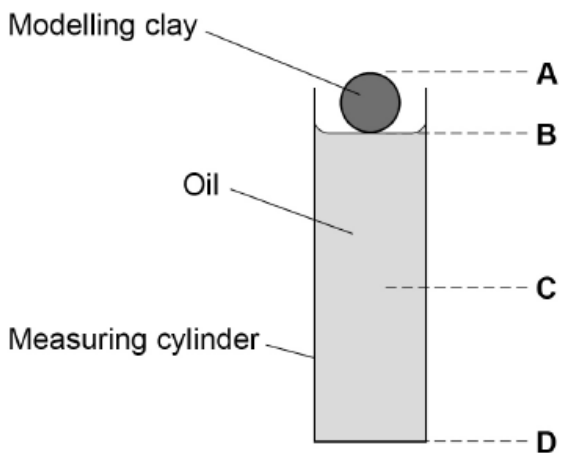
AQA - Forces and motion – GCSE Physics

1. June/2020/Paper_2F/No.1

0 1 A student dropped a piece of modelling clay into oil.

Figure 1 shows the modelling clay just before it was dropped into the oil.

Figure 1



0 1 . 1 What was the distance fallen by the modelling clay?

[1 mark]

Tick (✓) **one** box.

from A to C ☐

from A to D ☐

from B to C ☐

from B to D ☐

0 1 . 2 What measuring instrument should be used to measure the distance fallen?

[1 mark]

_____

The student dropped four pieces of modelling clay, each with a different shape.

For each piece the student measured the time taken to fall the same distance through the oil.

0 1 . 3 The student removed each piece of modelling clay from the oil before dropping the next piece.

Suggest **one** reason why.

[1 mark]

The student repeated the measurements and calculated mean values.

Table 1 shows the results.

Table 1

Shape	Time taken in seconds			
	Drop 1	Drop 2	Drop 3	Mean
 Sphere	47	38	41	42
 Cube	68	49	57	58
 Cylinder	34	37	34	**X**
 Cone	29	23	26	26

0 1 . 4 Calculate value **X** in **Table 1**.

[2 marks]

X = _____ s

0 1 . 5 Each piece of modelling clay had the same mass.

Which shape in **Table 1** had the smallest resistive force acting against it as it fell?

Tick (✓) **one** box.

Give **one** reason for your answer.

[2 marks]

Cone ☐

Cube ☐

Cylinder ☐

Sphere ☐

Reason _____

0 1 . 6 How would the time taken to fall change if the modelling clay was dropped through air instead of through oil?

[1 mark]

Tick (✓) **one** box.

Time through air would be less. ☐

Time through air would be more. ☐

Time through air would be the same. ☐

0 1 . 7 The mass of a piece of modelling clay was 0.050 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the piece of modelling clay.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

0 1 . 8 Weight causes the modelling clay to fall through the oil.

Weight is a non-contact force.

Which of the following are also non-contact forces?

[2 marks]

Tick (✓) **two** boxes.

- Air resistance ☐
- Electrostatic force ☐
- Friction ☐
- Magnetic force ☐
- Tension ☐

2. June/2020/Paper_2F/No.7(7.1_7.5)

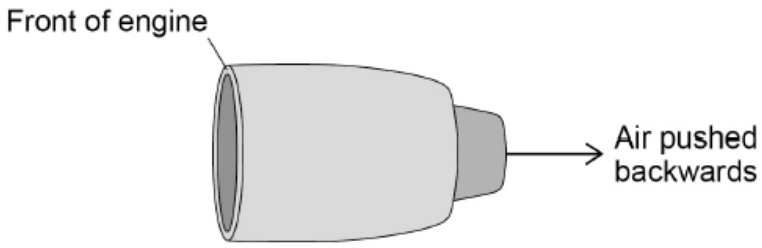
0 7 . 1 An aircraft travels at a constant velocity.

How is the velocity of the aircraft different to the speed of the aircraft?

[1 mark]

0 7 . 2 **Figure 11** shows one of the engines on the aircraft.

Figure 11



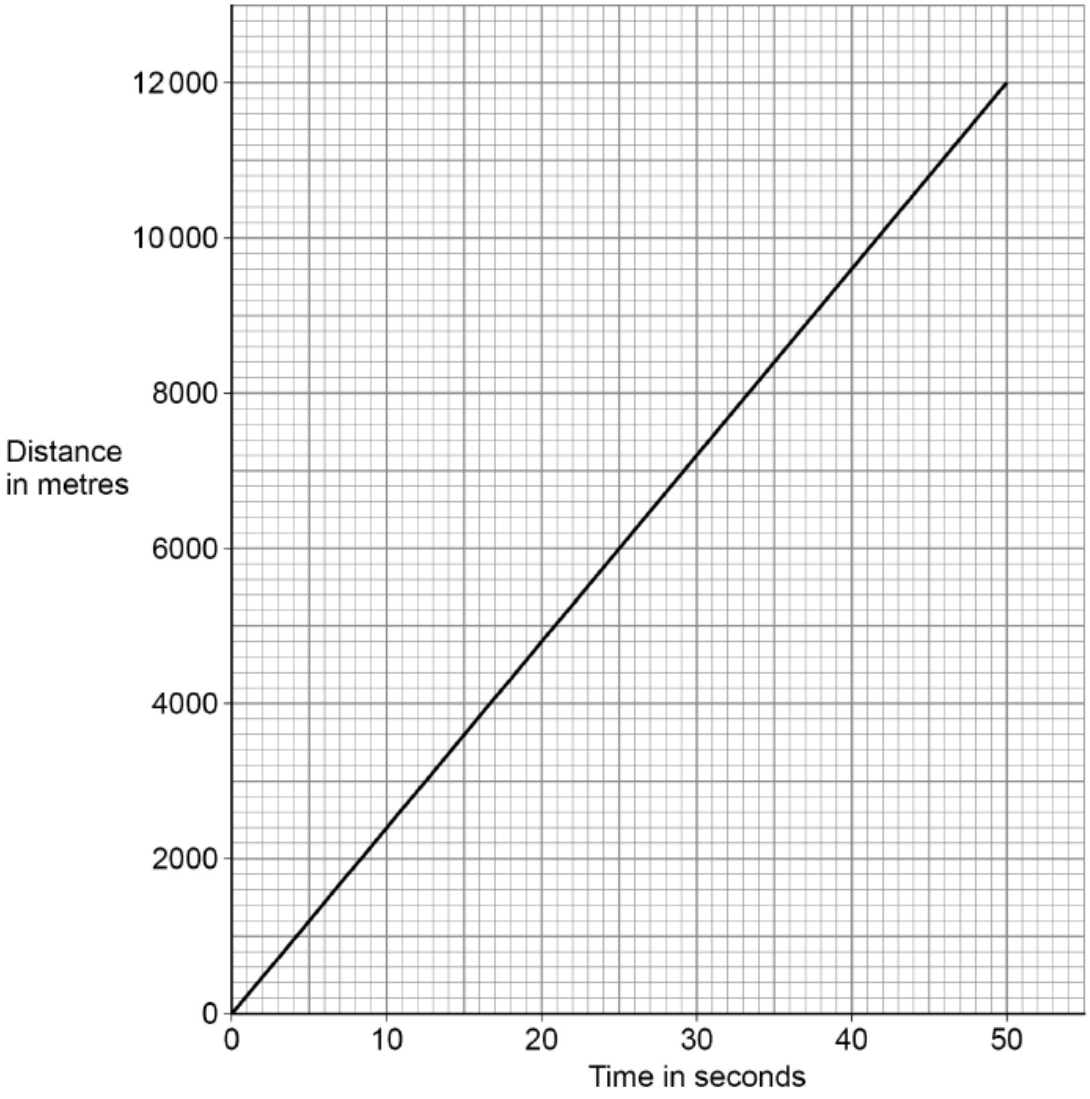
Air is taken into the front of the engine and pushed out of the back of the engine.

Explain the effect this has on the engine.

[2 marks]

0 7 . 3 **Figure 12** shows a distance-time graph for the aircraft.

Figure 12



Determine the speed of the aircraft.

[3 marks]

Speed = _____ m/s

0 7 . 4 Write down the equation that links acceleration (a), change in velocity (Δv) and time taken (t).

[1 mark]

0 7 . 5 At a different stage of the flight, the aircraft was travelling at a velocity of 250 m/s.

The aircraft then decelerated at 0.14 m/s^2.

Calculate the time taken for the aircraft to decelerate from 250 m/s to 68 m/s.

[4 marks]

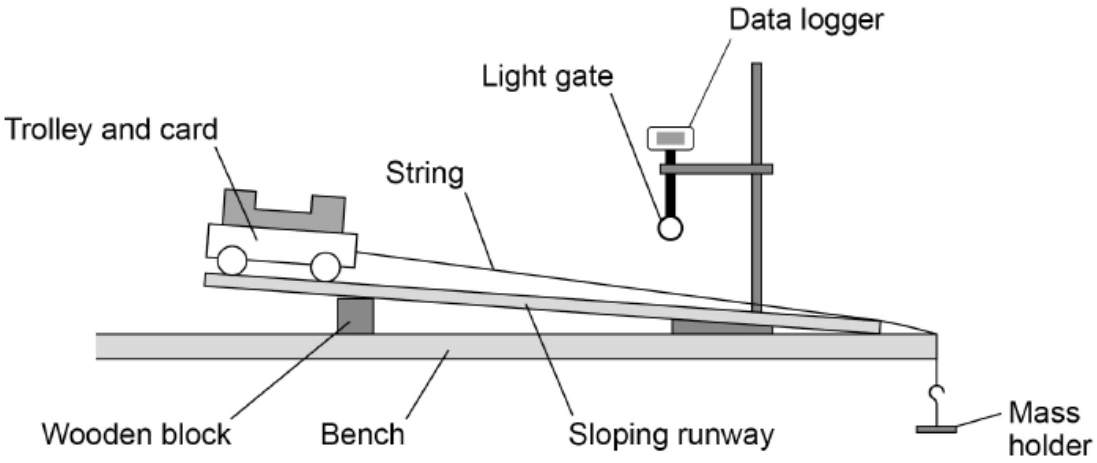
Time = _____ s

3. June/2020/Paper_2F/No.8

0 8 A student investigated the acceleration of a trolley.

Figure 13 shows how the student set up the apparatus.

Figure 13



0 8 . 1 Before attaching the mass holder the student placed the trolley at the top of the runway. The trolley rolled down the runway without being pushed.

What change to the apparatus in **Figure 13** could be made to prevent the trolley from starting to roll down the runway?

[1 mark]

Tick (✓) **one** box.

Move the wooden block to the left. ☐

Shorten the length of the runway. ☐

Use a taller wooden block. ☐

0 8 . 2 The student attached the mass holder to the string.

The string rubbed along the edge of the bench as the mass holder fell to the floor.

Suggest what the student could do to prevent the string from rubbing.

[1 mark]

_____

_____

The light gate and data logger were used to determine the acceleration of the trolley.

The student increased the resultant force on the trolley and recorded the acceleration of the trolley.

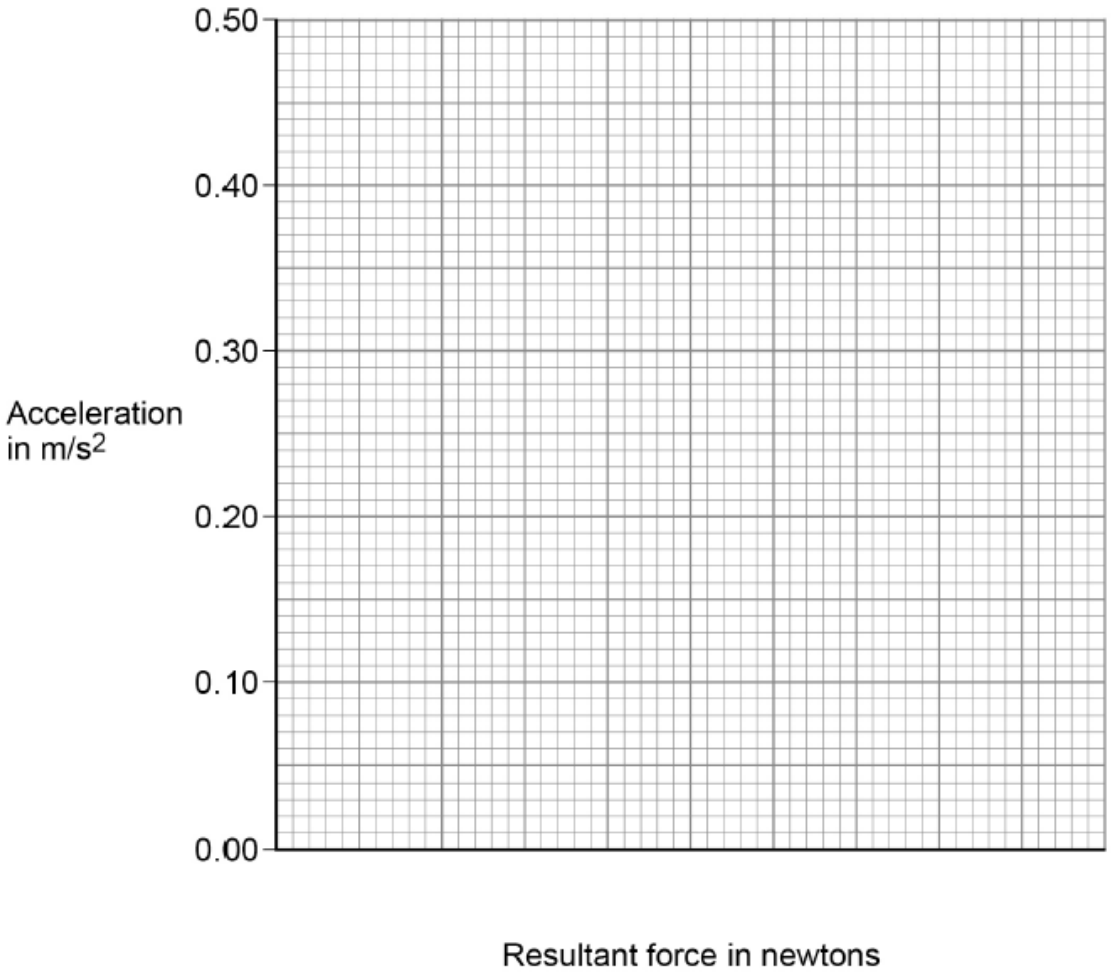
Table 4 shows the results.

Table 4

Resultant force in newtons	Acceleration in m/s²
0.05	0.08
0.10	0.18
0.15	0.25
0.20	0.32
0.25	0.41

Figure 14 is an incomplete graph of the results.

Figure 14



0 8 . 3 Complete **Figure 14**.

- Choose a suitable scale for the x-axis.
- Plot the results.
- Draw a line of best fit.

[4 marks]

0 8 . 4 Describe the relationship between the resultant force on the trolley and the acceleration of the trolley.

[1 mark]

0 8 . 5 Describe how the investigation could be improved to reduce the effect of random errors.

[2 marks]

0 8 . 6 Write down the equation that links acceleration (a), mass (m) and resultant force (F).

[1 mark]

0 8 . 7 The resultant force on the trolley was 0.375 N.

The mass of the trolley was 0.60 kg.

Calculate the acceleration of the trolley.

Give your answer to 2 significant figures.

[4 marks]

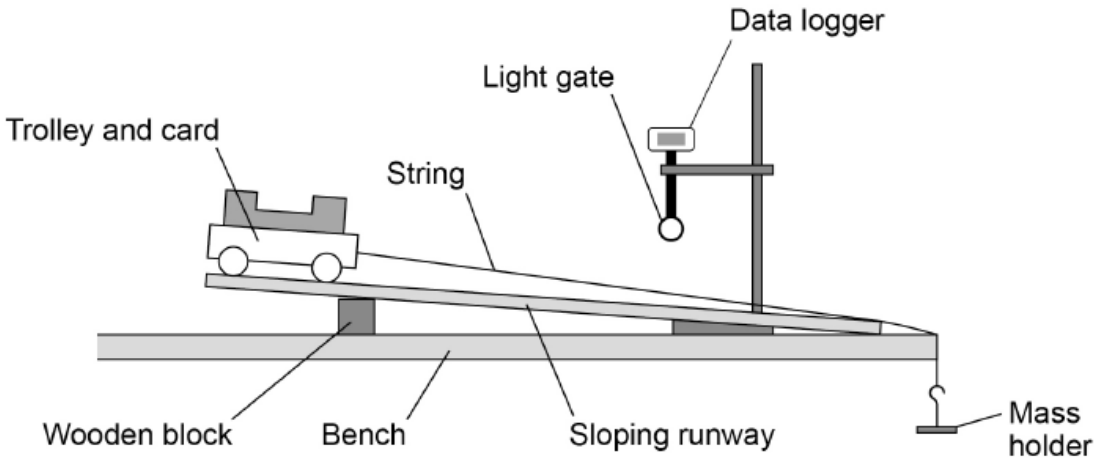
Acceleration (2 significant figures) = _____ m/s^2

4. June/2020/Paper_2H/No.1

0 1 A student investigated the acceleration of a trolley.

Figure 1 shows how the student set up the apparatus.

Figure 1



0 1 . 1 Before attaching the mass holder the student placed the trolley at the top of the runway. The trolley rolled down the runway without being pushed.

What change to the apparatus in **Figure 1** could be made to prevent the trolley from starting to roll down the runway?

[1 mark]

Tick (✓) **one** box.

Move the wooden block to the left. ☐

Shorten the length of the runway. ☐

Use a taller wooden block. ☐

0 1 . 2 The student attached the mass holder to the string.

The string rubbed along the edge of the bench as the mass holder fell to the floor.

Suggest what the student could do to prevent the string from rubbing.

[1 mark]

_____

The light gate and data logger were used to determine the acceleration of the trolley.

The student increased the resultant force on the trolley and recorded the acceleration of the trolley.

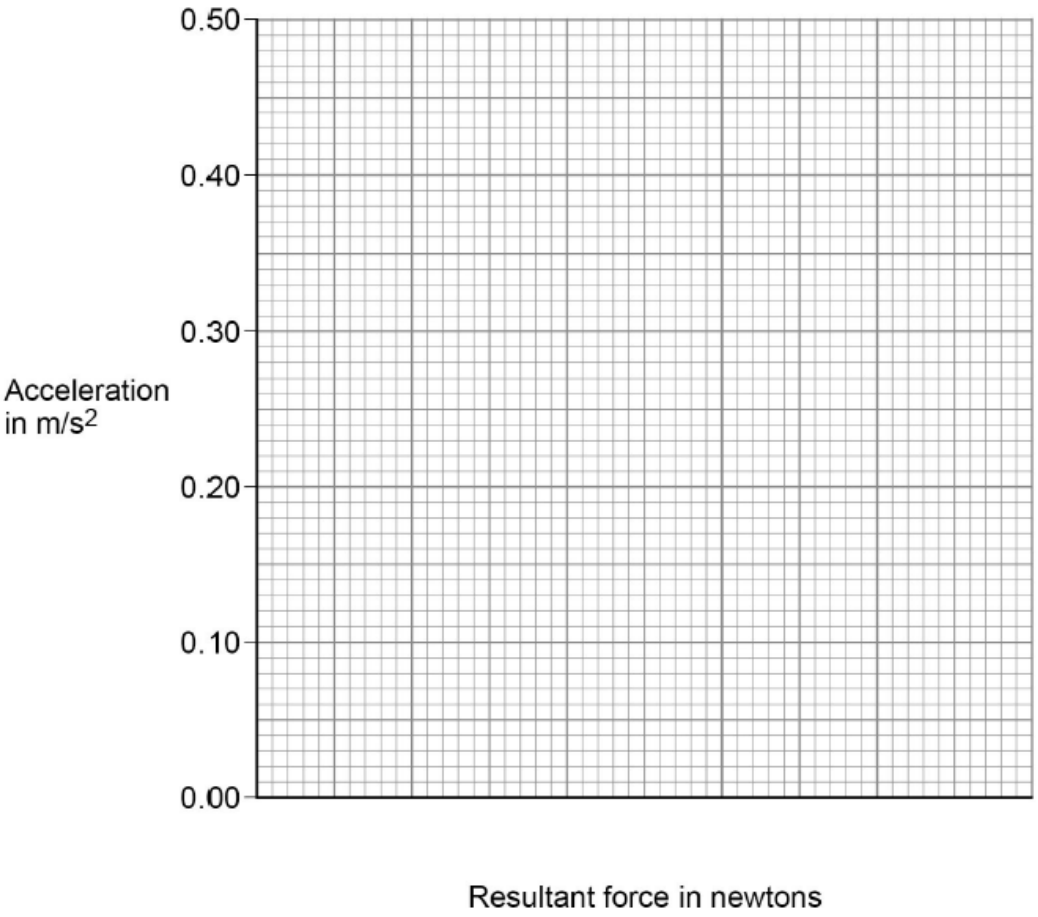
Table 1 shows the results.

Table 1

Resultant force in newtons	Acceleration in m/s^2
0.05	0.08
0.10	0.18
0.15	0.25
0.20	0.32
0.25	0.41

Figure 2 is an incomplete graph of the results.

Figure 2



0 1 . 3 Complete **Figure 2**.

- Choose a suitable scale for the x-axis.
- Plot the results.
- Draw a line of best fit.

[4 marks]

0 1 . 4 Describe the relationship between the resultant force on the trolley and the acceleration of the trolley.

[1 mark]

0 1 . 5 Describe how the investigation could be improved to reduce the effect of random errors.

[2 marks]

0 1 . 6 Write down the equation that links acceleration (a), mass (m) and resultant force (F).

[1 mark]

0 1 . 7 The resultant force on the trolley was 0.375 N.

The mass of the trolley was 0.60 kg.

Calculate the acceleration of the trolley.

Give your answer to 2 significant figures.

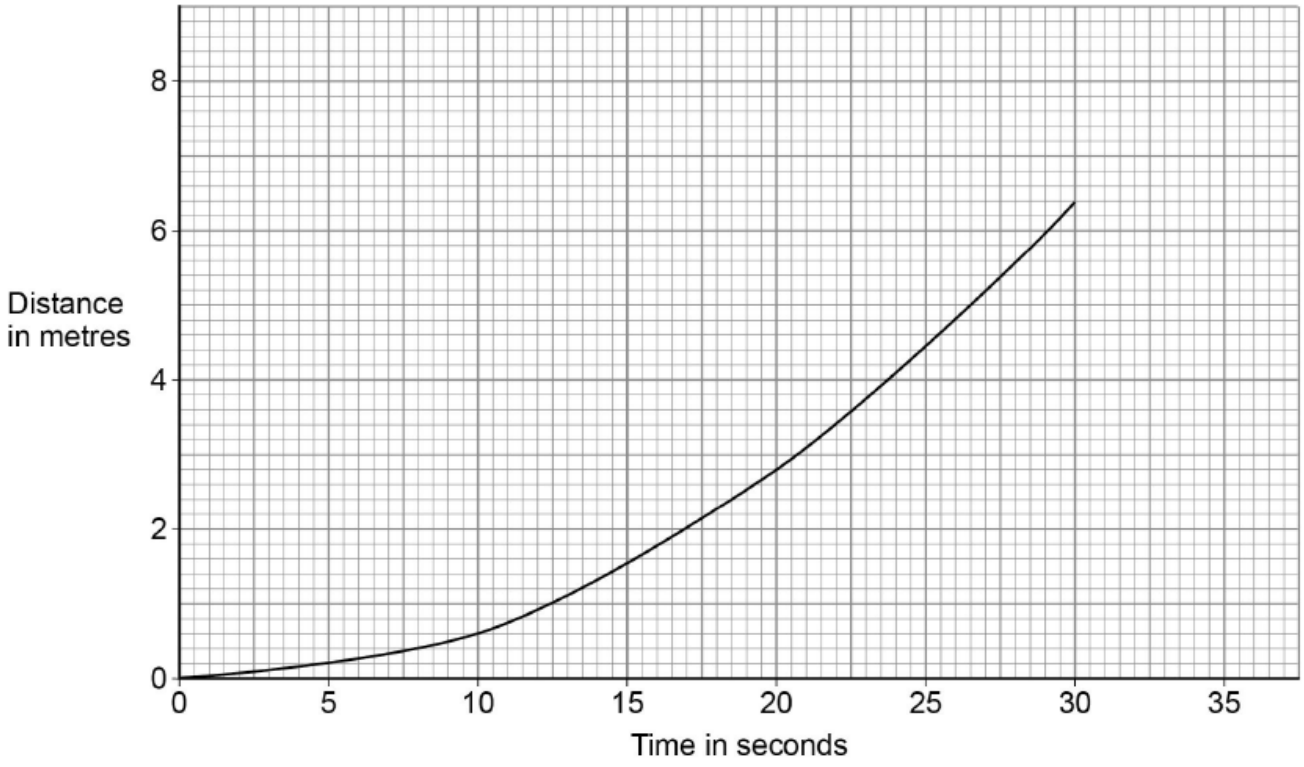
[4 marks]

Acceleration (2 significant figures) = _____ m/s^2

5. June/2020/Paper_2H/No.6(6.4_6.7)

Figure 9 shows the distance-time graph for the first 30 seconds of the car's motion.

Figure 9



0 6 . 4 Describe the motion of the car during the first 30 seconds.

[1 mark]

0 6 . 5 Determine the speed of the car 20 seconds after it started to move.

[4 marks]

Speed = _____ m/s

0 6 . 6 A different car accelerated from 0.12 m/s to 0.52 m/s.

The acceleration of the car was 0.040 m/s^2.

The work done to accelerate the car was 0.48 J.

Calculate the resultant force needed to accelerate the car.

[6 marks]

Resultant force = _____ N

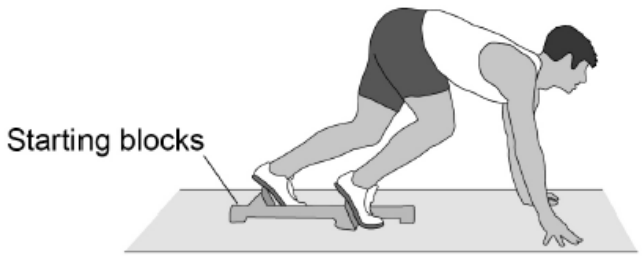
0 6 . 7 Explain why the car has a maximum speed.

[4 marks]

6. June/2019/Paper_2F/No.1

0 1 **Figure 1** shows an athlete on starting blocks waiting to start a 100 metre race.

Figure 1



0 1 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

equal to	**greater than**	**less than**

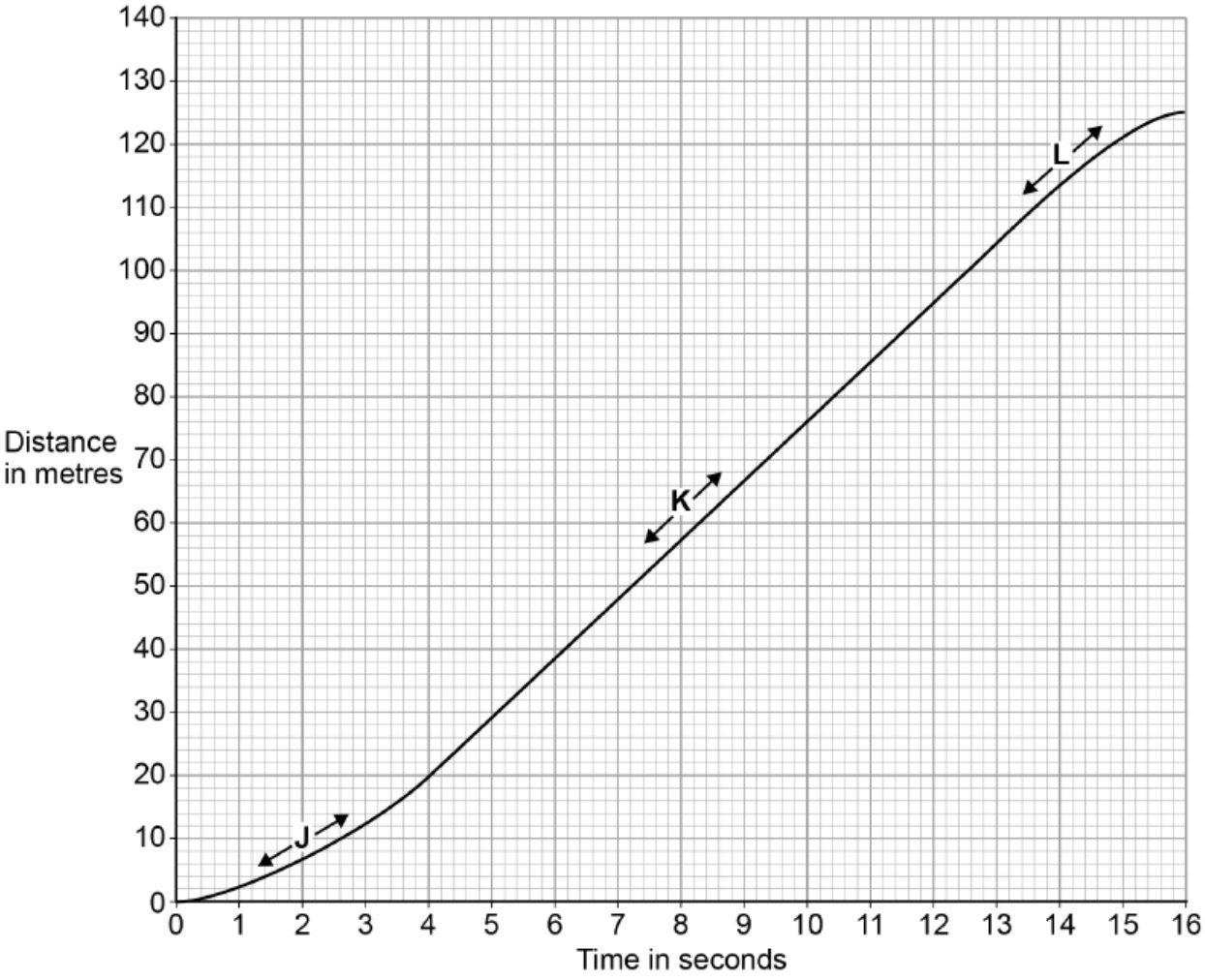
The force from the athlete pushing backwards on the starting blocks

is _____ the force from the starting

blocks pushing forwards on the athlete.

Figure 2 shows a distance-time graph for the athlete from the moment the race starts.

Figure 2



0 1 . 2 Three parts of the distance-time graph are labelled **J**, **K** and **L**.

Draw **one** line from **each** of the labels to the correct description of the athlete's motion for that part of the graph.

[2 marks]

Labels	Description of motion
J	not moving
K	constant speed
L	decreasing speed
	increasing speed

0 1 . 3 What distance does the athlete travel after the end of the race before stopping?

[1 mark]

Distance = _____ m

0 1 . 4 Calculate the average speed of the athlete between the start and finish of the 100 metre race.

Use the equation:

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

[2 marks]

_____

_____

_____

Average speed = _____ m/s

0 1 . 5 The athlete runs faster than a typical person.

What is the average running speed of a typical person in metres per second?

[1 mark]

Tick (✓) **one** box.

1.5 ☐

3.0 ☐

4.5 ☐

6.0 ☐

7. June/2019/Paper_2F/No.6

0 6 The following statements describe parts of a short train journey between two railway stations.

Part A: The train accelerates at a constant rate from 0 m/s to 20 m/s in 40 s

Part B: The train travels at a constant velocity for 260 s

Part C: The train decelerates at a constant rate coming to a stop in 60 s

0 6 . 1 During which part of the journey is the resultant force on the train zero?

[1 mark]

Tick (✓) **one** box.

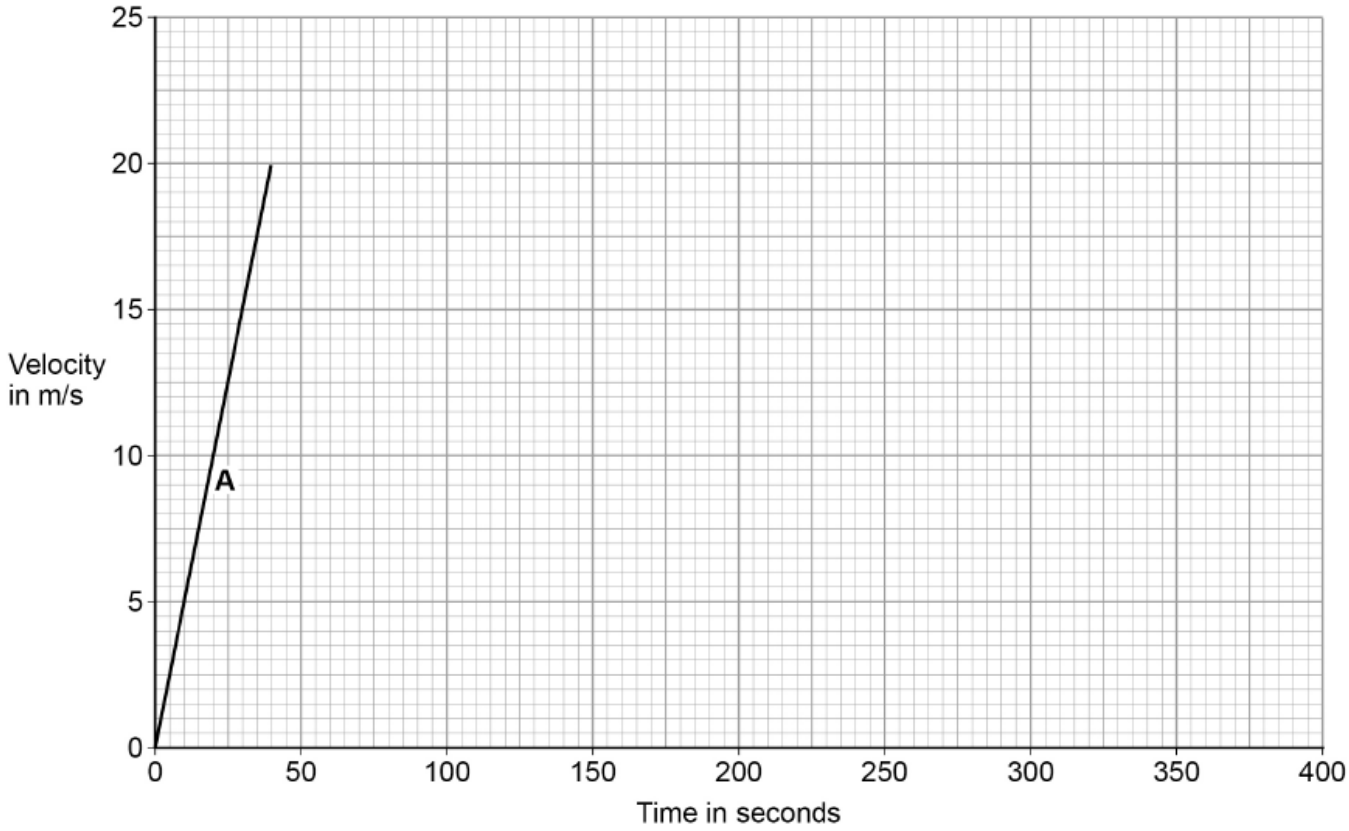
A ☐ **B** ☐ **C** ☐

0 6 . 2 **Figure 16** shows part of the velocity-time graph for the train journey.

Complete **Figure 16** showing part **B** and part **C** of the train journey.

[3 marks]

Figure 16



0 6 . 3 Write down the equation which links acceleration, change in velocity and time taken.

[1 mark]

0 6 . 4 Another train accelerated at 1.15 m/s^2 for 22.0 s

Calculate the increase in velocity of the train.

[3 marks]

Increase in velocity = _____ m/s

8. June/2019/Paper_2F/No.10

1 0 . 1 The driver of a vehicle sees a hazard on the road.

The driver uses the brakes to stop the vehicle.

Explain the factors that affect the distance needed to stop a vehicle in an emergency.

[6 marks]

1 0 . 2 Write down the equation which links distance, force and work done.

[1 mark]

_____

1 0 . 3 The work done by the braking force to stop a vehicle was 900 000 J

The braking force was 60 000 N

Calculate the braking distance of the vehicle.

[3 marks]

_____

_____

_____

_____

Braking distance = _____ m

1 0 . 4 The greater the braking force, the greater the deceleration of a vehicle.

Explain the possible dangers caused by a vehicle having a large deceleration when it is braking.

[2 marks]

_____

_____

_____

_____

_____

_____

9. June/2019/Paper_2H/No.3

0 3 . 1 The driver of a vehicle sees a hazard on the road.

The driver uses the brakes to stop the vehicle.

Explain the factors that affect the distance needed to stop a vehicle in an emergency.

[6 marks]

0 3 . 2 Write down the equation which links distance, force and work done.

[1 mark]

0 3 . 3 The work done by the braking force to stop a vehicle was 900 000 J

The braking force was 60 000 N

Calculate the braking distance of the vehicle.

[3 marks]

Braking distance = _____ m

0 3 . 4 The greater the braking force, the greater the deceleration of a vehicle.

Explain the possible dangers caused by a vehicle having a large deceleration when it is braking.

[2 marks]

10. June/2019/Paper_2H/No.6

0 6 . 1 An adult of mass 80 kg has more inertia than a child of mass 40 kg

What is inertia?

[1 mark]

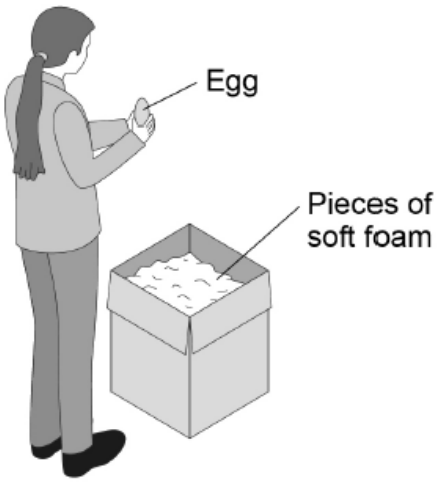
0 6 . 2 A teacher demonstrated the idea of a safety surface.

She dropped a raw egg into a box filled with pieces of soft foam.

The egg did not break.

Figure 10 shows the demonstration.

Figure 10

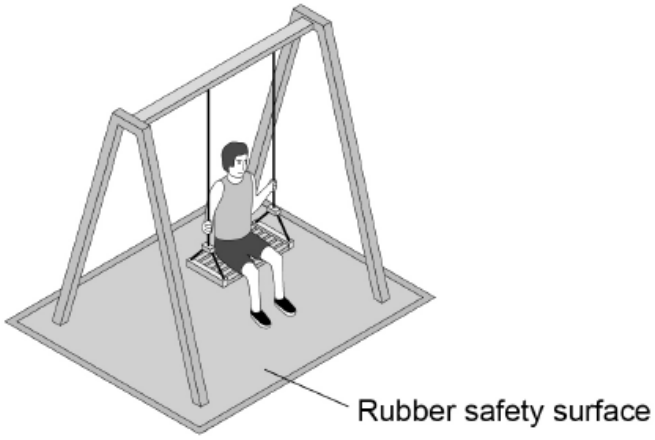


Explain why the egg is less likely to break when dropped onto soft foam rather than onto a concrete floor.

[3 marks]

0 6 . 3 **Figure 11** shows a child on a playground swing. The playground has a rubber safety surface.

Figure 11



A child of mass 32 kg jumped from the swing.

When the child reached the ground she took 180 milliseconds to slow down and stop.

During this time an average force of 800 N was exerted on her by the ground.

Calculate the velocity of the child when she first touched the ground.

Use the Physics Equations Sheet.

[4 marks]

Velocity = _____ m/s