Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number	Candidate Number

Wednesday 22 May 2019

Afternoon (Time: 1 hour 45 minutes) | Paper Reference **1PH0/1H**

Physics
Paper 1

Higher Tier

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.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an asterisk (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- A list of equations is included at the end of this exam paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over

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P 5 6 4 0 2 A 0 1 3 2

Pearson

Answer ALL questions. Write your answers in the spaces provided.

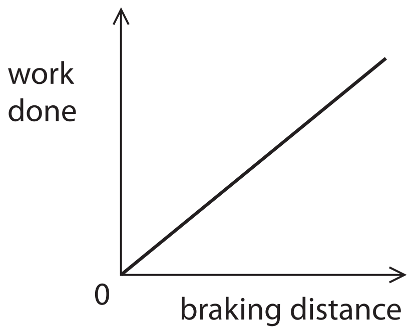
Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) The work done to bring a car to rest is given by the equation

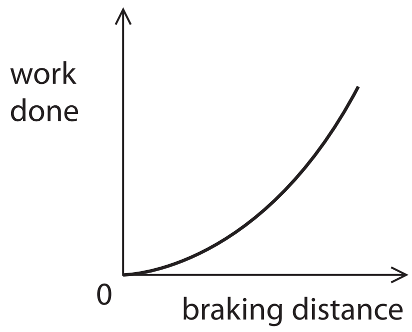
work done = braking force × braking distance

Which of these graphs is correct for the car if a constant braking force is applied?

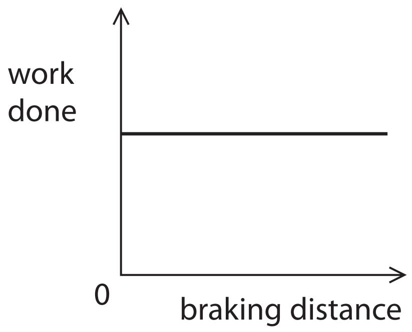
(1)



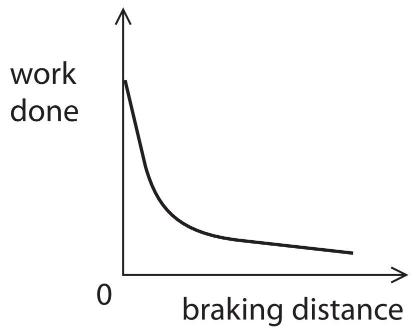
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(b) Before the car brakes it has kinetic energy.
The kinetic energy decreases as it brakes.

State what happens to the kinetic energy during braking.

(1)

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(c) The graph in Figure 1 shows how the braking distance, *d*, of a car depends on the velocity, *v*, of the car when the brakes are first applied.

