Edexcel GCSE

Physics

Unit P2: Physics for your future

Higher Tier

Sample Assessment Material **Time: 1 hour**	Paper Reference(s) **5PH2H/01**
You do not need any other materials.	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.*
- 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 (☒).

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.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Leave blank

FORMULAE

You may find the following formulae useful

charge = current × time $Q = I \times t$

potential difference = current × resistance $V = I \times R$

electrical power = current × potential difference $P = I \times V$

energy transferred = current × potential difference × time $E = I \times V \times t$

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}} \qquad a = \frac{(v - u)}{t}$$

force = mass × acceleration $F = m \times a$

weight = mass x gravitational field strength $W = m \text{ x } g$

momentum = mass x velocity

$$\text{force} = \frac{\text{change in momentum}}{\text{time}} \qquad F = \frac{(mv - mu)}{t}$$

work done = force × distance moved in the direction of the force $E = F \times d$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{E}{t}$$

gravitational potential energy =mass × gravitational field strength × vertical height

$\text{GPE} = m \times g \times h$

kinetic energy = ½ × mass × velocity^2 $\text{KE} = ½ \times m \times v^2$

Leave blank

Electrostatic paint spraying

1. Joe painted the frame of his bicycle.
He used an electrostatic paint gun.

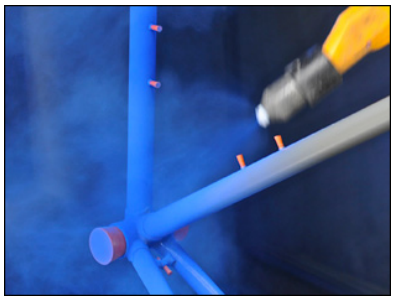


Photo: http://www.windridge.co.uk

(a) Paint is an insulator.

The droplets of paint become positively charged as they leave the nozzle of the paint gun.

(i) The droplets of paint become positively charged because they

A ☒ gain electrons

B ☒ lose electrons

C ☒ gain protons

D ☒ lose protons

(1)

(ii) Explain why the charged droplets of paint are spread out evenly when they leave the nozzle.

.....

.....

.....

.....

.....

.....

(2)

Leave blank

(b) Before spraying, Joe gives the metal frame a negative charge.
He then finds that the paint is attracted to the frame.

Photo: http://www.windridge.co.uk

(i) Why is the paint attracted to the metal frame?

.....

.....

(1)

(ii) Joe only needed to spray the metal frame from one side.

Why does all of the frame become covered in paint?

.....

.....

.....

(1)

(iii) Joe allowed the first layer of paint to dry.
He then tried to spray the frame with a second layer of paint.
The paint was not attracted to the painted frame.

Suggest a reason for this.

.....

.....

.....

(1)

(c) Why could the movement of the paint particles be described as a direct current?

.....

.....

.....

.....

.....

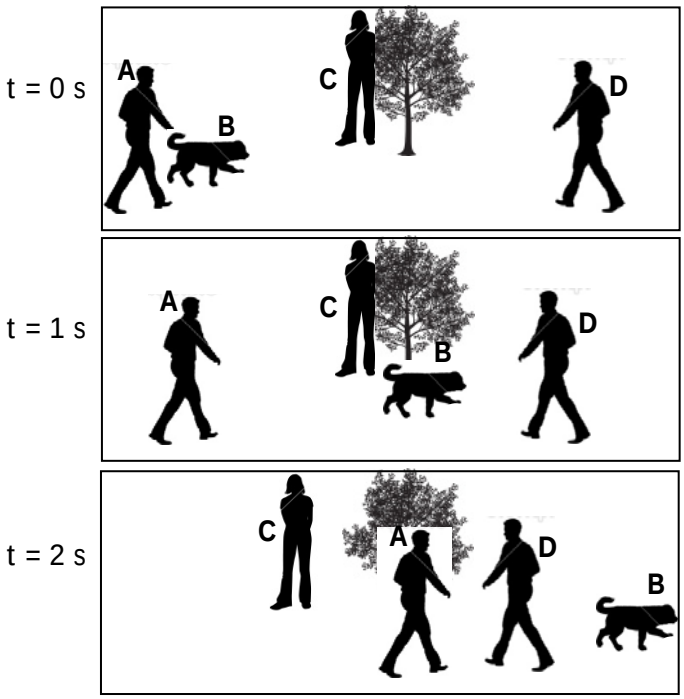
(2)

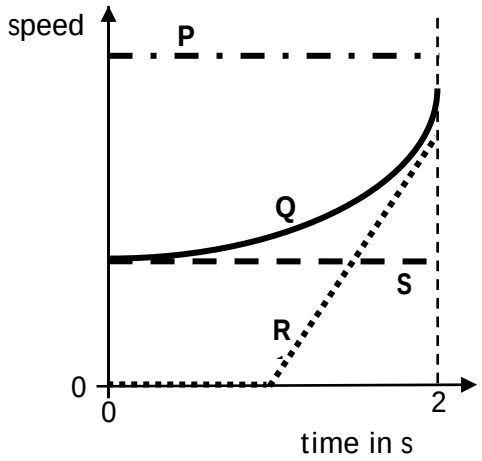
(Total for Question 1 = 8 marks)

Leave blank

Movement

2. The diagrams below show photographs taken one second apart.





The lines on the graph show the movements of the three people and the dog in the diagrams.

