OCR
Oxford Cambridge and RSA

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GCSE (9–1) Physics A (Gateway Science)

F

J249/02 Paper 2 (Foundation Tier)

Sample Question Paper

Date – Morning/Afternoon

Version 2

Time allowed: 1 hour 45 minutes

You must have:
- the Data Sheet

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

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 electromagnetic waves have the highest frequency?

A Gamma rays

B Microwaves

C Radio waves

D Ultra-violet rays

Your answer ☐ **[1]**

2 Which frequency is used for electricity supplied 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

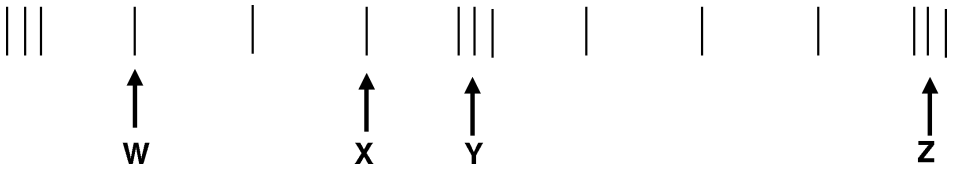
C 2 seconds

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 a snapshot of the position of the coils as the wave passes along the spring.



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 statement is **not** true of all electromagnetic waves?

A They have the same wavelength.

B They are transverse waves.

C They can travel through a vacuum.

D They travel at 300 000 000 m/s.

Your answer ☐ **[1]**

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

A Light from a torch

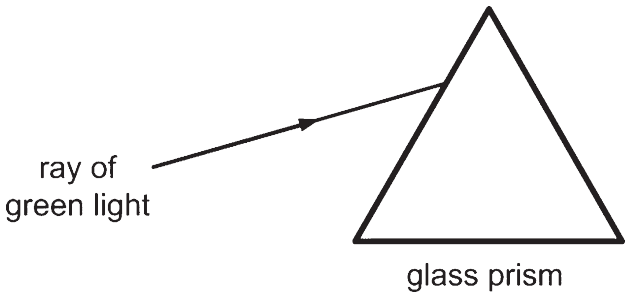
B Ripples from a stone dropped in water

C Sound from a loudspeaker

D Ultra-violet from the Sun

Your answer ☐ **[1]**

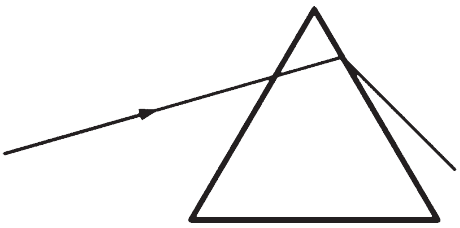
7 A ray of **green** light shines through a glass prism.



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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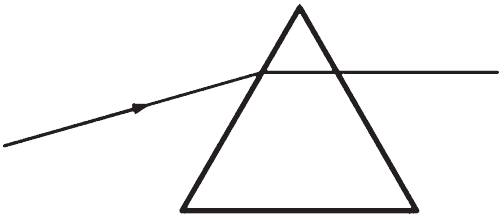

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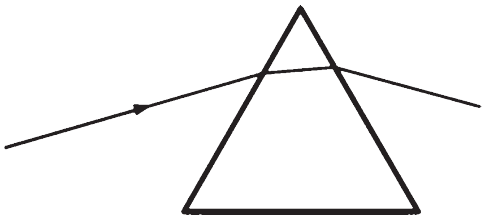

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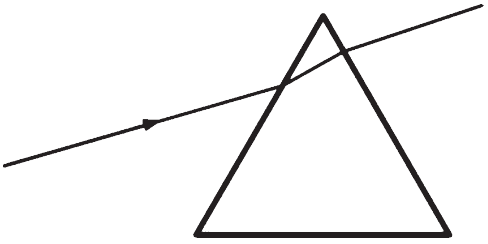


Your answer ☐ **[1]**

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 statement 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 an atom to decay.

B It is half the time for the activity of the source to decrease to zero.

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

D It is the time for 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 A **thick** wall made from a material with **high** thermal conductivity.

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

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

D A **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 They allow low resistance wires to be used.

B They produce a higher current.

