

**Paper Reference(s)     4SS0/1P**

**Pearson Edexcel International GCSE (9–1)**

**Science (Single Award)**

**Physics**

**Paper: 1P**

**Friday 14 June 2019 – Morning**

**Time: 1 hour 10 minutes plus your additional  
time allowance**

**INSTRUCTIONS TO CANDIDATES**

**Write your centre number, candidate number,  
surname, other names and your signature in  
the boxes below. Check that you have the  
correct question paper.**

<b>Centre No.</b>					
<b>Candidate No.</b>					
<b>Surname</b>					
<b>Other names</b>					
<b>Signature</b>					
<b>Paper Reference</b>	<b>4</b>	<b>S</b>	<b>S</b>	<b>0</b>	<b>/ 1 P</b>



- Use **BLACK** ink or ball-point pen.
- Answer **ALL** questions.
- Answer the questions in the spaces provided – there may be more space than you need.
- Calculators may be used.
- Some questions must be answered with a cross in a box ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

## **MATERIALS REQUIRED FOR EXAMINATION**

**Calculator, ruler**

## **ITEMS INCLUDED WITH QUESTION PAPERS**

**Formulae sheet**

## **INFORMATION FOR CANDIDATES**

- The total mark for this paper is 60.
- The marks for **EACH** question are shown in brackets – use this as a guide as to how much time to spend on each question.

**(Instructions continue on next page)**

**(Turn over)**

## **ADVICE TO CANDIDATES**

- **Read each question carefully before you start to answer it.**
- **Write your answers neatly and in good English.**
- **Try to answer every question.**
- **Check your answers if you have time at the end.**

**Answer ALL questions.**

- 1 Gallium-67 is a radioactive isotope of gallium used as a medical tracer.**

**Medical tracers are placed in the body to diagnose illnesses.**

**The tracer emits radiation which can be used to find the position of the tracer in the body.**

**(Question continues on next page)**

**(Turn over)**

**(a) Gallium-67 can be represented using the symbol**



**Give the number of protons and the number of neutrons in gallium-67.  
(2 marks)**

**number of protons = \_\_\_\_\_**

**number of neutrons = \_\_\_\_\_**

**(Question continues on next page)**

**(Turn over)**

**(b) When gallium-67 decays it emits gamma radiation.**

**Explain why this makes it an effective medical tracer. (2 marks)**

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**(Question continues on next page)**

**(Turn over)**

- (c) Gallium-68 is another radioactive isotope of gallium that can be used as a medical tracer.**

