Write your name here

Surname	Other names

Pearson Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics

Unit: 4PH0
Paper: 1PR

Wednesday 20 May 2015 – Afternoon
Time: 2 hours

Paper Reference
4PH0/1PR

You must have:
Ruler, calculator

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.*
- Show all the steps in any calculations and state the units.
- 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 120.
- 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.
- Keep an eye on the time.
- 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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P 4 4 2 6 5 A 0 1 3 6

PEARSON

EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time $E = I \times V \times t$

pressure × volume = constant $p_1 \times V_1 = p_2 \times V_2$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

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

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

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad v = \frac{2 \times \pi \times r}{T}$$

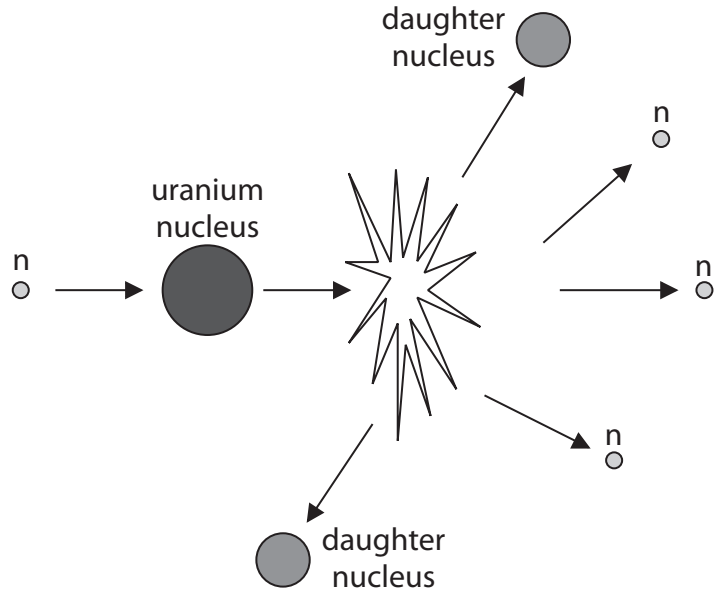
$$\frac{\text{pressure}}{\text{temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken}}$$

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

Answer ALL questions.

1 A student finds this representation of nuclear fission on a website.



(a) Describe what happens when nuclear fission of uranium occurs.

(3)

(b) The daughter nuclei move off with high speed.

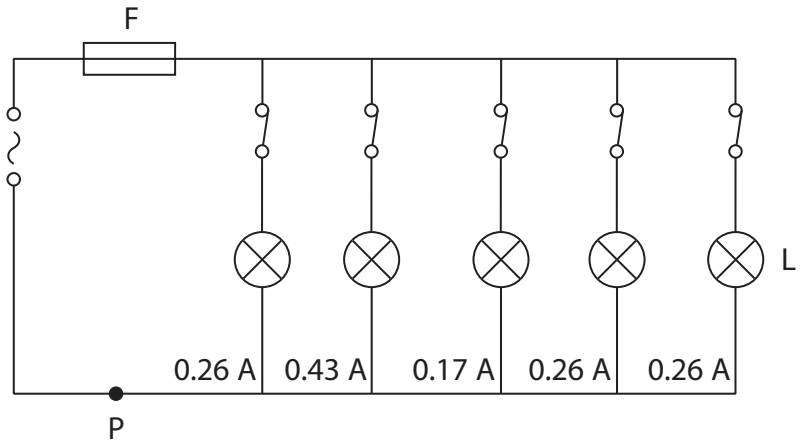
Name the type of energy that this gives them.

(1)

(Total for Question 1 = 4 Marks)

2 The diagram shows part of a lighting circuit in a house.

The circuit is protected by fuse F.



(a) Give two reasons why the lamps are wired in parallel.

(2)

1 .....

.....

.....

2 .....

.....

.....

(b) What is the current at P?

(1)

☒ **A** 0.17 A

☒ **B** 0.26 A

☒ **C** 0.43 A

☒ **D** 1.38 A

(c) Explain how the fuse protects the circuit.

