Oxford Cambridge and RSA

Accredited

GCSE (9–1) Physics A (Gateway Science)
J249/02 Paper 2 (Foundation Tier)
Sample Question Paper

F

Date – Morning/Afternoon
Time allowed: 1 hour 45 minutes

You must have:
- the Data Sheet

You may use:
- a scientific or graphical calculator
- a ruler

* 0 0 0 0 0 0 *

First name	
Last name	

Centre number						**Candidate number**				

INSTRUCTIONS
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages.

SECTION A

Answer **all** the questions.

You should spend a maximum of 30 minutes on this section.

1 Which of these electromagnetic waves has the highest frequency?

A microwaves

B gamma rays

C ultra-violet rays

D radio waves

Your answer ☐

[1]

2 Which correctly describes electricity supply to homes in the UK?

A 50 Hz a.c.

B 50 Hz d.c.

C 230 Hz a.c.

D 230 Hz d.c.

Your answer ☐

[1]

3 A student picks up a very hot plate.

What is the **shortest** time the student can react and drop the plate?

A 2 milliseconds

B 0.2 seconds

C 2 seconds

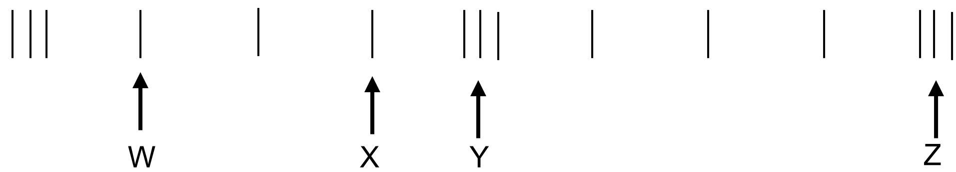
D 0.2 minutes

Your answer ☐

[1]

4 A longitudinal wave passes through a slinky spring. The coils of the spring vibrate backwards and forwards.

The diagram shows the position of the coils at a point in time whilst the wave is passing through.



Which pair of coils are one wavelength apart?

A W and X

B W and Z

C X and Y

D Y and Z

Your answer ☐

[1]

5 Which of these is **not** true of all electromagnetic waves?

A They are transverse waves

B They have the same wavelength

C They can travel through a vacuum

D They travel at 300 000 000 m/s

Your answer ☐

[1]

6 Which of these travels as a **longitudinal** wave?

A light from a torch

B ripples from a stone dropped in water

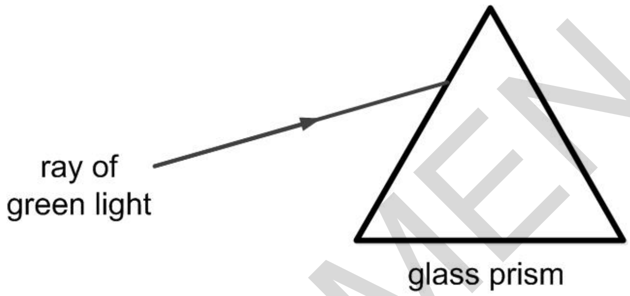
C sound from a loudspeaker

D ultra-violet from the Sun

Your answer ☐

[1]

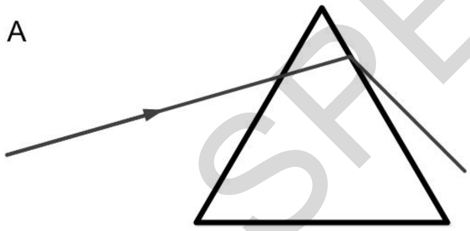
7 A ray of **green** light shines through a glass prism.



The ray travels through the prism and out of the other side.

Which diagram shows the correct path of the ray?