**Describe the difference between the nucleus of gallium-68 and the nucleus of gallium-67. (2 marks)**

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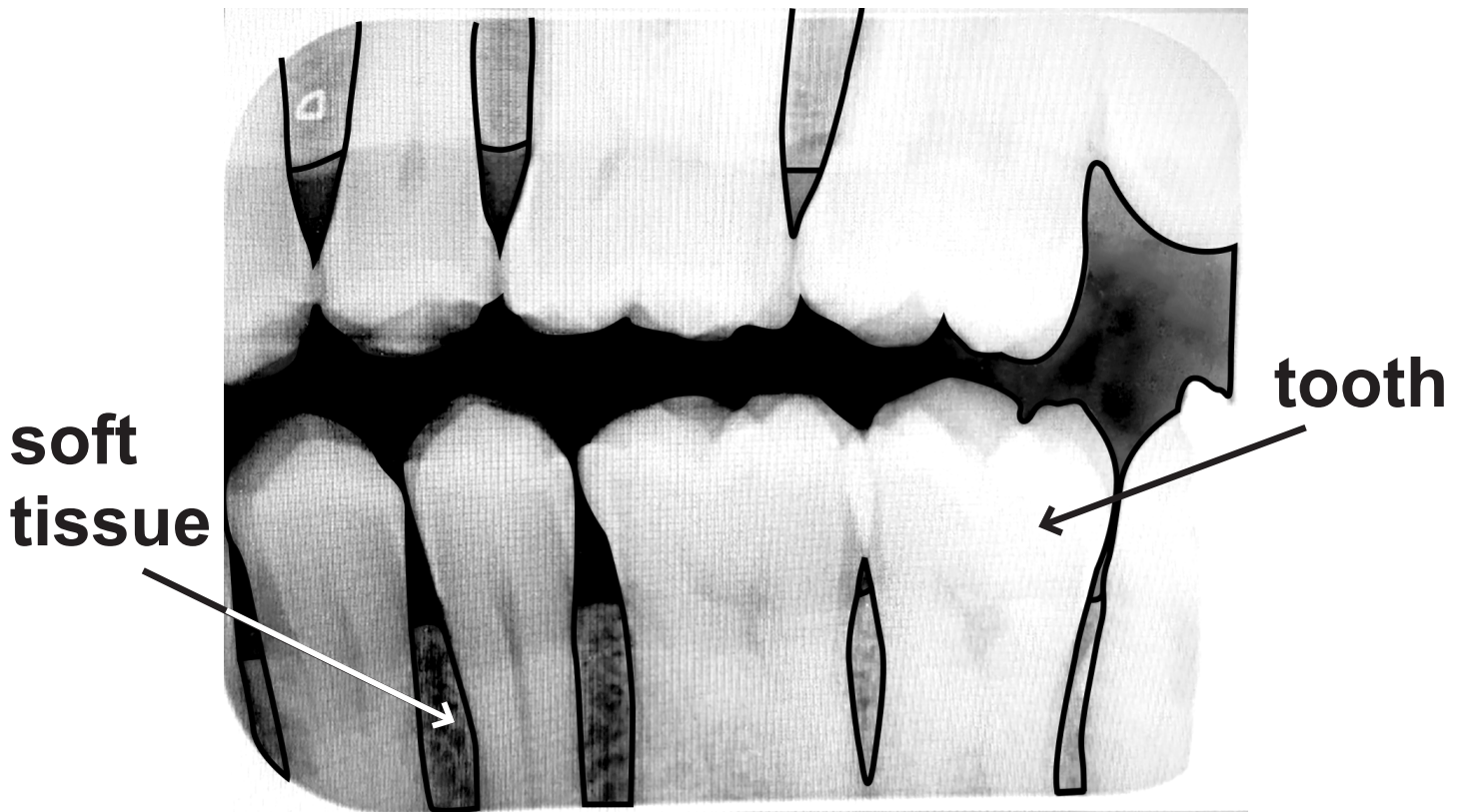
**(TOTAL FOR QUESTION 1 = 6 MARKS)**

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**(Questions continue on next page)**

**(Turn over)**

- 2 A dentist takes an x-ray image of a patient's teeth using photographic film.**



- (a) The film, which is initially white, changes to black when it absorbs x-rays.**

**The film is placed inside the patient's mouth and the x-ray source is outside the patient's body.**

**The teeth and soft tissue appear differently on the x-ray image.**

**(Question continues on next page)**

**(Turn over)**



**Use words from the box to complete the sentences. (2 marks)**

**absorbed**

**emitted**

**reflected**

**transmitted**

**The tooth appears white**

**because most of the x-rays are**

**\_\_\_\_\_ by the tooth.**

**The soft tissue appears darker in**

**colour because most of the x-rays**

**are \_\_\_\_\_ by the soft**

**tissue.**

**(Question continues on next page)**

**(Turn over)**

**(b) Explain why the dentist has to leave the room before taking the x-ray image but it is safe for the patient to stay in the room. (2 marks)**

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**(Question continues on next page)**

**(Turn over)**

**(c) The x-rays used have a frequency of  $3.5 \times 10^{16}$  Hz.**

**(i) State the formula linking wave speed, frequency and wavelength. (1 mark)**

**(Question continues on next page)**

**(Turn over)**

- (ii) X-rays have a speed of  $3.0 \times 10^8 \text{ m / s}$ .

