Paper Reference(s) **1SC0/1PH**

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

Combined Science

Paper 3: Physics 1

Higher Tier

Wednesday 22 May 2019 – Afternoon

Time: 1 hour 10 minutes plus your additional time allowance

INSTRUCTIONS TO CANDIDATES

Write your centre number, candidate number, surname, other names and your signature in the boxes below. Check that you have the correct question paper.

Centre No.								
Candidate No.								
Surname								
Other names								
Signature								
Paper Reference	1	S	C	0	/	1	P	H

Pearson

- Use BLACK ink or ball-point pen.
- 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.

MATERIALS REQUIRED FOR EXAMINATION
Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS
Equations booklet

INFORMATION FOR CANDIDATES
- 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.
- 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.

(Continues on next page)

ADVICE TO CANDIDATES

- 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.

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) Which colour of visible light has the longest wavelength? (1 mark)

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

(Question continues on next page)

(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 marks)

(Question continues on next page)

(c) Figure 1 is a diagram of a water wave.

A cork is floating on the water.

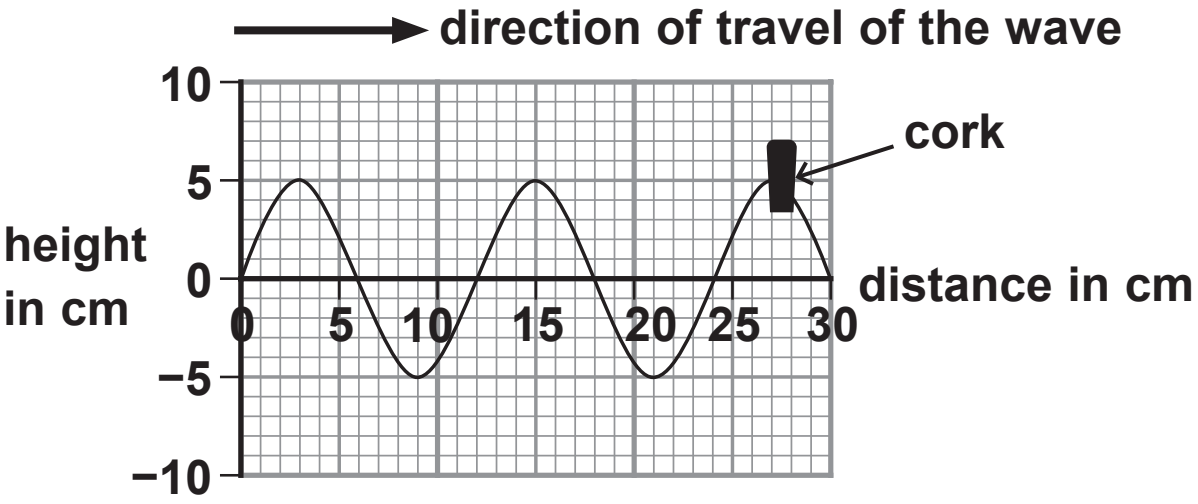

Figure 1

(i) Use the scale on the diagram to measure the wavelength of the wave. (2 marks)

wavelength = _____ cm

(Question continues on next page)

(ii) Describe the motion of the cork.

You should include how the cork moves relative to the direction of travel of the wave.
(2 marks)

(Question continues on next page)

(d) A different water wave has a wavelength of 0·25 m and a frequency of 1·5 Hz.