A



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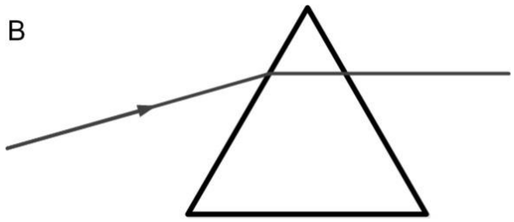

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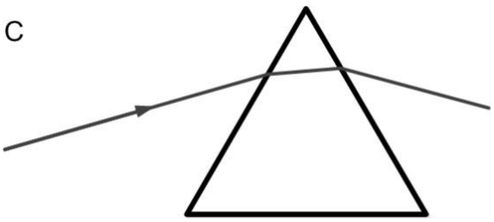

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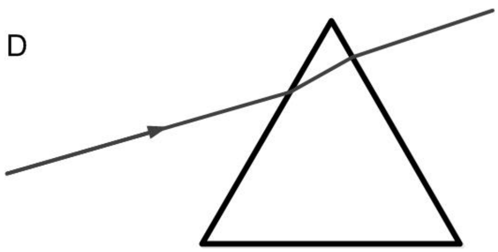


Your answer ☐

[1]

8 The Sun was formed from a cloud of dust and gas.

Which force brought together the particles of the cloud?

A electrostatic

B frictional

C gravitational

D magnetic

Your answer ☐

[1]

9 Which of these is evidence for an expanding universe?

A Light from galaxies is red shifted.

B Nuclear fusion occurs in stars.

C Many stars have orbiting planets.

D Stars were formed from dust and gas.

Your answer ☐

[1]

10 What is the number of neutrons in this isotope of uranium?

$$^{238}_{92}\mathrm{U}$$

A 92

B 119

C 146

D 238

Your answer ☐

[1]

11 All radioactive sources have a half-life.

Which statement about the half-life of a source is correct?

A It is half the time for the radioactive source to become safe.

B It is half the time it takes for an atom to decay.

C It is half the time it takes the activity of the source to decrease to zero.

D It is the time it takes the activity of the source to decrease by half.

Your answer ☐

[1]

12 Which wall would allow the **most** heat transfer through the wall?

A **Thick** wall made from a material with **high** thermal conductivity.

B **Thick** wall made from a material with **low** thermal conductivity.

C **Thin** wall made from a material with **high** thermal conductivity.

D **Thin** wall made from a material with **low** thermal conductivity.

Your answer ☐

[1]

13 Why are high voltages used to transfer electrical power from power stations in the National Grid?

A allows low resistance wires to be used.

B produces a higher current.

C reduces energy losses.

D voltage can be changed using transformers.

Your answer ☐

[1]

14 A radio transfers 30 J of potential energy to 27J of useful energy.

What is the efficiency and energy loss for the radio?

	Efficiency	Energy loss
A	10%	3J
B	10%	27J
C	90%	3J
D	90%	27J

Your answer ☐

[1]

15 A boy kicks a football.

The football has a mass of 400 g.

What is the potential energy of the football when it is 0.8 m above the ground?

Use the constant: gravitational field strength (g) = 10 N/kg.

A 0.032 J

B 3.2 J

C 320 J

D 3 200 J

Your answer ☐

[1]

SECTION B

Answer **all** the questions.

16 Many power stations burn fuels to generate electricity.

Fuels can be renewable or non-renewable.

(a) Wood is used in some power stations.

Why is it called a renewable fuel?

.... **[1]**

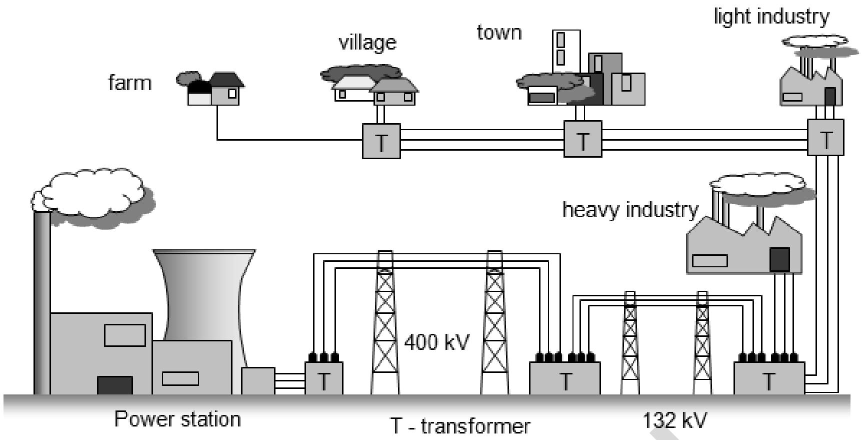
(b) Rachael has completed her homework on fuels used in power stations.