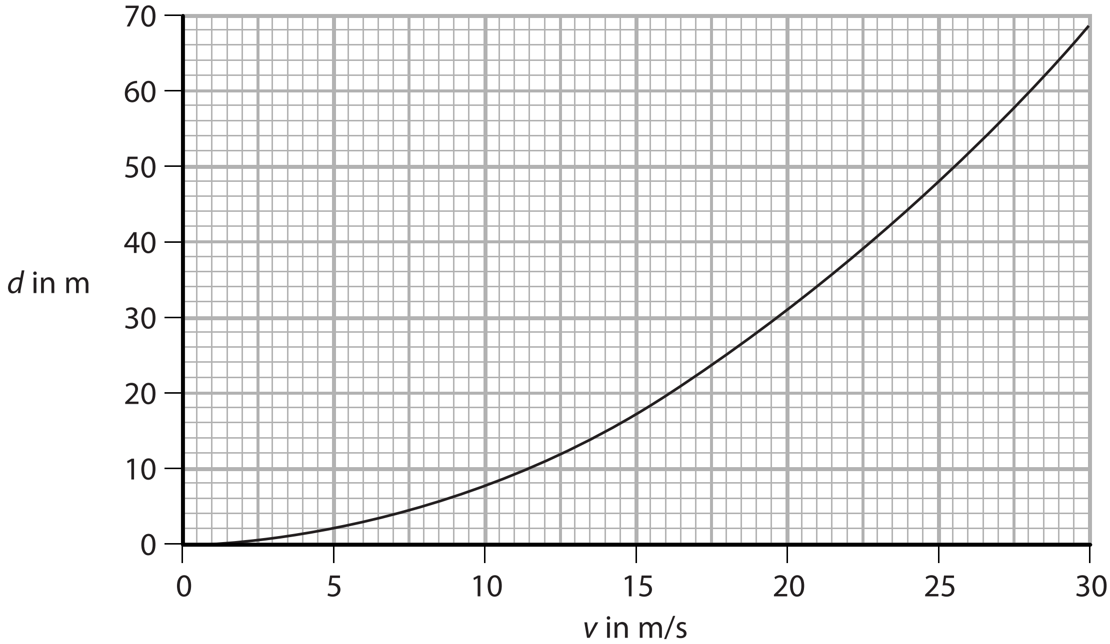

Figure 1

An equation relating braking distance, *d*, to velocity, *v*, is

$$d = \frac{v^2}{C}$$

where *C* is a constant.

Use the equation and data from the graph in Figure 1 to calculate a value for *C*.

Give a unit for *C*.

(4)

C = ... unit..

(Total for Question 1 = 6 marks)

2 (a) Which colour of visible light has the longest wavelength?

(1)

- ☒ **A** blue
- ☒ **B** green
- ☒ **C** red
- ☒ **D** yellow

(b) Some television remote controls use infrared radiation and other remote controls use radio waves.

Explain why an infrared remote control may not switch on the television from behind an armchair but a radio wave remote control always will.

(2)

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(c) Figure 2 is a diagram of a water wave.

A cork is floating on the water.

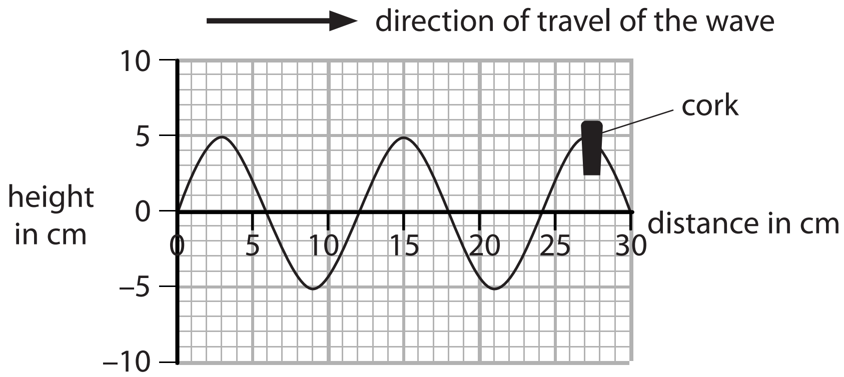

Figure 2

(i) Use the scale on the diagram to measure the wavelength of the wave.

(2)

wavelength = ... cm

(ii) Describe the motion of the cork.

You should include how the cork moves relative to the direction of travel of the wave.

(2)

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(d) A different water wave has a wavelength of 0.25 m and a frequency of 1.5 Hz.

Calculate the wave speed.

(2)

wave speed = ... m/s

(Total for Question 2 = 9 marks)

3 (a) Carbon-13 and carbon-14 are isotopes of carbon.

Nuclei of carbon-13 and carbon-14 can be represented by these symbols

$$^{13}_{6}C \quad \text{and} \quad ^{14}_{6}C$$

Complete the table for an atom of carbon-13 and an atom of carbon-14.

(2)

	number of neutrons in the nucleus	**number of electrons in orbit around the nucleus**
carbon-13		
carbon-14		

(b) (i) State the name of an instrument that can be used to measure radioactivity.

(1)

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(ii) State **two** sources of background radiation.

(2)

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(c) Carbon-14 is radioactive and has a half-life of 5 700 years.

The number of radioactive carbon-14 atoms in a very old piece of wood is found to have decreased from 1 000 000 to 125 000.

Determine the age of the piece of wood.

(2)

age of wood = ... years

(d) Carbon-14 decays into nitrogen-14.

