

# Topic 5 Forces and Motion Extended Writing Questions

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

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Time: **25 minutes**

Marks: **25 marks**

Comments:

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Q1. (a) The diagram shows the forces acting on a parachutist in free fall.



The parachutist has a mass of 75 kg.

Calculate the weight of the parachutist.

gravitational field strength = 10 N/kg

Show clearly how you work out your answer and give the unit.

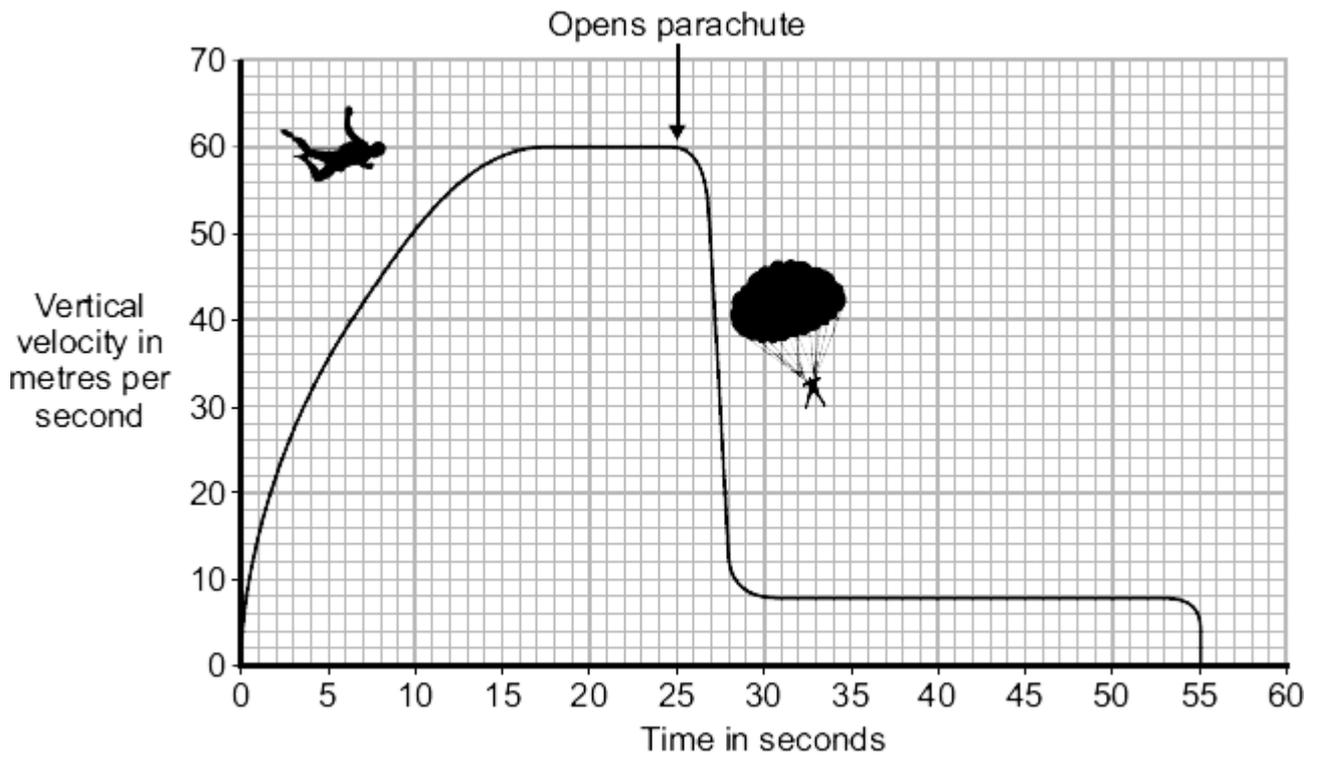
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Weight = .....

(3)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The graph shows how the vertical velocity of a parachutist changes from the moment the parachutist jumps from the aircraft until landing on the ground.



Using the idea of forces, explain why the parachutist reaches a terminal velocity and why opening the parachute reduces the terminal velocity.

