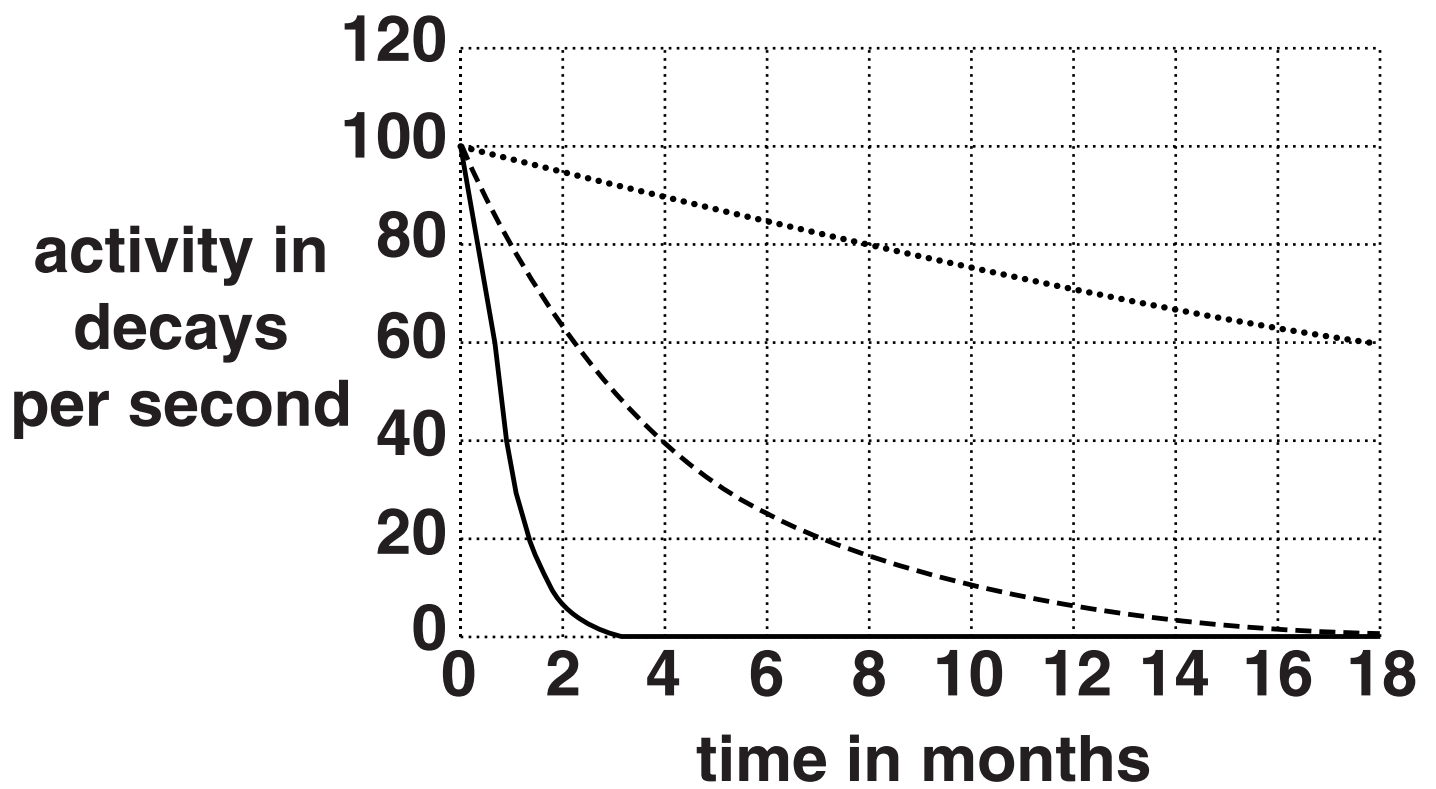
**the activity must be low after that time.**

**One particular tumour will have to be treated for 6 months to be destroyed.**

**A doctor has a choice of three different substances to treat the tumour.**

**Each substance gives out the same type of radiation.**

— substance 1  
--- substance 2  
..... substance 3





**Which substance should the doctor use to treat this tumour?**

**Justify your answer.**

**substance** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ **[3]**

- (e) (i) Denis wants to know if he should have brachytherapy for a cancer in his prostate gland.**