The symbol for nitrogen-14 is $^{14}_{7}N$

Explain what happens in a carbon-14 nucleus when it decays to a nitrogen-14 nucleus.

(2)

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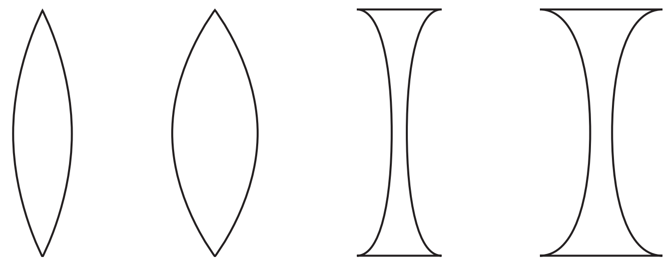
(Total for Question 3 = 9 marks)

4 (a) (i) Which lens is a converging lens with the greatest power?

(1)



☒ **A** ☒ **B** ☒ **C** ☒ **D**

(ii) The equation that relates the power of a lens to the focal length of the lens is

$$\text{power (in dioptres)} = \frac{1}{\text{focal length (in metres)}}$$

The power of a lens is 5 dioptres.

Use the equation to calculate the focal length of the lens in cm.

(2)

focal length = ... cm

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(b) Figure 3 shows a semicircular glass block.

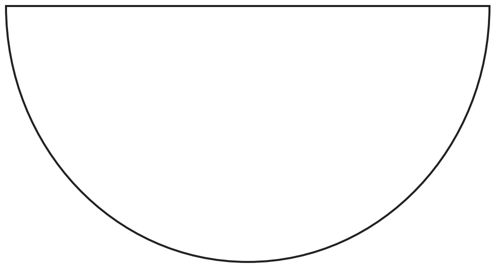

Figure 3

Describe how a student could use the semicircular glass block and other apparatus to determine the critical angle for a glass-air boundary.

You should add to the diagram in Figure 3 to help with your answer.

(4)

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(c) (i) A long time ago, scientists believed that the Earth was at the centre of the Solar System.

Evidence has since proved that the Sun is at the centre of the Solar System.

State **one other** idea about the Solar System that **has** changed over time.

(1)

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(ii) Figure 4 shows data for some of the planets of the Solar System.