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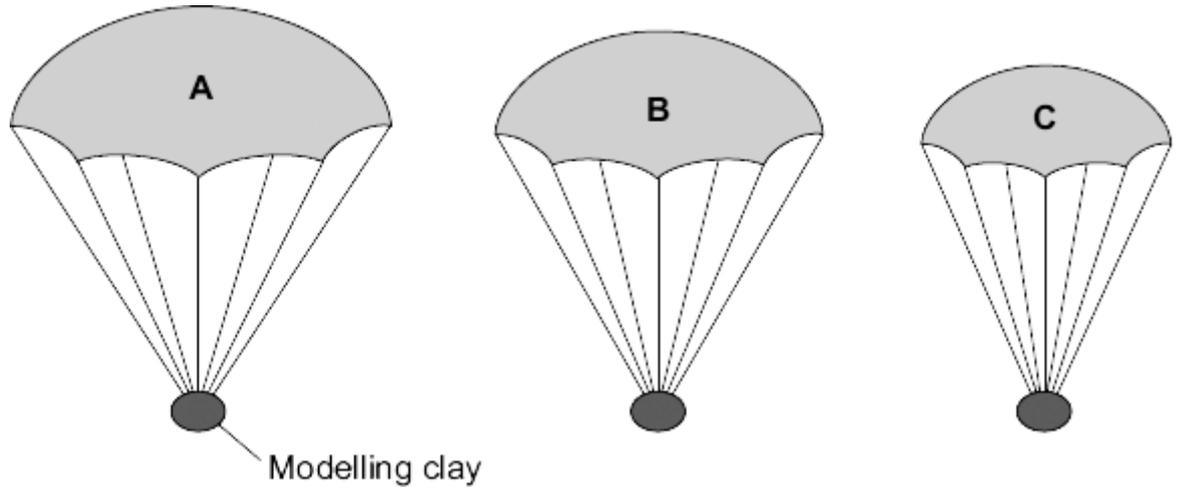
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(6)

(c) A student wrote the following hypothesis.

*'The larger the area of a parachute, the slower a parachutist falls.'*

To test this hypothesis the student made three model parachutes, **A**, **B** and **C**, from one large plastic bag. The student dropped each parachute from the same height and timed how long each parachute took to fall to the ground.



- (i) The height that the student dropped the parachute from was a control variable.

Name **one** other control variable in this experiment.

.....

(1)

- (ii) Use the student's hypothesis to predict which parachute, **A**, **B** or **C**, will hit the ground first.

Write your answer in the box.

Give a reason for your answer.

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(2)

(Total 12 marks)

**Q2.**A number of different forces act on a moving vehicle.

(a) A car moving at a steady speed has a driving force of 3000 N.

(i) What is the value of the resistive force acting on the car?

Tick (✓) **one** box.

	Tick (✓)
2000 N	
3000 N	
4000 N	

(1)

(ii) What causes most of the resistive force?

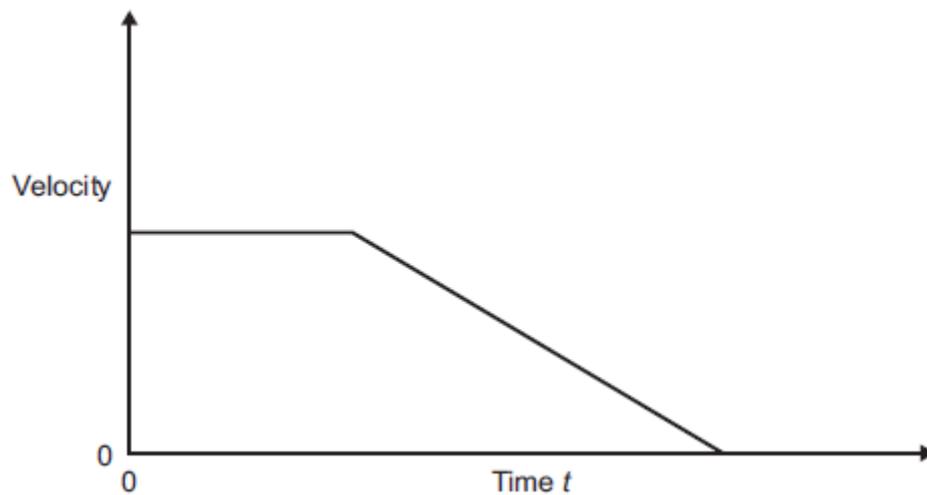
Tick (✓) **one** box.

	Tick (✓)
Air resistance	
Faulty brakes	
Poor condition of tyres	

(1)

(b) A car is moving along a road. The driver sees an obstacle in the road at time  $t = 0$  and applies the brakes until the car stops.

The graph shows how the velocity of the car changes with time.



(i) Which feature of the graph represents the negative acceleration of the car?

Tick (✓) **one** box.

