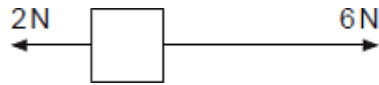


Q1. (a) The diagram shows two forces acting on an object.



What is the resultant force acting on the object?

Tick (✓) **one** box.

8 N to the right

8 N to the left

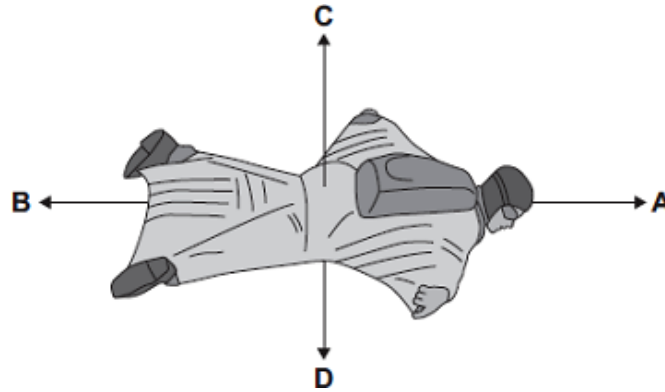
4 N to the right

4 N to the left

(1)

(b) BASE jumpers jump from very high buildings and mountains for sport.

The diagram shows the forces acting on a BASE jumper in flight.
The BASE jumper is wearing a wingsuit.



(i) Draw a ring around the correct answer in the box to complete each sentence.

The BASE jumper accelerates forwards when force **A** is

smaller than
equal to
bigger than

force **B**.

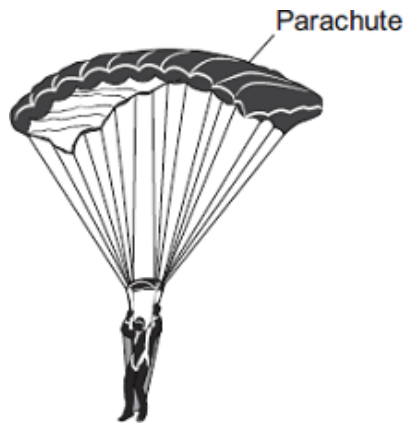
The BASE jumper falls with a constant speed when force **C** is

smaller than
equal to
bigger than

force **D**.

(2)

(ii) To land safely the BASE jumper opens a parachute.



What effect does opening the parachute have on the speed of the falling BASE jumper?

.....

Give a reason for your answer.

.....

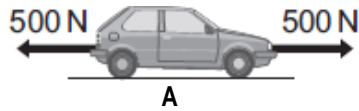
.....

(2)
(Total 5 marks)

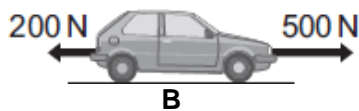
Q2. (a) The diagrams, **A**, **B** and **C**, show the horizontal forces acting on a **moving** car.

Draw a line to link each diagram to the description of the car's motion at the moment when the forces act.

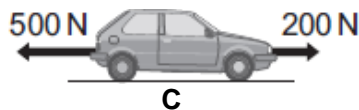
Draw only **three** lines.



stationary



constant speed

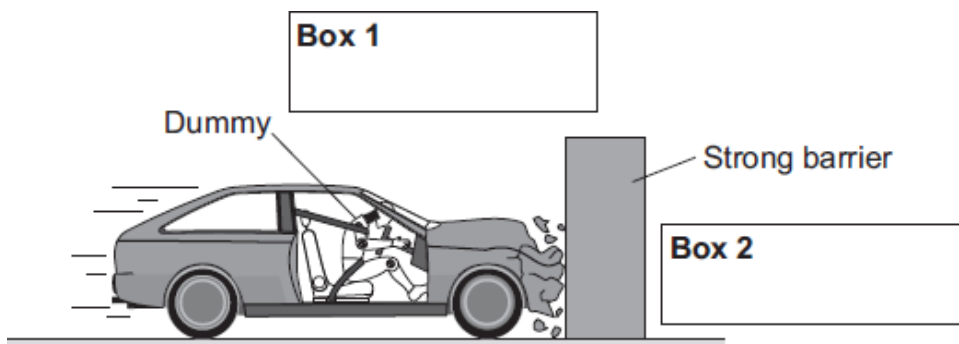


slowing down

accelerating forwards

(3)

(b) The front crumple zone of a car is tested at a road traffic laboratory. This is done by using a remote control device to drive the car into a strong barrier. Electronic sensors are attached to a dummy inside the car.