C They reduce energy losses.

D Voltage can be changed using transformers.

Your answer ☐ **[1]**

14 A radio transfers 30 J of potential energy to 27 J 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 with a mass of 400 g.

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

- 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 wood called a renewable fuel?

..... **[1]**

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

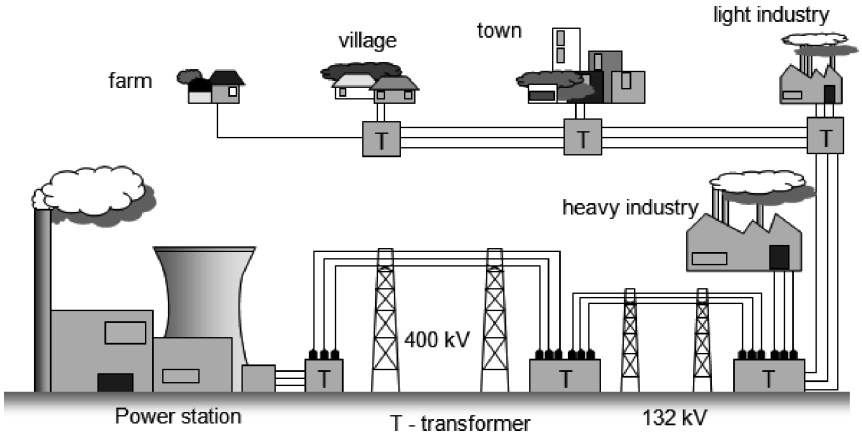
Look at her table below.

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

[2]

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

(c) Power stations produce electrical energy and use the National Grid to send the energy 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.

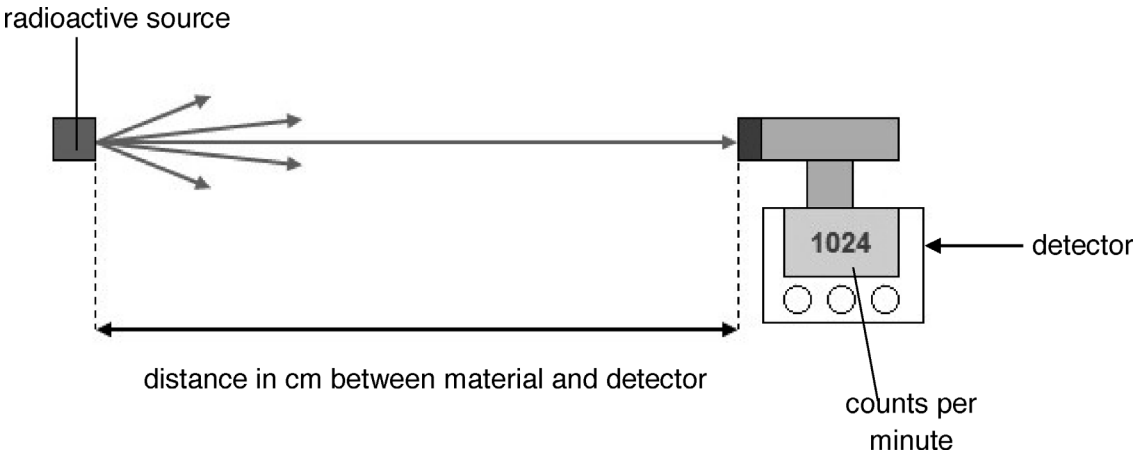
Draw lines to match up the wires to their **colour** and **function**.

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

[4]

17 A student does an experiment with radioactive materials.

- He investigates how the activity of radiation changes with distance.
- In the experiment, the radiation moves from the radioactive source to a detector.
- He measures the counts per minute at the detector.



The table shows the results.

