

FORMULAE

You may find the following formulae useful.

$$\text{average velocity} = \frac{\text{displacement}}{\text{time}}$$

$$v = \frac{s}{t}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

$$a = \frac{(v-u)}{t}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$F = m \times a$$

$$\frac{\text{change in potential energy}}{\text{energy}} = \text{mass} \times \text{gravitational field strength} \times \text{change in height} \quad PE = m \times g \times h$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times (\text{velocity})^2$$

$$KE = \frac{1}{2} \times m \times v^2$$

$$\text{electrical energy} = \text{voltage} \times \text{current} \times \text{time}$$

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

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

$$P = \frac{W}{t}$$

$$\text{work done} = \text{force} \times \text{distance moved in the direction of the force}$$

$$W = F \times s$$



1. A student does an experiment to find his power.
He lifts a ball onto a bench.
He has to measure

- the time he takes
- the weight of the ball
- and the height he lifts the ball

Use words from the box to complete the table to show the equipment he should use for each measurement.

ammeter	metre rule	newton meter	ratemeter	stopwatch	voltmeter
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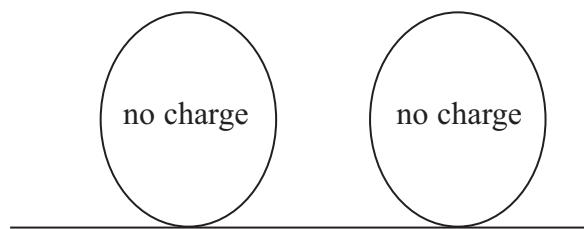
measurement	equipment
time	
weight	
height	

Q1

(Total 3 marks)



2. The diagram shows two rubber balloons on a wooden bench.



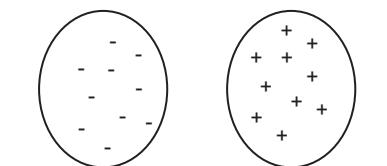
Each balloon can be left with no charge or given a positive charge or given a negative charge.

- (a) Use words from the box to describe the force between the balloons in each of the following diagrams.

attract	no force	repel
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The words may be used once, more than once or not at all.

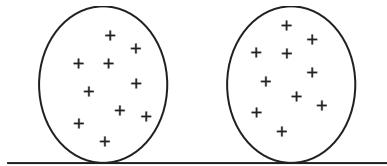
(i)



.....

(1)

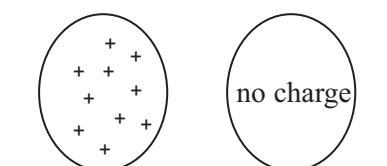
(ii)



.....

(1)

(iii)



.....

(1)



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(b) Complete the sentence by putting a cross (\times) in the correct box.

a magnet

The balloons can be given a charge by rubbing them with

a metal plate

a woollen jumper

(1)

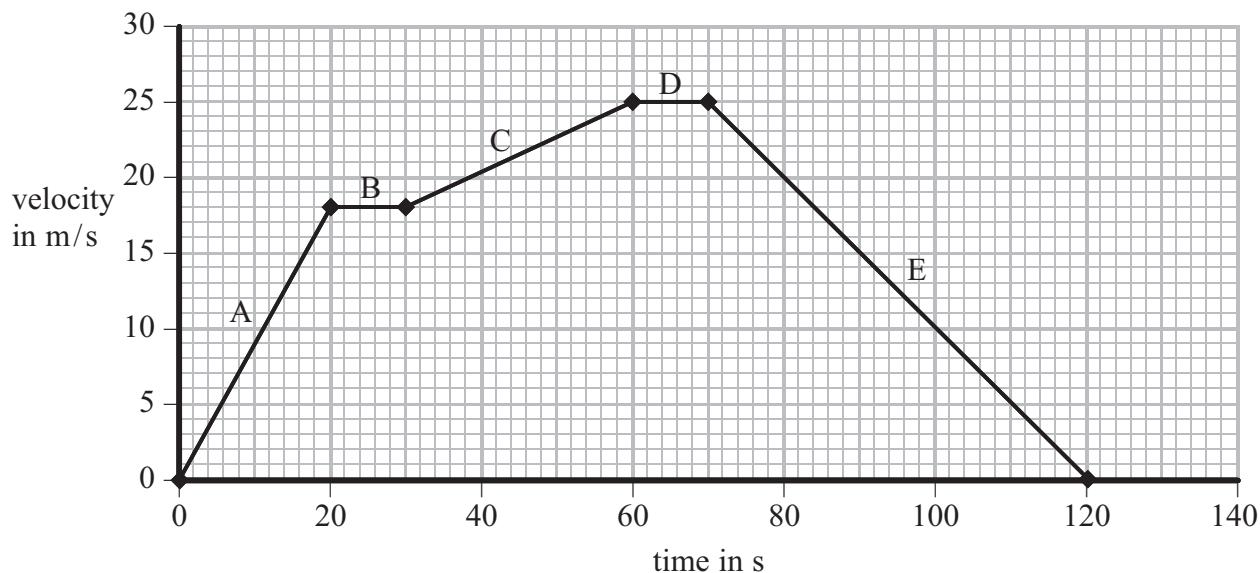
Q2

(Total 4 marks)



P 4 1 7 4 3 A 0 5 1 6

3. The graph shows the movement of a cyclist.



(a) Use numbers or letters from the graph to complete the following sentences.