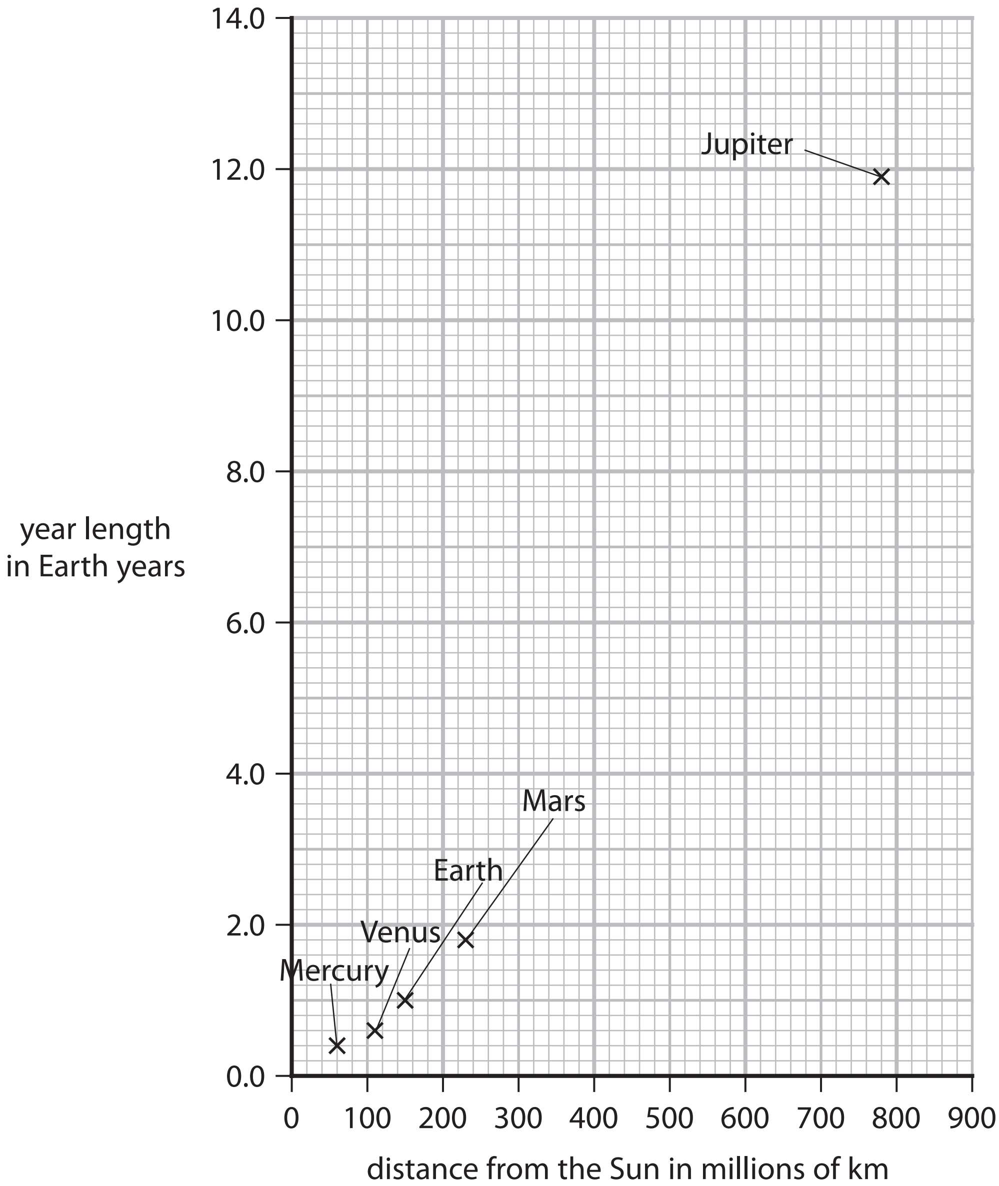

Figure 4

Ceres is an asteroid that orbits the Sun between Mars and Jupiter.
It takes Ceres 4.6 Earth years to make one orbit of the Sun.

Use the graph to estimate the distance of Ceres from the Sun.

Show your working.

(3)

distance of Ceres from the Sun = ... millions of km

(Total for Question 4 = 11 marks)

5 Figure 5 shows a way of projecting a small trolley up a sloping track.

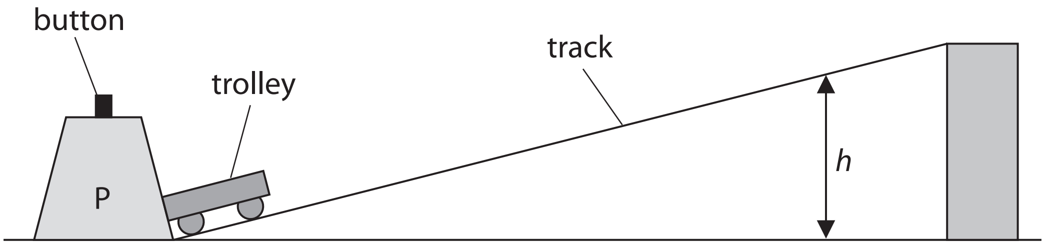

Figure 5

When the button is pressed, a spring is released in P that projects the trolley up the track.

The trolley travels up the track, stops and then rolls back down.

The spring in P always exerts the same force when projecting the trolley.

(a) A student investigates how the mass of the trolley affects the maximum vertical height, *h*, reached by the trolley.

State the measurements the student should make to complete the investigation.

You should make use of the equipment shown in Figure 5 and any other equipment that is needed.

(4)

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(b) Figure 6 is a graph of the student's results.