Calculate the wavelength of these x-rays. (3 marks)

wavelength = \_\_\_\_\_ m

(Question continues on next page)

(Turn over)

**(d) X-rays are electromagnetic waves.**

**Radio waves are also  
electromagnetic waves.**

**State one other similarity and one  
difference between x-rays and radio  
waves. (2 marks)**

**similarity** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**difference** \_\_\_\_\_

\_\_\_\_\_

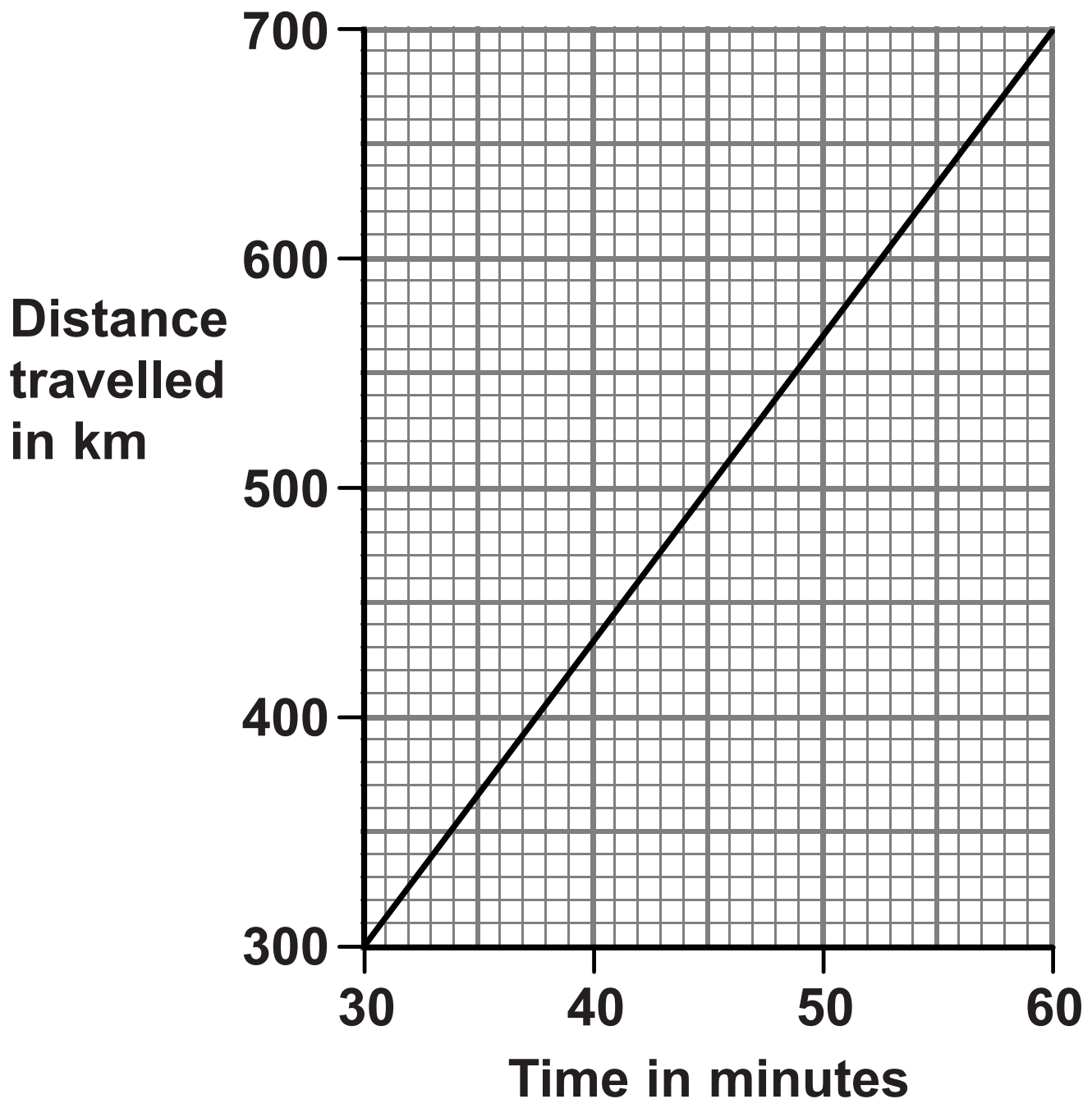
\_\_\_\_\_

**(TOTAL FOR QUESTION 2 = 10 MARKS)**

**(Questions continue on next page)**

**(Turn over)**

- 3 The graph shows how the distance travelled by an aeroplane changes during part of its journey.