- When the time is 100 s, the velocity of the cyclist is m/s
 - The section where the acceleration is largest is
 - The cyclist moves fastest in section
 - The cyclist slows down in section
- (4)
- (b) Calculate the acceleration during the first 20 s.
Show your working.

$$\text{acceleration} = \dots \text{ m/s}^2$$

(2)

Q3

(Total 6 marks)



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4. (a) The nucleus of an atom of plutonium-239 can be represented by



- (i) How many protons are in one nucleus of plutonium-239?

.....
(1)

- (ii) How many neutrons are in one nucleus of plutonium-239?

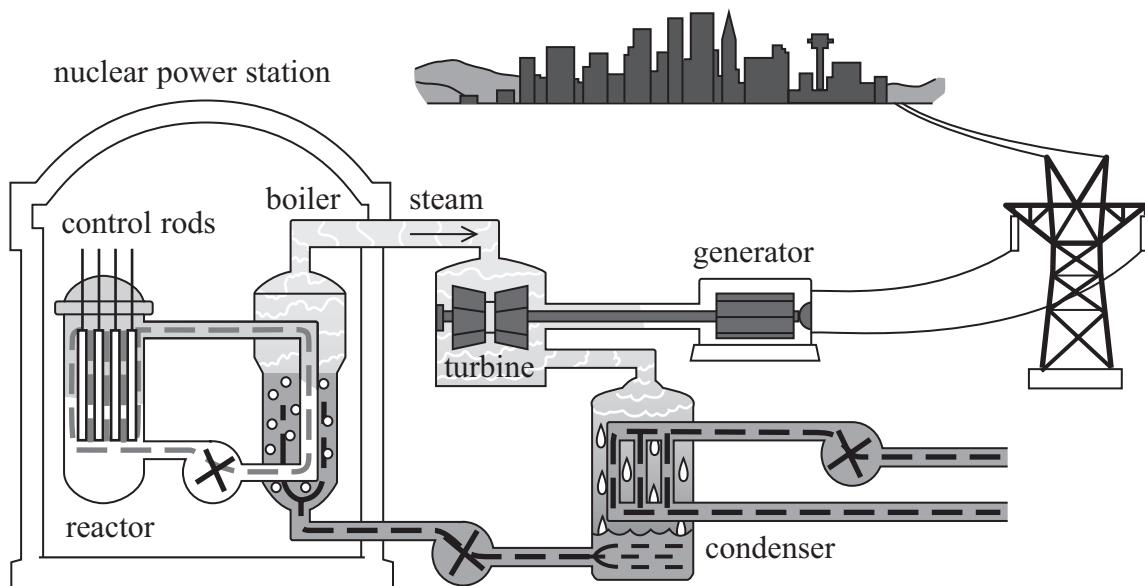
.....
(1)

- (b) Plutonium-239 is used as a fuel in a nuclear reactor.

The reactor is used in a nuclear power station.

Energy from the reactor is used to produce electricity.

The diagram shows the stages in the electricity production at a nuclear power station.



- (i) Complete the sentence by putting a cross (\boxtimes) in the correct box.

radiation

The reaction which takes place in the reactor is nuclear

fusion

fission

(1)



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blank

- (ii) Describe how the energy released in the reactor is used to produce electricity.

.....
.....
.....
.....

(2)

Q4

(Total 5 marks)



5. The photograph shows a log ride at a funfair.
The log is hollow and people can sit in it.
The log slides down a water chute.



- (a) As the log falls down the water chute, both its gravitational potential energy and its kinetic energy change.

Place ticks (\checkmark) in the table to show where each energy type is greatest.

energy type	T	M	B
gravitational potential energy is greatest at			
kinetic energy is greatest at			

(1)

- (b) A log is lifted to the top of the water chute using an electric motor.
The motor uses a current of 3.0 A at a voltage of 460 V.
It takes 25 s to lift the log to the top.