(3)

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(d) (i) State the equation linking power, current and voltage.

(1)

(ii) Calculate the power of lamp L.
[assume the mains voltage is 230 V]

(2)

power = ... W

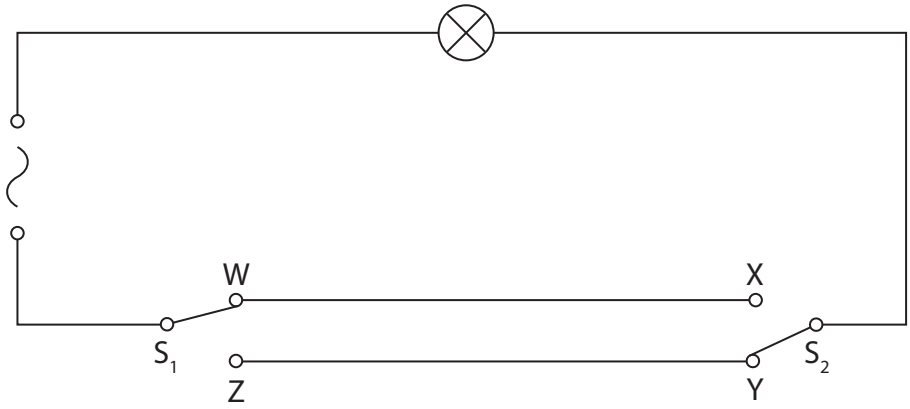
(iii) Calculate the amount of energy transferred by lamp L in 3 minutes.

Give the unit.

(3)

energy transferred = ... unit .....

(e) This diagram shows another lighting circuit.



(i) Complete the table by putting a tick (✓) in the box if the lamp is lit and a cross (✗) in the box if the lamp is not lit.

(2)

S_1 position	S_2 position	lamp lit (✓ or ✗)
W	X	
W	Y	
Z	X	
Z	Y	

(ii) Suggest where this circuit would be useful in a house.

(1)

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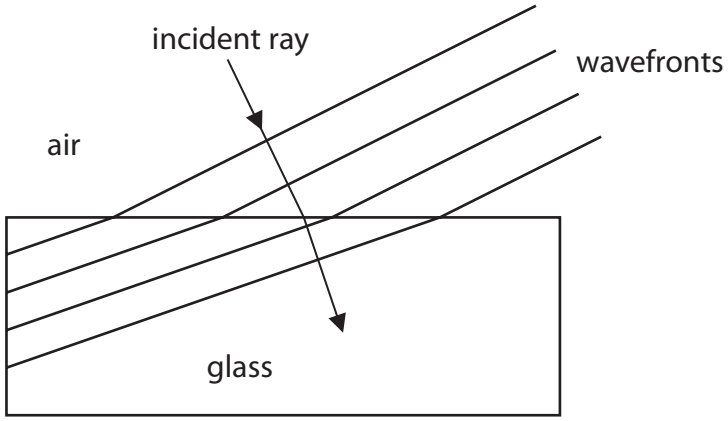
.....

(Total for Question 2 = 15 marks)

3 The diagram shows changes to light waves passing from air into glass.



(a) (i) The effect shown in the diagram is

(1)

- ☒ **A** diffraction
- ☒ **B** dispersion
- ☒ **C** reflection
- ☒ **D** refraction

(ii) State two ways in which the light waves change as they pass into the glass.

(2)

1 .....

2 .....

(b) (i) Draw the normal to the incident ray on the diagram.

(1)

(ii) Label the angle of incidence on the diagram.

(1)

(Total for Question 3 = 5 marks)

4 This question is about electromagnetic waves.

(a) (i) Which of these has the shortest wavelength?

(1)

- ☒ **A** infrared
- ☒ **B** microwaves
- ☒ **C** ultraviolet
- ☒ **D** visible light

(ii) Which of these statements is **not** correct?

(1)

- ☒ **A** electromagnetic waves are longitudinal
- ☒ **B** electromagnetic waves can transfer energy
- ☒ **C** electromagnetic waves can travel between stars
- ☒ **D** electromagnetic waves travel at the same speed in free space

(iii) Which of these is a use for x-rays?