**He finds the following information:**

**the therapy is successful in most cases**

**2 out of 125 patients in a study who had brachytherapy for prostate cancer went on to develop a cancer in a nearby organ as well.**

**Denis decides to go ahead with the therapy.**

**Suggest why he came to this conclusion, using this information.**

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**[3]**

- (ii) When doing his research, Denis finds information about the dose (in sieverts) from different treatments.**

**Which of the following statements explains what ‘dose (in sieverts)’ means?**

**Put a tick (✓) in the box next to the correct answer.**

**a measure of the possible harm to the body from radiation**

☐

**how many cells are ionised by a source**

☐

**the number of particles in a radioactive sample**

☐

**[1]**

**[TOTAL: 14]**

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## **2 Nuclear power today is generated by nuclear fission.**

**Some scientists believe that in the future, nuclear FUSION will be a major source of energy.**

**Use the structure of the atom to explain the process of nuclear fusion.**

**You may use the blank space to draw a diagram to help your explanation.**



**The quality of written communication will be assessed in your answer.**

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**[6]**

**[TOTAL: 6]**

### **3 Look at the graphs on the insert.**

**Anita is investigating three different electrical components, A, B and C.**

**(a) She changes the temperature of each component and measures the resistance.**

**She then changes the amount of light on each component and measures the resistance.**

**(i) Use the data to decide what each component is.**

**Draw straight lines on the opposite page to link each COMPONENT to its TYPE, and each TYPE to its SYMBOL. [4]**



**COMPONENT**

**A**

**B**

**C**

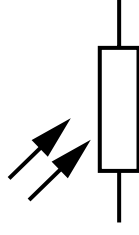
**TYPE**

**fixed resistor**

**LDR**

**thermistor**

**SYMBOL**



**(ii) Use the data to decide whether each statement about Anita's experiment is TRUE, FALSE or you CANNOT TELL.**

**Put ticks (✓) in the correct boxes.**

|   | <b>true</b> | <b>false</b> | <b>cannot tell</b> |
|---|-------------|--------------|--------------------|
| <b>Anita repeated her experiment three times.</b> |             |              |                    |
| <b>Anita had an outlier in her results.</b>       |             |              |                    |

**[2]**

- (b) (i) Anita measured the voltage and current of component A.**

**She used a 6V power supply. The current through the component was 0.06 A.**

**Calculate the resistance of the component.**

**Show your working.**

**resistance = \_\_\_\_\_  $\Omega$  [2]**

**(ii) Later, Anita used component A to find an unknown temperature.**

**The resistance of component A was  $200\ \Omega$ .**

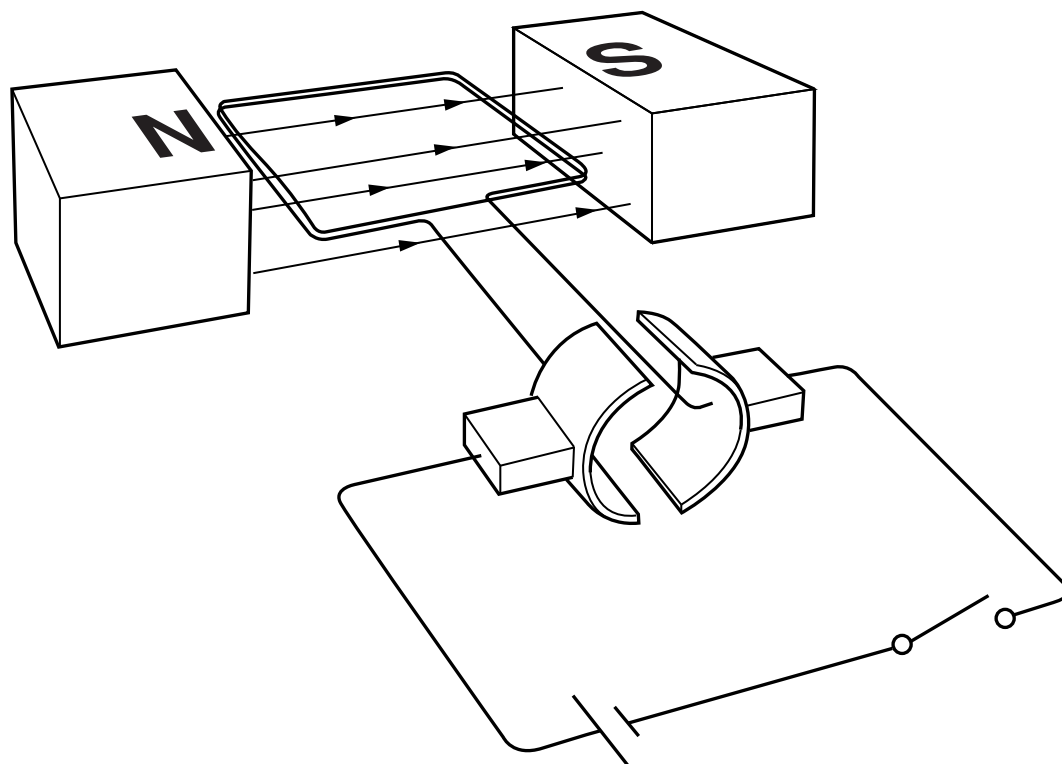
**Use Graph 1 to find the unknown temperature.**

