

FORMULAE

You may find the following formulae useful.

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

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

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

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

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

$$F = m \times a$$

$$\text{change in potential energy} = \text{mass} \times \text{gravitational field strength} \times \text{change in height}$$

$$PE = m \times g \times h$$

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

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

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

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

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

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

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

$$W = F \times s$$

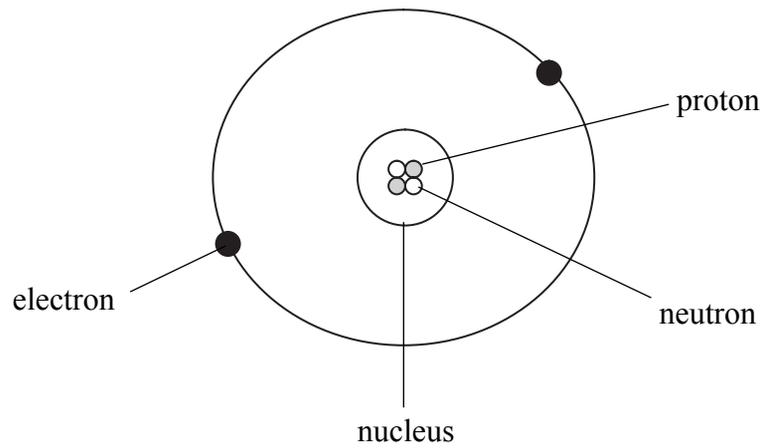


BLANK PAGE



N 3 3 0 2 2 A 0 3 1 6

1. The diagram shows the structure of a helium atom.



(a) (i) Use the information in the diagram to explain the numbers in the symbol below, used to represent a helium atom.



4

2

(2)

(ii) State the overall charge of a helium atom.

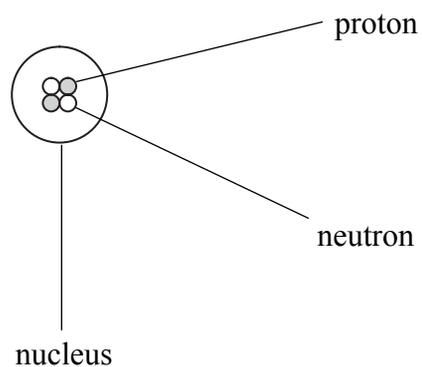
.....

(1)



Leave blank

- (b) Some radioactive isotopes emit alpha particles.
The diagram shows the structure of an alpha particle.



- (i) State the difference between a helium atom and an alpha particle.

..... (1)

- (ii) State the overall charge of an alpha particle.

..... (1)

- (c) An alpha particle travels only about 5 cm in air even though it is emitted with a large amount of energy.

ioniser.

An alpha particle is a good penetrator.

radiator.

Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Q1

(Total 6 marks)



2. (a) Tomas read a newspaper article about the government's plans for nuclear power. They want to increase the number of nuclear power plants over the next twenty years. The article gave some of the concerns protestors have about nuclear power.



- (i) State **one** reason why the protestors shown in the photograph might think nuclear power is unsafe.

.....
.....
(1)

- (ii) State **one** reason why other people might support nuclear power stations.

.....
.....
(1)



(b) Tomas is not sure how we obtain electrical energy from nuclear fuel.

The stages that take place in a nuclear power station have been listed in the table below.

Put all the stages into the correct order by adding numbers 2, 4, 6 and 8 to the second column.

stage	order
steam is produced	5
thermal energy is produced	
generator is turned	7
electrical energy is produced	
turbine turns	
chain reaction occurs in the core	1
thermal energy is removed from the core	3
water is heated	

(3)

Q2

(Total 5 marks)



N 3 3 0 2 2 A 0 7 1 6

BLANK PAGE



3. Karampal and his family went to the Alps for their summer holidays. The area is famous for its mountains and winding roads.



The photograph shows one of the roads they used in their travels.

(a) The road snakes backwards and forwards across the mountain rather than going straight up it.
Give **two** reasons for this.

1
.....
(1)

2
.....
(1)

(b) The road climbed through a vertical height of 1500 m from the valley bottom to the top of the mountain.
The mass of the car and its occupants was 1300 kg.

Calculate the gain in gravitational potential energy of the car and its occupants as they went up the mountain.

gravitational field strength = 10 m/s^2

.....
.....

potential energy gained = J
(2)

(Total 4 marks)

Q3



4. (a) Stewart is a keen racing cyclist. Charlie uses a touring bike to cycle to school. Their bikes are shown in the diagram.

racing bike has a light frame



Stewart



Charlie

touring bike has a heavy frame

Stewart and Charlie have the same mass, and produce the same driving forces on their bikes.

- (i) Which cyclist is able to produce the greater acceleration when they start moving? Suggest why.

Cyclist

Reason

(2)

- (ii) Stewart is able to reach a higher maximum speed on his bike. Suggest two reasons why.