Look at her table below.

Fuel	**Type**
Wood	renewable
Plant and vegetable oils	renewable
Peat	non-renewable
Coal	renewable
North Sea gas	non-renewable
Uranium	renewable

She has made **two** mistakes, identify these in the table by putting a cross (**x**) next to them. **[2]**

(c) Power stations produce electrical energy and use the National Grid to send it to factories and homes in the UK.



A step-up transformer is used in the National Grid.

State what a step-up transformer does.

....

.... **[1]**

(d) Domestic UK electrical wiring uses live, neutral and earth wires.

Complete the two empty boxes and then draw lines to match up the wires to their colour and function.

Wire	**Colour**	**Function**
Live		Completes the circuit
Earth	brown	
Neutral	yellow and green	Has a high potential difference

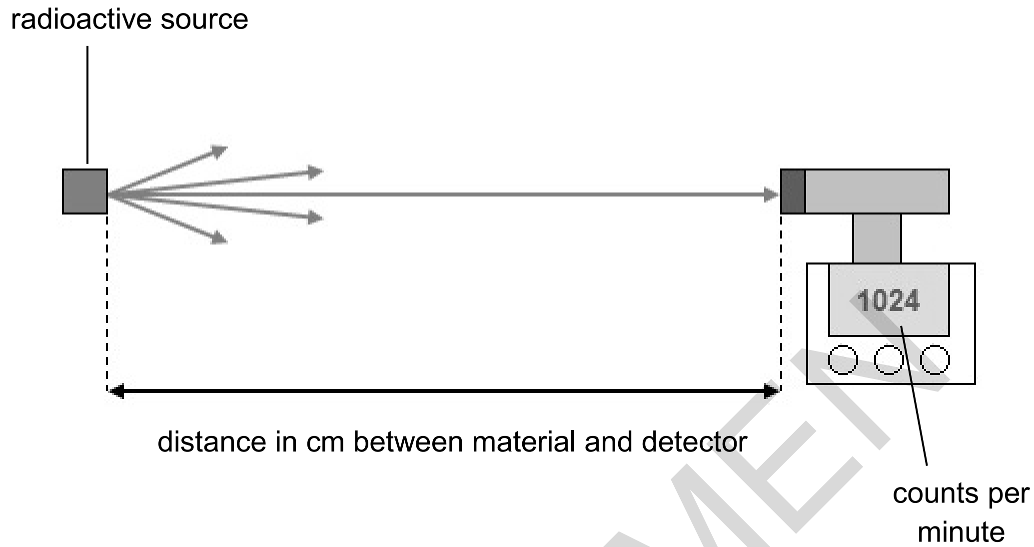
[4]

17 Matt experiments with radioactive materials.

He investigates how the activity of radiation changes with distance.

The radiation moves from the source to a detector.

He measures the counts per minute from a radioactive source.



The table shows the results from the experiment.

Distance between the source and the detector (cm)	Count rate (counts per minute)
10	1000
20	240
40	60
80	20