(Question continues on next page)

(Turn over)

- (a) (i) State the formula linking average speed, distance moved and time taken. (1 mark)**

**(Question continues on next page)**

**(Turn over)**

- (ii) Calculate the average speed of the aeroplane during this part of its journey.

Give a suitable unit. (4 marks)

average speed = \_\_\_\_\_  
unit \_\_\_\_\_

(Question continues on next page)

(Turn over)



**(b) During the flight, the height of the aeroplane decreases.**

**As the height of the aeroplane decreases, the temperature outside the aeroplane increases.**

**Explain how the air pressure outside the aeroplane changes as the height of the aeroplane decreases.  
(3 marks)**

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**(Continue your answer on next page)**

**(Turn over)**

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**(TOTAL FOR QUESTION 3 = 8 MARKS)**

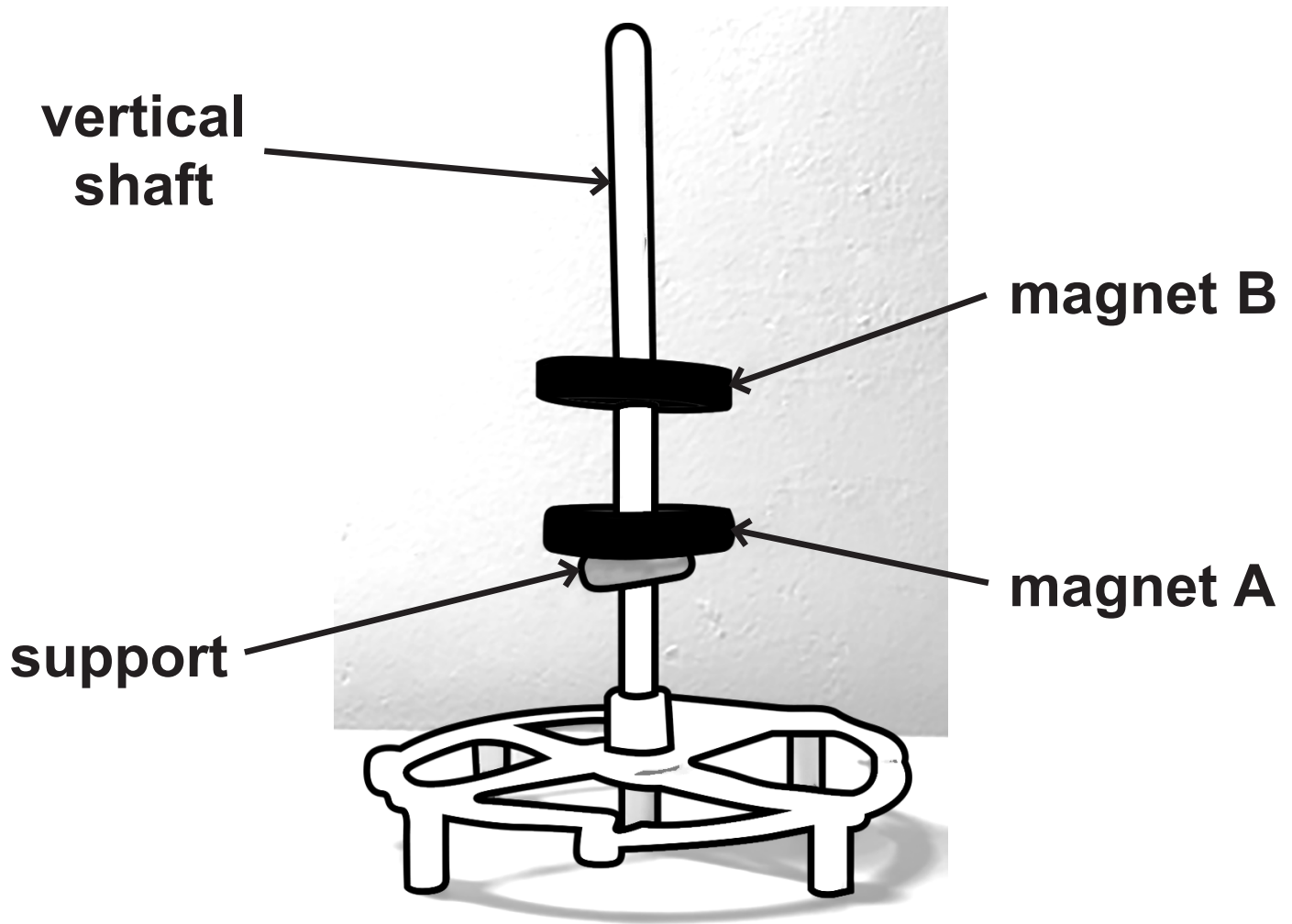
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**(Questions continue on next page)**