(i) Draw an arrow in **Box 1** to show the direction of the force that the car exerts on the barrier.

(1)

(ii) Draw an arrow in **Box 2** to show the direction of the force that the barrier exerts on the car.

(1)

(iii) Complete the following by drawing a ring around the correct line in the box.

The car exerts a force of 5000 N on the barrier. The barrier does not move. The force

exerted by the barrier on the car will be

more than

equal to

less than

5000 N.

(1)

(iv) Which **one** of the following gives the most likely reason for attaching electronic sensors to the dummy?

Put a tick (✓) in the box next to your answer.

To measure the speed of the car just before the impact.

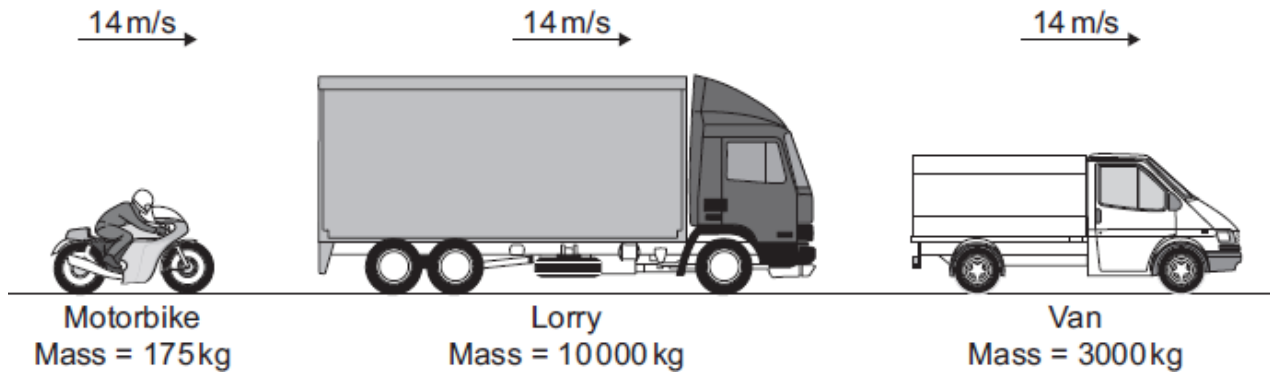
To measure the forces exerted on the dummy during the impact.

To measure the distance the car travels during the impact.

(1)

(Total 7 marks)

Q3. (a) (i) The diagram shows three vehicles travelling along a straight road at 14 m/s.



Which vehicle has the greatest momentum?

.....

Give the reason for your answer.

.....

(2)

(ii) Use the equation in the box to calculate the momentum of the motorbike when it travels at 14 m/s.

$\text{momentum} = \text{mass} \times \text{velocity}$
--

Show clearly how you work out your answer.

.....

Momentum = kg m/s

(2)

(b) The motorbike follows the lorry for a short time, and then accelerates to overtake both the lorry and van.

(i) Complete the following sentence by drawing a ring around the correct line in the box.