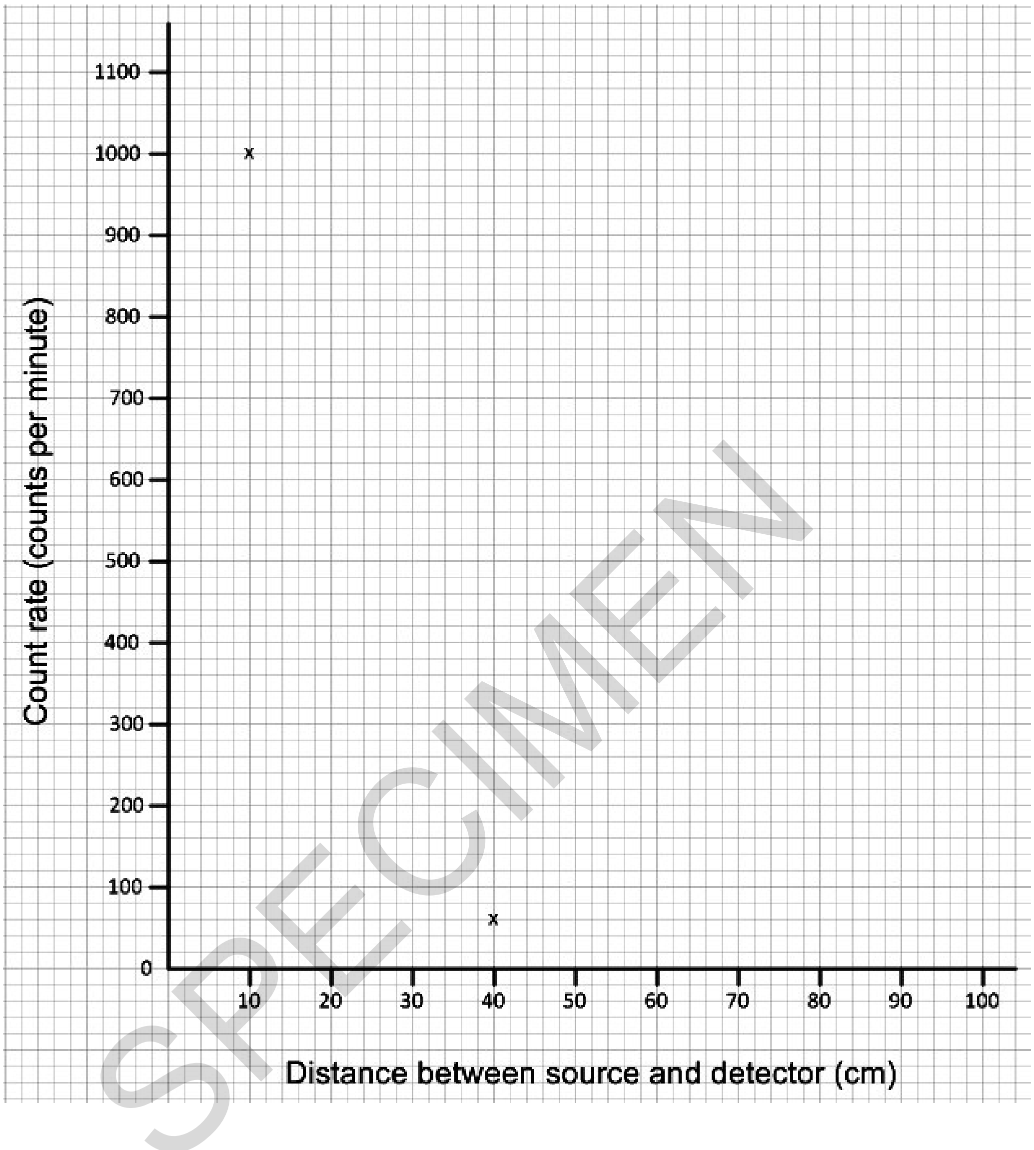
(a) Matt could **not** take an accurate reading at 0 cm.

Suggest a reason why.

.... **[1]**

(b) **(i)** Two points for 10 cm and 40 cm have been plotted on the graph below.

Plot the rest of Matt's results and join the points with a smooth curve.



[2]

(ii) Use the graph to estimate the reading at **30 cm**.

answer: ……………………………………….. counts per minute **[1]**

(c) **(i)** What pattern is shown by the results as the distance is increased from **20** cm to **40** cm?

………………………………………………………………………………………

……………………………………………………………………………………… **[2]**

(ii) Matt wants to find the count rate at 5 cm.

Estimate the count rate at a distance of 5 cm.

answer: ……………………………………….. counts per minute **[1]**

(d) Matt thinks that his results show that keeping your distance from radioactive materials is a good thing.

Radioactive material	State	Distance from source	Irradiation risk	Contamination risk
A	solid	1m	high	none
A	solid	4m	low	none
B	gas	1m	very high	high
B	gas	4m	high	high

He writes down his conclusions about two radioactive sources in a table.

