Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | | | | | |

Candidate Number | | | | |

Friday 14 June 2019

Morning (Time: 1 hour 10 minutes) | Paper Reference **4SS0/1P**

Science (Single Award)

Physics

Paper: 1P

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- 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 ☒.

Information

- 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.*

Advice

- 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.

Turn over ▶

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Pearson

FORMULAE

You may find the following formulae useful.

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

Where necessary, assume the acceleration of free fall, $g = 10\,\text{m/s}^2$.

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.

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

$$^{67}_{31}Ga$$

Give the number of protons and the number of neutrons in gallium-67.

(2)

number of protons =

number of neutrons =

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

Explain why this makes it an effective medical tracer.

(2)

(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)

(Total for Question 1 = 6 marks)

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.

Use words from the box to complete the sentences.

(2)

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.

(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)

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

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

(1)

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

Calculate the wavelength of these x-rays.

(3)

(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.

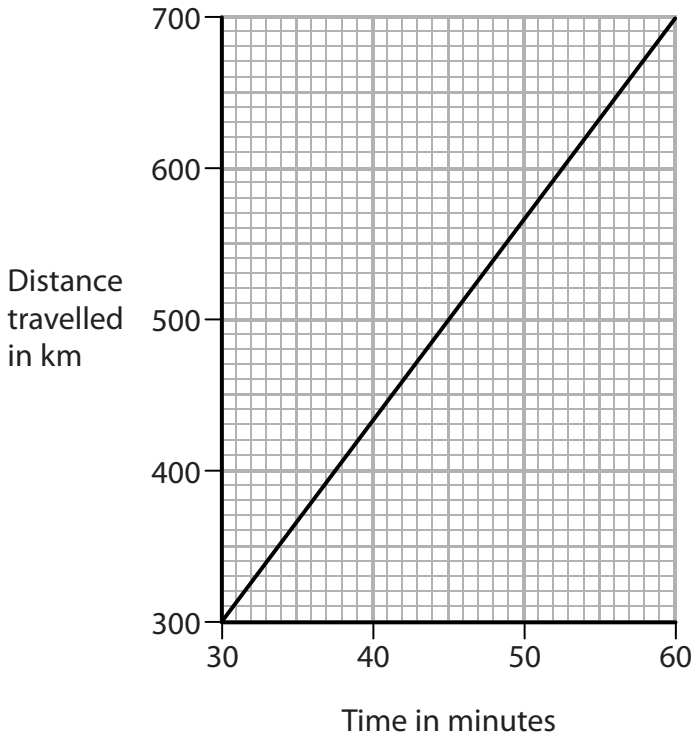
(2)

similarity

difference

(Total for Question 2 = 10 marks)

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



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

(1)

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

Give a suitable unit.

(4)

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

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

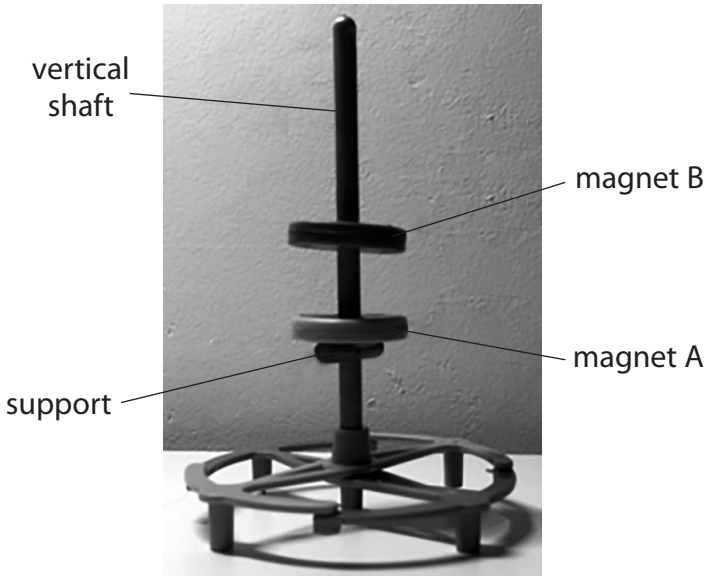
Explain how the air pressure outside the aeroplane changes as the height of the aeroplane decreases.

(3)

(Total for Question 3 = 8 marks)

4 Photograph 1 shows a child's toy.

The toy has two magnets on a vertical shaft.



Photograph 1

(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.