When the motorbike starts to overtake, the kinetic energy

of the motorbike

- | |
|-----------------|
| decreases. |
| stays the same. |
| increases. |

(1)

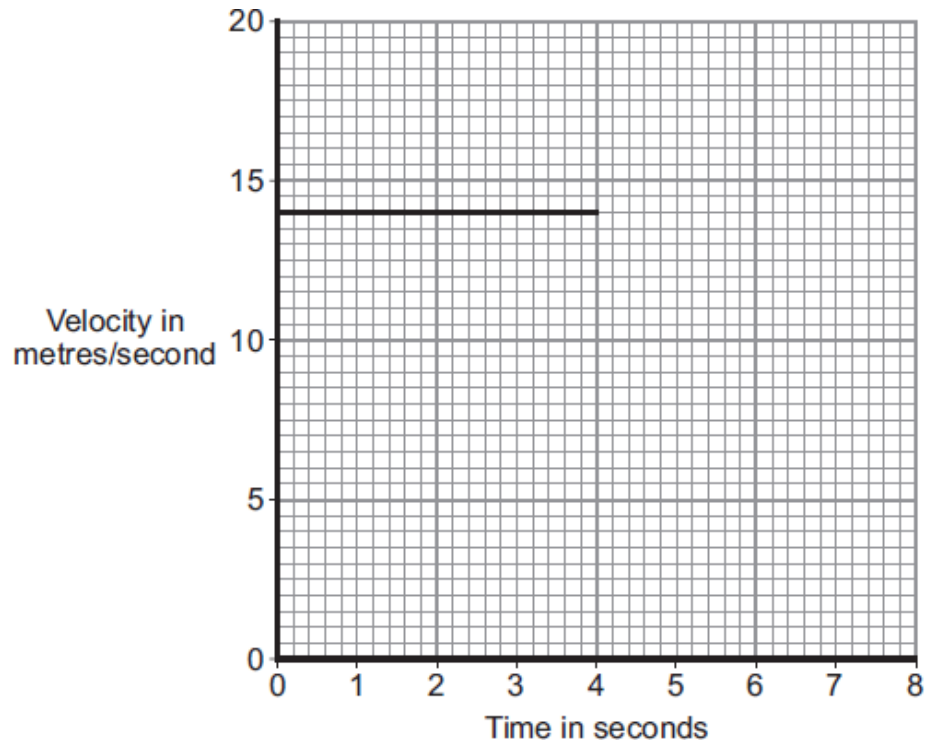
(ii) Give a reason for your answer to part (b)(i).

.....
.....

(1)

(iii) The graph shows the velocity of the motorbike up to the time when it starts to accelerate. The motorbike accelerates constantly, going from a speed of 14 m/s to a speed of 20 m/s in a time of 2 seconds. The motorbike then stays at 20 m/s.

Complete the graph to show the motion of the motorbike over the next 4 seconds.

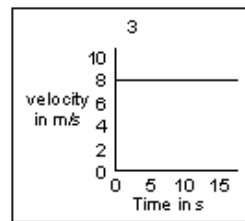
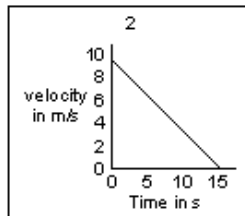
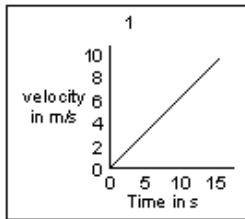


(3)
(Total 9 marks)

Q4. The graphs in **List A** show how the velocities of three vehicles change with time. The statements in **List B** describe different motions.

Draw **one** line from each graph in **List A** to the description of the motion represented by that graph in **List B**.

List A
Velocity–time graphs



List B
Descriptions of motion

Constant velocity

Constant acceleration

Not moving

Constant deceleration

(Total 3 marks)

Q5. The diagram shows the horizontal forces acting on a car travelling along a straight road.



(a) Complete the following sentences by drawing a ring around the correct word in each box.

(i) When the driving force equals the drag force, the speed of the car is

- | |
|------------|
| decreasing |
| constant |
| increasing |

(1)

(ii) Putting the brakes on transforms the car's kinetic energy mainly into




heat
light
sound

(1)

(b) The charts, **A**, **B** and **C** give the thinking distance and the braking distance for a car driven under different conditions.

(i) Draw straight lines to match each chart to the correct conditions.

Draw only **three** lines.