**(Turn over)**

**4 Photograph 1 shows a child's toy.**

**The toy has two magnets on a vertical shaft.**



**Photograph 1**

**(Question continues on next page)**

**(Turn over)**

- (a) Magnet A rests on a support near the bottom of the vertical shaft.**

**A student places magnet B at the top of the vertical shaft and releases it from rest.**

**Magnet B is repelled by magnet A causing it to come to rest again at the position shown.**

**The table on page 21 shows some energy stores in magnet B.**

**Put ticks (✓) in the correct boxes to show whether the amount of energy in each store of magnet B increases, decreases or stays the same when compared to its value at the top of the vertical shaft. (3 marks)**

**(Question continues on next page)**

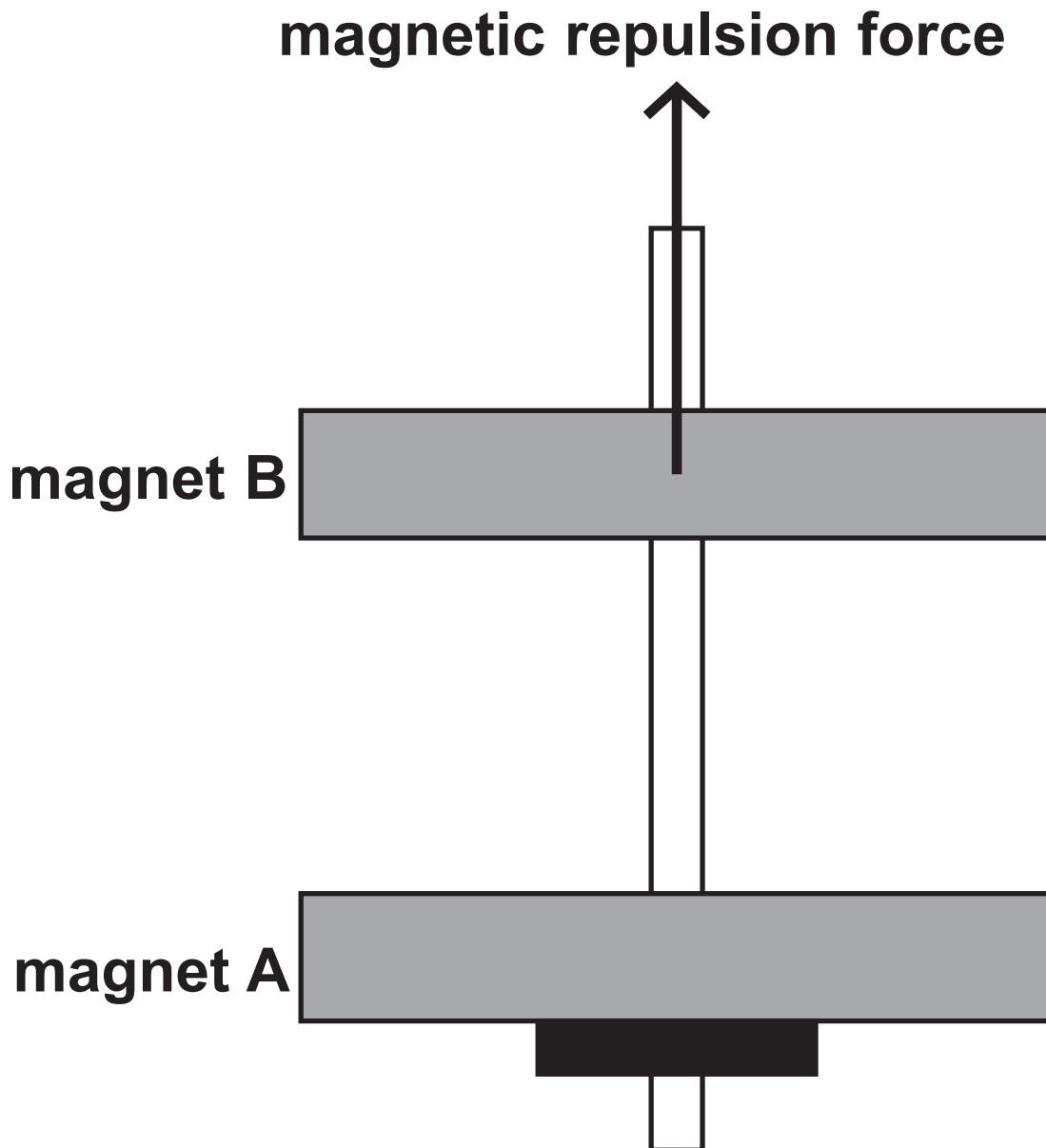
**(Turn over)**

Energy store in magnet B	Increases	Decreases	Stays the same
gravitational			
magnetic			
kinetic			

(Question continues on next page)

(Turn over)

**(b) This is a diagram of the toy shown in photograph 1.**



**One of the forces acting on magnet B is shown.**

**Draw another labelled arrow on the diagram to show the other force acting on magnet B. (2 marks)**

**(Question continues on next page)**

**(Turn over)**

- (c) The student adds a 10 g mass on top of magnet B when it is stationary above magnet A and observes that the distance between the magnets decreases.**

**He carries out an investigation to see how the distance changes as more masses are added.**

**Describe a method for the student's investigation.**

**In your answer, you should refer to**

- the measuring equipment required**
- the independent and dependent variables**
- a way to check the reliability of the data**