(a) Draw one straight line from each moving object to the graph letter which shows its movement.

One has been done for you.

moving object	graph letter
A	P
B	Q
C	R
D	S

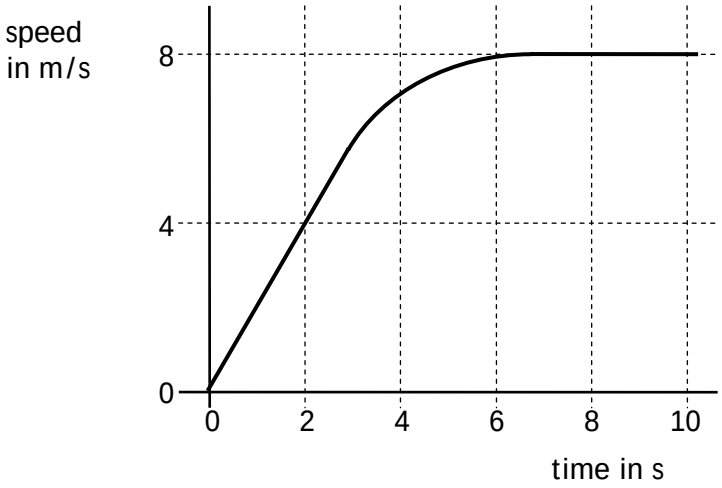
(2)

Leave blank

(b) The dog has a mass of 30 kg.
At one time its momentum is 15 kg m/s.
At what velocity is it moving?

velocity = ... m/s
(2)

(c) The graph below shows the movement of a different dog, chasing a ball.



(i) Calculate the acceleration of the dog in the first 2 s.
Give the unit.

acceleration = ... unit .....
(3)

(ii) Calculate the distance the dog moves in the time between 8 s and 10 s.

distance = ... m
(2)

(Total for Question 2 = 9 marks)

Leave blank

Heating water

3. Shefali buys a battery-operated water heater.
She connects it to a 12 V car battery.
The current in the metal heater element of the kettle produces a heating effect.

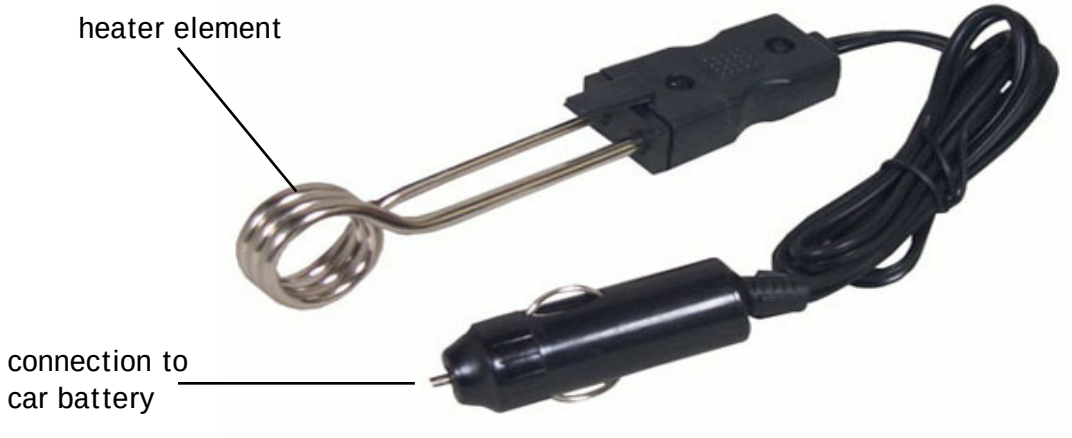


Photo: www.roadpro.co.uk

(a) (i) The current in the heater element is a flow of

A ☒ electrons

B ☒ atoms

C ☒ protons

D ☒ neutrons

(1)

(ii) 12 V is the same as

A ☒ 12 W/s

B ☒ 12 W/C

C ☒ 12 J/s

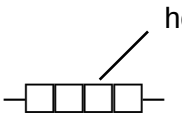
D ☒ 12 J/C

(1)

Leave blank

(b) Shefali wants to investigate how the current in the heater element varies with the potential difference across the element.