Conditions	Charts
Speed = 22 m/s driver wide awake	 A
Speed = 13 m/s driver wide awake	 B
Speed = 13 m/s driver very tired	 C
<div style="border: 1px solid black; padding: 5px; display: inline-block;"><p style="text-align: center;">Key</p><p>■ Thinking distance</p><p>□ Braking distance</p></div>	

(2)

(ii) The three charts above all apply to dry road conditions.

How would the braking distances be different if the road were wet?

.....
.....

(1)

(Total 5 marks)

Q6. The diagram shows a supermarket worker stacking jars of coffee onto a shelf.



(a) The mass of each jar of coffee is 0.4 kg.

Calculate the weight of each jar of coffee.

gravitational field strength = 10 N/kg

Write down the equation you use, and then show clearly how you work out your answer.

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

Weight = N

(2)

(b) The distance between the floor and the middle shelf is 1.2 m.

Calculate the work done to lift one jar of coffee from the floor onto the shelf.

Write down the equation you use, and then show clearly how you work out your answer and give the unit.

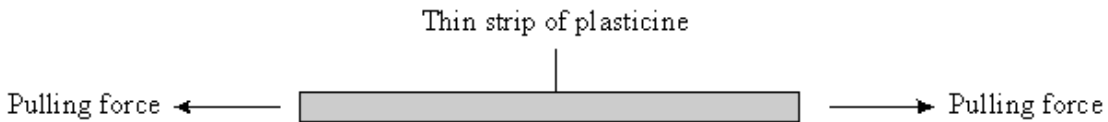
.....
.....
.....
.....
.....
.....

Work done =

(3)
(Total 5 marks)

Q7. The diagrams show pairs of forces acting on different objects. In each case describe what happens when the forces are increased. Then describe what happens when the forces are removed.

(a)



When the forces are increased

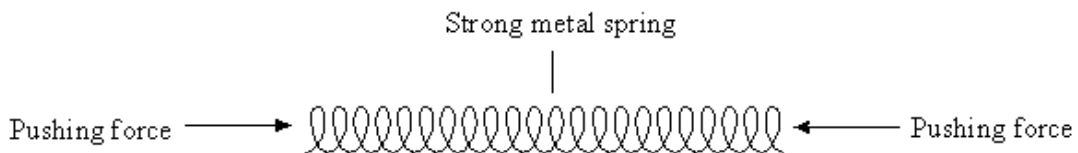
.....

When the forces are removed

.....

(2)

(b)



When the forces are increased

.....

When the forces are removed

.....

(2)
(Total 4 marks)

Q8. The diagram shows an adult and a child pushing a loaded shopping trolley.



(a) (i) What is the *total force* on the trolley due to the adult and child?

.....

(1)

(ii) Which **one** of the terms in the box means the same as *total force*?

Draw a ring around your answer.

answer force mean force resultant force

(1)

(iii) The trolley is pushed at a constant speed for 80 metres.

Use the equation in the box to calculate the work done to push the trolley 80 metres.

work done = force applied \times distance moved in direction of force

Show clearly how you work out your answer.

.....

.....

Work done =

(2)

(b) Complete the following sentences by drawing a ring around the correct word in each of the boxes.

(i) The unit of work done is the

joule
newton
watt

(1)

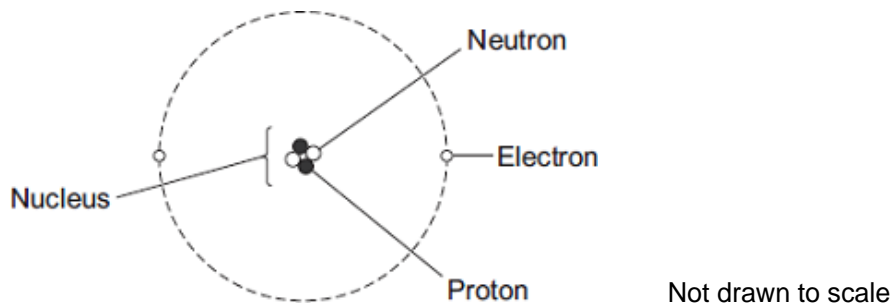
(ii) Most of the work done to push the trolley is transformed into

heat
light
sound

(1)

(Total 6 marks)

Q9. The diagram shows the structure of an atom.