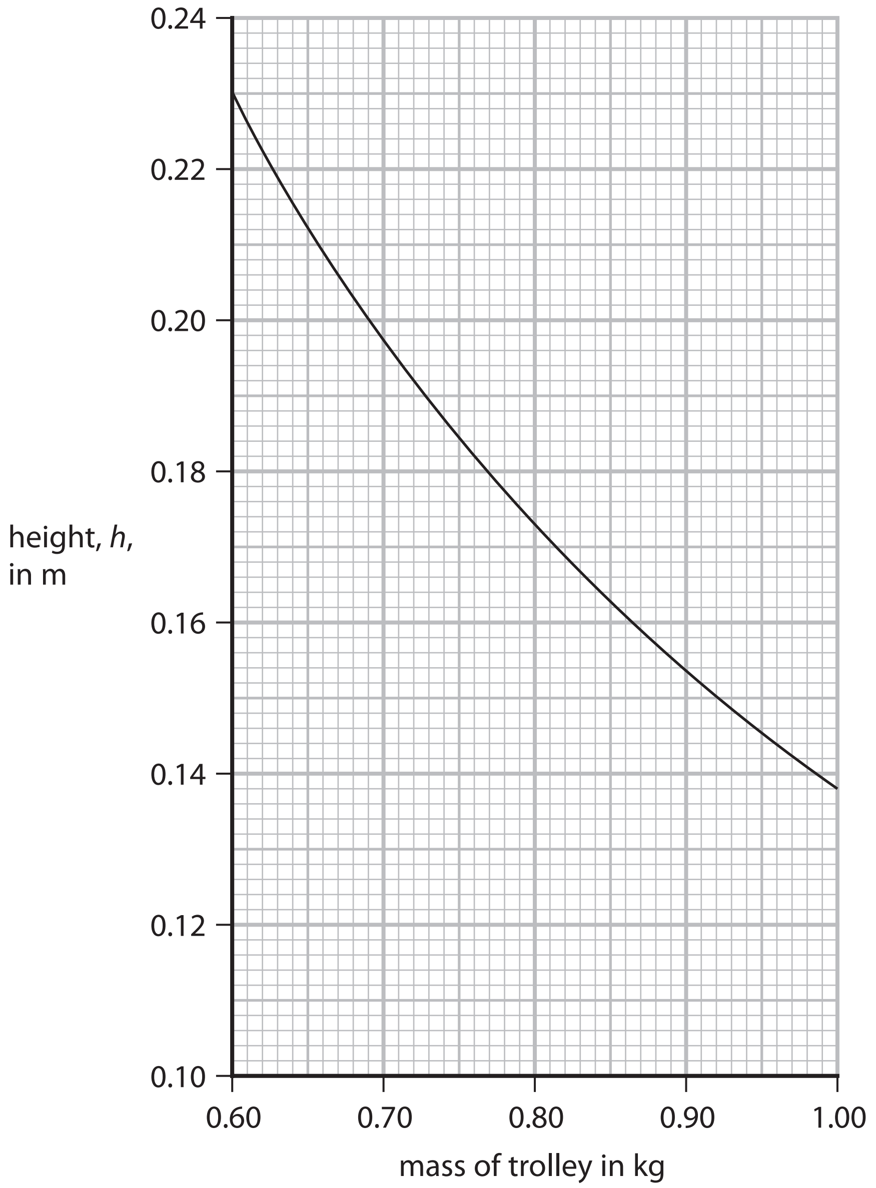

Figure 6

The student states that the energy transferred by the spring is the same each time it is used.

Use data from any two points on the graph in Figure 6 to support this statement.

(3)

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(c) Describe how the student could extend the investigation to determine the average speed of the trolley as it rolls back down the track.

(3)

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(Total for Question 5 = 10 marks)

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6 (a) The diagram in Figure 7 shows two students, P and Q, trying to measure the speed of sound in air.

Figure 7

P will clap his hands together.

When Q sees P clap his hands, she will start a timer.

When Q hears the clap, she will stop the timer.

Explain **one** way the students could improve their method.

(2)

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(b) Figure 8 shows a long metal rod and a hammer.
The rod is hit at one end by the hammer.
This causes a sound wave to travel along the inside of the metal rod.