**temperature = \_\_\_\_\_  $^{\circ}\text{C}$  [1]**

**[TOTAL: 9]**

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**4 The diagram shows the main features of a motor.**



**Add labels to the diagram and use it to explain how a motor works.**



**The quality of written communication will be assessed in your answer.**

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[6]

[TOTAL: 6]

**5 (a) Alice has a new toy.**

**It uses an electrostatic effect to make it 'fly'.**

**The toy has three parts: a plastic tray, a plastic 'flyer' and a cloth.**

**She rubs the flyer with the cloth.**

**She rubs the tray with the cloth.**

**The flyer hovers above the tray.**

**Explain why rubbing the tray and the flyer makes the flyer hover above the tray.**

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**[3]**



**(b) Static electricity is different from current electricity.**

**Complete the table to show whether each statement applies to STATIC ELECTRICITY, CURRENT ELECTRICITY or BOTH.**

**Put a tick (✓) in the one correct box in each row.**

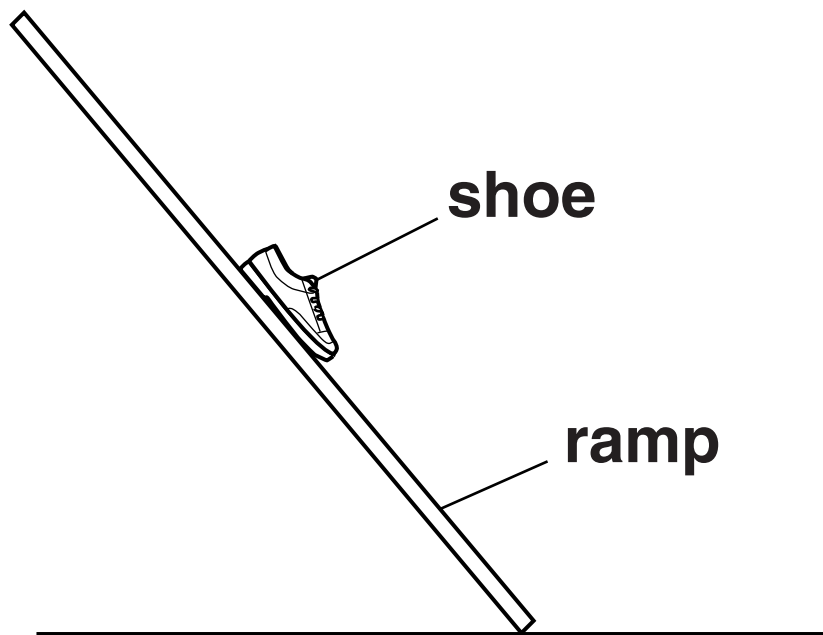
|   | <b>Static<br/>electricity</b> | <b>Current<br/>electricity</b> | <b>Both</b> |
|---|-------------------------------|--------------------------------|-------------|
| <b>involves<br/>electrons</b>                     |                               |                                |             |
| <b>involves a<br/>flow of charge</b>              |                               |                                |             |
| <b>requires a<br/>power supply<br/>or battery</b> |                               |                                |             |
| <b>involves<br/>charged<br/>insulators</b>        |                               |                                |             |