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

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

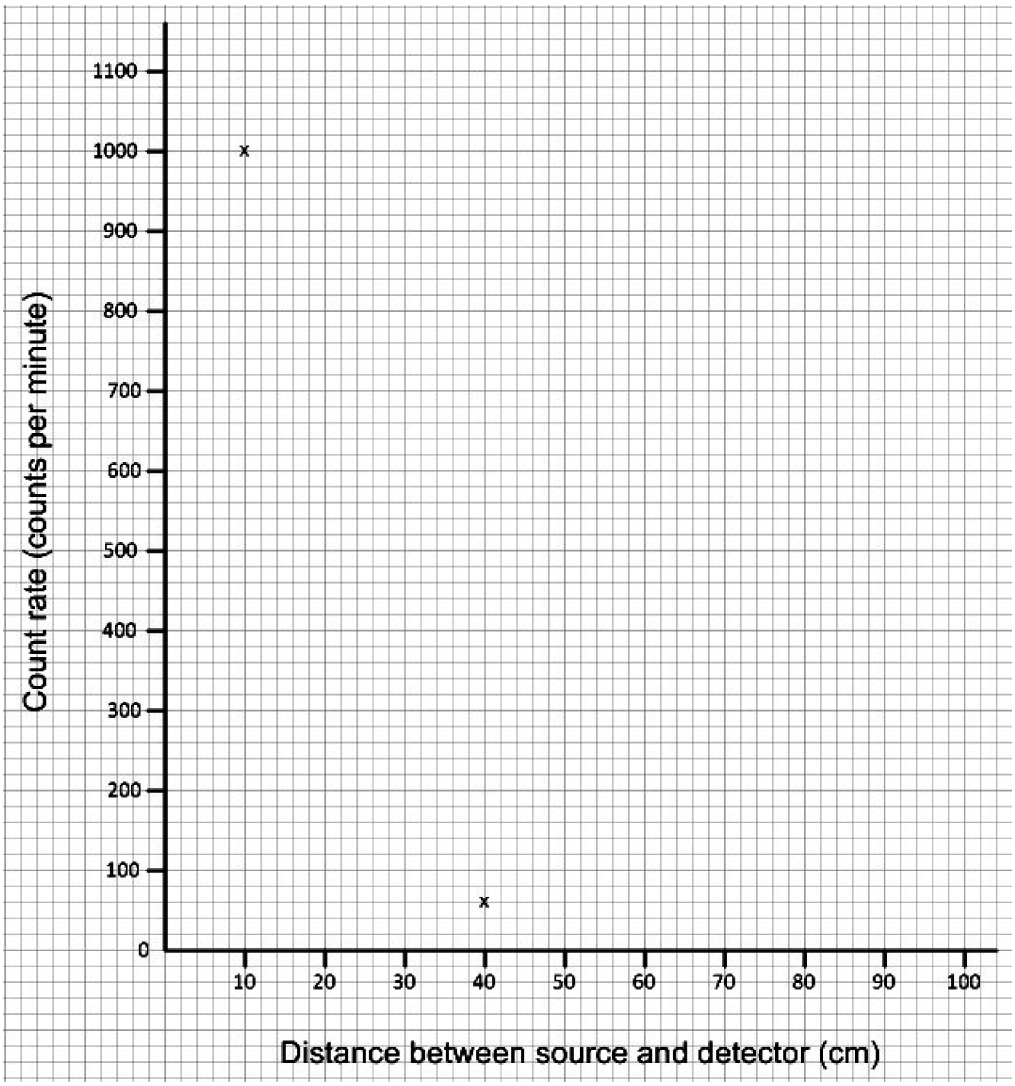
Suggest a reason why.

..... **[1]**

(b) (i) Plot the results on the graph below.

Two points for 10 cm and 40 cm have been plotted for you.

Join the points with a smooth curve.



[2]

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

Answer = ... counts per minute **[1]**

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

.....

..... **[2]**

(ii) The student 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) The student considers the risks of doing experiments with radioactive sources.

He does experiments with two radioactive sources, **A** and **B**.

He writes down his conclusions about the sources in the table below.

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

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) Satellites are kept in orbit around a planet by a force.

Name this force?

..... **[1]**

(b) Name the Earth's natural satellite.

..... **[1]**

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

Mars Rover

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 Mars Rover vehicle on Mars.
State the unit for weight.

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

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Answer = ... Unit = ... **[5]**

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

..... **[1]**

19 A student has two radiators in her home. They are filled with different liquids and have different power ratings.

Fig. 19.1 shows information about the two heaters.