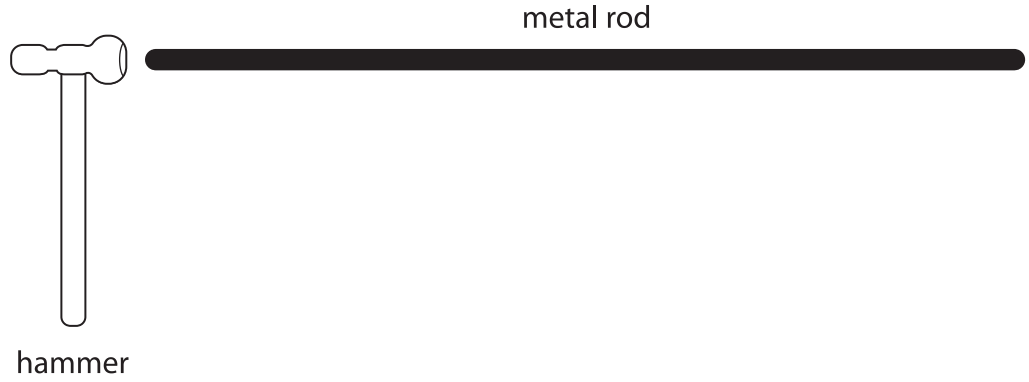

Figure 8

Describe how hitting the rod causes a sound wave to travel along the inside of the rod.

(2)

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(c) Sound travels slower in air than it does in water.

Figure 9 shows the direction of travel of a sound wave approaching a boundary between air and water.

The sound wave refracts at the boundary between air and water.

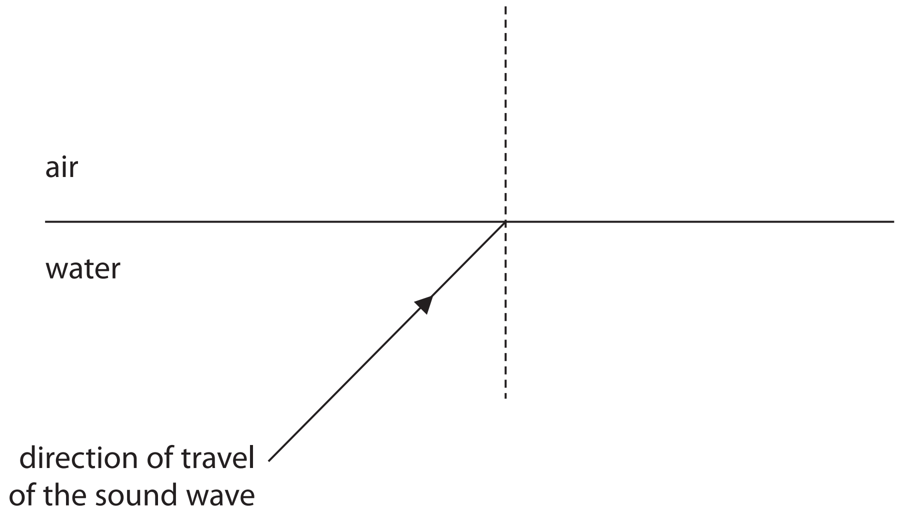

Figure 9

Complete the diagram in Figure 9 to show the direction the sound wave travels in the air.

(2)

(d) Sound travels slower in cold air than it does in warm air.

The equation relating the speed of sound in air to the density of the air is

$$\text{speed of sound} = \frac{K}{\sqrt{(\text{density})}} \qquad \text{where K is a constant.}$$

The table in Figure 10 gives some data about the speed of sound in air and the density of air.

	speed of sound in m/s	**density of air in kg / m^3**
in cold air	331	1.29
in warm air		1.16

Figure 10

Use the equation and the data in the table in Figure 10 to calculate the speed of sound in warm air.

Give your answer to an appropriate number of significant figures.

(3)

speed of sound in warm air = ... m/s

(Total for Question 6 = 9 marks)

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7 (a) The force that keeps an object moving in a circular path is known as the

(1)

☒ **A** balancing force

☒ **B** centripetal force

☒ **C** reaction force

☒ **D** resistance force

(b) Figure 11 shows an object moving in a circular path.