(a) In 1931 scientists thought that atoms contained **only** protons and electrons.

Suggest what happened in 1932 to change the idea that atoms contained only protons and electrons.

.....

(1)

(b) The table gives information about the particles in an atom.

Complete the table by adding the names of the particles.

Particle	Relative Mass	Relative Charge
	1	0
	very small	-1
	1	+1

(2)

(Total 3 marks)

- Q10.** (a) The names of three types of radiation are given in **List A**. Various properties of these three types of radiation are given in **List B**.

Draw a line to link each type of radiation in **List A** to its correct property in **List B**. Draw only **three** lines.

List A Type of radiation	List B Property of radiation
alpha (α)	not dangerous
beta (β)	stopped by paper
gamma (γ)	travels at 300 000 000 m/s
	travels up to 1 metre in air

(3)

- (b) This sign warns people that a radioactive source is being used in a laboratory.



Why is it important to warn people that a radioactive source is being used?

.....

(1)

- (c) To study the blood flow in a patient's lungs, a doctor injects some technetium-99 compound into the patient. The gamma radiation given out by the technetium-99 atoms is detected using a gamma camera outside the patient's body.

Which statement gives the reason why gamma radiation is used? Put a tick (✓) in the box next to your choice.

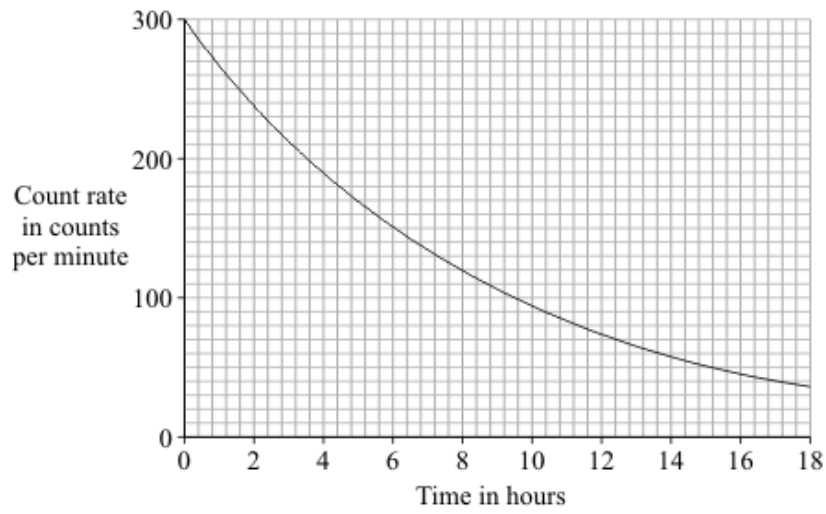
It can travel through a vacuum.

It is not affected by a magnet.

It can pass through the human body.

(1)

(d) The graph shows how the count rate from a sample of technetium-99 changes with time.



M1. (a) 4 N to the right

1

(b) (i) bigger than

1

equal to

1

(ii) reduces it

1

increases air resistance / drag / force C

accept parachute has large(r) (surface) area

1

[5]

M2. (a) 3 lines drawn

all correct

allow 1 mark for each correct line

if two or more lines are drawn from any diagram then all these lines are incorrect

The diagram shows three cars, labeled A, B, and C, on a horizontal surface. Each car has two horizontal force arrows acting on it. Car A has a 500 N arrow pointing left and a 500 N arrow pointing right. Car B has a 200 N arrow pointing left and a 500 N arrow pointing right. Car C has a 500 N arrow pointing left and a 200 N arrow pointing right. To the right of each car is a box for its motion state. Lines connect the cars to the boxes: Car A to 'stationary', Car B to 'slowing down', and Car C to 'accelerating forwards'.

