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

Higher Tier

Wednesday 23 May 2018 – Afternoon
Time: 1 hour 10 minutes

Paper Reference
1SC0/1PH

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.
- 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 ▶

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 student investigates what happens when light travels from air to glass.

Figure 1 shows some of the apparatus used in the investigation.

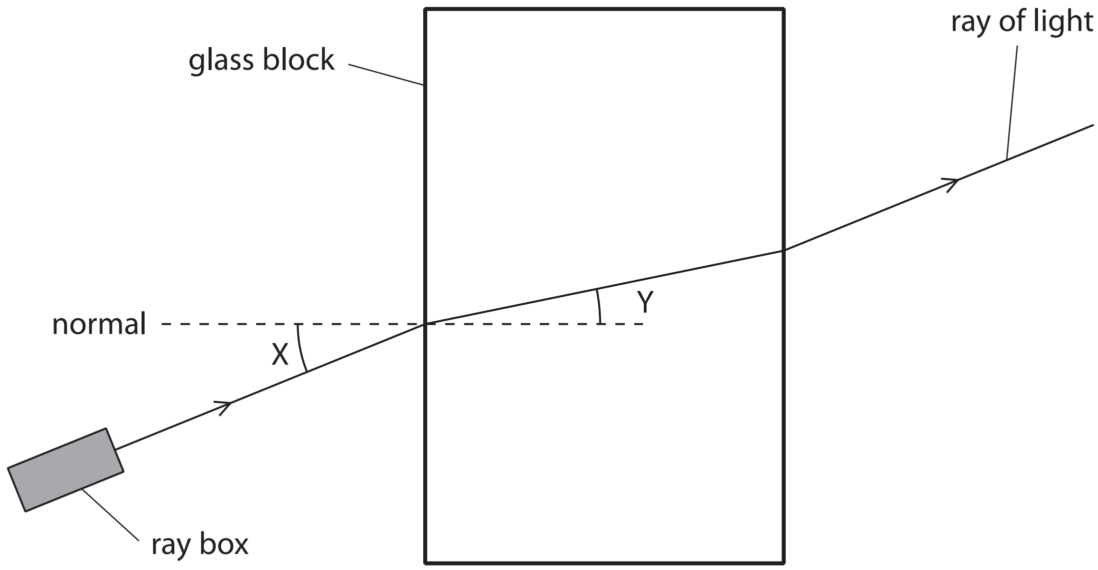

Figure 1

(i) In Figure 1, angle Y is the angle of

(1)

☐ **A** deflection

☐ **B** incidence

☐ **C** reflection

☐ **D** refraction

(ii) Figure 2 is a graph of the student's results.

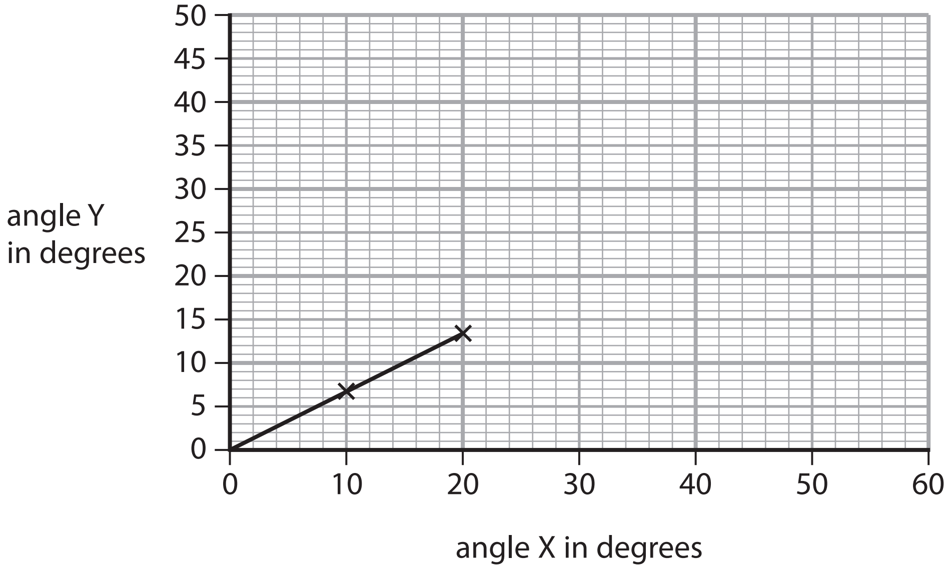

Figure 2

Use the graph to calculate a value for

$$\frac{\text{angle Y}}{\text{angle X}}$$

(2)

$\frac{\text{angle Y}}{\text{angle X}}$ = ...

(iii) The student concludes that angle Y is directly proportional to angle X.