1

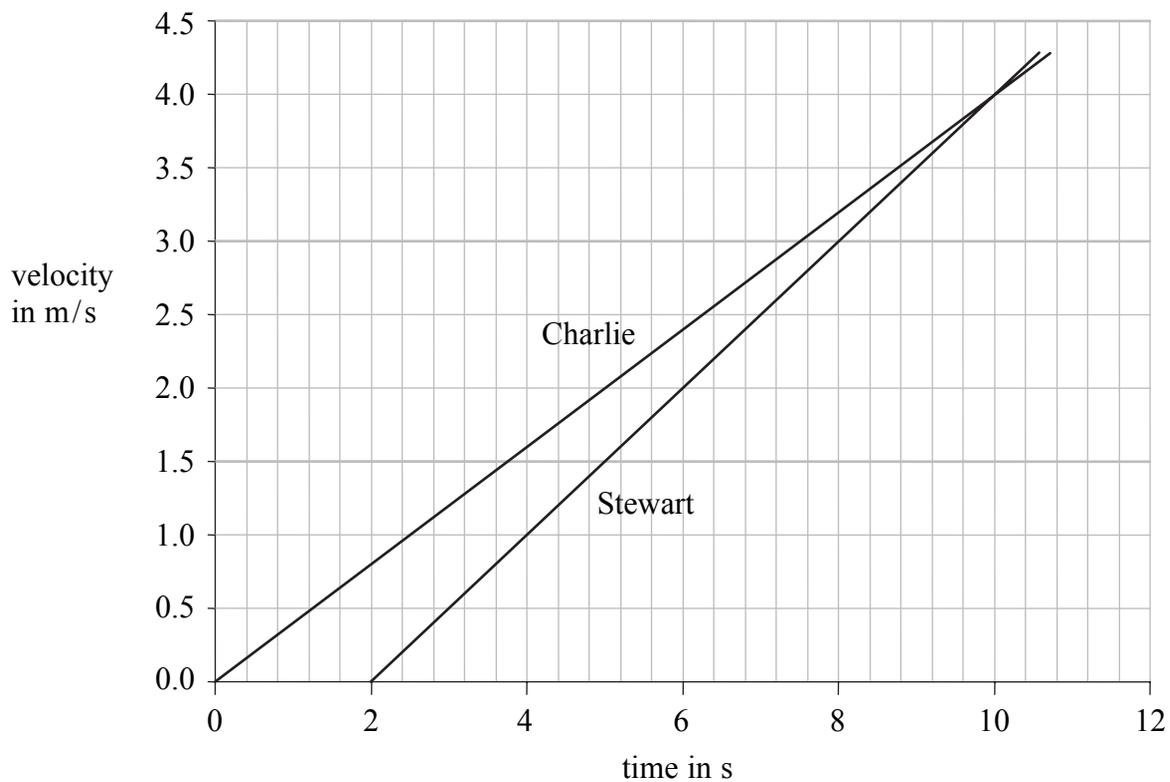
2

(2)



(b) One day Stewart and Charlie decided to have a bike race. Stewart started some time after Charlie, because he felt his bike was better suited to racing than Charlie's bike.

The graph shows how the velocity changed with time for both cyclists.



(i) How many seconds after Charlie did Stewart start?

time = s
(1)

(ii) How many seconds did it take Stewart to reach the same speed as Charlie?

time = s
(1)

(iii) Use the graph to calculate Charlie's acceleration.

.....
.....

acceleration = m/s²
(2)

(Total 8 marks)

Q4



5.

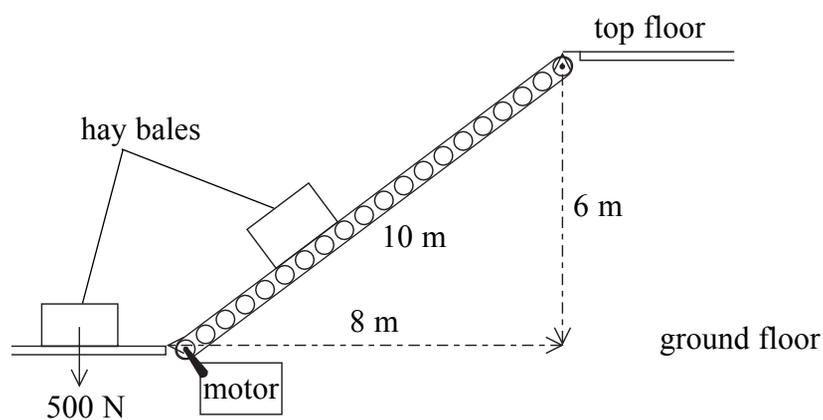


Sam uses a conveyor belt to lift hay bales up one at a time to the top floor of his barn.

The diagram below shows the conveyor belt in use.

Each hay bale weighs 500 N.

The time taken for each bale to rise to the top is 5.0 s.



(a) Calculate the work done in lifting one bale to the top floor.

State the unit in your answer.

.....

work done =
(3)

(b) The motor works at a voltage of 220 V and a current of 4.5 A.

Calculate the electrical energy transferred by the motor in 5.0 s.

.....

energy = J
(2)



Leave
blank

(c) Suggest two reasons why your answer in part (a) is less than your answer for part (b).

1

2

(2)

Q5

(Total 7 marks)

TOTAL FOR PAPER: 30 MARKS

END



BLANK PAGE



BLANK PAGE



N 3 3 0 2 2 A 0 1 5 1 6

BLANK PAGE