Calculate the wave speed. (2 marks)

wave speed = _____ m/s

(TOTAL FOR QUESTION 1 = 9 MARKS)

(Questions continue on next page)

2 (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 marks)

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

(Question continues on next page)

(b) (i) State the name of an instrument that can be used to measure radioactivity. (1 mark)

_____

(ii) State TWO sources of background radiation. (2 marks)

1 _____

_____

2 _____

_____

(Question continues on next page)

(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 marks)

age of wood = _____ years

(Question continues on next page)

(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 marks)

(TOTAL FOR QUESTION 2 = 9 MARKS)

(Questions continue on next page)

3 Figure 2 shows a way of projecting a small trolley up a sloping track.

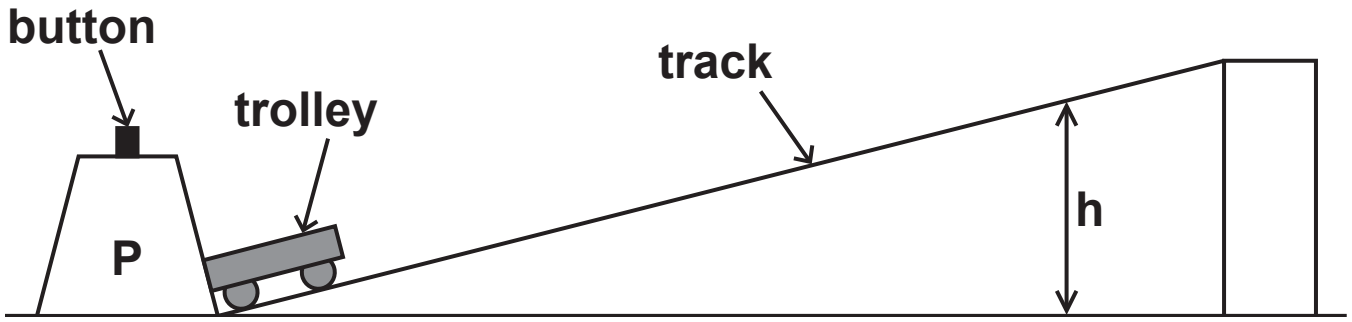

Figure 2

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.

(Question continues on next page)

(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 2 and any other equipment that is needed.
(4 marks)

(Continue your answer on next page)

(Question continues on next page)

(b) Figure 3 is a graph of the student's results.