**[3]**

**[TOTAL: 6]**

**6 Ross is doing an experiment with shoes.**

**He places a shoe at the top of a ramp and measures the time it takes the shoe to slide down the ramp.**



**Ross has four different size shoes.**

**He does the experiment three times with each shoe.**

**Here are his results.**

| <b>Shoe size</b> | <b>Time to slide down the ramp in seconds</b> |               |               |
|------------------|---|---------------|---------------|
|                  | <b>Test 1</b>                                 | <b>Test 2</b> | <b>Test 3</b> |
| <b>5</b>         | <b>0.9</b>                                    | <b>1.0</b>    | <b>1.0</b>    |
| <b>7</b>         | <b>1.3</b>                                    | <b>1.2</b>    | <b>1.1</b>    |
| <b>9</b>         | <b>1.4</b>                                    | <b>1.5</b>    | <b>1.4</b>    |
| <b>11</b>        | <b>1.6</b>                                    | <b>1.6</b>    | <b>1.7</b>    |

- (a) Ross measured the distance the shoes slide down the ramp to be 1.8 m.**

**Calculate the average speed of the SIZE 7 shoe down the ramp, and write down the unit.**

**Show your working.**

**speed = \_\_\_\_\_ unit \_\_\_\_\_ [3]**

**(b) (i) Read the statements about his data.**

**Put ticks (✓) in the boxes to show whether each statement is TRUE or FALSE.**

|  | <b>True</b> | <b>False</b> |
|--|-------------|--------------|
| <b>As the shoe size increases, the time taken to slide down the ramp increases.</b>          |             |              |
| <b>As some of the repeats are different, Ross must have made mistakes in his experiment.</b> |             |              |

**[1]**

**(ii) Another student tries to make the same measurements with another ramp and a shoe of size 4.**

**Here are the results.**

| <b>Shoe size</b> | <b>Time to slide down the ramp in seconds</b> |               |               |
|------------------|---|---------------|---------------|
|                  | <b>Test 1</b>                                 | <b>Test 2</b> | <b>Test 3</b> |
| <b>4</b>         | <b>1.2</b>                                    | <b>1.4</b>    | <b>1.3</b>    |

**Ross says: “You must have made a mistake. Your results do not fit my data.”**

**Is Ross correct?**

**Justify your answer.**

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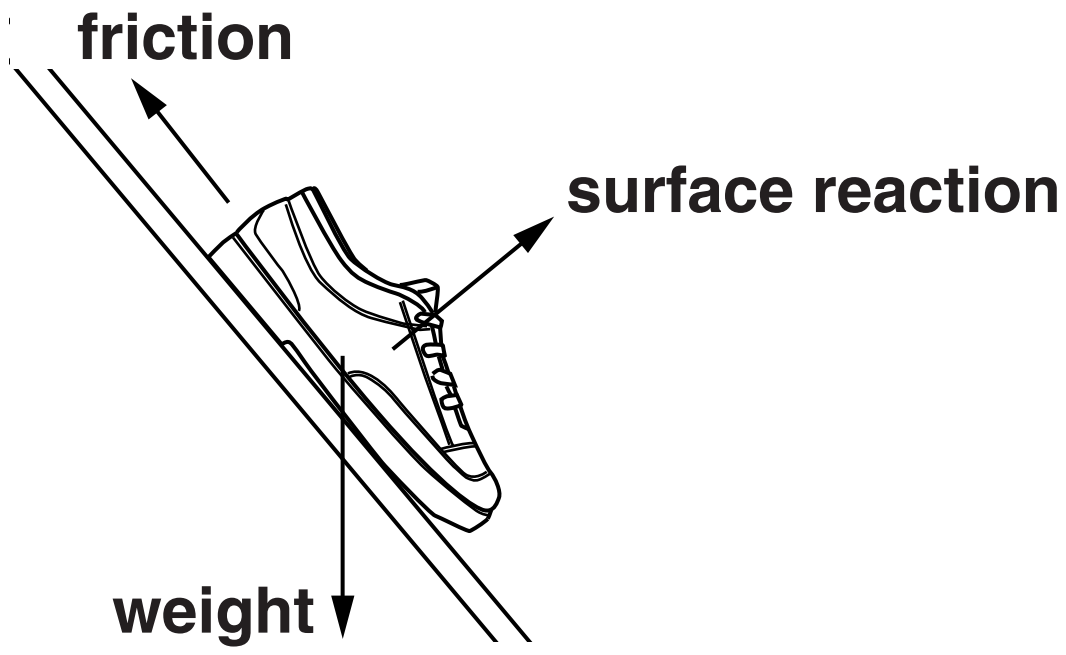
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[3]