(1)

- ☒ **A** broadcasting television
- ☒ **B** cooking a potato
- ☒ **C** looking at the internal structure of objects
- ☒ **D** looking through night vision goggles

(b) Gamma radiation is used in hospitals even though it can be dangerous.

(i) Describe one use of gamma radiation in hospitals.

(2)

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(ii) Explain the risks to patients and doctors of using gamma radiation.

(2)

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.....

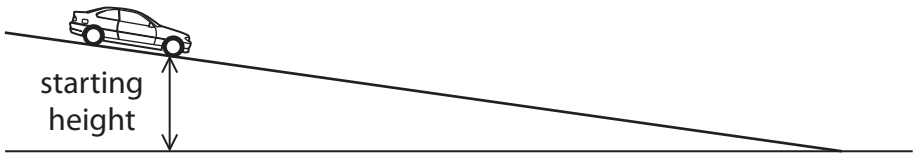
(iii) State one way of reducing the risks to a doctor who uses gamma radiation.

(1)

.....

(Total for Question 4 = 8 marks)

5 A student investigates the speed of different toy cars as they roll down a slope.



(a) The student makes this prediction.

'The more weight a toy car has the faster it will roll down the slope.'

(i) What is the independent variable in the student's prediction?

(1)

.....

(ii) What is the dependent variable in the student's prediction?

(1)

.....

(b) State two factors that the student should keep constant in his investigation.

(2)

1 .....

.....

2 .....

.....

(c) Put ticks (✓) in the boxes to show which pieces of apparatus the student needs for his investigation.

One has been done for you.

(2)

battery	
joulemeter	
micrometer	
newtonmeter	
ruler	✓
stopwatch	
thermometer	

(d) Describe what the student should do to test his prediction that the more weight the toy car has, the faster it will roll down the slope.

(5)

(Total for Question 5 = 11 marks)

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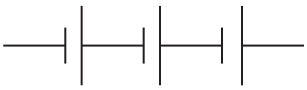
6 (a) The diagram shows part of an electric circuit.

Complete the circuit diagram by adding

- a resistor in series with the lamp and battery
- a second lamp in parallel with the first lamp
- a voltmeter that measures the voltage across the resistor
- an ammeter that measures the current in the resistor

(4)



(b) The current in a resistor is measured for different voltages.

The table shows the results.

Voltage in V	Current in A
1.0	0.10
2.5	0.25
3.0	0.30
4.5	0.40
5.0	0.50
6.0	0.60

(i) Plot a graph of this data on the grid.