stationary

constant speed

slowing down

accelerating forwards

3

(b) (i) horizontal arrow to the right

judge by eye

accept an arrow drawn outside the box if it is labelled correctly

1

- (ii) horizontal arrow to the left
judge by eye
accept an arrow drawn outside the box if it is labelled correctly 1
- (iii) equal to 1
- (iv) to measure the forces exerted on the dummy during the impact 1

[7]

- M3.** (a) (i) lorry
reason only scores if lorry chosen 1

- greatest mass
accept weight for mass
accept heaviest
accept correct calculations for all 3 vehicles
the biggest is insufficient 1

- (ii) 2450
allow 1 mark for correct substitution
ie 175 x 14 2

- (b) (i) increases
accept any clear indication of the correct answer 1

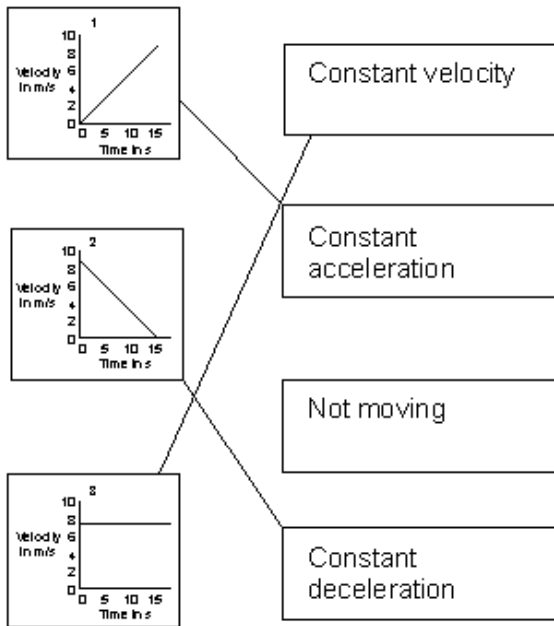
- (ii) speed increases
accept velocity for speed
accept gets faster
*do **not** accept it accelerates on its own*
moves more is insufficient 1

- (iii) straight line going to 6, 20
allow 1 mark for a curve going to 6,20
***or** a straight line diagonally upwards but missing 6,20* 2

- horizontal line from 6,20 to 8,20
*allow a horizontal line from where their **diagonal** meets 20m/s to 8,20* 1

[9]

M4. 1 mark for each line



if more than 1 line is drawn from a graph in List A then all those lines are marked incorrect

[3]

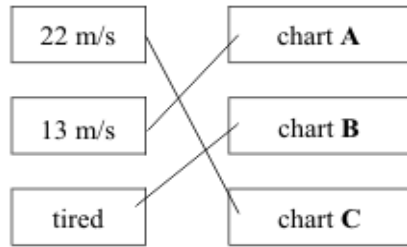
M5. (a) (i) constant

1

(ii) heat

1

(b) (i) 3 links correct



allow 1 mark for 1 correct link

if more than one line is drawn from a condition mark all lines from that condition incorrect

2

(ii) increased

1

[5]

M6. (a) 4 (N)

allow 1 mark for correct substitution into correct equation
ie 0.4×10

2

(b) 4.8

their (a) $\times 1.2$ correctly calculated gains 2 marks
allow 1 mark for substitution into correct equation
ie 4×1.2 or their (a)(i) $\times 1.2$

2

joule or J

1

[5]

M7. (a) plasticine stretches/snaps
stays stretched/snapped/same
for 1 mark each

2

- (b) spring compresses OWTTE
returns to original length/gets longer
for 1 mark each

2

[4]

- M8.** (a) (i) 50 (N)
ignore any units

1

- (ii) resultant force

1

- (iii) 4000

*accept their (a)(i) × 80 correctly calculated for 2 marks
allow 1 mark for correct substitution i.e. 50 × 80 or their (a)(i) × 80
ignore any units*

2

- (b) (i) joule

1

- (ii) heat

1

[6]

- M9.** (a) neutron discovered

1

- (b) neutron
all 3 in correct order

electron
allow 1 mark for 1 correct

proton

2

[3]

