Write your name here

Surname	Other names

Centre Number | Candidate Number

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

Combined Science

Paper 5: Physics 1

Foundation Tier

Sample Assessment Material for first teaching September 2016

Time: 1 hour 10 minutes

Paper Reference
1SC0/1PF

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 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) A car approaches traffic lights.
The traffic lights turn to red so the car has to stop.

Which of the following factors affects the thinking distance when the car has to stop?

(1)

- ☐ **A** condition of the road
- ☐ **B** mass of the car
- ☐ **C** reaction time
- ☐ **D** worn brakes

(b) Figure 1 shows how the thinking distance and braking distance change depending on the speed of a car.

speed in km / h	speed in m / s	thinking distance in m	braking distance in m	stopping distance in m
50	14	21	21	42
60	17	25	31	56
70		29	42	71
80	22	33	55	88
90	25	37	85	107
100	28	42	85	127

Figure 1

(i) Fill in the gap in the table.

(1)

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(ii) A student studies these results and writes the conclusion:

'The thinking distance is proportional to the speed of the car'.

Comment on the student's conclusion.

(3)

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(c) (i) The car is moving at 90 km/h when the driver has to stop.
Calculate the thinking time of the driver.

Using the equation:

time = distance ÷ average speed

(2)

thinking time = ... s

(ii) A car has a mass of 1300 kg.

Calculate the kinetic energy of the car when it is travelling at 20 m/s.

(2)

kinetic energy = ... J

(Total for Question 1 = 9 marks)

2 A student investigates the motion of a trolley along a horizontal runway using the apparatus in Figure 2.

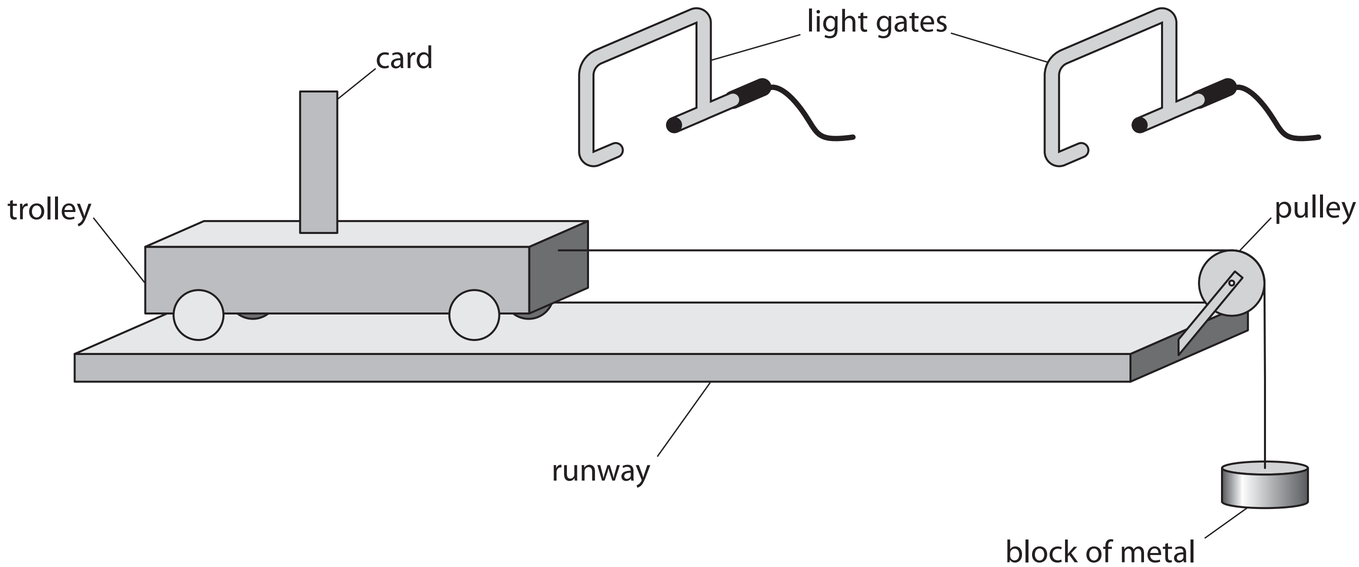

Figure 2

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

A block of metal hangs on the end of the string.

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

When the trolley is released, it moves along the track.

A computer measures the time it takes for the card to pass between each light gate.

(a) (i) The card took 0.080 s to pass through the first light gate.

The width of the card is 5 cm.