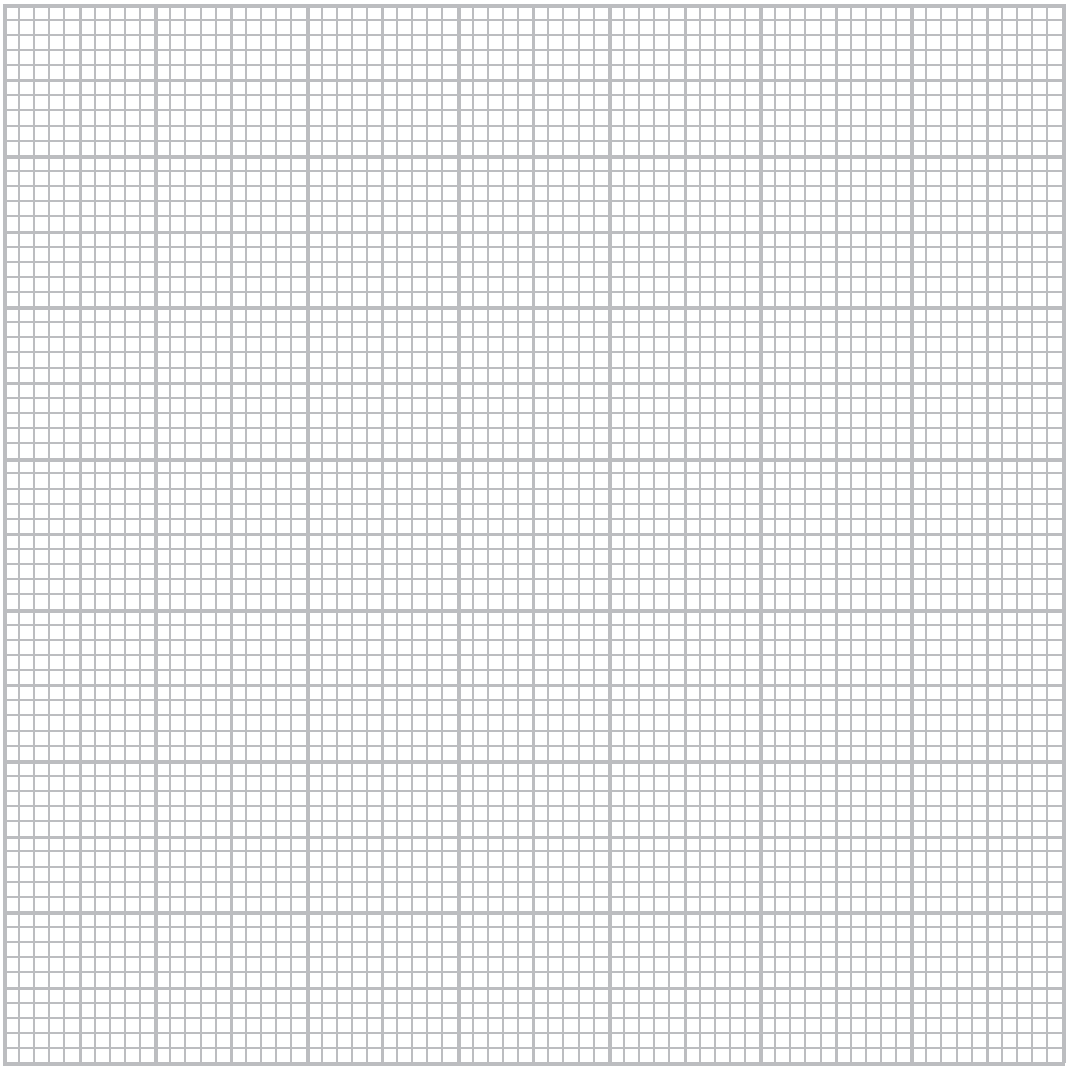
(4)

(ii) Circle the anomalous point on the graph.

(1)

(iii) Draw a line of best fit.

(1)



(iv) State the equation linking voltage, current and resistance.

(1)

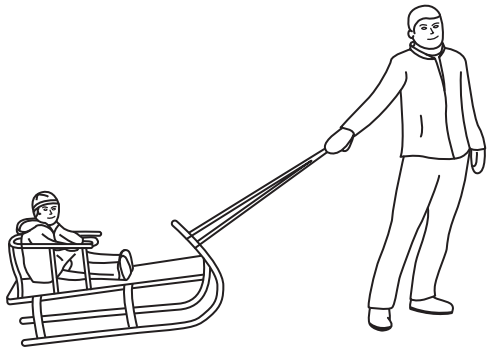
(v) Use your graph to find a value for the resistance of the resistor.

(2)

resistance ..... Ω

(Total for Question 6 = 13 marks)

7 The diagram shows a man pulling a child on a sledge.



(a) The acceleration of the sledge is 1.5 m/s^2.

The mass of the child and sledge is 38 kg.

(i) State the equation linking force, mass and acceleration.

(1)

(ii) Calculate the force needed to produce this acceleration.

(2)

force = ... N

(iii) Suggest a reason why the force exerted on the sledge by the man must be greater than the force calculated.

(1)

.....

.....

.....

(b) The sledge starts from rest and accelerates at 1.5 m/s^2 until its velocity is 2.8 m/s.