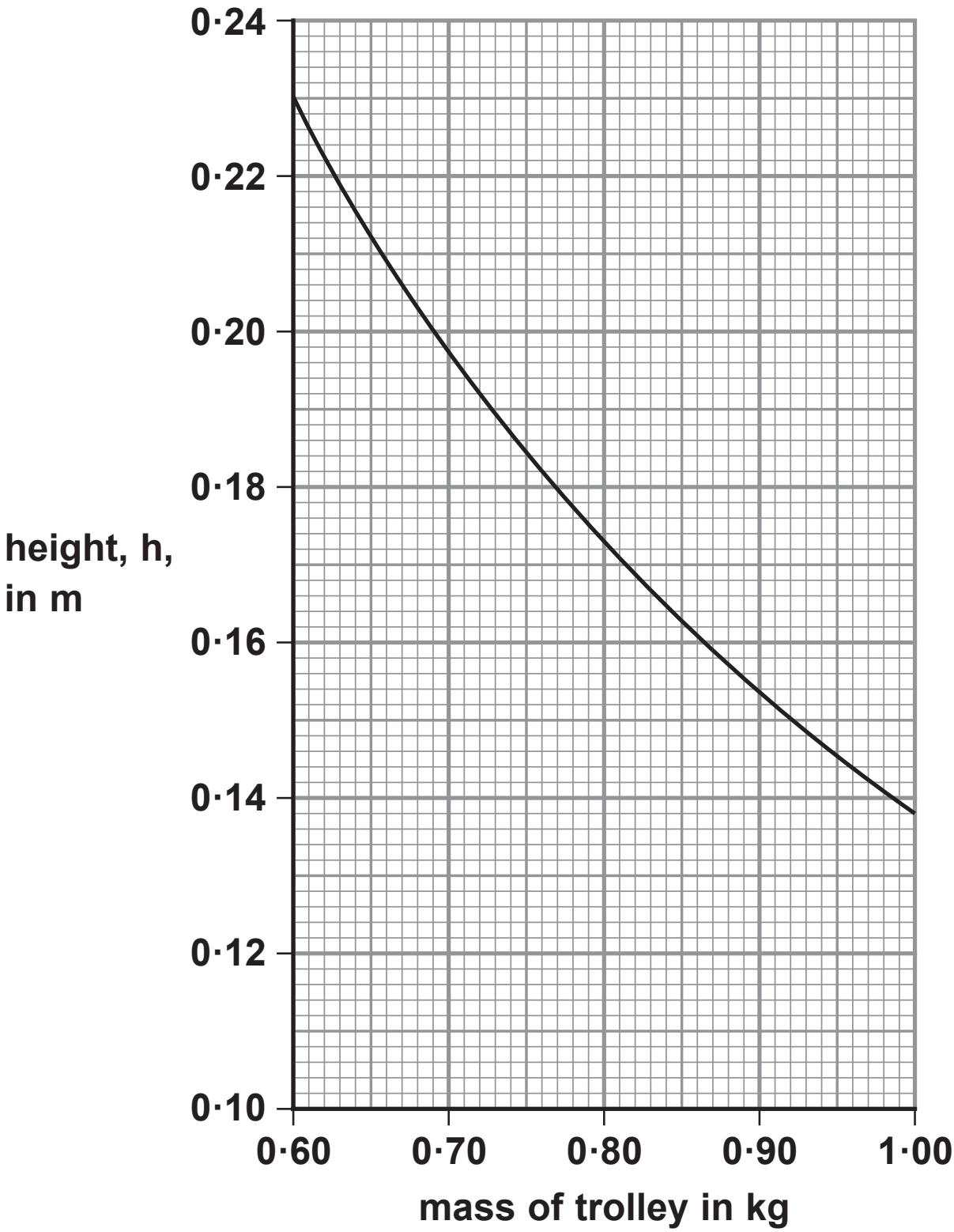

Figure 3

(Question continues on next page)

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 3 to support this statement. (3 marks)

(Question continues on next page)

(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 marks)

(TOTAL FOR QUESTION 3 = 10 MARKS)

(Questions continue on next page)

4 (a) The diagram in Figure 4 shows two students, P and Q, trying to measure the speed of sound in air.

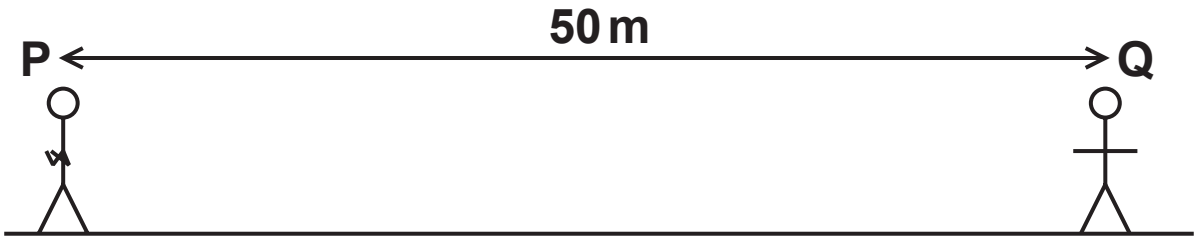

Figure 4

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 marks)

(Question continues on next page)

(b) Figure 5 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.