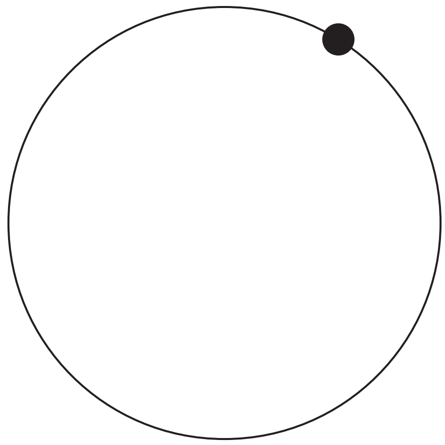

Figure 11

(i) Draw an arrow on Figure 11 to show the direction of the force that keeps the object moving in a circular path.

(1)

(ii) The object in Figure 11 is moving at constant speed.

Explain why it is not moving with constant velocity.

(2)

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(c) Figure 12 shows a skier on a slope.

The skier travels down the slope with a constant acceleration.

The speed of the skier is measured at points P and Q.

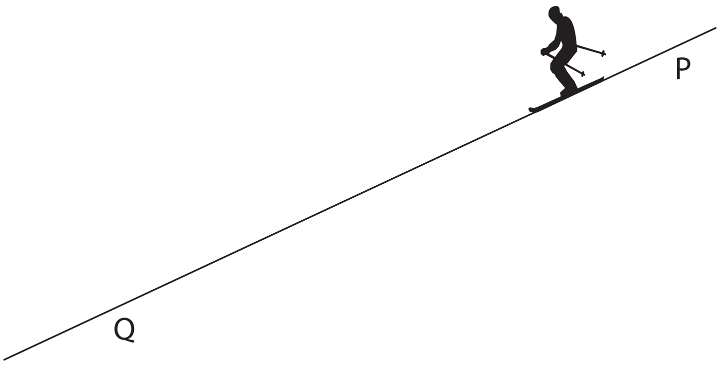

Figure 12

The table in Figure 13 gives some data about the skier making one downhill run.

acceleration	3.0 m/s^2
speed at P	7.6 m/s
speed at Q	24 m/s

Figure 13

(i) Calculate the distance from P to Q.

Use an equation selected from the list of equations at the end of this paper.

(3)

distance from P to Q = ... m

(ii) Calculate the time taken for the skier to travel from P to Q.

(3)

time from P to Q = ... s

(Total for Question 7 = 10 marks)

8 (a) Energy from the nuclei of atoms can be used in medical diagnosis and treatment.

(i) Fluorine-18 is a radioactive isotope used in PET scanners for medical diagnosis.

Explain why fluorine-18 must be produced close to the hospital where it is used.

(2)

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(ii) Some tumours inside the body can be treated by using either alpha radiation or gamma radiation.

Explain why the source of alpha radiation is usually inside the body but the source of gamma radiation can be outside the body.

(4)

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(b) (i) In a controlled chain reaction of uranium-235, which of these could cause a uranium-235 nucleus to undergo fission?

(1)

☒ **A** an alpha particle

☒ **B** a beta particle

☒ **C** a neutron

☒ **D** a proton

(ii) The kinetic energy of one of the particles released in a fission reaction is 1.2×10^{-11} J.

The mass of the particle is 1.4×10^{-25} kg.

Calculate the velocity of the particle.

(3)

velocity of the particle = ... m/s

(Total for Question 8 = 10 marks)

9 (a) Some sunglasses have photochromic lenses.

Photochromic lenses are clear when the lenses are indoors but they darken in bright sunlight to reduce the effects of the sunlight.

Photochromic lenses react to ultraviolet light.

Suggest a benefit of making the lenses go dark with ultraviolet light.

(1)

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(b) Radio waves from Jupiter take 40 minutes to reach Earth.

Light waves from the Sun take 8 minutes to reach Earth.

Calculate how many times further it is from Earth to Jupiter than from Earth to the Sun.

State the property of electromagnetic radiation that is used in your answer.

(2)

.... times

property..

....

(c) Ultraviolet waves cover a range of frequencies.

Scientists divide this range into three types, UVA, UVB and UVC.