**(Question continues on next page)**

**(Turn over)**

**You may draw a diagram to help your answer. (5 marks)**

**(Continue your answer on next page)**

**(Turn over)**



**(Turn over)**

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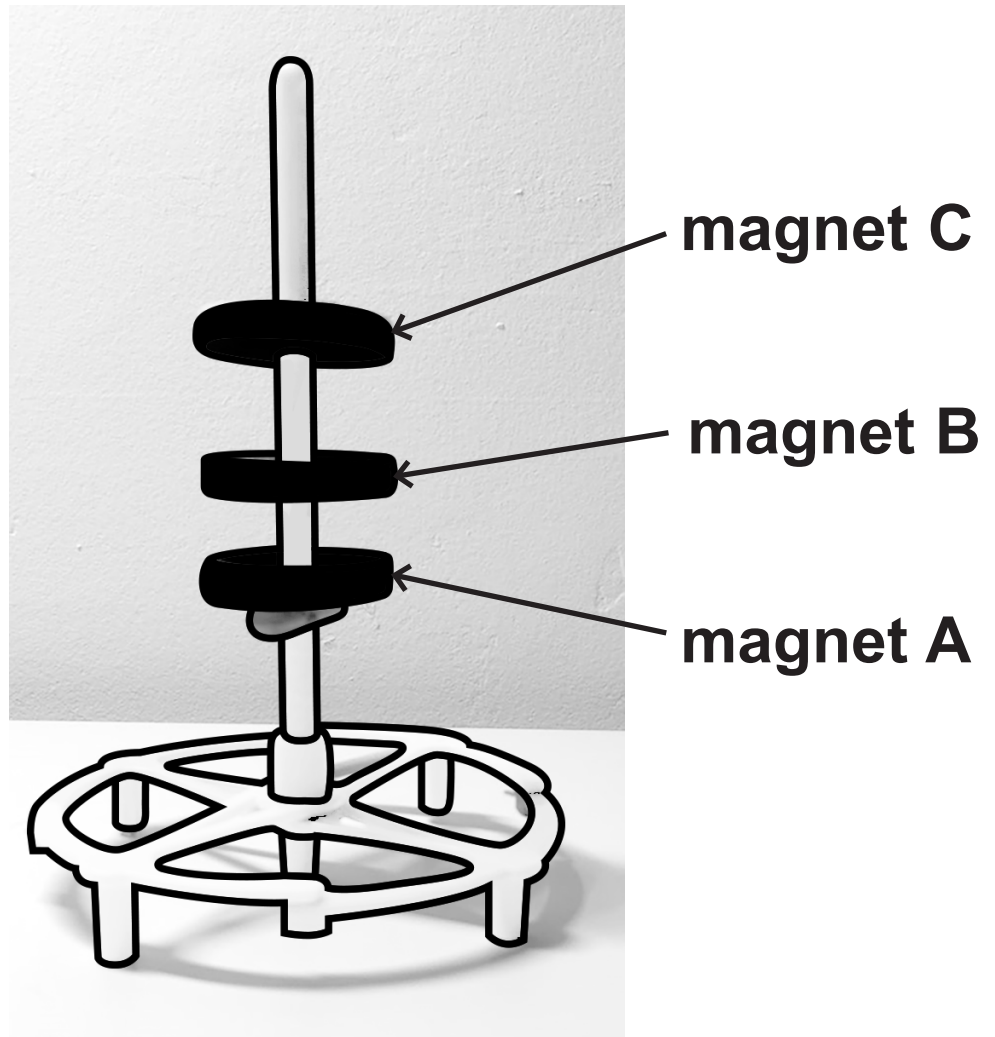
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**(Question continues on next page)**

**(Turn over)**

**(d) The student removes the masses from magnet B.**

**He then adds magnet C on to the vertical shaft.**



**Photograph 2**

**Photograph 2 shows that when magnet C is added, magnet B moves further down the shaft until it is at rest again.**

**(Question continues on next page)**

**(Turn over)**

**Explain why the distance between magnet A and magnet B has decreased. (3 marks)**

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**(TOTAL FOR QUESTION 4 = 13 MARKS)**

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**(Questions continue on next page)**

**(Turn over)**

**5 The Sun is a main sequence star.**

**In the Sun, hydrogen nuclei are changed into helium nuclei, releasing energy.**

**(a) Name the process that changes hydrogen into helium. (1 mark)**

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**(Question continues on next page)**

**(Turn over)**

**(b) Describe the evolution of the Sun when it leaves the main sequence. (2 marks)**

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**(Question continues on next page)**

**(Turn over)**

- (c) The Sun's core has a mass of approximately  $7 \times 10^{29}$  kg.**

**Approximately 75% of the mass of the core is hydrogen.**

- (i) Calculate the approximate mass of hydrogen in the Sun's core.  
(1 mark)**

**mass of hydrogen = \_\_\_\_\_ kg**

- (ii) When most of the hydrogen nuclei in the Sun's core have been changed into helium nuclei the Sun will leave the main sequence.**

**The Sun's core loses approximately  $9 \times 10^{19}$  kg of hydrogen each year.**

**(Question continues on next page)**

**(Turn over)**

**Estimate the time until the Sun leaves the main sequence.**

**Give your answer to one significant figure. (2 marks)**

**time = \_\_\_\_\_ years**

**(TOTAL FOR QUESTION 5 = 6 MARKS)**

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**(Questions continue on next page)**