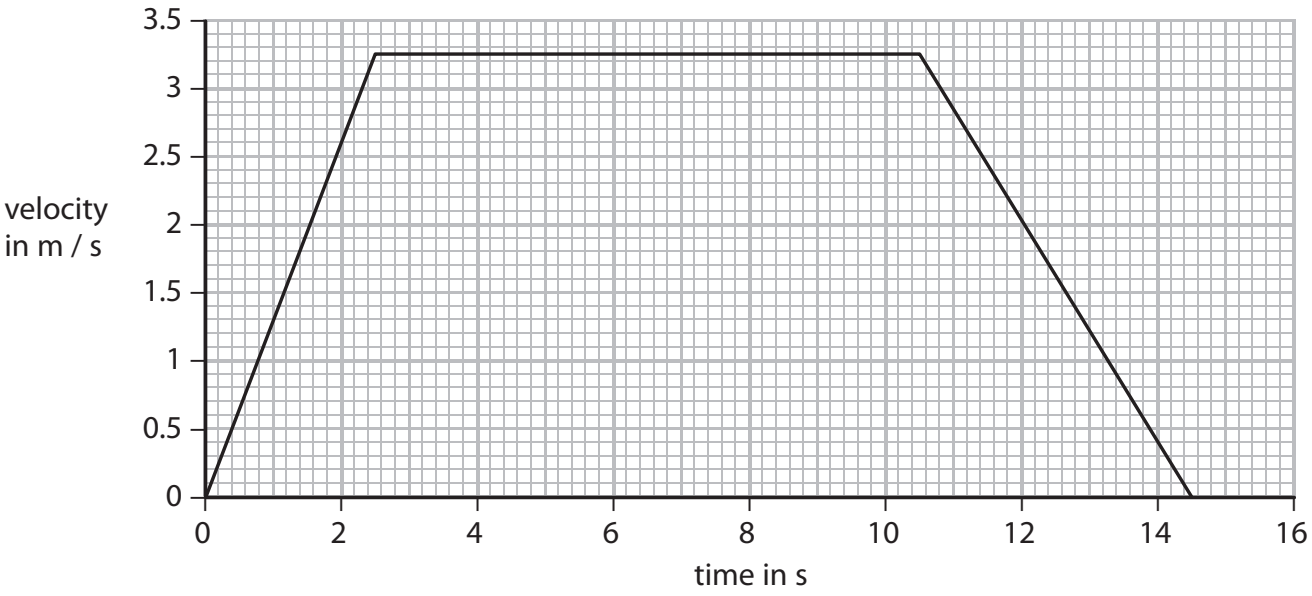
(i) State the relationship between acceleration, velocity and time.

(1)

(ii) Show that the time taken to reach 2.8 m/s is about 2 s.

(2)

(c) This velocity-time graph shows the motion of the sledge as it travels down a hill.



(i) Calculate the distance travelled by the sledge.

(3)

distance travelled = ... m

(ii) State the equation linking average speed, distance moved and time taken.

(1)

(iii) Calculate the average speed of the sledge for the whole journey.

(2)

average speed = ... m/s

(Total for Question 7 = 13 marks)

8 All gases above absolute zero exert a pressure on the walls of their container.

(a) (i) State the value of absolute zero in °C.

(1)

absolute zero = ... °C

(ii) Explain, in terms of its molecules, how a gas exerts a pressure on the walls of its container.

(3)

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(b) A pressure switch is used in a washing machine to control the flow of water. The water pushes on a flexible container and compresses some trapped air. When the pressure of this trapped air reaches 104 kPa, the pressure switch turns the water off.

The pressure of the trapped air is given by this relationship

$$\text{pressure of the trapped air} = \text{atmospheric pressure} + \text{pressure difference caused by water}$$

(i) State the equation linking pressure difference, height, density and g.

(1)

(ii) Calculate the height of water in the machine when the pressure of the trapped air reaches 104 kPa and the switch operates.

[atmospheric pressure = 100 kPa, density of water = 1000 kg/m^3]

(4)

height of water = ...m

(Total for Question 8 = 9 marks)

9 Diagram 1 shows some of the apparatus used to investigate the force on a current-carrying wire, XY, in a magnetic field.