Describe the difference in the risks for irradiation and contamination for **A** and **B**.

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……………………………………………………………………………………………… **[4]**

18 Rockets carry satellites into space.

(a) These satellites are kept in orbit around a planet by a force.

What is the name of this force?

.... **[1]**

(b) Write down the name of the Earth's natural satellite.

.... **[1]**

(c) A rocket carrying a vehicle called the Mars Rover was sent to Mars.

The Mars Rover has a mass of 185 kg.

The gravitational field strength (g) on Mars is 3.75 N/kg.

Calculate the weight of the Rover vehicle on Mars.

Show your working and give your answer to **3** significant figures.

State the unit for weight.

....

....

....

....

answer: .... **unit**........... **[5]**

(d) Why did the Mars Rover weigh more on Earth than on Mars?

.... **[1]**

19 Alex has two radiators in her home. They are filled with 10 kg of different liquids.

oil-filled radiator	**water-filled radiator**
 **Heater contains 10 kg of oil** **1000 W heater**	 **Heater contains 10 kg of water** **1500 W heater**

The table below shows information about oil and water.

Material	Specific heat capacity (J/kg°C)	Freezing point (°C)	Boiling point (°C)
Oil	1 700	-24	250
Water	4 200	0	100

(a) Alex's conservatory can be very cold.

Sometimes it can get as low as -6 ºC.

Alex thinks that the oil radiator may be better for the conservatory.

Suggest why.

....

.... **[1]**

(b) Both radiators have a 'cut-out' which prevents them getting hotter than 60 ºC.

Suggest why.

....

.... **[1]**

(c) Alex does a calculation.

She knows that the oil heater produces 800 J of energy each second.

Calculate the energy produced by the oil heater in 10 minutes.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

answer: ……………………………… J **[2]**

(d) **(i)** Alex wants the oil heater to heat up by 40ºC.

How much energy is needed? Show your working.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

answer: ………………J **[2]**

(ii) She supplies enough energy to heat up the oil radiator by 40ºC but it only heats up to 32ºC.

Suggest two reasons why.

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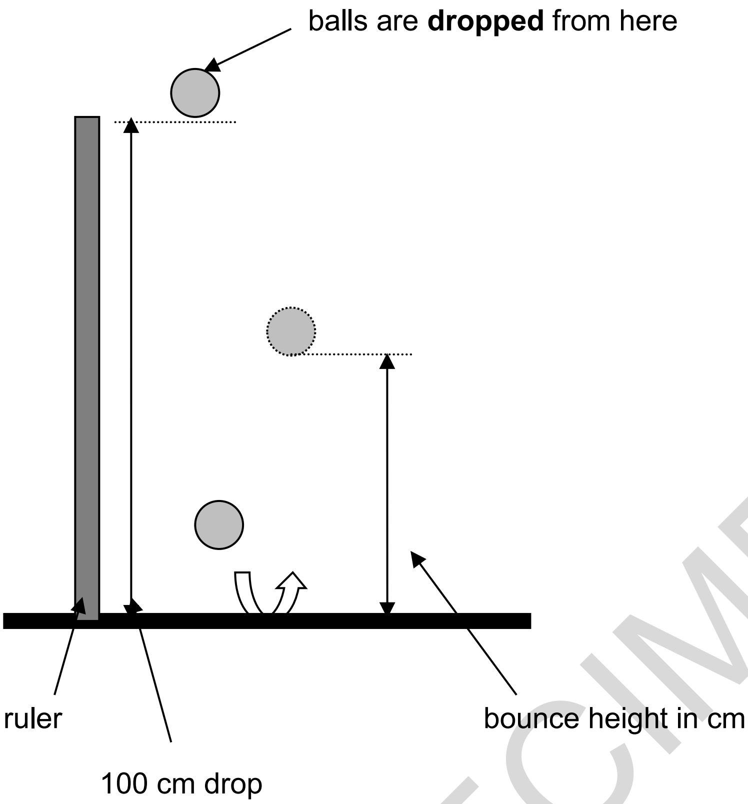
…………………………………………………………………………………………………

………………………………………………………………………………………………… **[2]**

20 Kate investigates how well different balls bounce.

She drops different balls from the same height and measures the height the balls bounce.