Calculate the average speed, in m/s, of the trolley through the first light gate.

(2)

average speed = ... m/s

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Another trolley passes through the first light gate at a velocity of 0.72 m/s.

This trolley passes through the second light gate at a velocity of 1.1 m/s.

The time it takes for the card on the trolley to travel between the two light gates is 0.53 s.

(ii) State the equation relating acceleration, change in velocity and time.

(1)

(iii) Calculate the acceleration of the trolley between the two light gates.

(2)

acceleration = ... m/s^2

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(b) Figure 3 shows a graph of acceleration against force for three trollies of different mass that are pulled along the runway.

The graphs for the trollies are labelled P, Q and R.

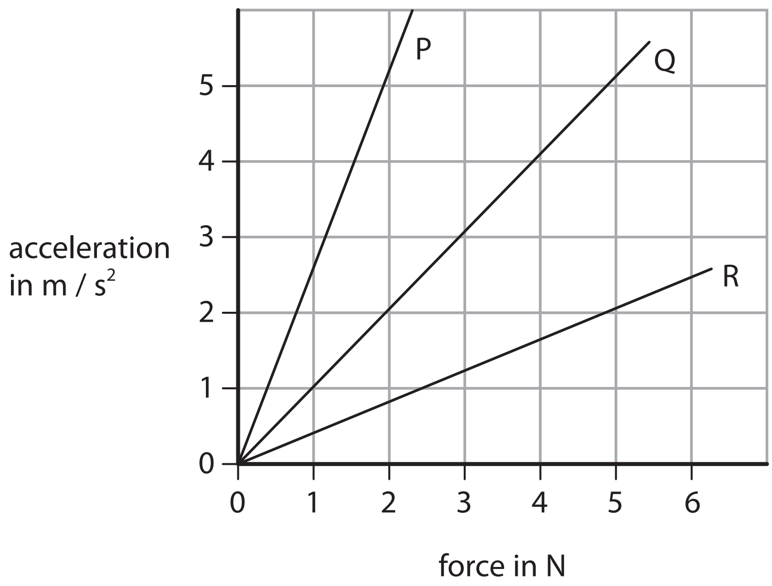

Figure 3

Use the information from the graph.

(i) Calculate the mass of trolley Q

(2)

mass of trolley Q = ... kg

(ii) Describe how the graph shows that trolley R has the greatest mass.

(2)

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(Total for Question 2 = 9 marks)

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3 A man throws a stone into a pond.

(a) The stone makes waves that spread out in circles.

Figure 4 shows some of the waves.

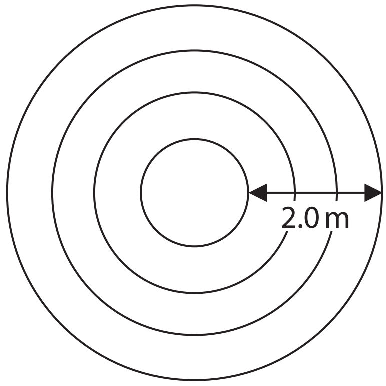

Figure 4

(i) Which of the following changes is correct as the waves spread out?

(1)

☒ **A** the amplitude is higher

☒ **B** the frequency is higher

☒ **C** the wavefront is longer

☒ **D** the period is longer

(ii) The stone hits the water 4.0 m from the bank.

The wave speed is 0.70 m/s.

Calculate the time for the wave to reach the bank.

(2)

time = ... s

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(iii) The wavelength of the waves is the distance between one wavefront and the next.

Use the diagram to find the wavelength of the waves.

(1)

wavelength = ... m

(iv) There is a cork which bobs up and down in the water as the wave goes past.

Explain how this shows that the wave is transverse.

(2)

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(b) On the other side of the pond, the water becomes very shallow.

In the shallow water, the wave is slower but the frequency does not change.

State what happens to the wavelength when a wave reaches the shallow water.

(1)

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(c) Devise a method of measuring the frequency of the waves.

