Write your name here

Surname	Other names

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

Centre Number

Candidate Number

Physics

Paper 1

Higher Tier

Sample Assessment Material for first teaching September 2016

Time: 1 hour 45 minutes

Paper Reference
1PH0/1H

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.

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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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) State **three** differences between radio waves and sound waves.

(3)

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2 ....

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3 ....

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(b) Which of the following does **not** use microwaves ?

(1)

☒ **A** a mobile phone

☒ **B** Wifi

☒ **C** a speed camera

☒ **D** a TV remote control

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(c) Microwaves are used to send and receive television signals from high orbit geostationary satellites.

Describe why microwaves rather than radio waves are used.

(2)

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(d) Describe the significance of microwave radiation in the development of a theory of the origin of the universe.

(2)

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(Total for Question 1 = 8 marks)

2 (a) What is the approximate size of a hydrogen atom?

(1)

☒ **A** 10^{-3} m

☒ **B** 10^{-10} m

☒ **C** 10^{-19} m

☒ **D** 10^{-31} m

(b) Figure 1 is a diagram of three atoms.

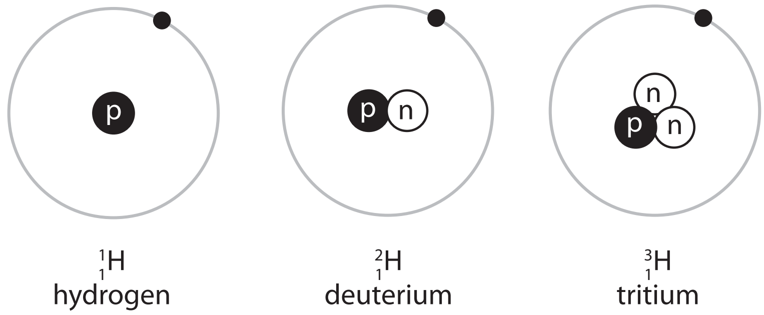

Figure 1

Give reasons why these atoms are isotopes.

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(c) Some isotopes are unstable.
They emit β^- particles when they decay.

Explain how a nucleus changes when a β^- particle is emitted.

(2)

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(d) Other unstable isotopes emit alpha particles.

Which of these describes an alpha particle?

(1)

☒ **A** a hydrogen nucleus

☒ **B** a hydrogen atom

☒ **C** a helium nucleus

☒ **D** a helium atom

(e) Early in the twentieth century, scientists fired a beam of alpha particles at thin gold foil.

Figure 2 shows the main parts of their experiment with some results.

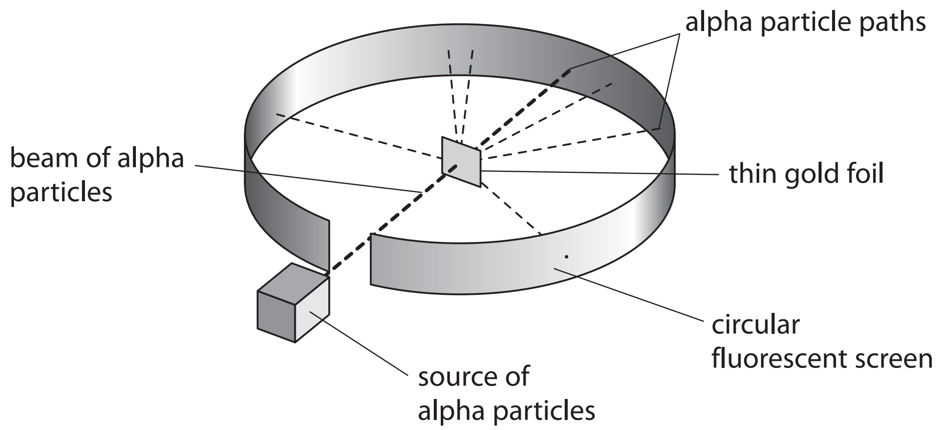

Figure 2

Explain how the results of the experiment shown in Figure 2 support the nuclear model of an atom.

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(Total for Question 2 = 9 marks)

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3 (a) A student looks through a blue filter at a green leaf on a white background.

