

Write your name here

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Centre Number	Candidate Number																
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Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Combined Science

Paper 5: Physics 1

Higher Tier

Sample Assessment Material for first teaching September 2016	Paper Reference
Time: 1 hour 10 minutes	1SC0/1PH

You must have: Calculator, ruler	Total Marks
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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 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.

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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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)

1

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2

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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)

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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.

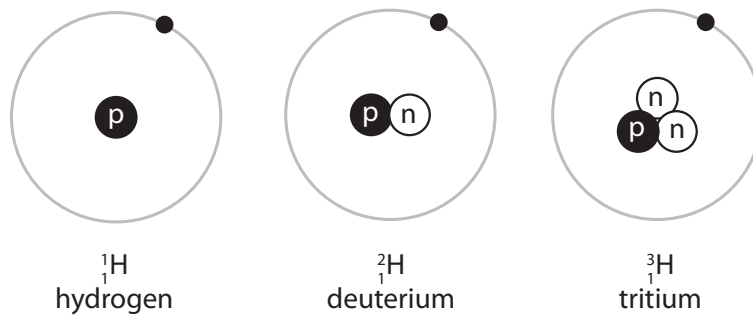


Figure 1

Give reasons why these atoms are isotopes.

(2)

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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

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3 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 3 shows the pictures of one throw.

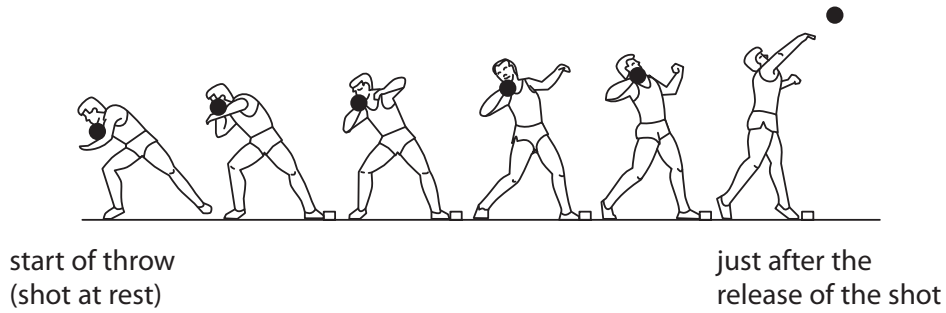


Figure 3

(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



S 5 8 2 5 9 A 0 9 2 0

- (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 3 = 13 marks)

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- 4 (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 4 shows the car just before it meets the sand.

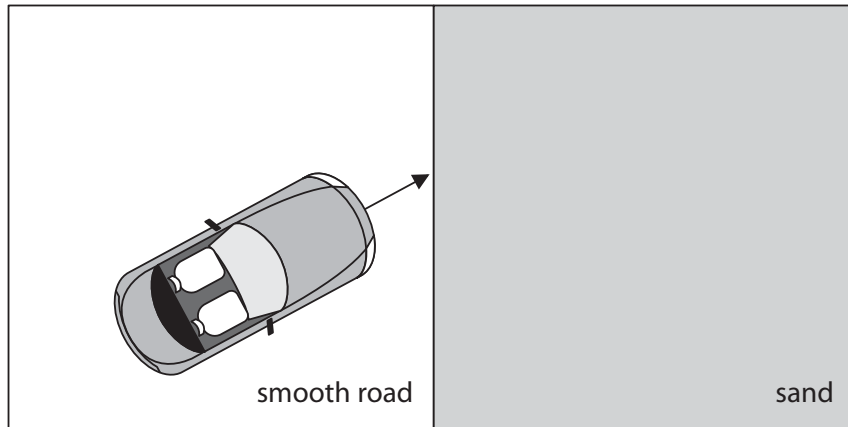


Figure 4

- (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 5 shows how a glass prism is used to produce a spectrum from a beam of sunlight.

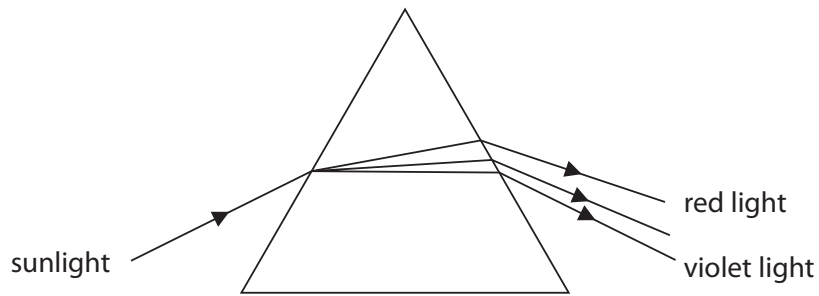


Figure 5

(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 5 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 4 = 8 marks)



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

Figure 6 shows the apparatus.