The table in Figure 14 shows the frequency range for each type.

type	frequency range in Hz
UVA	7.5×10^{14} to 9.4×10^{14}
UVB	9.4×10^{14} to 10×10^{14}
UVC	10×10^{14} to 30×10^{14}

Figure 14

Figure 15 is a diagram about the effect that the Earth's atmosphere has on three types of ultraviolet radiation.

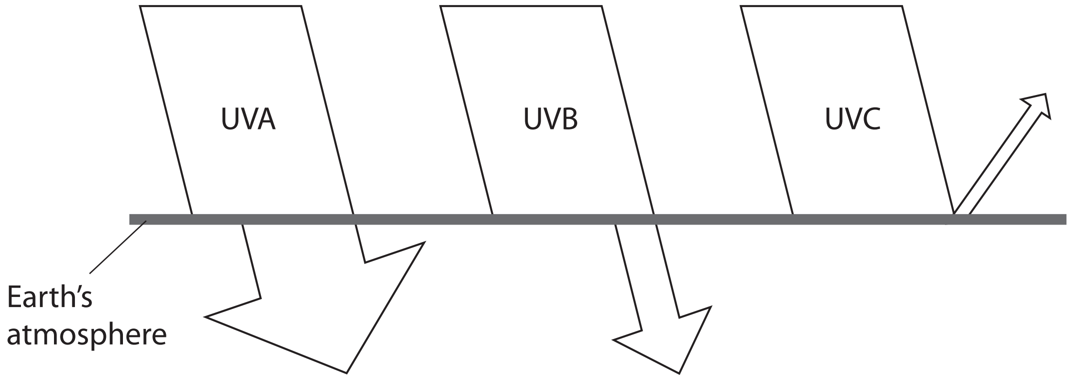

Figure 15

Describe how the effects change with **wavelength**, using information from Figure 14 and Figure 15.

The width of the arrows drawn indicates the amount of radiation that is involved.

Calculations are **not** required.

(4)

*(d) Radio waves and gamma radiation are at opposite ends of the electromagnetic spectrum.

Compare how these two electromagnetic radiations are produced.

(6)

(Total for Question 9 = 13 marks)

10 (a) Stars may originate as a nebula.

(i) Describe the process that then occurs to produce the conditions necessary for nuclear fusion in a new star.

(3)

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(ii) The energy, E, released in nuclear fusion is equivalent to loss in mass, m, according to the equation.

$$E = mc^2$$

where c is the velocity of light.

$c = 3.00 \times 10^8$ m/s

In 1 second, the energy radiated by the Sun is 3.86×10^{26} J.

Calculate the loss in mass of the Sun in 1 second.

(2)

loss in mass = ... kg *(b) The Big Bang theory gives an explanation for the origin of the Universe.

Explain how evidence supports the ideas that

- the Universe is expanding
- the Universe began at a single point.

(6)

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(c) A star has evolved to become a neutron star.

The mass, M, of the neutron star, of radius R, is given by

$$M = \frac{4 \times \pi \times D \times R^3}{3} \qquad \text{where D is a constant}$$

$M = 4 \times 10^{30}$ kg

$D = 6 \times 10^{17}$ kg/m^3

Use the equation to calculate the value for R.

(2)

R = ... m

(Total for Question 10 = 13 marks)

TOTAL FOR PAPER = 100 MARKS

Equations

(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance $v^2 - u^2 = 2 \times a \times x$
force = change in momentum ÷ time $F = \frac{(mv - mu)}{t}$
energy transferred = current × potential difference × time $E = I \times V \times t$
force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length $F = B \times I \times l$
$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$
potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil $V_p \times I_p = V_s \times I_s$
change in thermal energy = mass × specific heat capacity × change in temperature $\Delta Q = m \times c \times \Delta\theta$
thermal energy for a change of state = mass × specific latent heat $Q = m \times L$
$P_1 V_1 = P_2 V_2$ to calculate pressure or volume for gases of fixed mass at constant temperature
energy transferred in stretching = 0.5 × spring constant × (extension)^2 $E = ½ \times k \times x^2$
pressure due to a column of liquid = height of column × density of liquid × gravitational field strength $P = h \times \rho \times g$

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