(2)

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(Total for Question 3 = 9 marks)

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

(1)

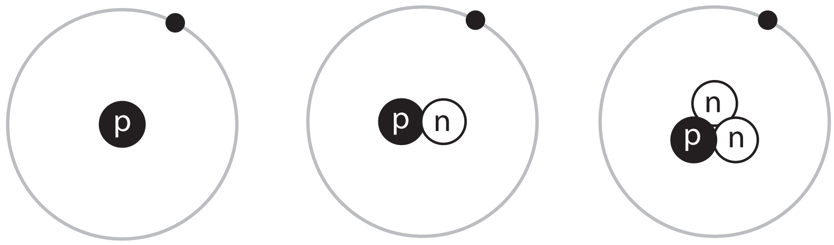
☒ **A** 10^{-3} m

☒ **B** 10^{-10} m

☒ **C** 10^{-19} m

☒ **D** 10^{-31} m

(b) Figure 5 is a diagram of three atoms.



$^{1}_{1}H$
hydrogen

$^{2}_{1}H$
deuterium

$^{3}_{1}H$
tritium

Figure 5

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

(e) Figure 6 shows an atom of iron with its electron orbits.

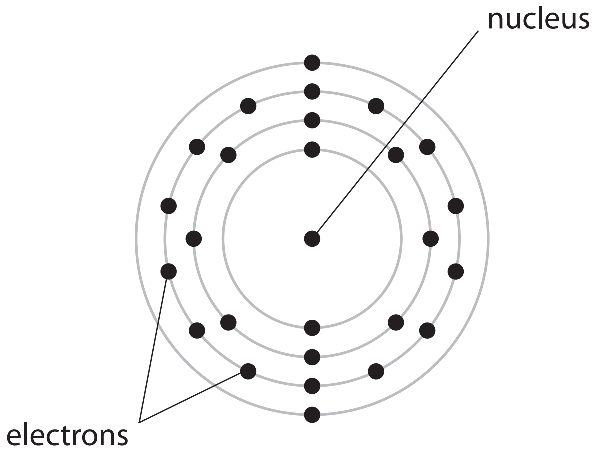

Figure 6

When iron is heated it glows red.

Explain what happens to the electrons during this process.

(3)

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(Total for Question 4 = 9 marks)

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5 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 can measure several quantities in the analysis.

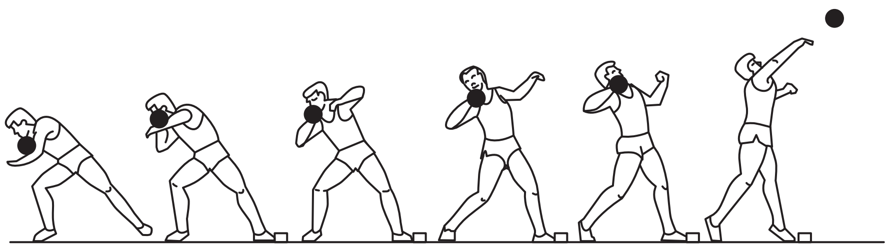
Which one of the following is a scalar quantity?

(1)

- ☒ **A** acceleration
- ☒ **B** force
- ☒ **C** mass
- ☒ **D** velocity

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

Figure 7 shows the pictures of one throw.



start of throw (shot at rest)

just after the release of the shot

Figure 7

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

(1)

time = ... s

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(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

(c) 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.

(i) Calculate the amount of gravitational potential energy gained by the shot.
(2)

gravitational potential energy gained = ... J

(ii) Explain how the total energy stored in the shot changes between leaving the athlete's hand and hitting the ground.
(2)

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(Total for Question 5 = 13 marks)

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6 (a) A house has a boiler to provide hot water.

One type of boiler burns natural gas.

Natural gas is a non-renewable source of energy.

(i) State a renewable source of energy that could be used to heat water in a house. **(1)**

....

Figure 8 shows some information in a booklet supplied with a gas boiler.

fuel	natural gas
temperature of hot water	65°C
energy supplied to the boiler in one second	7500 J
efficiency of boiler	96%

Figure 8

(ii) Calculate the energy transferred to the water by the boiler in one second. **(2)**

energy transferred to water = ... J

(b) Figure 9 shows a foam jacket around a copper cylinder.

Figure 9

The hot water is stored in the copper cylinder until it is needed.

The foam jacket helps to keep the water hot.

Explain how the foam helps to keep the water hot.

(2)

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*(c) A company has developed a new material which they think could be used instead of foam around the cylinder.

Devise an investigation they could carry out to make a fair comparison of the insulating properties of their new material with those of the foam.

(6)

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

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Equations

(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance $v^2 - u^2 = 2 \times a \times x$
energy transferred = current × potential difference × time $E = I \times V \times t$
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 $Q = m \times L$
energy transferred in stretching = 0.5 × spring constant × (extension)^2 $E = ½ \times k \times x^2$

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