She repeats the experiment 3 times for each ball.



Her results are shown in the table.

Ball	Drop height (cm)	1st reading bounce height (cm)	2nd reading bounce height (cm)	3rd reading bounce height (cm)	Mean bounce height (cm)
Red	100	75	77	73	75
Blue	100	61	62	60	61
Green	100	60	31	58	
White	100	84	86	85	85
Yellow	100	26	24		26

(a) Calculate the **mean** bounce height for the **green** ball.

.... **[1]**

answer:.......................... cm

(b) Kate forgot to write down one of the results for the **yellow** ball.

Suggest the value of the **missing** result for the **yellow** ball.

....

answer: .... cm **[1]**

(c) Evaluate the reliability of the results

Suggest how she could have improved her experiment.

....

....

.... **[3]**

(d) **(i)** Kate suggests that 15% of the **white** ball's initial energy was not transferred usefully. Use calculations to show that this is correct and suggest where the energy was transferred to.

....

....

.... **[2]**

(ii) How could the efficiency of the ball be improved?

.... **[1]**

(e) Explain how energy is transferred and lost from the ball when it bounces.

....

....

.... **[2]**

21 The table below shows the stopping distances for a car.

Speed of car (m/s)	Thinking distance (m)	Braking distance (m)	Total stopping distance (m)
8	6	6	12
16	12	24	
32		96	120

(a)* Analyse the data in the table and use it to describe the trends shown.

Suggest reasons for the differences in the patterns in the data.

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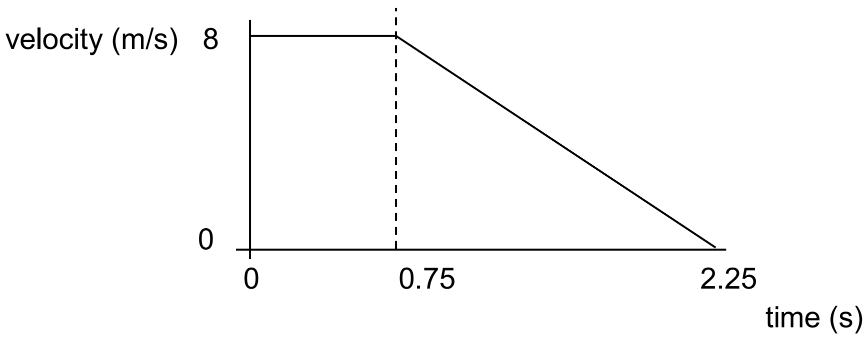
.... **[6]**

(b) The car takes 6 m to brake when moving at 8 m/s.

Look at the graph of a car travelling at 8 m/s, starting to brake and then stopping.



(i) Calculate the acceleration of the car during braking.

Show your working and state the unit.

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....

....

....

answer: ....**unit**.............. **[4]**

(ii) The car has a braking force of 5000 N.

Calculate the work done by the brakes on the car.

....

....

....

answer: .... J **[2]**

(c) If a driver is tired how will this affect the braking distance?

Explain your answer.

....

.... **[2]**

22 **(a)** A crowd makes a Mexican wave.

A Mexican wave **starts** with people lifting and lowering their arms.

The Mexican wave **continues** by people, next to them, lifting and lowering their arms.