Describe the colours that the student sees.

(2)

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(b) Figure 3 shows an image taken at night using a camera that is sensitive to infrared radiation.

Figure 3

Radiation with shorter wavelengths shows as brighter areas in this image.

Explain why the people can be seen against the background in this image.

(2)

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(c) A student investigates how light is reflected from a plane mirror.

Figure 4 shows part of the student's investigation.

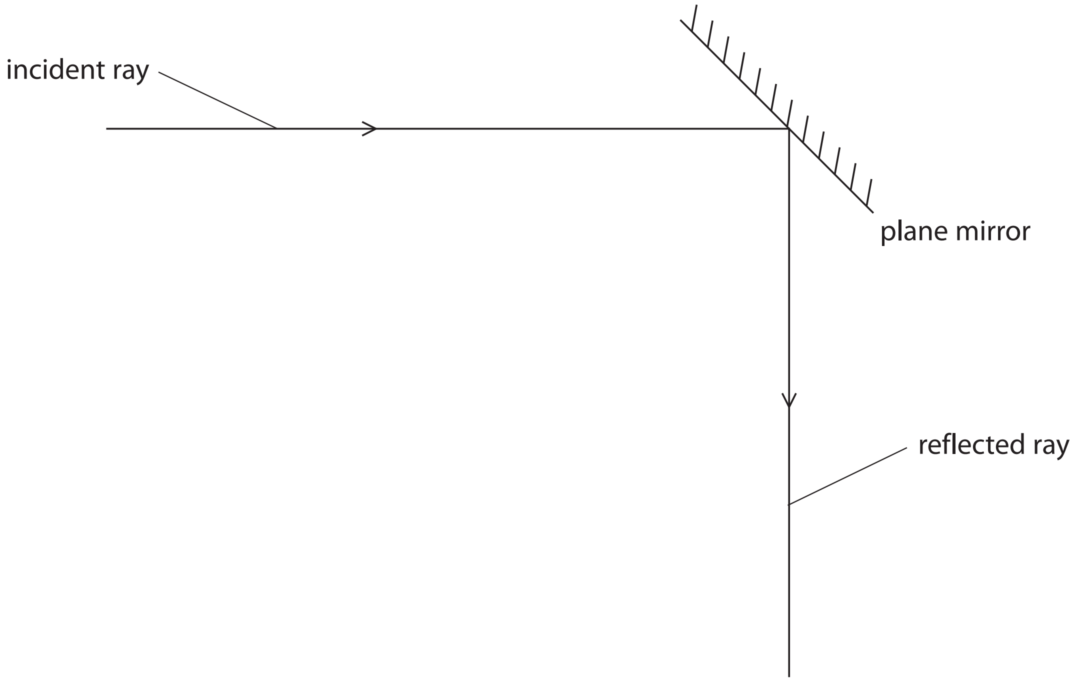

Figure 4

(i) Complete the diagram to show

- the normal
- the angle of incidence (*i*) and the angle of reflection (*r*).

(2)

(ii) Figure 5 shows a ray of light travelling through a 45°-glass prism.