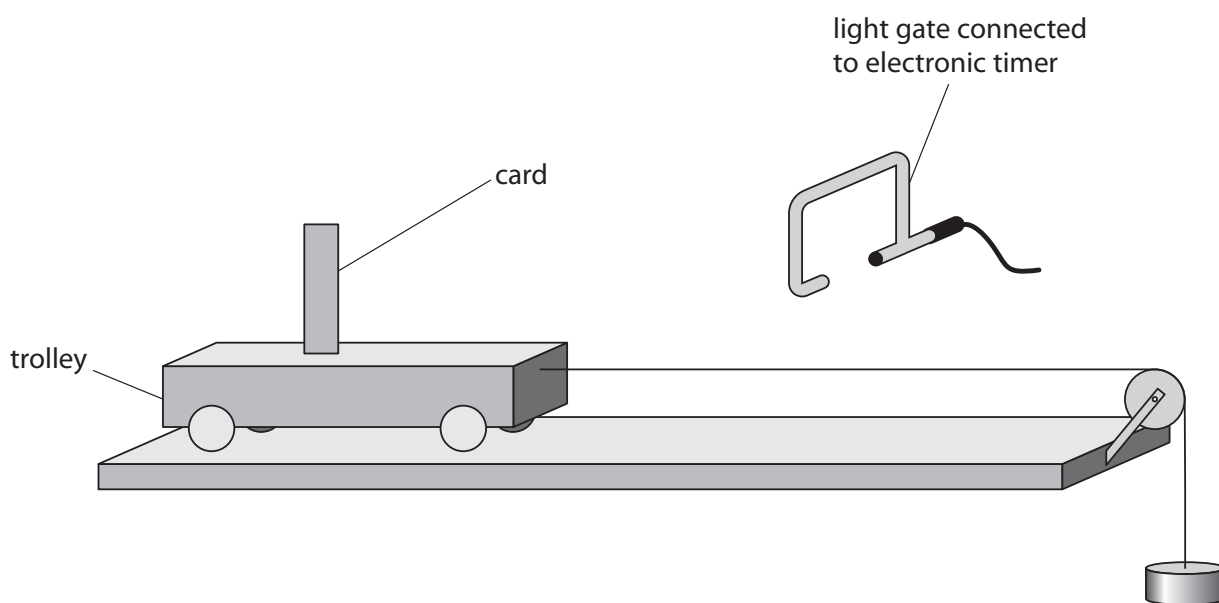


Figure 6

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/s².

(2)



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

Figure 7 shows a graph of the results.

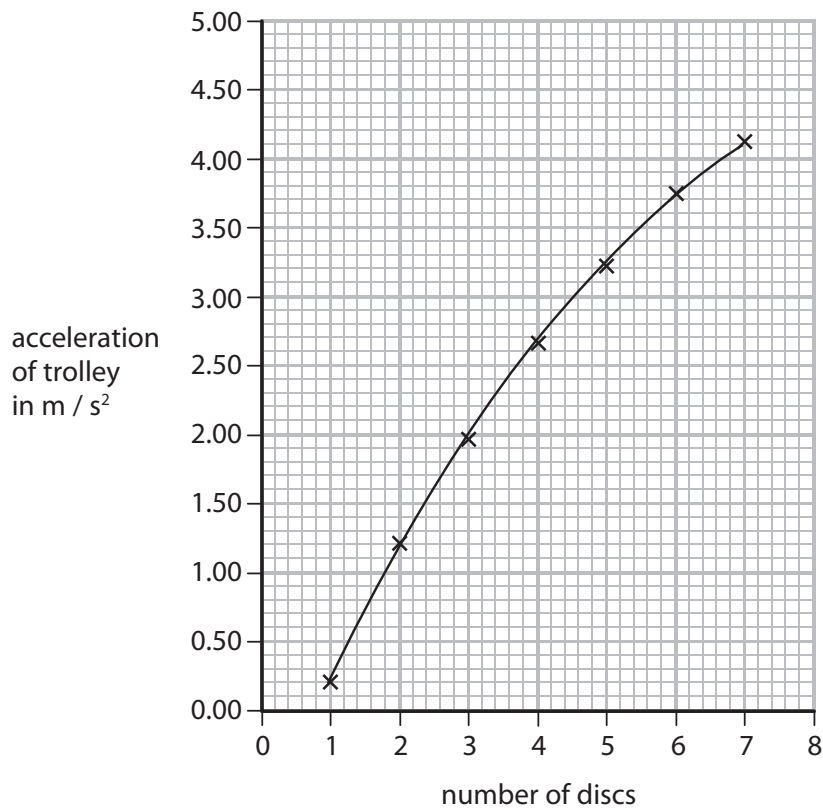


Figure 7

(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 5 = 10 marks)

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- 6 (a) Figure 8 shows two ice skaters during a performance.



Figure 8

- (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



* (b) Figure 9 shows two ice skaters during a sequence in their performance.

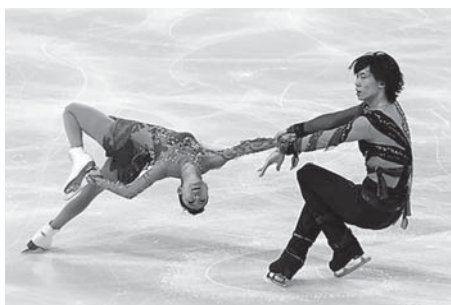


Figure 9

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)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS



Equations

$$(\text{final velocity})^2 - (\text{initial velocity})^2 = 2 \times \text{acceleration} \times \text{distance}$$

$$v^2 - u^2 = 2 \times a \times x$$

force = change in momentum \div time

$$F = \frac{(mv - mu)}{t}$$

energy transferred = current \times potential difference \times time

$$E = I \times V \times t$$

force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density \times current \times length

$$F = B \times I \times l$$

For transformers with 100% efficiency,
potential difference across primary coil \times current in primary coil = potential difference across secondary coil \times current in secondary coil

$$V_p \times I_p = V_s \times I_s$$

change in thermal energy = mass \times specific heat capacity \times change in temperature

$$\Delta Q = m \times c \times \Delta\theta$$

thermal energy for a change of state = mass \times specific latent heat

$$Q = m \times L$$

energy transferred in stretching = 0.5 \times spring constant \times (extension)²

$$E = \frac{1}{2} \times k \times x^2$$

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