Oil radiator	Water radiator
 Heater contains 10 kg of **oil**	 Heater contains 10 kg of **water**
1000 W heater	**1500 W heater**

Fig. 19.1

Table 19.1 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

Table 19.1

(a) The student's conservatory can be very cold.
Sometimes the temperature can get as low as –6 °C.

She thinks that it may be better to use the oil radiator in the conservatory than the water radiator.

Suggest why.
Use the information in **Table 19.1** to help you answer.

.....

..... **[1]**

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

Suggest why.

.....

..... **[1]**

(c) The student 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) The student wants the oil heater to heat up by 40°C.

(i) How much energy is needed?

Use the information in **Fig. 19.1** and **Table 19.1** to help you answer.

Show your working.

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Answer = ... J **[2]**

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

Suggest **two** reasons why.

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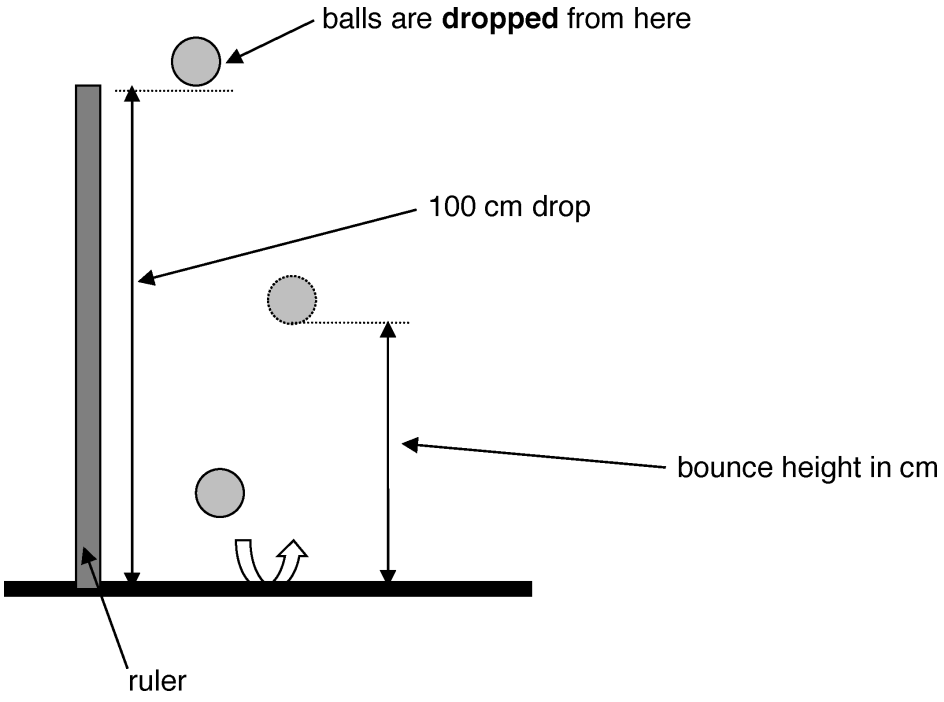
..... **[2]**

20 A student investigates how well different balls bounce.

- She drops five different balls from the same height and measures the height the balls bounce.
- She repeats the experiment three times for each ball.



Her results are shown in **Table 20.1**.

Ball	Drop height (cm)	Bounce height (cm)			Mean bounce height (cm)
		1st reading	2nd reading	3rd reading	
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

Table 20.1

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

.....

Answer = ... cm **[1]**

(b) The student forgot to write down one of the bounce heights for the **yellow** ball.

Suggest 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.

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..... **[3]**

(d) The student suggests that 15% of the **white** ball's initial energy was not transferred usefully.

(i) Show that her suggestion is correct and suggest where the energy has been transferred to.

Use calculations and the information in **Table 19.1** to help you answer.

.....

.....

..... **[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.

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..... **[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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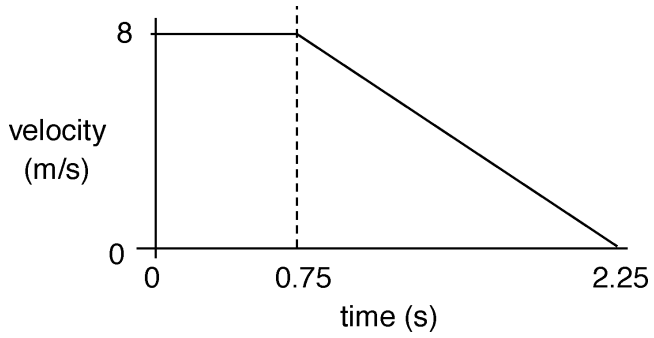
..... **[6]**

(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 units.