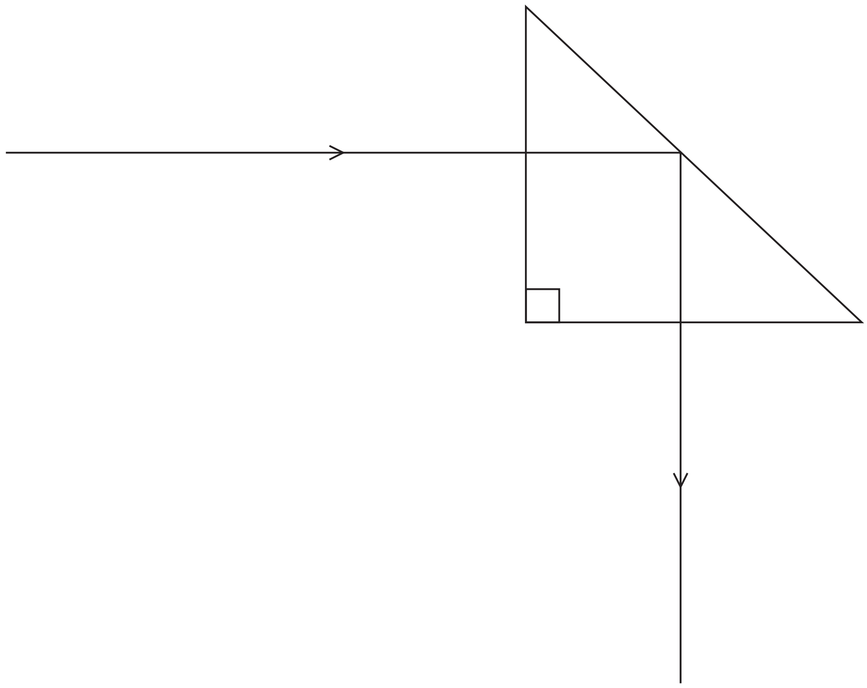

Figure 5

State what can be deduced from this diagram about the value of the critical angle for glass.

(1)

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(iii) Give a reason why high quality optical instruments use prisms instead of mirrors to reflect light.

(2)

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(Total for Question 3 = 9 marks)

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4 Shot-put is an Olympic event.
The shot is a heavy ball.
An athlete throws the shot as far as possible.

A sports scientist analyses an athlete's throw to help improve performance.

(a) The scientist takes pictures of the athlete every 0.1 s during one throw.

Figure 6 shows the pictures of one throw.

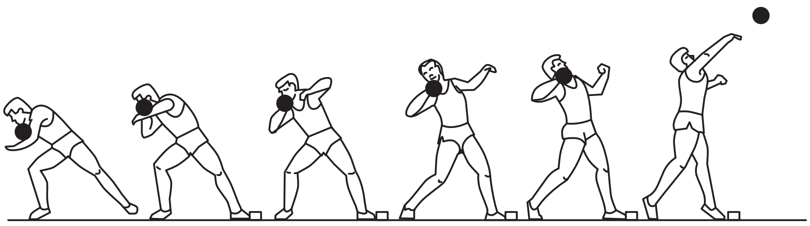

Figure 6

(i) Estimate the amount of time during the throw when the shot is in the athlete's hand.
(1)

time = ... s

(ii) Explain how the scientist could improve this method of analysing the throw.
(2)

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(iii) The average acceleration of the shot while in the athlete's hand is 20.6 m/s^2.
The mass of the shot is 7.26 kg.

Calculate the average force that the athlete applies to the shot during the throw.

(2)

force = ... N

(iv) In another throw, the shot is in the athlete's hand for 0.48 s.
The average acceleration during this time is 23 m/s^2.

Calculate the velocity of the shot as it leaves the athlete's hand.

(3)

velocity = ... m/s

(b) In one throw, the shot continues to rise by another 1.3 m after it leaves the athlete's hand.
The mass of the shot is 7.26 kg.

Calculate the amount of gravitational potential energy gained by the shot.

(2)

gravitational potential energy gained = ... J

(c) The scientist examines the images to find ways of increasing the momentum of the shot when it leaves the athlete's hand without the athlete using any extra force.

The scientist advises the athlete to

lean further down at the start
and make his arm straight before he releases the shot.

Explain the scientific principles behind this advice.

(3)

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(Total for Question 4 = 13 marks)

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5 (a) Which of the following particles is absorbed and emitted during a nuclear fission reaction?

(1)

☒ **A** electron

☒ **B** neutron

☒ **C** positron

☒ **D** proton

(b) Explain the use of a moderator in a nuclear reactor.

(3)

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(c) Describe how the thermal energy from nuclear fission can be used to turn the electrical generator in a power station.

(2)

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(d) Nuclear fusion is another type of nuclear reaction.

Explain why there are no power stations using nuclear fusion.

(3)

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(Total for Question 5 = 9 marks)

6 (a) A class is learning about refraction of waves.
The teacher shows them a demonstration using a battery-powered toy car travelling across a smooth road and onto some sand.
The car slows down as it enters the sand.