**(c) The forces on a shoe as it rests on a ramp are shown in the diagram.**



**Complete the sentences about this situation.**

**Choose words from the list.**

**BALANCED**

**EARTH**

**LARGE**

**MASS**

**RAMP**

**SMALL**

**VERTICAL**

**WEIGHT**

**Each force comes from an  
interaction between two objects.**

**The friction on the shoe is caused  
by the interaction between the shoe  
and the \_\_\_\_\_ .**

**The weight of the shoe is caused by  
the interaction between the shoe  
and the \_\_\_\_\_ .**

**If the shoe is stationary, then the  
forces must be**

**\_\_\_\_\_ .**

**[3]**

**(d) Ali carried out a similar experiment to Ross.**

**She used three shoes which were all size 7. Each shoe had a different tread pattern.**

**She repeated her experiment three times.**



**(i) Draw a line from each FEATURE OF HER EXPERIMENT to the correct REASON for the feature.**

**Draw TWO lines only.**

**FEATURE  
OF HER  
EXPERIMENT**

**REASON**

**to control this  
factor**

**all shoes were  
size 7**

**to get a better  
estimate of the  
true value**

**repeat the  
experiment  
three times**

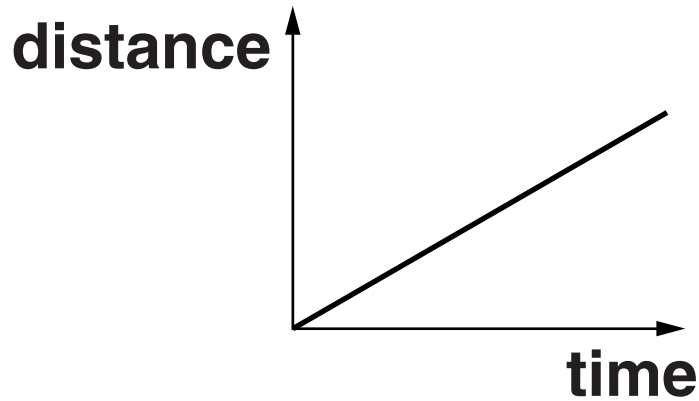
**to increase the  
range of the  
experiment**