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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.

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Answer = ... J **[2]**

(c) How is the braking distance affected if a driver is tired?

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?

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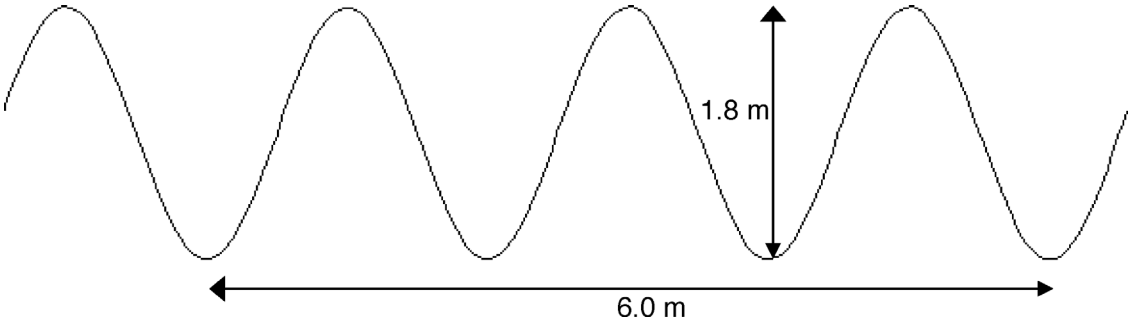
..... **[1]**

(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?

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..... **[2]**

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

Show your working.

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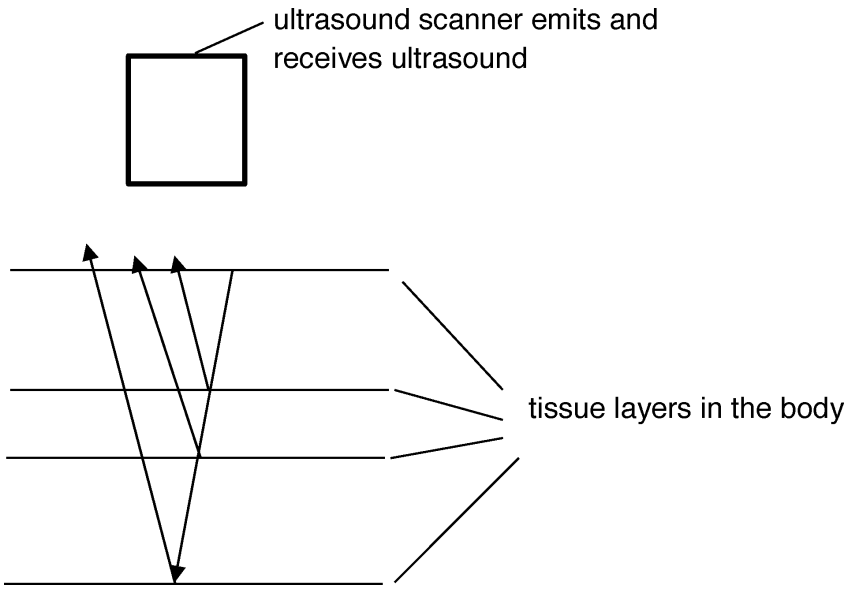
Answer = ... seconds **[3]**

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



Ultrasound waves are emitted.

The waves 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, benefit 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.

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

(a) Calculate the car's height above the ground.

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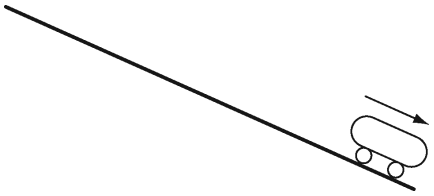
Answer = ... m **[2]**

(b) The diagram shows the roller coaster car moving down a slope.



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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..... **[2]**

END OF QUESTION PAPER