Figure 7 shows the car just before it meets the sand.

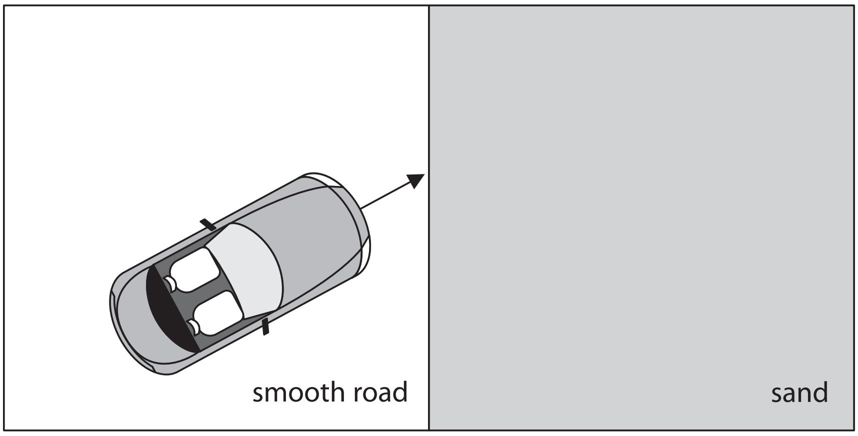

Figure 7

(i) Draw an arrow on the diagram to show the direction of the car as it travels across the sand.

(1)

(ii) Explain why this is a useful model for refraction of light.

(2)

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(b) Figure 8 shows how a glass prism is used to produce a spectrum from a beam of sunlight.

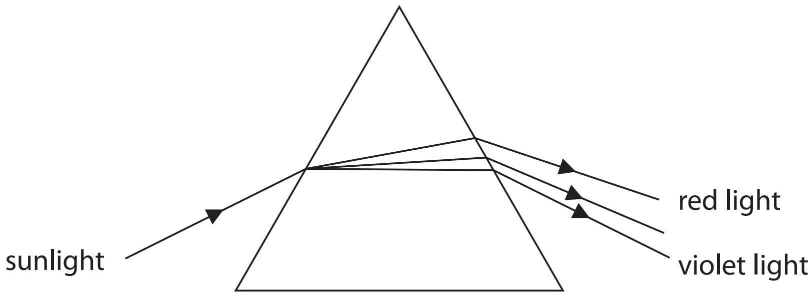

Figure 8

(i) Explain, in terms of refraction and wavelength, the paths taken by the light through the prism.

(3)

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(ii) Describe how a student could develop the procedure shown in Figure 8 to search for evidence that sunlight consists of additional electromagnetic waves with frequencies lower than visible light.

(2)

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(Total for Question 6 = 8 marks)

7 A student investigates the motion of a trolley along a horizontal runway.

Figure 9 shows the apparatus.