**(Turn over)**



**6 A student investigates four cars P, Q, R and S.**

**(a) How is energy transferred usefully from the engine of a car to its wheels? (1 mark)**

- ☐ **A by heating**
- ☐ **B by radiation**
- ☐ **C electrically**
- ☐ **D mechanically**

**(Question continues on next page)**

**(Turn over)**

- (b) The engine of a car burns petrol, which transfers energy usefully from the chemical store of the petrol to the kinetic store of the car.**

**The useful power output of car P's engine is 47 kW.**

- (i) Calculate the useful energy output of car P's engine during a 15 minute period. (3 marks)**

**useful energy output = \_\_\_\_\_ J**

**(Question continues on next page)**

**(Turn over)**

- (ii) State the formula linking efficiency, useful energy output and total energy output. (1 mark)**

**(Question continues on next page)**

**(Turn over)**

- (iii) During the 15 minute period,  $2.0 \times 10^8 \text{ J}$  of energy is transferred from the chemical store of the petrol.

Calculate the efficiency of car P's engine. (2 marks)

efficiency = \_\_\_\_\_

(Question continues on next page)

(Turn over)

- (c) The student extends her investigation by collecting data for cars P, Q, R and S.

She records the useful power output of their engines, their masses and their maximum speeds.

The table shows her data.

Car	Engine useful power output in kW	Mass in kg	Maximum speed in m/s
P	47	721	41
Q	92	1143	51
R	194	915	62
S	198	1226	68

(Question continues on next page)

(Turn over)

**Using information from the table, discuss the relationships between useful power output, mass and maximum speed. (4 marks)**

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**(Continue your answer on next page)**

**(Turn over)**

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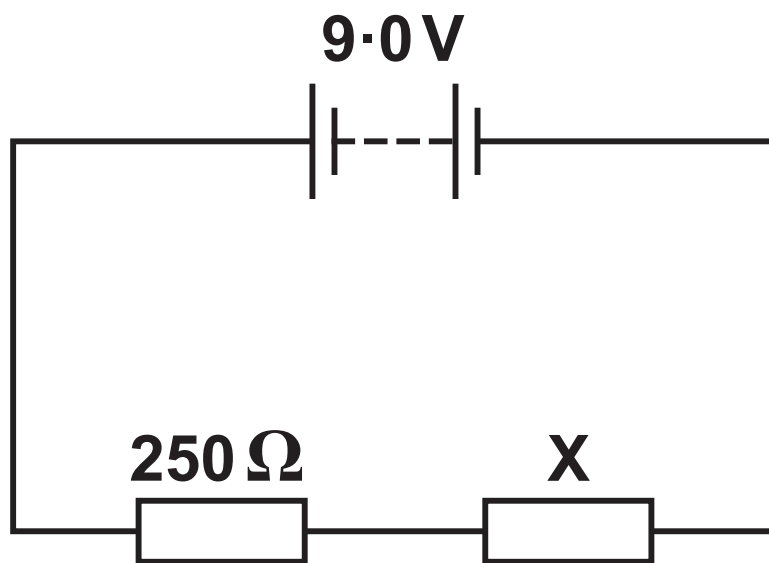
**(TOTAL FOR QUESTION 6 = 11 MARKS)**

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**(Questions continue on next page)**

**(Turn over)**

- 7 The circuit diagram shows a 9.0 V battery connected in series with a  $250\ \Omega$  resistor and another resistor, X.



- (a) Draw a voltmeter on the circuit diagram to measure the voltage of resistor X. (2 marks)

(Question continues on next page)

(Turn over)



**(b) The current in the circuit is 0.012A.**

**Calculate the resistance of resistor X.  
(4 marks)**

**resistance = \_\_\_\_\_  $\Omega$**

**(TOTAL FOR QUESTION 7 = 6 MARKS)**

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**TOTAL FOR PAPER = 60 MARKS  
END**