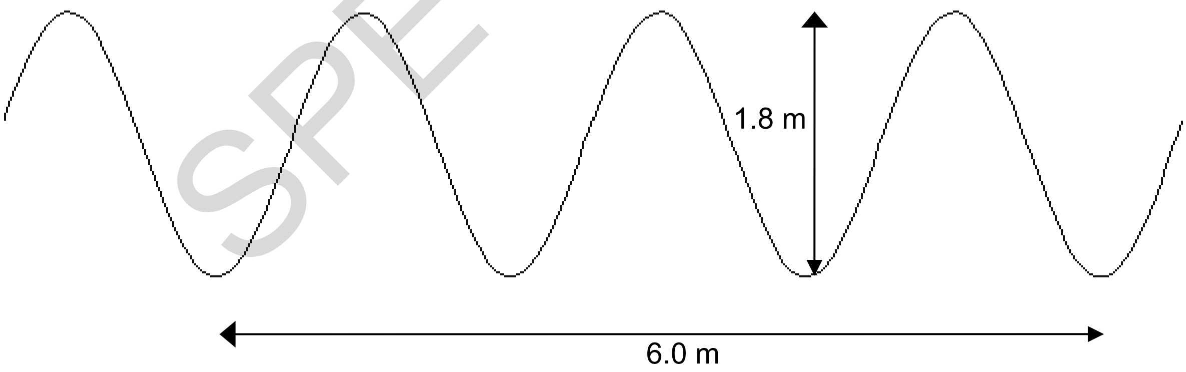
Why is a Mexican wave an example of a transverse wave?

....

.... **[1]**

(b) In the classroom a teacher demonstrates waves using a rope.

Look at the diagram of the wave.



(i) The frequency of the wave is 2 Hz.

What does this statement mean?

....

.... **[2]**

(ii) How many seconds will it take this wave to travel 12 m?

Show your working.

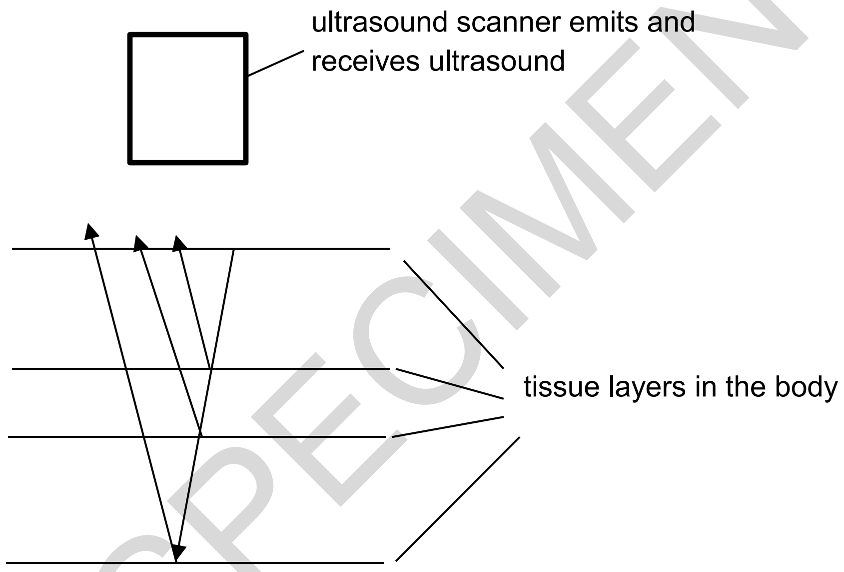
....

....

....

answer: .... seconds **[3]**

(c) Ultrasound scans are used to produce images of tissues inside the body.



Ultrasound waves are emitted.

They reflect from layers of tissue inside the body.

Explain how the reflections are used to produce an image of the tissues.

....

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....

....

.... **[3]**

(d) Ultrasound and X rays are used to scan patients in hospitals.

Complete the table to show a medical use, benefits and risk of using these waves to scan patients.

Wave	**Medical use**	**Example of a benefit**	**Risk**
X-rays	Shows up hard tissues inside the body.	Takes images of broken bones.	Damages living cells by causing ....
ultrasound	....	....	None

[3]

23 A car on a roller coaster is stationary at the top of a slope.

It has a weight of 6 500 N and a potential energy of 217 000 J.

(a) Calculate how high above the ground it is.

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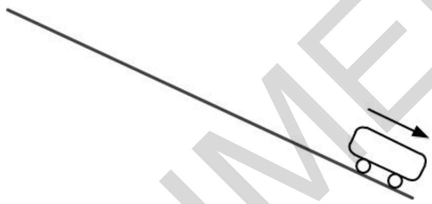
answer: ………………m **[2]**

(b)



The energy at the bottom of the slope is lower than expected.

Suggest **two** ways to improve the efficiency of the roller coaster car.

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....

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.... **[2]**

END OF QUESTION PAPER