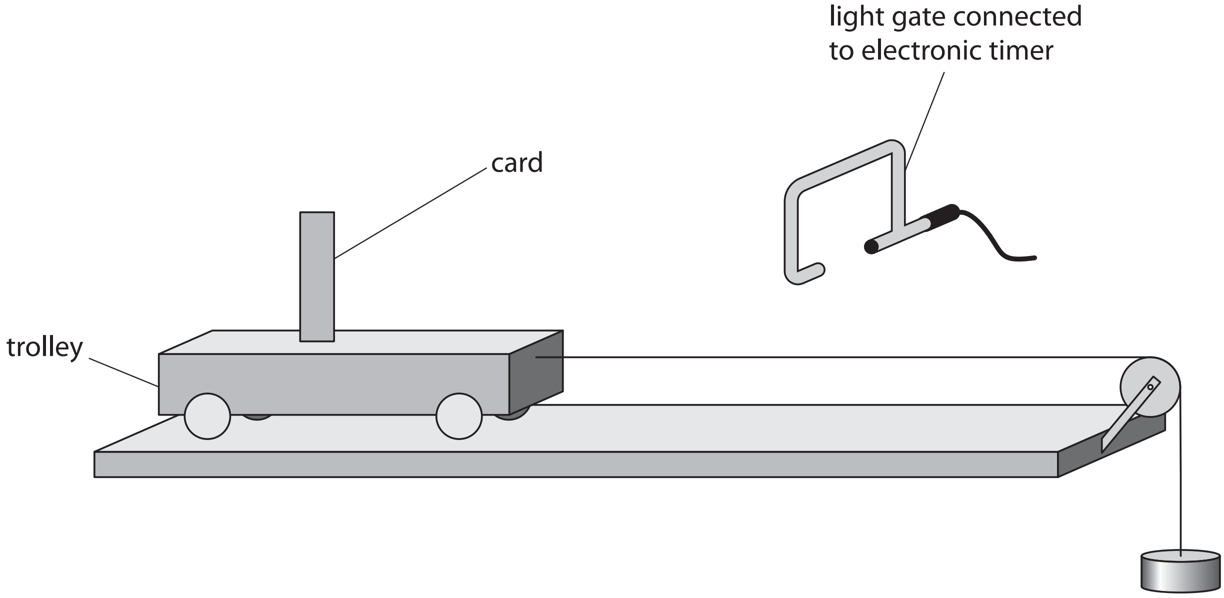

Figure 9

The trolley is attached to a string passing over a pulley.

A 100 g metal disc hangs on the end of the string.

The light gate measures the time it takes for the card to pass through it.

(a) When the trolley is released, it accelerates along the track.

(i) Explain why the trolley accelerates along the track.

(2)

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(ii) The card takes 0.040 s to travel through the light gate.

The student calculates that the average speed of the trolley through the light gate is 1.15 m/s.

Calculate the width of the card.

(2)

width = ... cm

(iii) The trolley travels 1.2 m along the track from the start before the card reaches the light gate.

Show that acceleration of the trolley along this distance is approximately 0.55 m/s^2.

(2)

(b) The student repeats the process several times by adding extra 100 g metal discs.

Figure 10 shows a graph of the results.

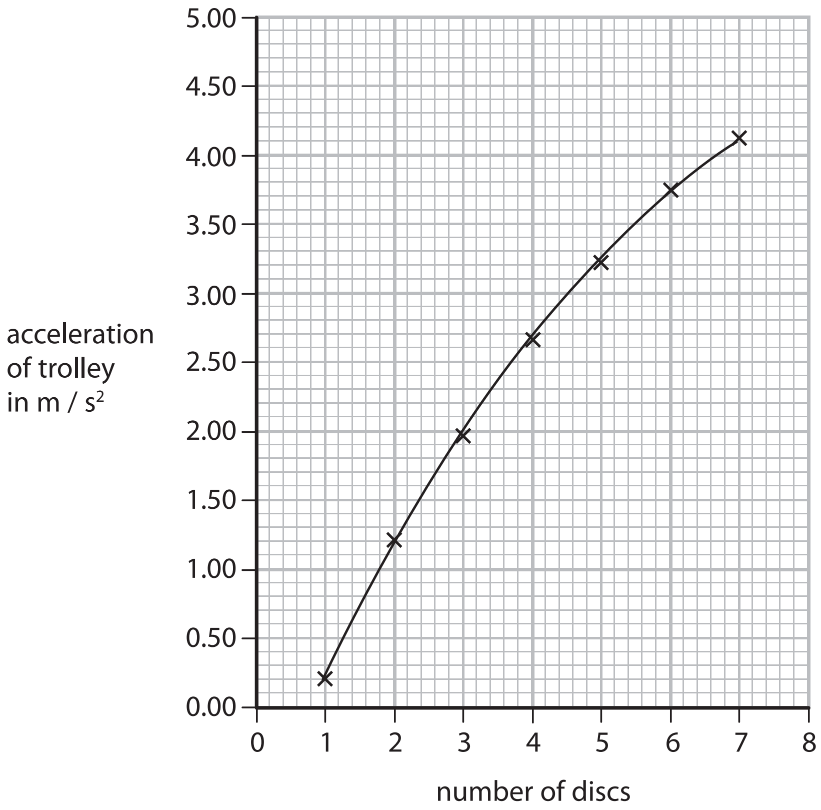

Figure 10

(i) Predict the acceleration if discs with a total mass of 800 g are used.
(1)

acceleration = ... m/s^2

(ii) There are frictional forces in the system.