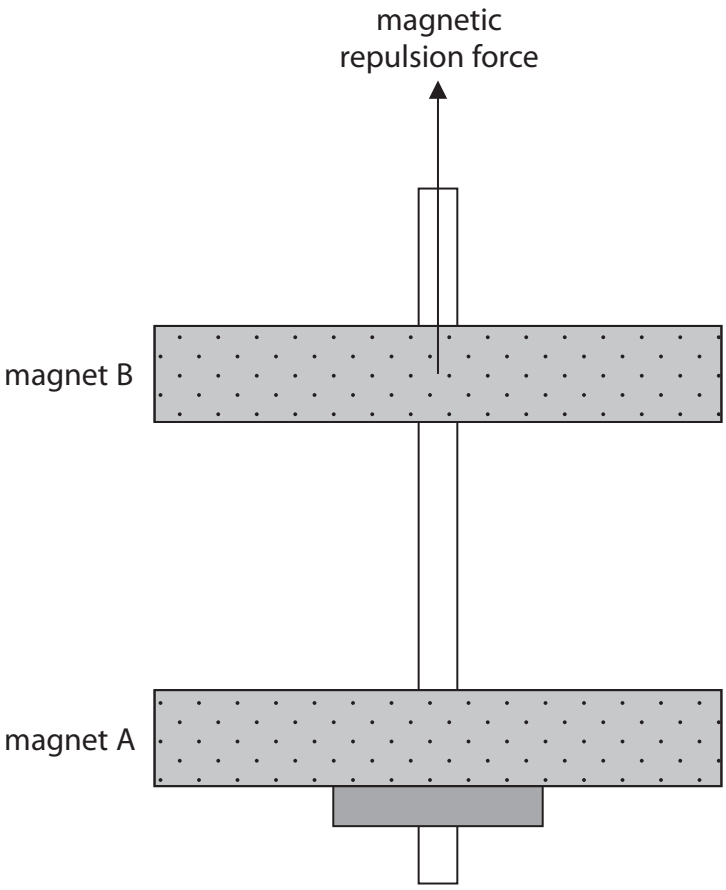
The table shows some energy stores in magnet B.

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)

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

(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)

(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

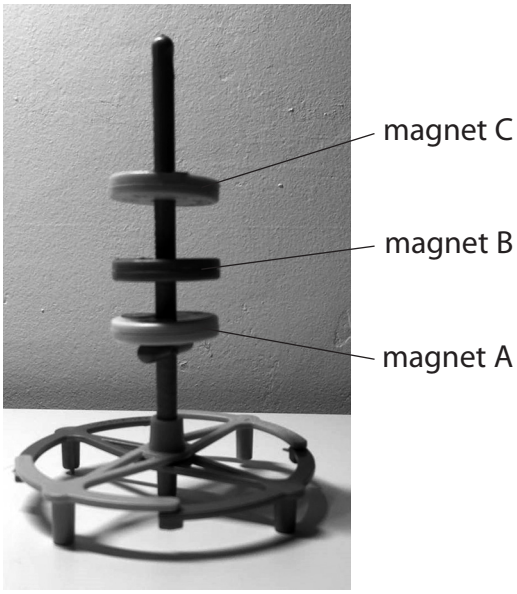
- the measuring equipment required
- the independent and dependent variables
- a way to check the reliability of the data

You may draw a diagram to help your answer.

(5)

(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.

Explain why the distance between magnet A and magnet B has decreased.

(3)

(Total for Question 4 = 13 marks)

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)

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

(2)

(c) The Sun's core has a mass of approximately 7×10^{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)

(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 9×10^{19} kg of hydrogen each year.

Estimate the time until the Sun leaves the main sequence.

Give your answer to one significant figure.

(2)

(Total for Question 5 = 6 marks)

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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)

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

(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)

(ii) State the formula linking efficiency, useful energy output and total energy output.

(1)

(iii) During the 15 minute period, 2.0×10^8 J of energy is transferred from the chemical store of the petrol.

Calculate the efficiency of car P's engine.

(2)

(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.

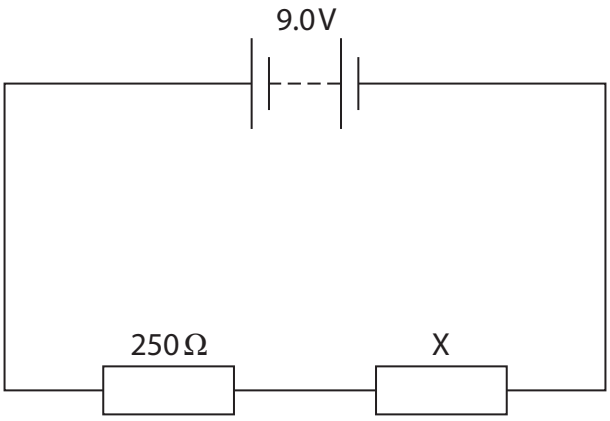
Car	Engine useful power output in kW	Mass in kg	Maximum speed in m/s
P	47	721	41
Q	92	1143	51
R	194	915	62
S	198	1226	68

Using information from the table, discuss the relationships between useful power output, mass and maximum speed.

(4)

(Total for Question 6 = 11 marks)

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



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

(2)

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

Calculate the resistance of resistor X.

(4)

(Total for Question 7 = 6 marks)

TOTAL FOR PAPER = 60 MARKS