Calculate the electrical energy supplied to lift the log to the top.
Show your working.

$$\text{electrical energy supplied} = \dots \text{J}$$

(2)

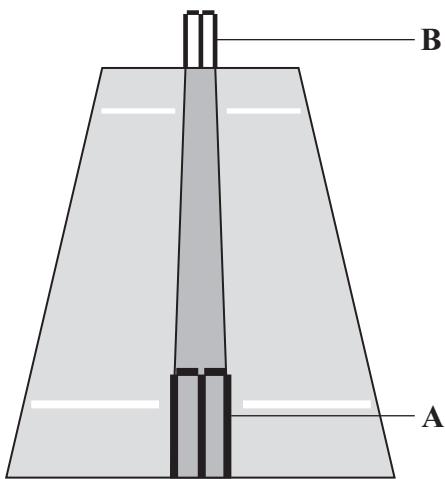
Q5

(Total 3 marks)



6. James is playing cricket.

He bowls a cricket ball from point **A** to point **B** in the diagram.



The ball leaves his hand at a speed of 40 m/s.

When the ball reaches **B**, it has a speed of 36 m/s.

- (a) Suggest one reason why the speed is less at **B** than it is at **A**.

.....

(1)

- (b) (i) The average speed from **A** to **B** is calculated using this equation.

$$\text{average speed} = \frac{\text{speed at } \mathbf{A} + \text{speed at } \mathbf{B}}{2}$$

Calculate the average speed from **A** to **B**.

average speed = m/s

(1)

- (ii) The distance from **A** to **B** is 20 m.

Use the equation below to calculate the time it takes for the ball to travel from **A** to **B**.

Show your working.

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

time = s

(2)

Q6

(Total 4 marks)



7. The photograph shows a battery-operated smoke detector.



The smoke detector contains some americium-241.

Americium-241 is radioactive.

It emits alpha radiation.

- (a) Complete the sentence by putting a cross () in the correct box.

electrons

Alpha radiation is a stream of electromagnetic waves

helium nuclei

(1)

- (b) Alpha radiation can be harmful.

State one of the harmful effects of alpha radiation.

.....
.....

(1)

- (c) Smoke detectors containing americium-241 are still safe to use in houses.

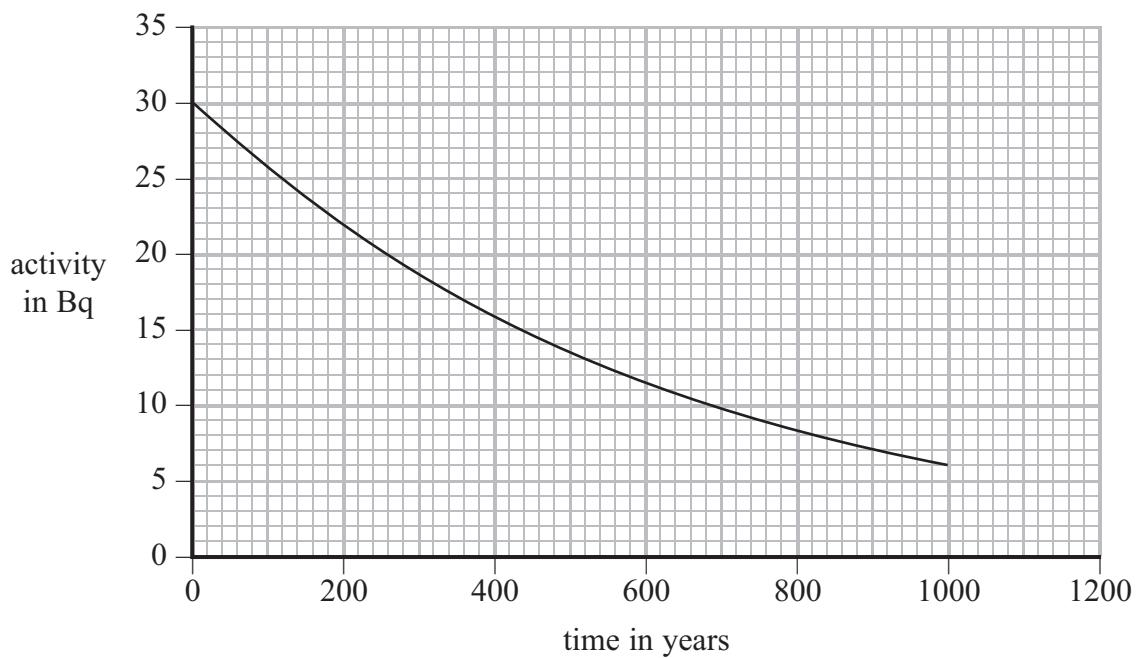
Why are these smoke detectors safe to use in houses?

.....
.....
.....

(1)



- (d) The graph shows how the activity of a sample of americium-241 changes with time.



Use the graph to estimate the half-life of americium-241.

half-life = years
(2)

Q7

(Total 5 marks)

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