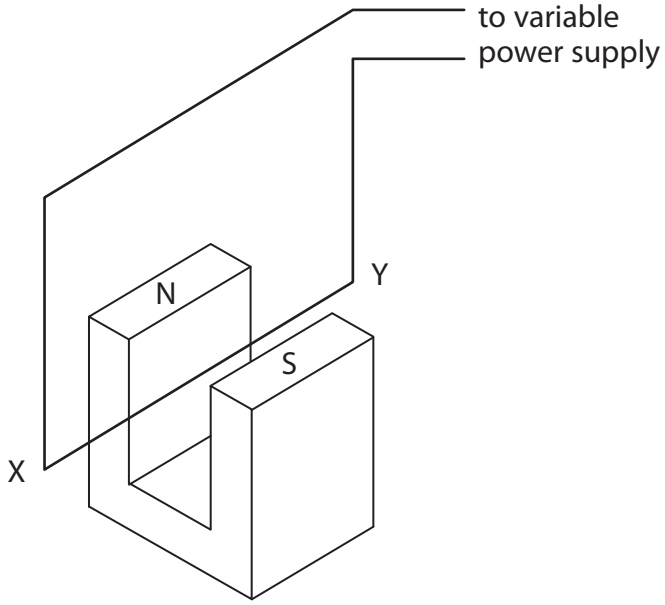

Diagram 1

(a) Diagram 2 shows the poles of the magnet viewed from above.

Draw the uniform magnetic field between the poles.

(2)

Diagram 2

(b) The current-carrying wire XY is at right angles to the magnetic field.

The current in the wire is 10 A.

(i) Suggest why the wire used in this investigation must be thick.

(1)

.....

.....

(ii) Explain why the wire XY experiences a force when there is a current in the circuit.

(3)

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(iii) State two ways in which this force can be reduced.

(2)

1 .....

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2 .....

.....

(Total for Question 9 = 8 marks)

10 The table shows some data about planets in our Solar System.

Planet	Diameter in km	Distance from Sun in 10^6 km	Time of orbit in Earth days or Earth years	Mass of planet in 10^{24} kg
Mercury	4 880	58	88 d	0.33
Venus	12 100	108	224 d	4.9
Earth	12 800	150	365 d	6.0
Mars	6 790	228	687 d	0.64
Jupiter	143 000	778	11.9 y	1 900
Saturn	121 000	1 427	29.5 y	570
Uranus	51 000	2 870	84 y	87
Neptune	50 000	4 497	165 y	100

Use data from the table to answer these questions.

(a) Which planet has about the same diameter as the Earth?

(1)

.....

(b) Jupiter has the largest gravitational field strength.

Suggest a reason for this.

(1)

.....

.....

(c) (i) State the equation linking density, mass and volume.

(1)

(ii) Calculate the density of Neptune in kg/km^3.

You may assume that Neptune is a sphere and that its volume is given by

$$\text{volume} = \frac{4\pi r^3}{3}$$

(3)

density = ... kg/km^3

(d) Calculate the orbital speed of Earth in km/s.

(3)

orbital speed = ...km/s

(e) A student says

'The smaller the planet, the shorter its period of orbit.'

Use data from the table to evaluate this statement.

(3)

(Total for Question 10 = 12 marks)