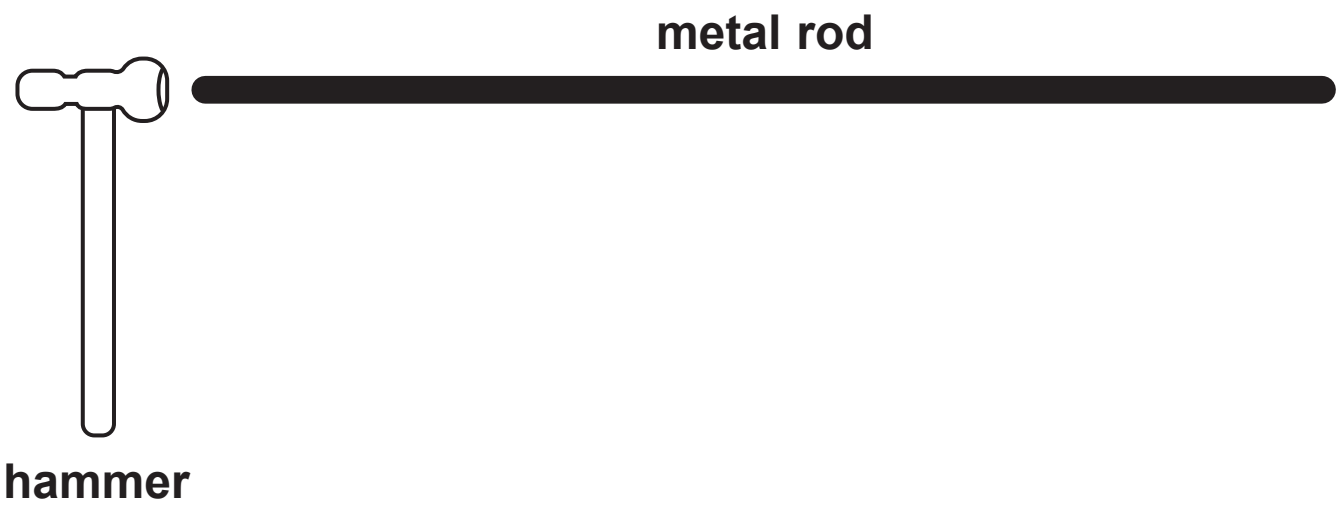

Figure 5

Describe how hitting the rod causes a sound wave to travel along the inside of the rod. (2 marks)

(Question continues on next page)

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

Figure 6 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.