Complete the circuit diagram below that Shefali could use for her investigation.



(2)

(c) The current in the element produces a heating effect.

Explain why this occurs.

.....

.....

.....

.....

(2)

(d) A charge of 10 C flows in 2 s when the heater is connected to a potential difference of 12 V.

Calculate the energy transferred to the heater in a time of 60 s.
Give the unit.

energy transferred = ... unit .....

(4)

(Total for Question 3 = 10 marks)

Leave blank

Heavy hydrogen

4. The table below shows information about the most common isotope of hydrogen.

isotope	number of protons	number of neutrons	symbol
hydrogen	1	0	$^{1}_{1}\mathrm{H}$

Tritium is a radioactive isotope of hydrogen. The symbol for tritium is $^{3}_{1}\mathrm{H}$.

(a) (i) How many neutrons does a tritium nucleus contain?

A ☒ 0

B ☒ 1

C ☒ 2

D ☒ 3

(1)

(b) In an experiment to measure the half-life of tritium, scientists have to allow for background radiation.

(i) Name **one** source of background radiation.

.....

.....

(1)

(ii) Explain how the background count is taken into account when measuring half-life.

.....

.....

.....

.....

.....

.....

(2)

Leave blank

(c) Some glow-sticks emit light from the decay of tritium.

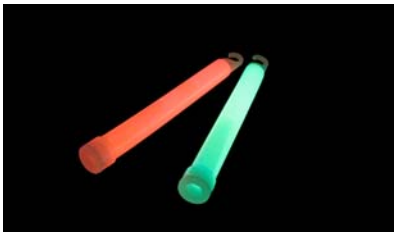
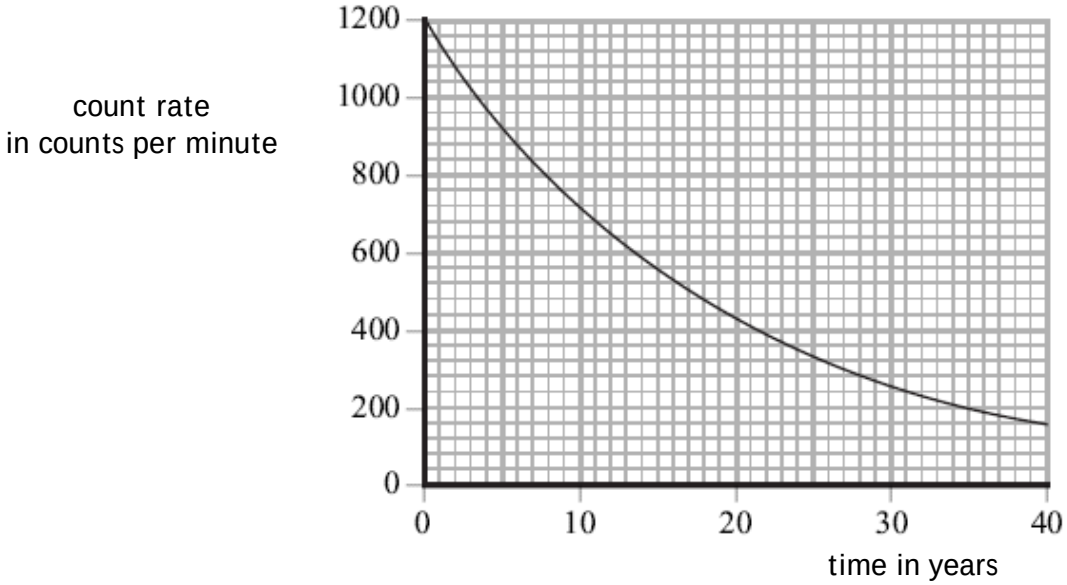


Photo: Scientifica, visuals Unlimited/Science Photo Library

The graph shows how the count rate from the tritium in the glow-stick varies with time.



(i) Estimate, from the graph, the half-life of tritium.
Show your working clearly.

half life = ... years
(2)

(ii) The minimum count rate needed for this glow-stick to work is 400 counts per minute.
The manufacturer claims that the glow-stick will work for 20 years.

Evaluate the reliability of this claim, quoting data from the graph.

.....

.....

.....

.....

.....
(2)

Leave blank

(d) Tritium can be used in nuclear fusion.
Nuclear fusion occurs in stars.

In 1989, two scientists claimed to have achieved fusion on Earth without the extreme conditions found in stars.

Why was their claim not accepted by the scientific community?

.....

.....

.....

.....

.....

.....