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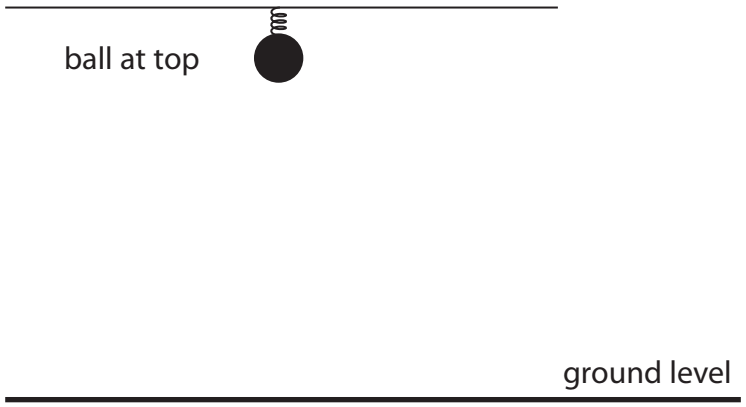
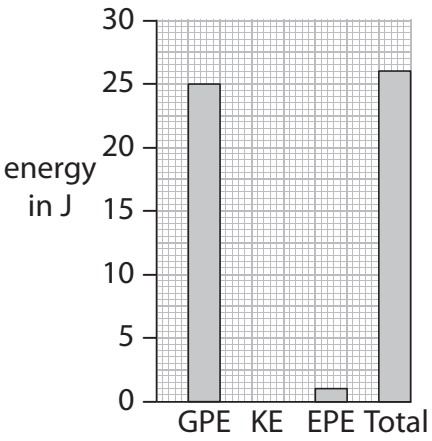
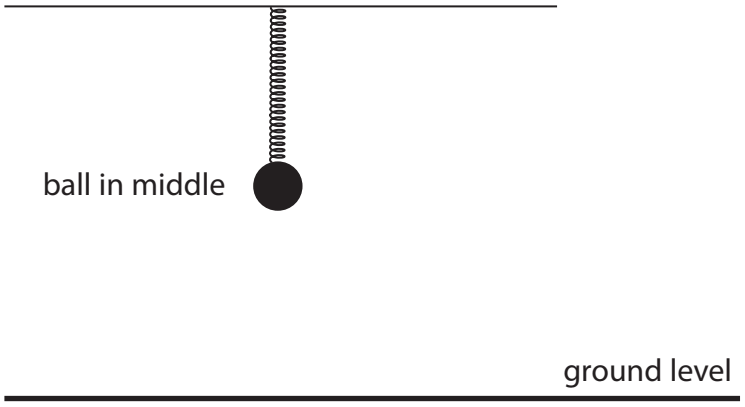
11 A student investigates how the energies of a ball and spring change when the ball and spring vibrate together.

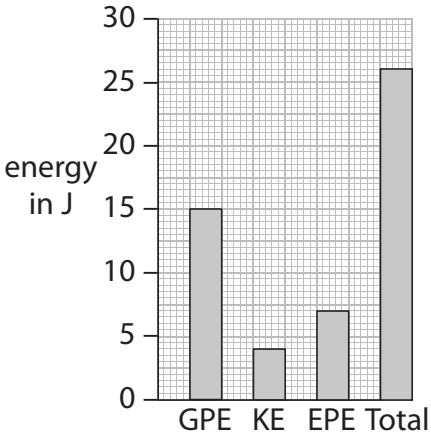
The diagrams and bar charts show how the energies of the ball and spring vary with the position of the ball.

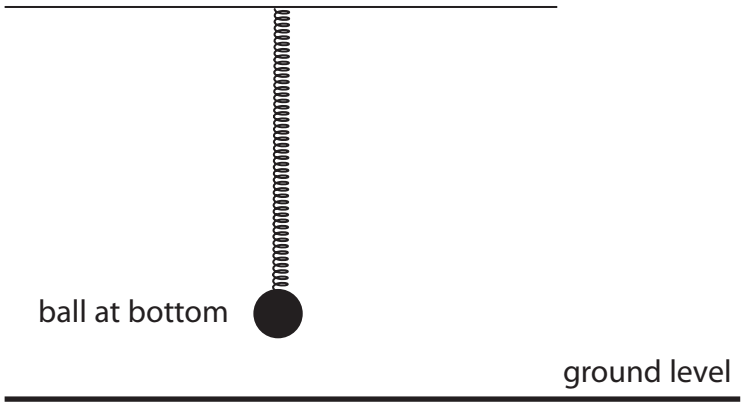
The ball has a mass of 1 kg.