Explain what the student must do to test this conclusion in more detail.

(3)

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(b) The speed of light is 3.0×10^8 m/s.

The wavelength of yellow light is 5.8×10^{-7} m.

Calculate the frequency of yellow light.

State the unit.

Use the equation

$$\text{frequency} = \frac{\text{speed}}{\text{wavelength}}$$

(3)

frequency = ... unit ....

(Total for Question 1= 9 marks)

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2 Figure 3 shows a Geiger-Müller (GM) tube used for measuring radioactivity.

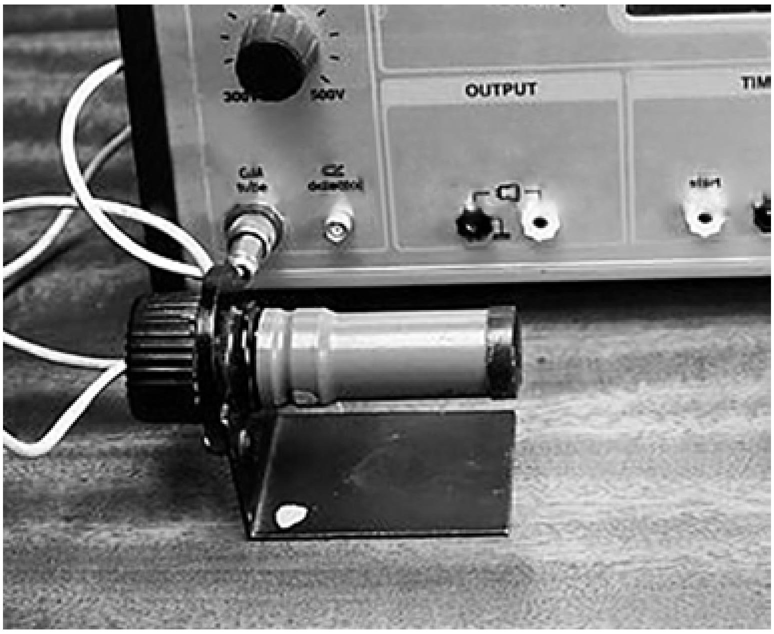

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Figure 3

(a) Describe how a teacher should use a Geiger-Müller (GM) tube to compare the count-rates from two different radioactive rocks.

(4)

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(b) A hospital uses a radioactive isotope with a half-life of 6 hours.

A technician measures a count rate of 80 counts per minute (cpm) from this isotope.