	Tick (✓)
The area under the graph	
The gradient of the sloping line	
The intercept on the y-axis	

(1)

(ii) Which feature of the graph represents the distance travelled by the car?

Tick (✓) **one** box.

	Tick (✓)
The area under the graph	
The gradient of the sloping line	
The intercept on the y-axis	

(1)

(iii) On a different journey, the car is moving at a **greater** steady speed.

The driver sees an obstacle in the road at time  $t = 0$  and applies the brakes until the car stops.

The driver's reaction time and the braking distance are the same as shown the graph above.

On the graph above draw another graph to show the motion of the car.

(3)

(c) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Thinking distance and braking distance affect stopping distance.

Explain how the factors that affect thinking distance and braking distance affect stopping distance.

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(6)  
(Total 13 marks)

M1. (a) 750

*allow 1 mark for correct substitution, ie  $75 \times 10$  provided no subsequent step shown*

2

newton(s) / N

*do **not** accept  $n$*

1

- (b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the Marking Guidance, and apply a 'best-fit' approach to the marking.

**0 marks**

No relevant content.

**Level 1 (1-2 marks)**

There is a brief attempt to explain why the velocity / speed of the parachutist changes.

**or**

the effect of opening the parachute on velocity/speed is given.

**Level 2 (3-4 marks)**

The change in velocity / speed is clearly explained in terms of force(s)

**or**

a reasoned argument for the open parachute producing a lower speed.

**Level 3 (5-6 marks)**

There is a clear and detailed explanation as to why the parachutist reaches terminal velocity **and** a reasoned argument for the open parachute producing a lower speed

**examples of the physics points made in the response to explain first terminal velocity**

- on leaving the plane the only force acting is weight (downwards)  
*accept gravity for weight throughout*
- as parachutist falls air resistance acts (upwards)  
*accept drag / friction for air resistance*
- weight greater than air resistance  
**or** resultant force downwards
- (resultant force downwards) so parachutist accelerates
- as velocity / speed increases so does air resistance

- terminal velocity reached when air resistance = weight  
*accept terminal velocity reached when forces are balanced*

**to explain second lower terminal velocity**

- opening parachute increases surface area
- opening parachute increases air resistance
- air resistance is greater than weight
- resultant force acts upwards / opposite direction to motion
- parachutist decelerates / slows down
- the lower velocity means a reduced air resistance

air resistance and weight become equal but at a lower (terminal) velocity

6

(c) (i) any **one** from:

- mass of the (modelling) clay  
*accept size/shape of clay size/amount/volume/shape of clay*  
*accept plasticine for (modelling)clay*
- material parachute made from  
*accept same (plastic) bag*
- number / length of strings

1

(ii) **C**

*reason only scores if C is chosen*

1

smallest (area) so falls fastest (so taking least time)

*accept quickest/quicker for fastest*

*if A is chosen with the reason given as 'the largest area so falls slowest' this gains 1 mark*

1

[12]

M2.(a) (i) 3000 N

1

(ii) air resistance

1

(b) (i) the gradient of the sloping line

1

(ii) the area under the graph

1

(iii) horizontal line above previous one

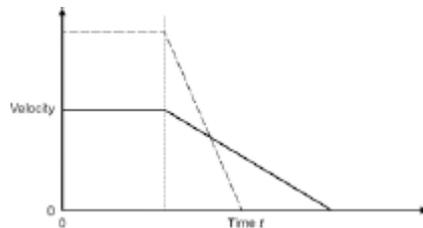
1

for the same time

1

sloping line cutting time axis before previous line

eg



1

(c) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

**0 marks**

No relevant content.

**Level 1 (1–2 marks)**

One factor is given that affects thinking distance

**or**

one factor is given that affects braking distance

**Level 2 (3–4 marks)**

One factor and a description of its effect is given for **either** thinking distance **or** braking distance

**Level 3 (5–6 marks)**

One factor and a description of its effect is given for **both** thinking distance and braking distance

**plus**

some extra detail

**Examples of the points made in the response**

stopping distance = thinking distance + braking distance

the faster the car travels the greater the stopping distance

thinking distance is the distance travelled from when the driver sees an obstacle to when the brakes are applied

braking distance is the distance travelled from when the brakes are applied to when the car stops

**thinking distance:**

- tiredness increases thinking distance
- taking drugs increases thinking distance
- drinking alcohol increases thinking distance
- distractions in the car increase thinking distance.

**braking distance:**

- poor condition of brakes increases braking distance
- poor condition of tyres increases braking distance
- wet roads increase braking distance
- icy roads increase braking distance.