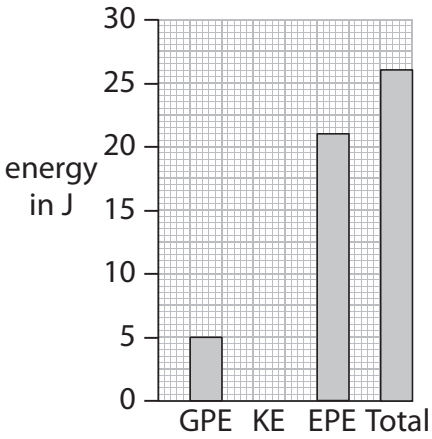












GPE = gravitational potential energy of the ball (zero at ground level)

KE = kinetic energy of the ball

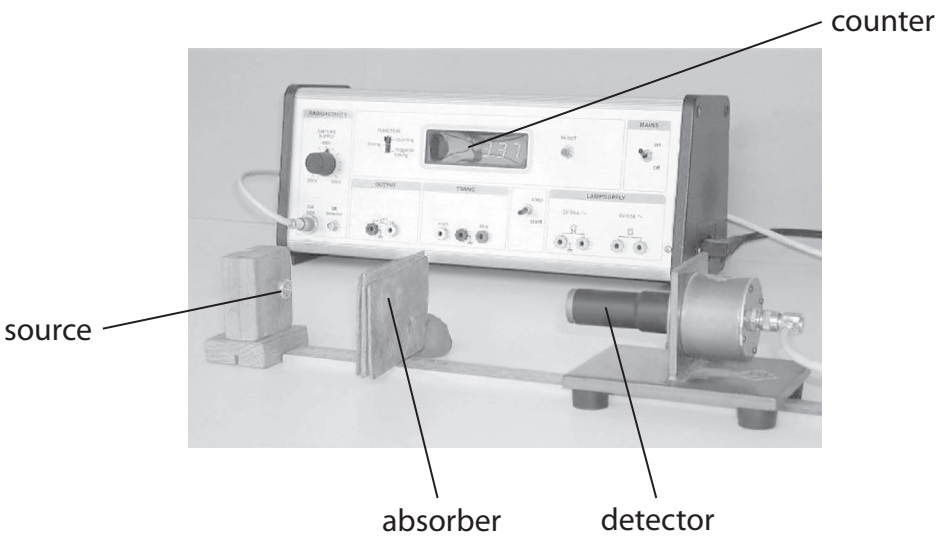
EPE = elastic potential energy of the spring

Use information from the diagrams and the bar charts to describe what happens to the energy, speed and position of the ball as it vibrates on the spring.

(6)

(Total for Question 11 = 6 marks)

12 A teacher uses this apparatus to demonstrate radioactivity to his students.



(a) The teacher needs to take some safety precautions.

Put one tick (✓) on each row to show whether the safety precaution is needed or not.

Two have been done for you.

(2)

safety precaution	needed	not needed
not touch the source with bare hands	✓	
use tongs		
wear gloves		✓
wear goggles		
students sit at least two metres away		
wear a lead apron		
store source in a lead box		

(b) The teacher uses this method to investigate radioactivity.

- place the detector 10 cm from the radioactive source
- record the count with different absorbent materials between the source and the detector
- repeat the investigation using a different radioactive source
- also repeat the investigation without a source

The table shows his results.

Source used	Counts in 30 s for each material					
	5 mm of aluminium	5 mm of lead	0.2 mm of paper	5 mm of plastic	5 mm of stone	5 mm of wood
barium-133	3 843	1 989	not taken	4 551	10 408	4 557
strontium-90	14	15	42 770	182	13	331
none	15	15	14	15	14	15

(i) State why the teacher keeps the distance constant between the source and the detector.

(1)

.....

.....

(ii) Explain why there is a reading when no source is used.

(2)

.....

.....

.....

.....

(iii) Explain which of the materials the teacher used is the best absorber of radiation.

(3)

(iv) A student makes this conclusion.

'Stone is the worst absorber of radiation.'

Evaluate this conclusion.

(3)

(v) Explain what type of radiation strontium-90 emits.

(3)

(vi) Suggest why the teacher does not take a reading for barium-133 and paper.

(1)

(vii) Barium-133 and strontium-90 both have a half-life of over 10 years.

Suggest why isotopes with a much shorter half-life are not suitable for this investigation.

(1)

(Total for Question 12 = 16 marks)

TOTAL FOR PAPER = 120 MARKS

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