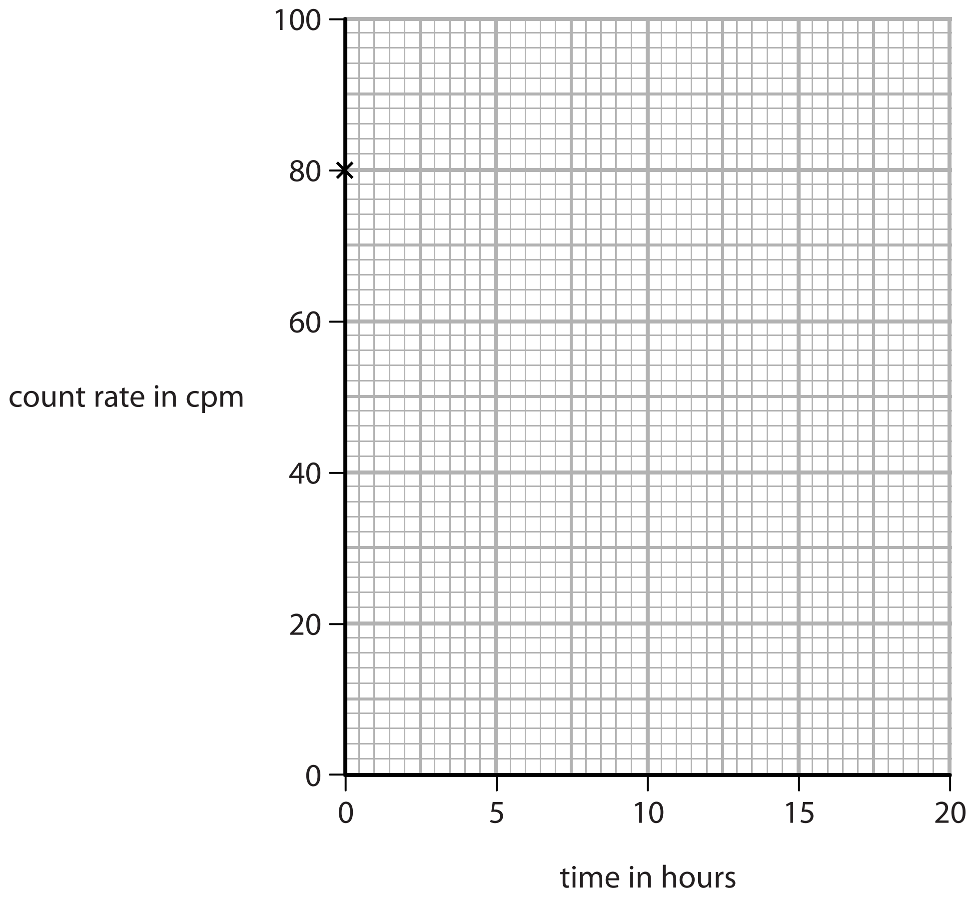

Figure 4

Complete the graph on Figure 4, as accurately as possible, to show how the count-rate from this isotope will change from the time of the first measurement.

The first point is already drawn in Figure 4.

(3)

(c) One radioactive source used in hospitals is technetium (Tc).

Technetium is produced from the radioactive decay of molybdenum (Mo).

Complete the following nuclear equation.

(1)

$$^{99}_{42}\text{Mo} \rightarrow \,^{\dots\dots}_{\dots\dots}\text{Tc} + \,^{0}_{-1}\beta$$

(Total for Question 2 = 8 marks)

3 (a) Figure 5 shows a tuning fork.

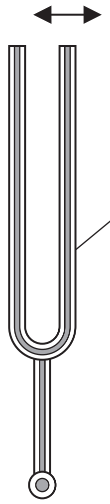

Figure 5

When the prongs of the tuning fork are struck, the prongs vibrate in the directions shown by the arrows on Figure 5.

Describe how the vibrating tuning fork causes a sound wave to travel through the air.

You may add to the diagram if it helps your answer.

(2)

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(b) The following descriptions describe waves from different parts of the electromagnetic spectrum.

Complete each description by adding the name of the wave.

Use the name of each wave only once. Each description refers to a different part of the electromagnetic spectrum.

(4)

Description 1

used in cooking

used in short-range communication

typical wavelength 900 nm

name of wave ....

Description 2

used in cooking

used in communication

typical wavelength 150 mm

name of wave ....

Description 3

used in communication

produced by oscillations in electrical circuits

typical wavelength 150 m

name of wave ....

Description 4

used in medical scanning

is emitted by the nucleus of an atom

typical wavelength 2.0×10^{-3} nm

name of wave ....

(c) When white light crosses the boundary between air and glass, it can split up into the colours of the spectrum.

Explain, in terms of speed, why the light behaves like this.

(3)

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(Total for Question 3 = 9 marks)

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4 (a) The symbol '*g*' can be used to refer to the acceleration due to gravity.

The acceleration due to gravity '*g*' has the unit of m/s^2.

'*g*' can also have another unit.

Which of these is also a unit for *g*?

(1)

☒ **A** J/kg

☒ **B** J/kg^2

☒ **C** N/kg

☒ **D** N/kg^2

(b) Two students try to determine a value for *g*, the acceleration due to gravity.

(i) They measure the time, *t*, for a small steel ball to fall through a height, *h*, from rest.

They measure *t* to be 0.74 s, using a stopwatch.

They measure *h* to be 2.50 m, using a metre rule.

Calculate a value for *g* from the students' measurements.

Use the equation

$$g = \frac{2h}{t^2}$$

(2)

g = ... m/s^2

(ii) They record the time t for two more drops from the same height.

The three values for time t are

0.74 s, 0.69 s, 0.81 s.

Calculate the average value of time t to an appropriate number of significant figures.

(2)

average value of time t = ... s

(c) Explain **one** way the students could improve their procedure to obtain a more accurate value for g.

(2)

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(d) A car travelling at 15 m/s comes to rest in a distance of 14 m when the brakes are applied.

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

(3)

deceleration = ... m/s^2

(Total for Question 4 = 10 marks)

5 (a) Which of these is a non-renewable source of energy?

(1)

- ☒ **A** geothermal
- ☒ **B** natural gas
- ☒ **C** tidal
- ☒ **D** solar

(b) Explain why renewable sources provide an increasing fraction of the electricity supply for many countries.

(2)

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(c) Electricity can be generated using a water turbine.

(i) Water gains kinetic energy by falling from the top of a dam.

Calculate the minimum height that 7.0 kg of water must fall to gain 1300 J of kinetic energy.

(3)

minimum height = ... m

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(ii) As water enters the turbine at the bottom of the dam, the kinetic energy of 8.0 kg of moving water is 1100 J.

Calculate the speed of the moving water as it enters the turbine.