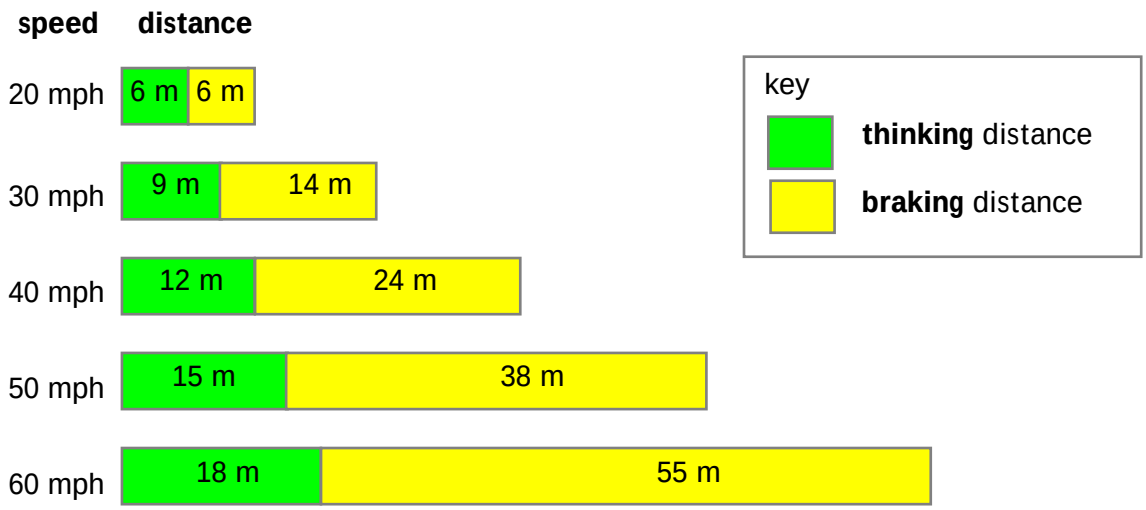
(2)

(Total for Question 4 = 10 marks)

Leave blank

Road safety

5. The chart shows the **thinking** distances and the **braking** distances for a car driven at different speeds.
The speeds are shown in miles per hour (mph).
The distances are shown in metres (m).



(a) (i) The **thinking** distance for a speed of 70 mph is

A ☒ 17 m

B ☒ 21 m

C ☒ 37 m

D ☒ 90 m

(1)

(ii) 10 mph is the same speed as 4.5 m/s.
A particular car is travelling at 20 mph.
It has a kinetic energy of 40 500 J.

What is its mass?

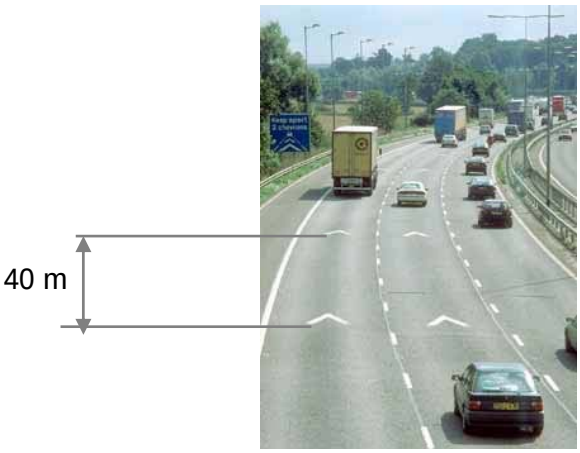
mass = ... kg
(3)

(iii) How much work is done to stop the car described in part (ii)?

work done = ... J
(1)

Leave blank

*(b) On some motorways there are markings on the road.



The markings are 40 m apart.
Drivers are advised to keep at least two markings between cars.
The maximum speed for a driver on the motorway is 70 mph.

The thinking distance and braking distance can be affected by other factors, as well as speed.

Evaluate whether a distance of 40m between markings is suitable.

(6)

(Total for Question 5 = 11 marks)

Leave blank

Nuclear power

6. (a) A chain reaction occurs in fuel rods in a nuclear power station.
One model of this chain reaction involves the toppling of dominoes as shown in the diagram.

Photo: Shutterstock

(i) State one way in which this model is similar to the chain reaction in the reactor.

.....

.....

.....

(1)

(ii) The type of particle responsible for continuing the nuclear chain reaction is

A ☒ a proton

B ☒ an electron

C ☒ a neutron

D ☒ an alpha particle

(1)

(iii) Describe the principle of the nuclear chain reaction in the fuel rods in a power station.

.....

.....

.....

.....

.....

.....

(2)

Leave blank

(iv) Moderators and control rods both affect the rate of the chain reaction in a nuclear reactor.

Explain how either of these controls the rate of the reaction.

(2)

*(b) The processes of nuclear fission and nuclear fusion both produce energy.

There are 19 nuclear power stations in the UK. All of these use fission.
However, the Government is investing a lot of money, time and effort to develop fusion power stations instead.

Explain why fusion power stations would be preferable but the UK only has fission power stations at present.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS