This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lebanon Evangelical School
for Boys and Girls Loueizeh - Baabda

Stage Exam 02
19DEC2022

Do NOT write in this box. Your MARK will be placed here.

Subject :	Physics
Class :	9A
Teacher :	Dr Ruth Brett
Duration :	1 hour

Write all your answers in black pen on this exam paper. You may use pencil for diagrams. There is a list of formulae that you might find useful on the last page.

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

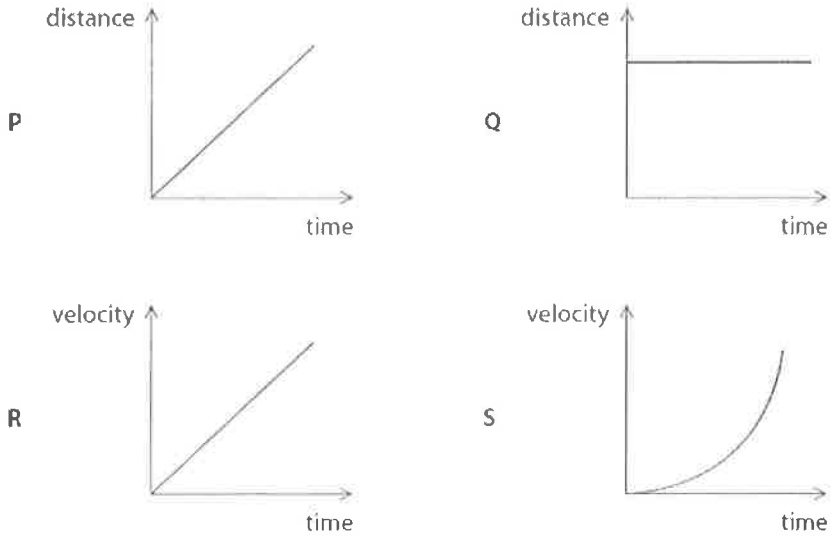
Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.
You should assume the acceleration of free fall, g, is 10 ms^{-2} unless you are told otherwise.
You may find this equation useful:

$$v^2 = u^2 + (2 \times a \times s)$$

(final speed)^2 = (initial speed)^2 + (2 x acceleration x distance moved)

1. The motion of an object can be represented using graphs.

(a) The graphs, P, Q, R and S, show different types of motion.



The table lists some types of motion.
Place one tick (✓) in each row of the table to show which graph represents which type of motion.

(4)

Type of motion	Graph			
	P	Q	R	S
constant acceleration				
increasing acceleration				
moving at constant velocity				
stationary				

(b) State the feature of a velocity-time graph that can be used to determine the distance travelled by an object.

(1)

.....

(Total for question = 5 marks)

2. Which row of the table is correct for both force and velocity?

(1)

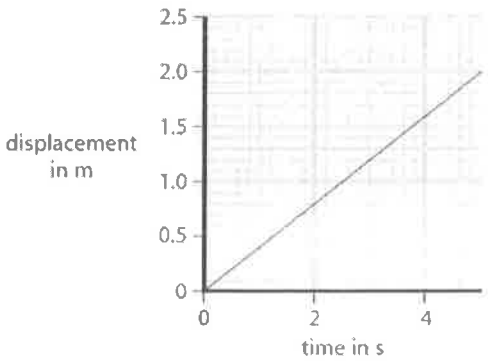
	force	velocity
☐ A	scalar	scalar
☐ B	scalar	vector
☐ C	vector	scalar
☐ D	vector	vector

(Total for question = 1 mark)

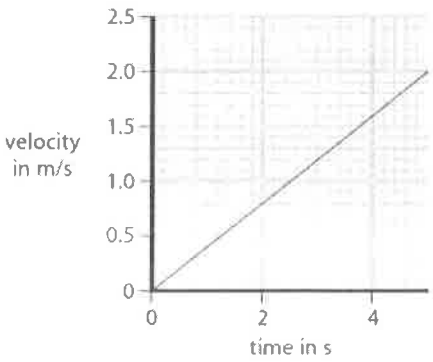
3. Which of these graphs represents an object moving with a constant velocity of 2 m/s?

(1)

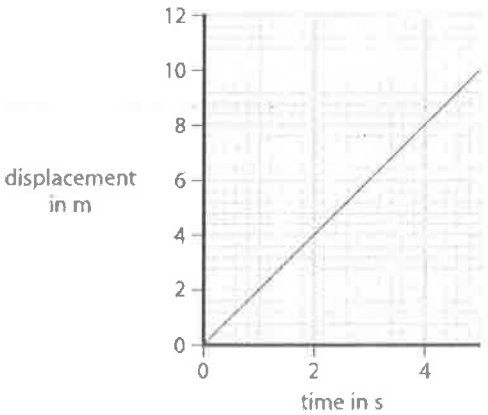
☐ A



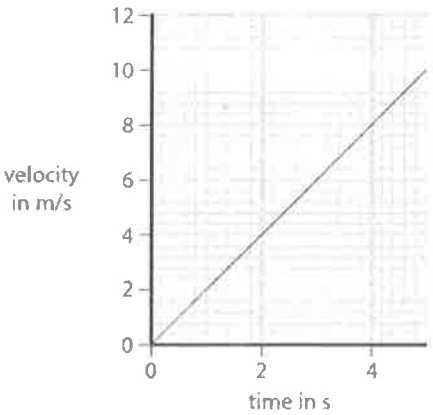
☐ B



☐ C

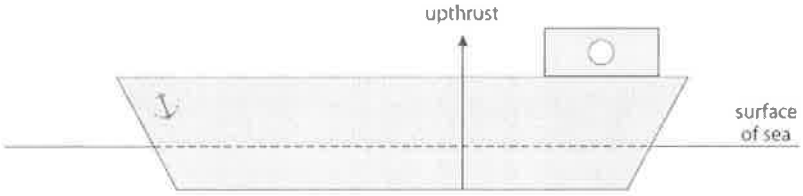


☐ D



(Total for question = 1 mark)

4. A ship floats on the sea.



(a) The ship floats because of the forces acting on it.

(i) The upward force acting on the ship is called upthrust.
This force is shown on the diagram.
Draw another labelled arrow on the diagram to show the other vertical force acting on the ship.

(2)

(ii) Forces are vector quantities.
State what is meant by the term **vector quantity**.

(2)

.....

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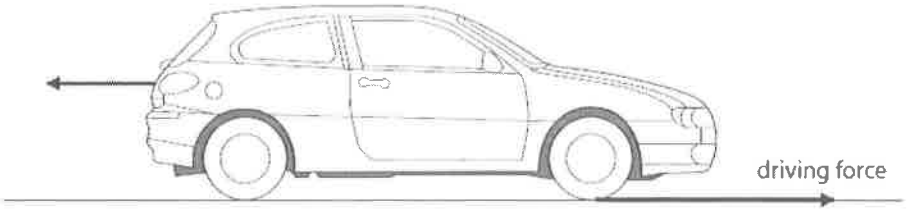
(iii) Give another example of a vector quantity.

(1)

.....

(Total for question = 5 marks)

5. (a) A car accelerates along a level road.
The diagram shows some of the horizontal forces acting on the car as it accelerates.



(Source: DEEWI114481 © father/Shutterstock)

(i) A driving force acts on the car, as shown in the diagram.
State the name of the other force shown in the diagram.

(1)

.....

(ii) State the formula linking unbalanced force, mass and acceleration.

(1)

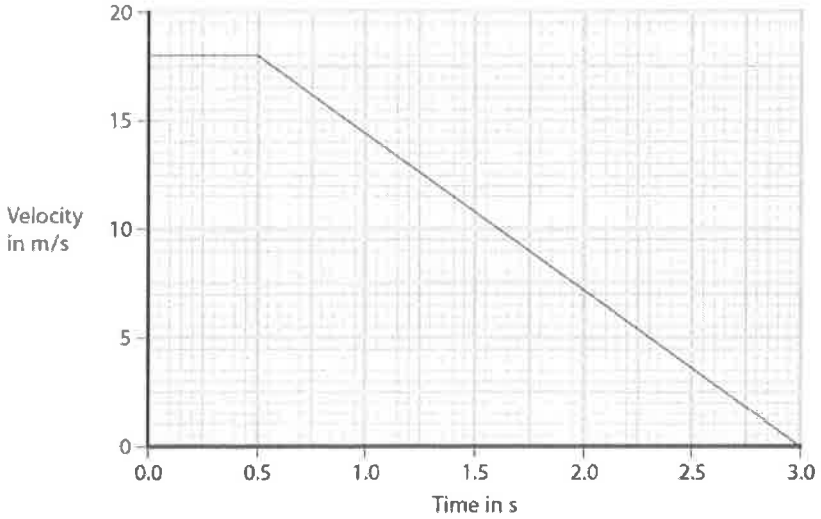
(iii) The unbalanced force acting on the car is 2900 N.
The mass of the car is 1200 kg.
Calculate the acceleration of the car.

(2)

acceleration = ... m/s^2

(b) The driver sees an obstacle in the road and applies the brakes.

The driver has a reaction time of 0.5 s. He applies the brakes for 2.5 s.
The graph shows how the velocity of the car changes from when the driver sees the obstacle until the car stops.



(i) Describe how the thinking distance is affected by the condition of the car's brakes and the speed of the car.

(2)

condition of brakes

.....

.....

speed of car

.....

.....

(ii) Use the graph to calculate the braking distance.

(3)

braking distance = ... m

(Total for question = 9 marks)

6. (a) (i) State Hooke's Law.

(2)

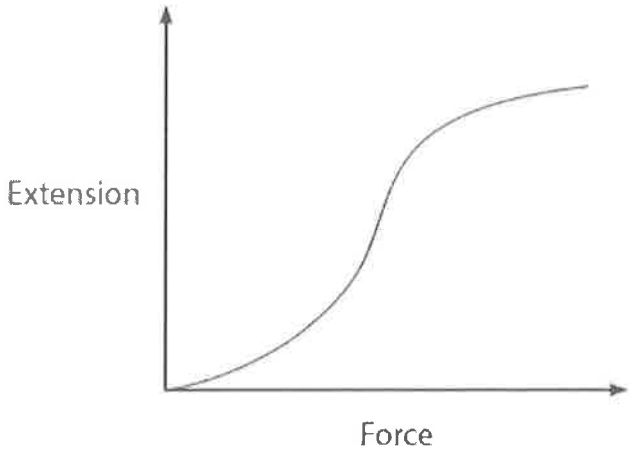
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(ii) The graph shows how the extension of a rubber band varies with the force applied.



Explain how the graph shows that the rubber band does not obey Hooke's Law.

(2)

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(b) A rubber band is used to power a toy aeroplane. Diagram 2 shows the aeroplane flying horizontally to the right.

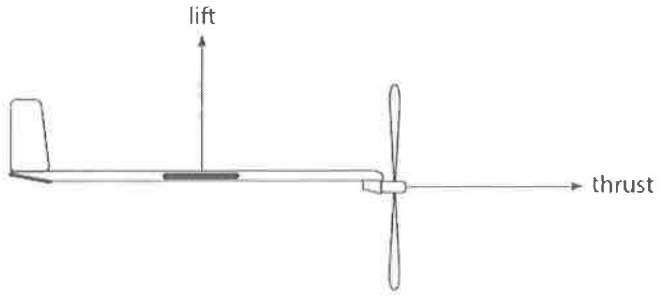
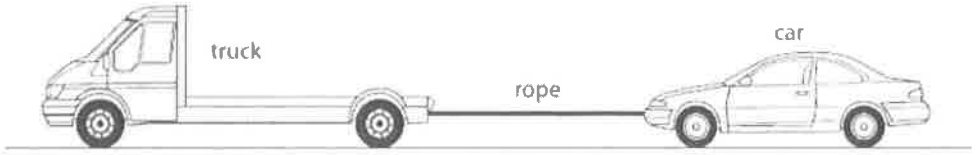


Diagram 2

The aeroplane flies at a constant speed.
Diagram 2 shows two forces acting on the aeroplane.
Draw labelled arrows on diagram 2 to show two more forces acting on the aeroplane.

(Total for question = 8 marks)

7. The diagram shows a truck using a rope to pull a car along a level road.



(a) The truck and car are travelling at a velocity of 14 m / s.

The truck and car then accelerate at 1.6 m / s^2 until they are travelling at a velocity of 22 m / s.

(i) State the formula linking acceleration, change in velocity and time taken.

(1)

(ii) Calculate the time taken for the truck and car to accelerate from 14 m / s to 22 m / s.

(3)

time taken = ... s

(b) The rope breaks so the car and the truck are no longer connected.

The engine of the car is not working.

Explain what happens to the motion of the car after the rope breaks.

(2)

.....

.....

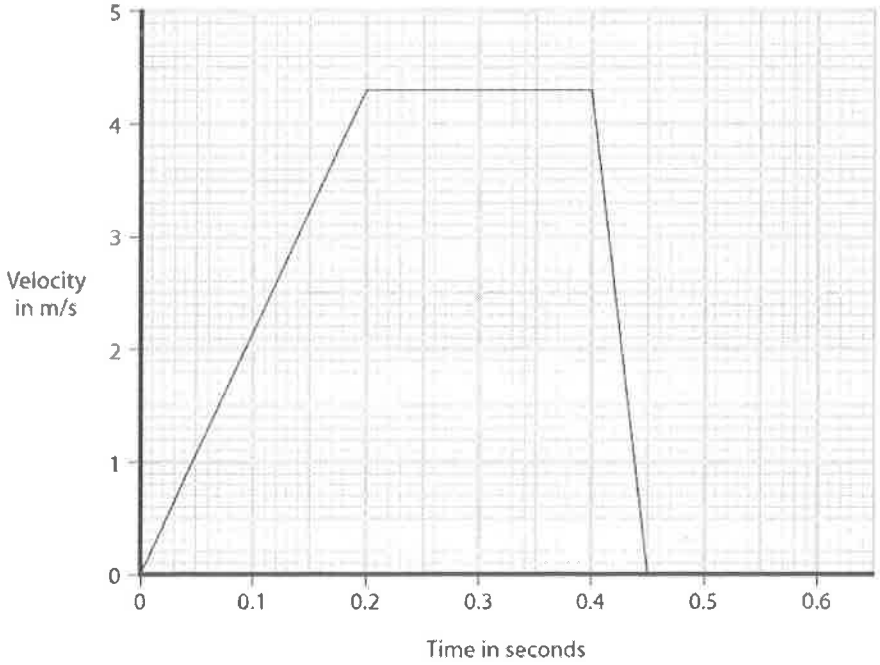
.....

.....

(Total for question = 6 marks)

8. A student does an investigation to show how the velocity of a toy car changes when the car rolls down a ramp onto a table and hits a wooden block.

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



(a) Calculate the distance travelled by the car during the first 0.4 seconds.

(4)

distance = ... m

(b) (i) Calculate the acceleration of the car between 0.40 s and 0.45 s.

(3)

acceleration = ... m/s^2

(Total for question = 7 marks)

9. The photograph shows a whale jumping out of the surface of the sea.



(Source: © Alexander Baumann/Shutterstock)

(a) At the top of the jump, the whale's velocity is 0 m/s.

The whale falls 2.2 m from the top of the jump to the surface of the sea.
Calculate the velocity of the whale when it hits the surface of the sea.

(4)

velocity = ... m/s

(b) A resultant force causes the whale to slow down when it hits the surface of the sea.

(i) Draw an arrow to show this resultant force.

(1)



(Source: © Eugenia Petrovskaya/Shutterstock)

(Total for question = 5 marks)

10. Figure 3 shows a Mars Exploration Rover.



(Source: *photojournal.jpl.nasa.gov*)

Figure 3

The mass of the rover is 190 kg.

(i) State the equation linking weight, mass and gravitational field strength

(1)

(ii) The gravitational field strength on Earth is 10 N / kg.

Calculate the weight of the rover on Earth.

(1)

weight on Earth = ... N

(ii) The weight of the rover on Mars is 700 N.

Calculate the gravitational field strength on Mars.

(2)

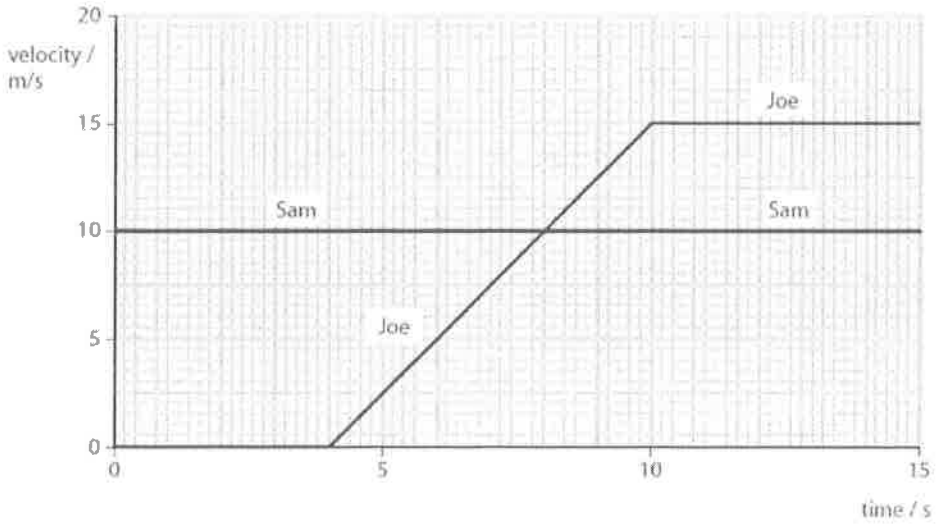
gravitational field strength on Mars = ... N/kg

(Total for question = 4 marks)

11. Sam and Joe are on their bikes. They are on a flat, straight road.

(a) Joe is stationary when Sam rides past at a constant velocity of 10 m/s.

Joe waits for 4 s and then follows Sam.
This is a velocity/time graph of their motion.



(i) How far did Sam travel during these 15 s?

(1)

- ☐ **A** 1.5 m
- ☐ **B** 10 m
- ☐ **C** 100 m
- ☐ **D** 150 m

(ii) At which of these times is the resultant force on Joe bigger than the resultant force on Sam?
Put a cross (⊠) in the box next to your answer.

(1)

- ☐ **A** at 3 s
- ☐ **B** at 7 s
- ☐ **C** at 11 s
- ☐ **D** at 15 s

(b) On another day, Joe is riding the same bike on the same piece of road.

This time he does not have the heavy bag on his back.
He finds that it is easier to accelerate.
Explain why Joe finds it easier to accelerate.

(2)

.....

.....

.....

.....

(Total for Question = 4 marks)

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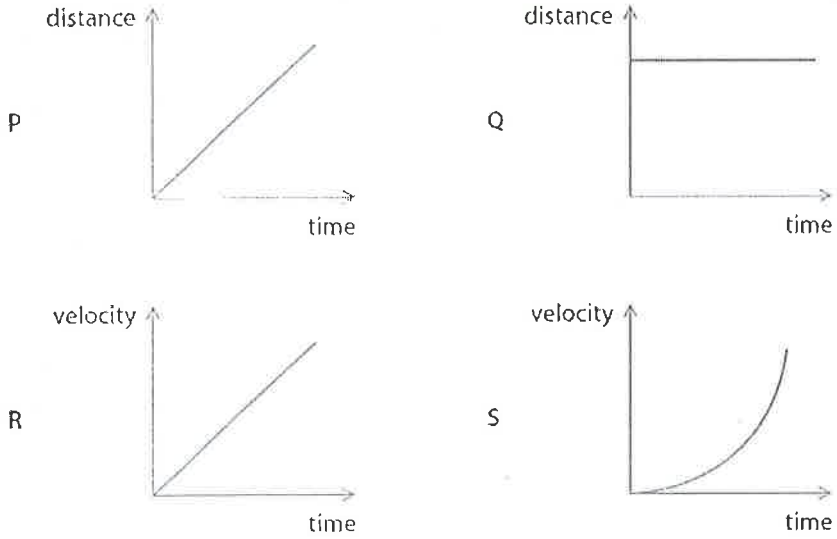
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You may find this equation useful:

$$v^2 = u^2 + (2 \times a \times s)$$

(final speed)^2 = (initial speed)^2 + (2 x acceleration x distance moved)

1. The motion of an object can be represented using graphs.

(a) The graphs, P, Q, R and S, show different types of motion.



The table lists some types of motion.
Place one tick (✓) in each row of the table to show which graph represents which type of motion.

(4)

Type of motion	Graph				
	P	Q	R	S	
constant acceleration			✓		(1)
increasing acceleration				✓	(1)
moving at constant velocity	✓				(1)
stationary		✓			(1)

(b) State the feature of a velocity-time graph that can be used to determine the distance travelled by an object.

Area under the line (1)

(Total for question = 5 marks)

2. Which row of the table is correct for both force and velocity?

(1)

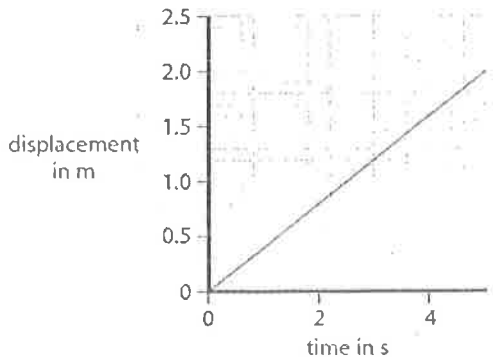
	force	velocity
☐ A	scalar	scalar
☐ B	scalar	vector
☐ C	vector	scalar
☒ D	vector	vector

(Total for question = 1 mark)

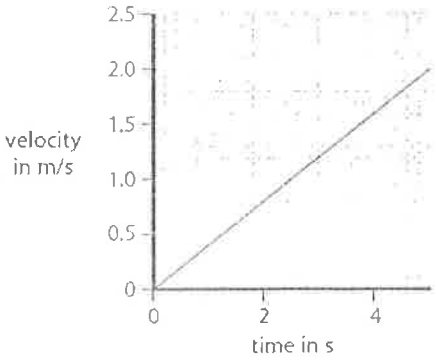
3. Which of these graphs represents an object moving with a constant velocity of 2 m/s?

(1)

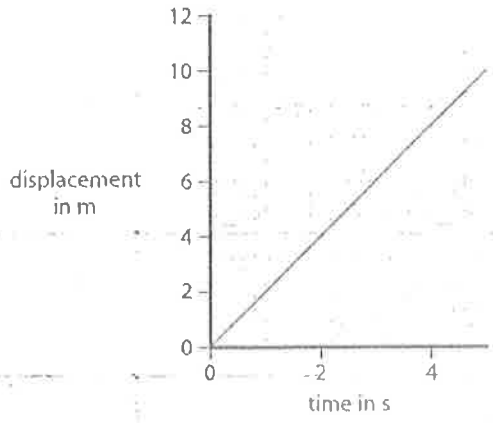
☐ A



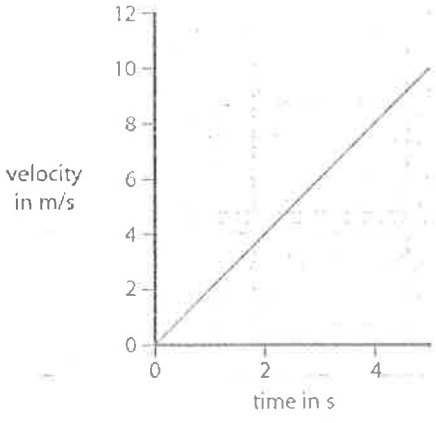
☐ B



(1) ☒ C

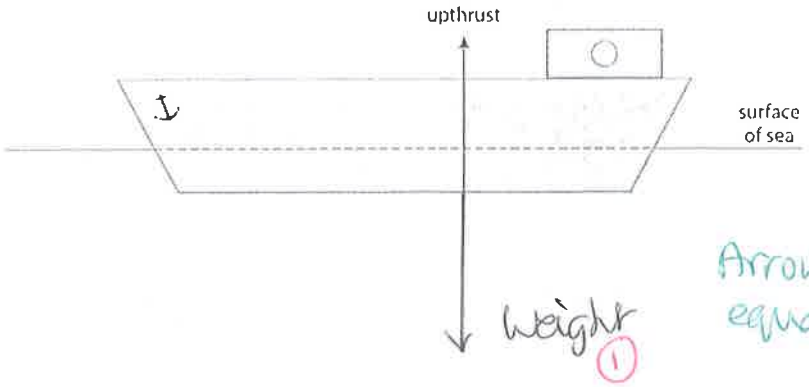


☐ D



(Total for question = 1 mark)

4. A ship floats on the sea.



Arrows are equal length (1)

(a) The ship floats because of the forces acting on it.

(i) The upward force acting on the ship is called upthrust.
This force is shown on the diagram.
Draw another labelled arrow on the diagram to show the other vertical force acting on the ship.

(2)

(ii) Forces are vector quantities.
State what is meant by the term **vector quantity**.

(2)

A vector is a quantity that has both magnitude (1) and direction (1)

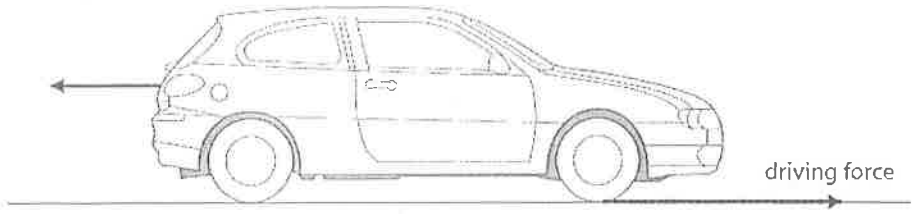
(iii) Give another example of a vector quantity.

(1)

velocity (1) /acceleration/ displacement

(Total for question = 5 marks)

5. (a) A car accelerates along a level road.
The diagram shows some of the horizontal forces acting on the car as it accelerates.



(Source: DEEWI114481 © father/Shutterstock)

(i) A driving force acts on the car, as shown in the diagram.
State the name of the other force shown in the diagram.

(1)

Drag / air resistance (1)

(ii) State the formula linking unbalanced force, mass and acceleration.

(1)

force = mass x acceleration (1)

(iii) The unbalanced force acting on the car is 2900 N.
The mass of the car is 1200 kg.
Calculate the acceleration of the car.

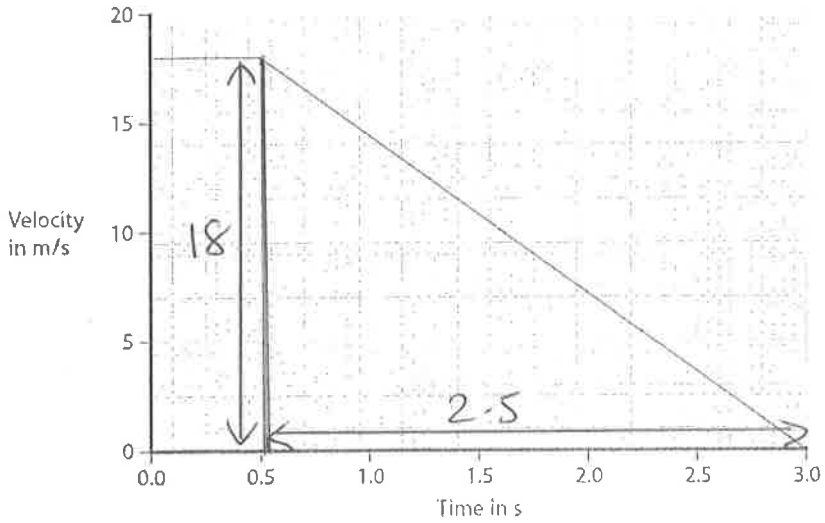
$2900 = 1200 \times a$ (1)

$a = \frac{2900}{1200} = 2.42$

acceleration = 2.4 (1) m/s^2

(b) The driver sees an obstacle in the road and applies the brakes.

The driver has a reaction time of 0.5 s. He applies the brakes for 2.5 s.
The graph shows how the velocity of the car changes from when the driver sees the obstacle until the car stops.



(i) Describe how the thinking distance is affected by the condition of the car's brakes and the speed of the car.

(2)

condition of brakes

No effect (1)

speed of car

The greater the speed, the greater the thinking distance (1)

(ii) Use the graph to calculate the braking distance.

(3)

Area of triangular section when the car is decelerating (1)

$\text{Area} = \frac{1}{2} \times 2.5 \times 18 = 22.5$ (1)

(1)

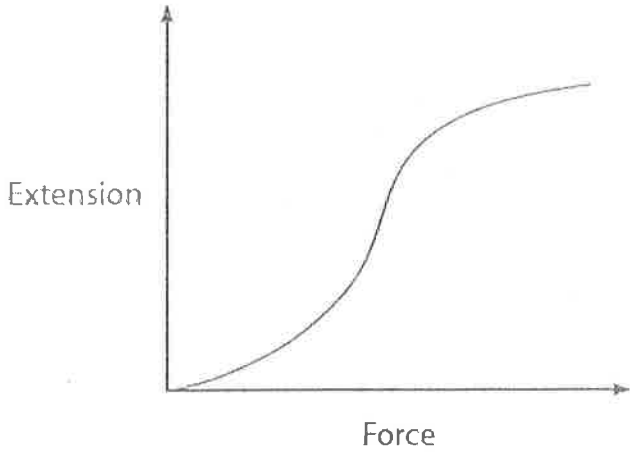
braking distance = 22.5 m

(Total for question = 9 marks)

6. (a) (i) State Hooke's Law.

The extension is proportional to the load (1)
up to the limit of proportionality. (1)

(ii) The graph shows how the extension of a rubber band varies with the force applied.



Explain how the graph shows that the rubber band does not obey Hooke's Law.

The line is curved, so the force and extension (1)
cannot be proportional to each other. (1)

(b) A rubber band is used to power a toy aeroplane. Diagram 2 shows the aeroplane flying horizontally to the right.

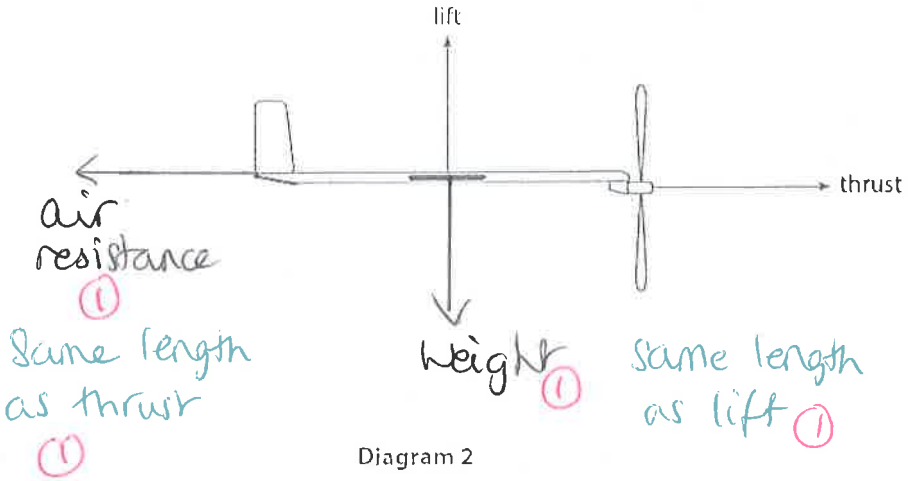


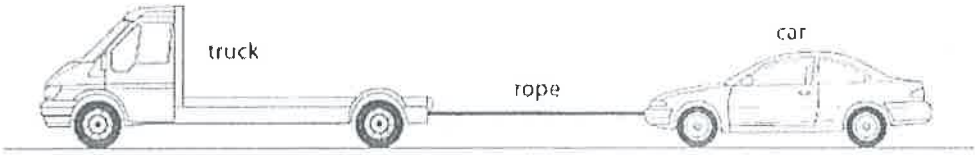
Diagram 2

The aeroplane flies at a constant speed.
Diagram 2 shows two forces acting on the aeroplane.
Draw labelled arrows on diagram 2 to show two more forces acting on the aeroplane.

(2)

(Total for question = 8 marks)

7. The diagram shows a truck using a rope to pull a car along a level road.



(a) The truck and car are travelling at a velocity of 14 m / s.

The truck and car then accelerate at 1.6 m / s^2 until they are travelling at a velocity of 22 m / s.

(i) State the formula linking acceleration, change in velocity and time taken.

(1)

acceleration = change in velocity / time taken (1)

(ii) Calculate the time taken for the truck and car to accelerate from 14 m / s to 22 m / s.

(3)

$1.6 = \frac{22 - 14}{t}$ (1) $= \frac{8}{t}$

$t = \frac{8}{1.6}$ (1) $= 5.0$

time taken = 5.0 (1) s

(b) The rope breaks so the car and the truck are no longer connected.

The engine of the car is not working.

Explain what happens to the motion of the car after the rope breaks.

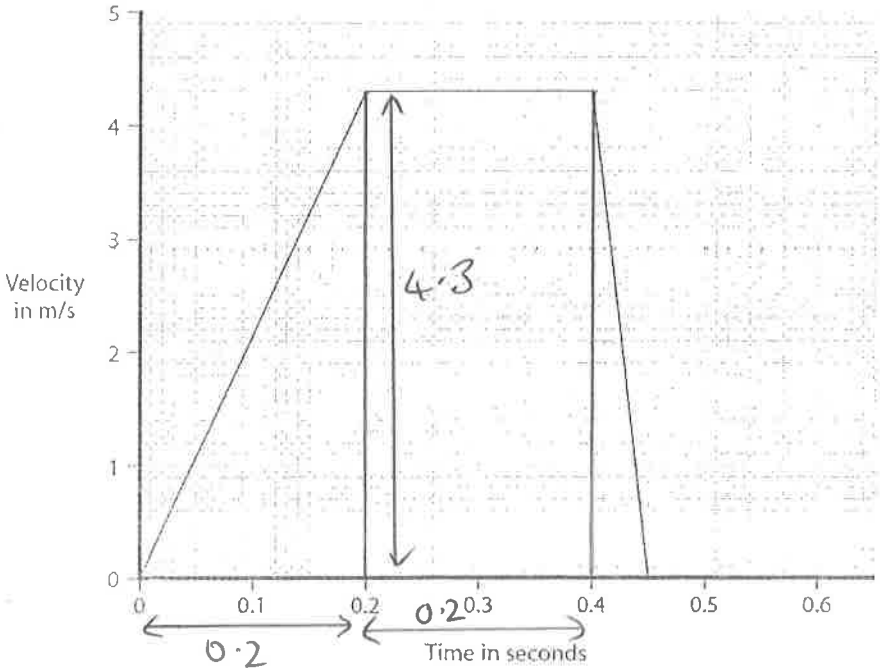
(2)

The car decelerates (1) because the only forces acting on it is are the resistive forces (drag / air resistance / friction) (1)

(Total for question = 6 marks)

8. A student does an investigation to show how the velocity of a toy car changes when the car rolls down a ramp onto a table and hits a wooden block.

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



(a) Calculate the distance travelled by the car during the first 0.4 seconds.

Distance = area under line (1)

1) area = $\frac{1}{2} \times 0.2 \times 4.3 = 0.43$ m (1)

2) area = $0.2 \times 4.3 = 0.86$ m (1)

Total = $0.43 + 0.86 = 1.29$ m

distance = 1.29 (1) m

(b) (i) Calculate the acceleration of the car between 0.40 s and 0.45 s.

Acceleration = gradient (1)

Gradient = $\frac{-4.3}{0.05}$ (1)

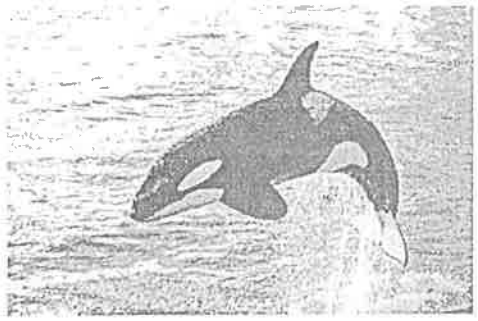
$a = -86$

(1)

acceleration = −86 m/s²

(Total for question = 7 marks)

9. The photograph shows a whale jumping out of the surface of the sea.



(Source: © Alexander Baumann/Shutterstock)

(a) At the top of the jump, the whale's velocity is 0 m/s.

The whale falls 2.2 m from the top of the jump to the surface of the sea.
Calculate the velocity of the whale when it hits the surface of the sea.

(4)

$v^2 = u^2 + (2 \times a \times s)$ (1)

$v^2 = 0 + (2 \times 10 \times 2.2) = 44$ (1)

$v = \sqrt{44} = 6.63$ (1)

(1)

velocity = 6.6 m/s

(b) A resultant force causes the whale to slow down when it hits the surface of the sea.

(i) Draw an arrow to show this resultant force.

(1)



(Source: © Eugenia Petrovskaya/Shutterstock)

(Total for question = 5 marks)

10. Figure 3 shows a Mars Exploration Rover.



(Source: *photojournal.jpl.nasa.gov*)

Figure 3

The mass of the rover is 190 kg.

(i) State the equation linking weight, mass and gravitational field strength

$W = m \times g$ (1)

(1)

(ii) The gravitational field strength on Earth is 10 N / kg.

Calculate the weight of the rover on Earth.

$W = 190 \times 10 = 1900\,N$

(1)

weight on Earth = 1900 (1) N

(ii) The weight of the rover on Mars is 700 N.

Calculate the gravitational field strength on Mars.

(2)

$700 = 190 \times g$ (1)

$g = \frac{700}{190} = 3.68$

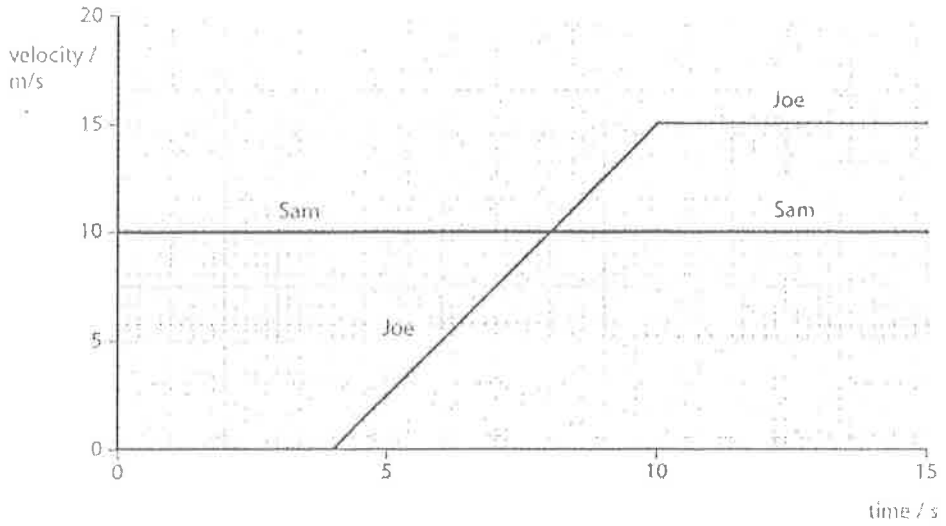
gravitational field strength on Mars = 3.7 (1) N/kg

(Total for question = 4 marks)

11. Sam and Joe are on their bikes. They are on a flat, straight road.

(a) Joe is stationary when Sam rides past at a constant velocity of 10 m/s.

Joe waits for 4 s and then follows Sam.
This is a velocity/time graph of their motion.



(i) How far did Sam travel during these 15 s?

- ☐ **A** 1.5 m
- ☐ **B** 10 m
- ☐ **C** 100 m
- ☒ **D** 150 m

(1)

$10 \times 15 = 150$

(ii) At which of these times is the resultant force on Joe bigger than the resultant force on Sam?
Put a cross (☒) in the box next to your answer.

- ☐ **A** at 3 s
- ☒ **B** at 7 s
- ☐ **C** at 11 s
- ☐ **D** at 15 s

(1)

Any time when Joe is accelerating

(b) On another day, Joe is riding the same bike on the same piece of road.

This time he does not have the heavy bag on his back.
He finds that it is easier to accelerate.
Explain why Joe finds it easier to accelerate.

The mass is less (1) without his bag.
Since $F = m \times a$ then to get the same acceleration he needs a smaller force,
so it will feel easier (1)

(Total for Question = 4 marks)