(3)

speed = ... m/s

P 6 0 4 7 0 A 0 1 5 2 4

Turn over ▶

(d) Moving air can be used to generate electricity using a wind turbine.

Figure 6 is a graph of kinetic energy against wind speed for a mass of moving air.

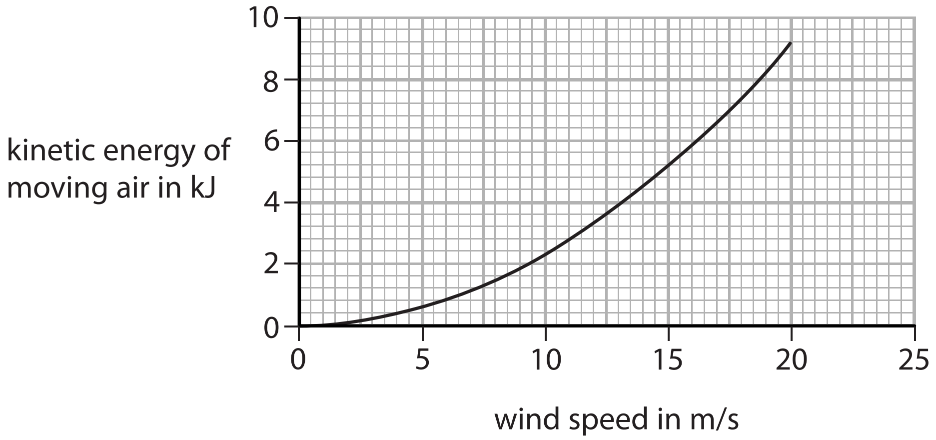

Figure 6

Just before the air reaches a wind turbine it has a wind speed of 15 m/s.

When the air has gone through the turbine it has a wind speed of 13 m/s.

As the air moves through the turbine some of its kinetic energy is transferred to the turbine.

Use the graph to determine the percentage of the kinetic energy transferred to the turbine from the air.

(3)

percentage of kinetic energy transferred from the air = ... %

(Total for Question 5 = 12 marks)

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6 (a) A student investigates the relationship between force and acceleration for a trolley on a runway.

Figure 7 shows some of the apparatus the student uses.

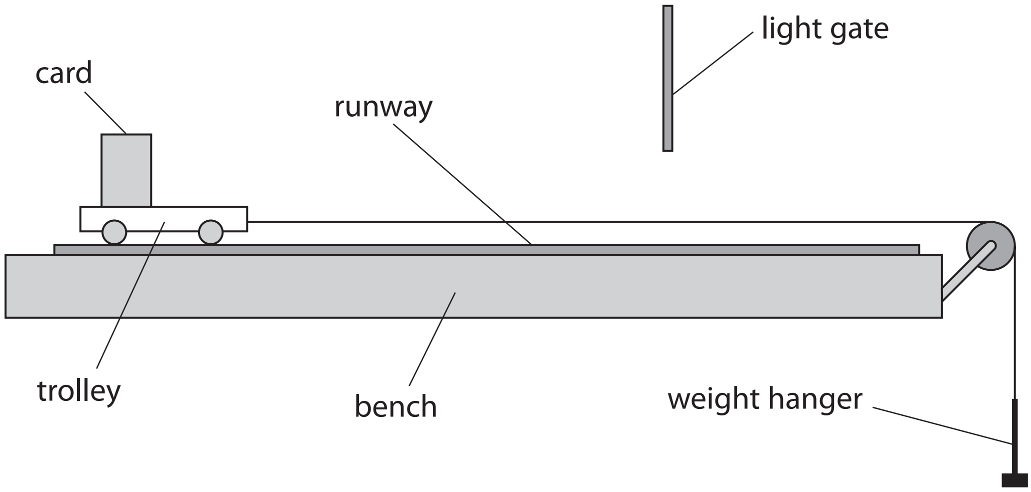

Figure 7

(i) Describe how the student could increase the accelerating force applied to the trolley.

(2)

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(ii) Describe how the mass of the moving system can be kept constant.

(2)

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(iii) Explain how the student could improve the procedure to compensate for the effects of frictional forces acting on the trolley.

(2)

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*(b) Figure 8 shows two objects, Q and R, before and after they collide.

Figure 8

The arrows show the direction of movement of the objects.
The arrows are not to scale.

Explain how momentum is conserved in the collision.

Use Newton's third law and Newton's second law in your answer.

Newton's second law can be written as

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 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 $F = B \times I \times l$
$\frac{\textit{voltage across primary coil}}{\textit{voltage across secondary coil}} = \frac{\textit{number of turns in primary coil}}{\textit{number of turns in secondary coil}}$ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$
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 $E = \frac{1}{2} \times k \times x^2$
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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