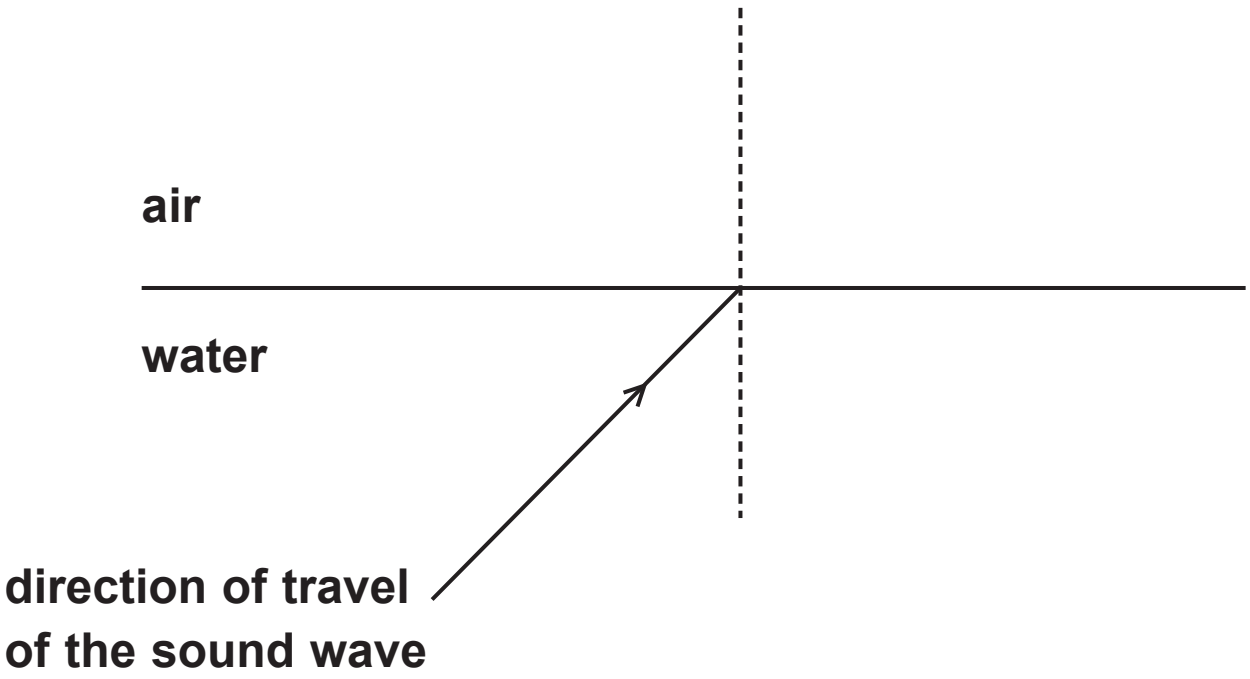

Figure 6

Complete the diagram in Figure 6 to show the direction the sound wave travels in the air.
(2 marks)

(Question continues on next page)

(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

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

The table in Figure 7 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 7

Use the equation and the data in the table in Figure 7 to calculate the speed of sound in warm air.

(Question continues on next page)

Give your answer to an appropriate number of significant figures. (3 marks)

speed of sound in warm air = _____ m/s

(TOTAL FOR QUESTION 4 = 9 MARKS)

(Questions continue on next page)

5 (a) The force that keeps an object moving in a circular path is known as the (1 mark)

☐ A balancing force

☐ B centripetal force

☐ C reaction force

☐ D resistance force

(b) Figure 8 shows an object moving in a circular path.

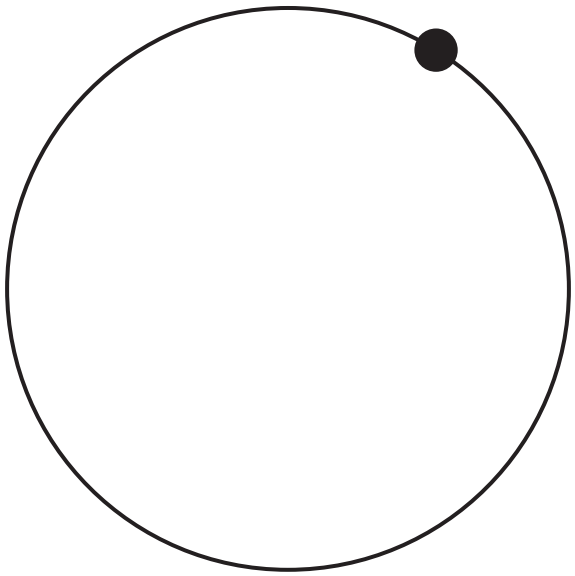

Figure 8

(i) Draw an arrow on Figure 8 to show the direction of the force that keeps the object moving in a circular path. (1 mark)

(Question continues on next page)

(ii) The object in Figure 8 is moving at constant speed.

Explain why it is not moving with constant velocity. (2 marks)

(Question continues on next page)

(c) Figure 9 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.

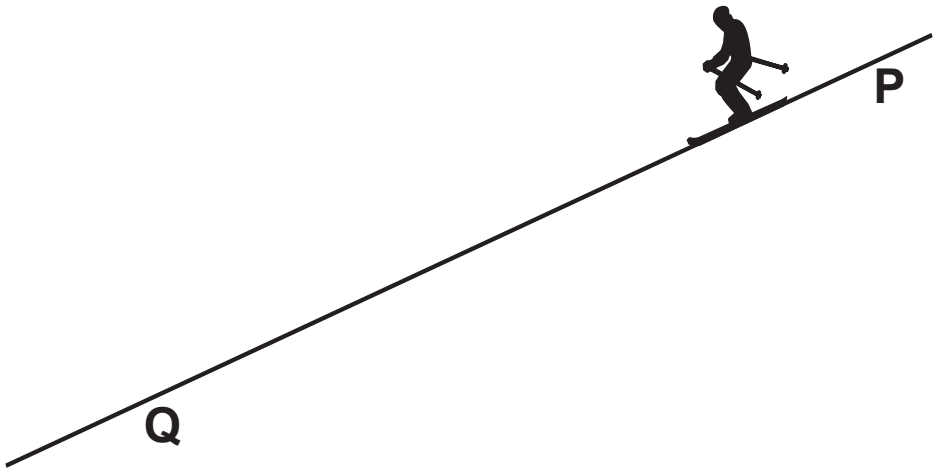

Figure 9

The table in Figure 10 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 10

(Question continues on next page)

(i) Calculate the distance from P to Q.