**to improve the  
precision of the  
experiment**

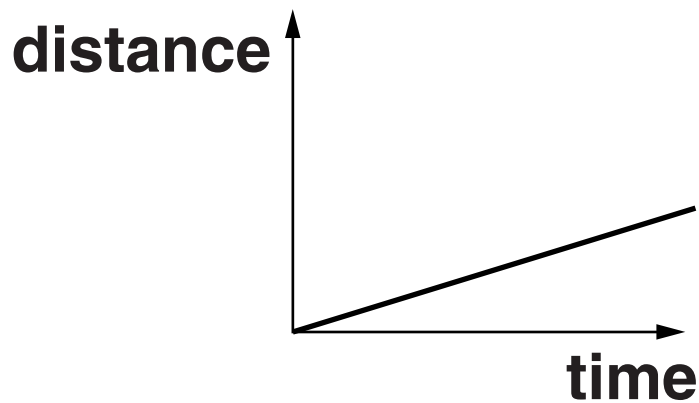
**[1]**

**(ii) Ali drew distance-time graphs of her results.**

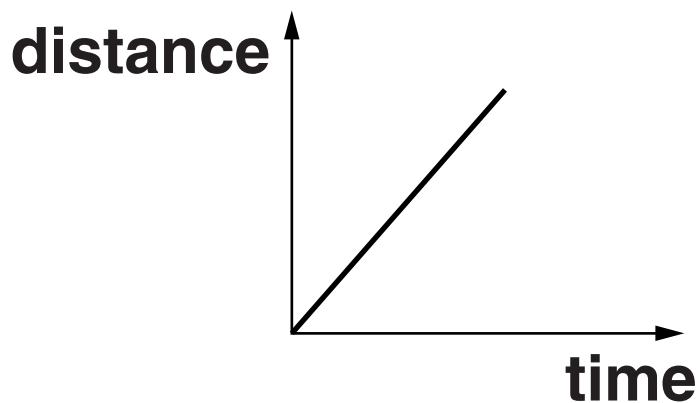
**TREAD PATTERN A**



**TREAD PATTERN B**



**TREAD PATTERN C**



**Which tread pattern allowed the shoe to move fastest down the slope?**

**All graphs are drawn to the same scale.**

**tread \_\_\_\_\_ [1]**

**(iii) Ali then drew a SPEED-time graph of her results.**

**She forgot to label the three lines.**

**Write A, B and C next to each of the lines to show which line is for which tread pattern.**



**[1]**

**[TOTAL: 13]**

**7 A simple roller coaster has one line of track on which a vehicle travels backwards and forwards.**

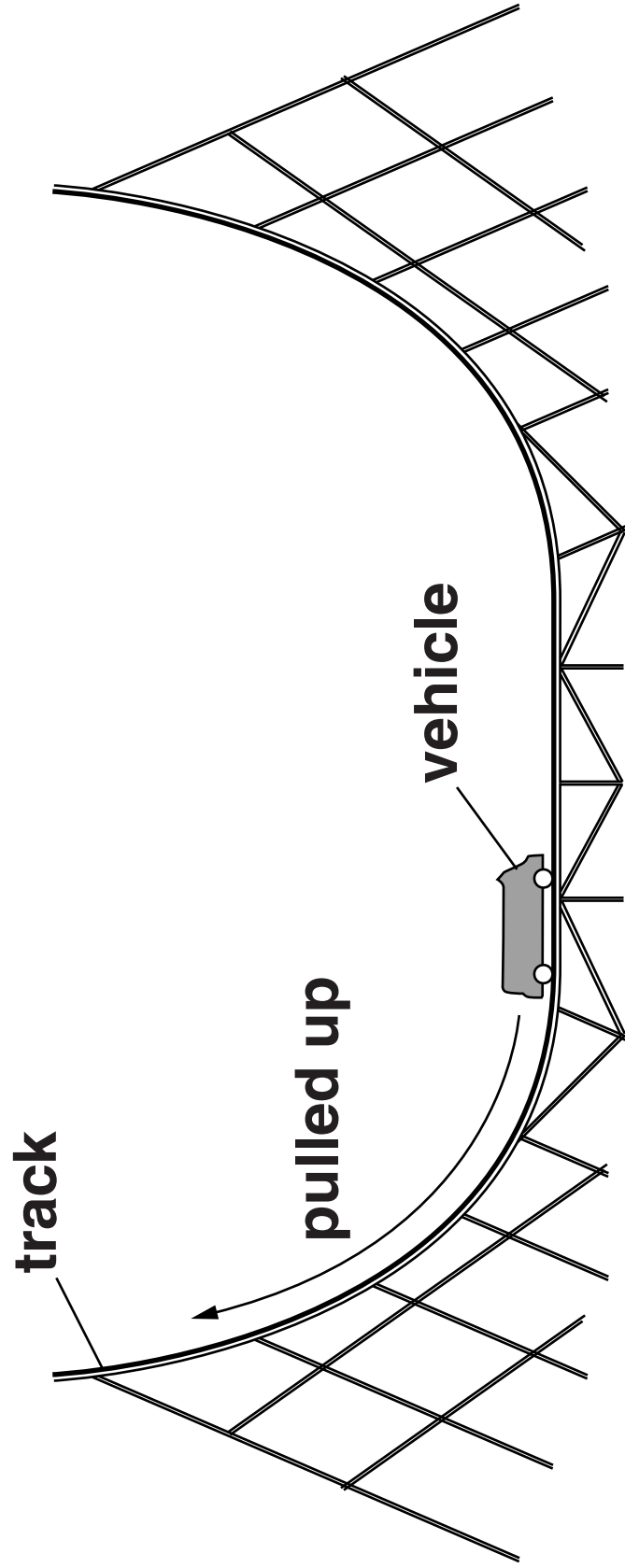
**The vehicle is pulled up the left side of the track, and is then released.**

**It travels down the track, speeding up as it moves.**

**It rises up the right side of the track, slowing down as it moves upwards.**

**It rolls back down.**

**It moves backwards and forwards on the track several times, with each move becoming lower and lower and the top speed becoming slower and slower.**



**Use ideas of energy to explain the motion of the vehicle.**



**The quality of written communication will be assessed in your answer.**

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[6]

**[6]**

**[TOTAL: 6]**

**END OF QUESTION PAPER**

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