Identify a feature of the graph that shows there are frictional forces in the system.
(1)

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(iii) Explain how the investigation could be developed to remove the effects of friction.

(2)

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(Total for Question 7 = 10 marks)

8 (a) Figure 11 shows a dolphin.

Figure 11

Dolphins emit sounds under water.
Scientists at four different research centres investigate the sounds made by dolphins.
Each centre chooses one of their dolphins and analyses the frequencies of the sounds the dolphin makes.

Figure 12 shows the range of frequencies from four different dolphins, W, X, Y and Z.

dolphins	lowest frequency (Hz)	highest frequency (kHz)
W	200	92
X	100	120
Y	85	105
Z	90	130

Figure 12

(i) Which of the following statements is a correct deduction from this information?

(1)

☒ **A** all four dolphins emit infrasound and ultrasound

☒ **B** all four dolphins emit ultrasound

☒ **C** only some of the four dolphins emit infrasound and ultrasound

☒ **D** only some of the four dolphins emit ultrasound

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(ii) The frequency range of the sounds from dolphin W is 91.8 kHz.
Calculate the frequency range of the sounds from dolphin X.

(2)

range = ... kHz

(b) A scientist records the sounds made by a dolphin as it swims towards him.

The dolphin stops swimming but continues to emit the sounds.

Describe what happens to the frequency and wavelength of the sounds when the dolphin stops swimming.

(2)

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(c) Scientists believe that dolphins use sound waves to detect objects under water.

Describe how a dolphin could use sound waves to determine which of two objects is nearer to it.

You may draw a diagram to help your answer.

(3)

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(d) A sound wave travels with a velocity of 1530 m/s.

The frequency of the wave is 1.20 kHz.

Calculate the wavelength of the wave.

(3)

wavelength = ... m

(Total for Question 8 = 11 marks)

9 (a) The Sun reaches its highest point in the sky on Midsummer's day.

Describe how you could use this fact to measure the time it takes for the Earth to orbit the Sun once.

(2)

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(b) The table shows some data about the Earth's orbit of the Sun.

orbital radius (R)	1.5×10^8 km
time for one orbit (T)	3.2×10^7 s

Use the following equation to calculate the orbital speed, *v*, of the Earth.

$$v = \frac{2 \times \pi \times R}{T}$$

(3)

v = ... m/s

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*(c) The Sun is likely to remain as a main sequence star for 2000 million years.

Explain why the Sun does not explode now.

(6)

(Total for Question 9 = 11 marks)

10 (a) Figure 13 shows two ice skaters during a performance.

Figure 13

(i) The two ice skaters are travelling together in a straight line at 3.50 m/s.

Their total momentum is 371 kgm/s.

The man has a mass of 64.5 kg.

Calculate the mass of the woman.

(4)

mass = ... kg

(ii) Calculate the kinetic energy of the man.

(2)

kinetic energy = ... J

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*(b) Figure 14 shows two ice skaters during a sequence in their performance.

Figure 14

The man stays at the same place on the ice throughout the sequence.

At the start of the sequence, the woman is moving at a constant speed around the man while the man holds her arm.

After she has gone round the man several times, the man lets go of the woman's arm. The sequence ends a few seconds later.

Explain the motion of the woman, in terms of the forces acting and the effects on her motion, for the whole sequence.

(6)

(Total for Question 10 = 12 marks)

TOTAL FOR PAPER = 100 MARKS

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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 $F = B \times I \times l$
$\frac{\textit{potential difference across primary coil}}{\textit{potential difference across secondary coil}} = \frac{\textit{number of turns in primary coil}}{\textit{number of turns in secondary coil}}$ $\frac{V_p}{V_s} = \frac{V_p}{N_s}$
For transformers with 100% efficiency, 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 $P = h \times \rho \times g$