Use an equation selected from the list of equations at the end of this paper. (3 marks)

distance from P to Q = _____ m

(Question continues on next page)

(ii) Calculate the time taken for the skier to travel from P to Q. (3 marks)

time from P to Q = _____ s

(TOTAL FOR QUESTION 5 = 10 MARKS)

(Questions continue on next page)

6 (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 mark)

(Question continues on next page)

(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 marks)

_____ times

property _____

_____

_____

(Question continues on next page)

(c) Ultraviolet waves cover a range of frequencies.

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

The table in Figure 11 shows the frequency range for each type.

type	frequency range in Hz
UVA	$7{\cdot}5 \times 10^{14}$ to $9{\cdot}4 \times 10^{14}$
UVB	$9{\cdot}4 \times 10^{14}$ to 10×10^{14}
UVC	10×10^{14} to 30×10^{14}

Figure 11

(Question continues on next page)

Figure 12 is a diagram about the effect that the Earth's atmosphere has on three types of ultraviolet radiation.

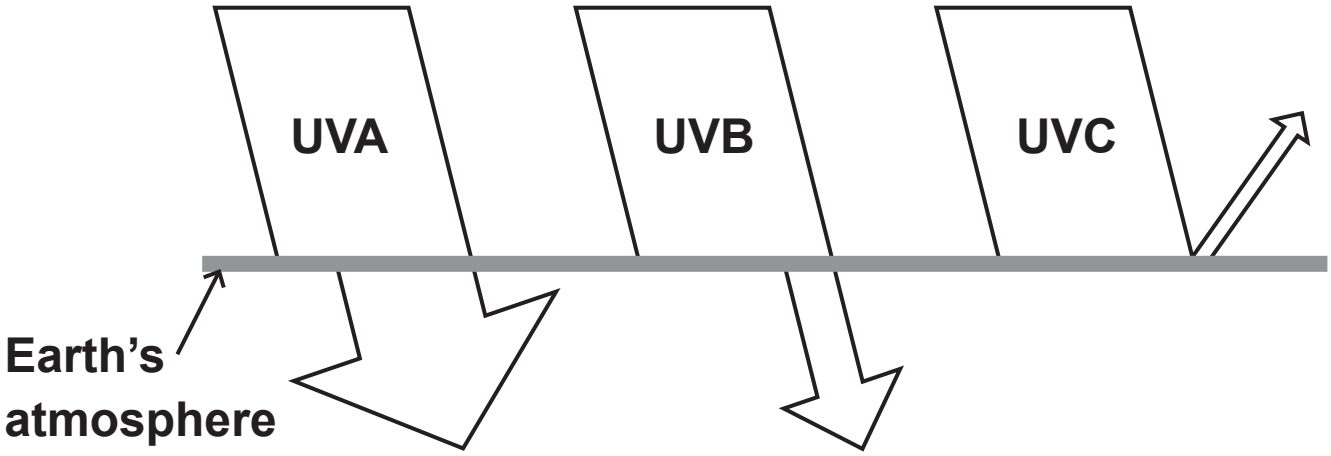

Figure 12

Describe how the effects change with WAVELENGTH, using information from Figure 11 and Figure 12.

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

Calculations are NOT required. (4 marks)

(Continue your answer on next page)

(Question continues on next page)

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

Compare how these two electromagnetic radiations are produced. (6 marks)

(Continue your answer on next page)

(TOTAL FOR QUESTION 6 = 13 MARKS)

TOTAL FOR PAPER = 60 MARKS

END