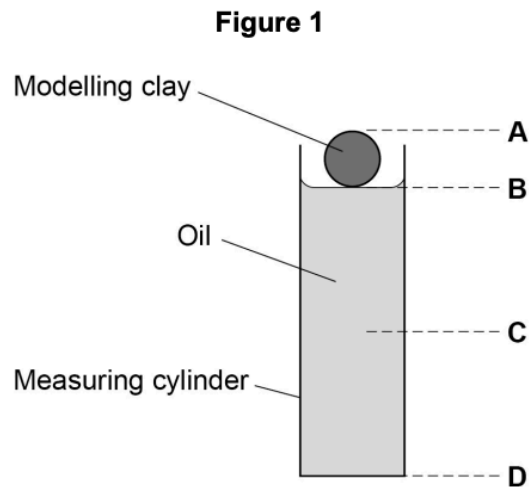


Q1.(2020)

a)

A student dropped a piece of modelling clay into oil.

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



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

☐

b)

What measuring instrument should be used to measure the distance fallen?

[1 mark]

c)

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.

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

Suggest **one** reason why.

[1 mark]

d)

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

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

[2 marks]

X = _____ s

e)

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 _____

f)

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.

☐

g)

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:

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

[2 marks]

Weight = _____ N

h)

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

☐

Q2.(2020)

a)

An aircraft travels at a constant velocity.

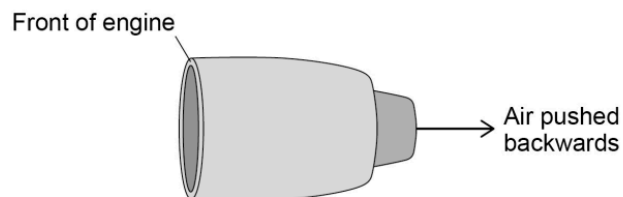
How is the velocity of the aircraft different to the speed of the aircraft?

[1 mark]

b)

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.

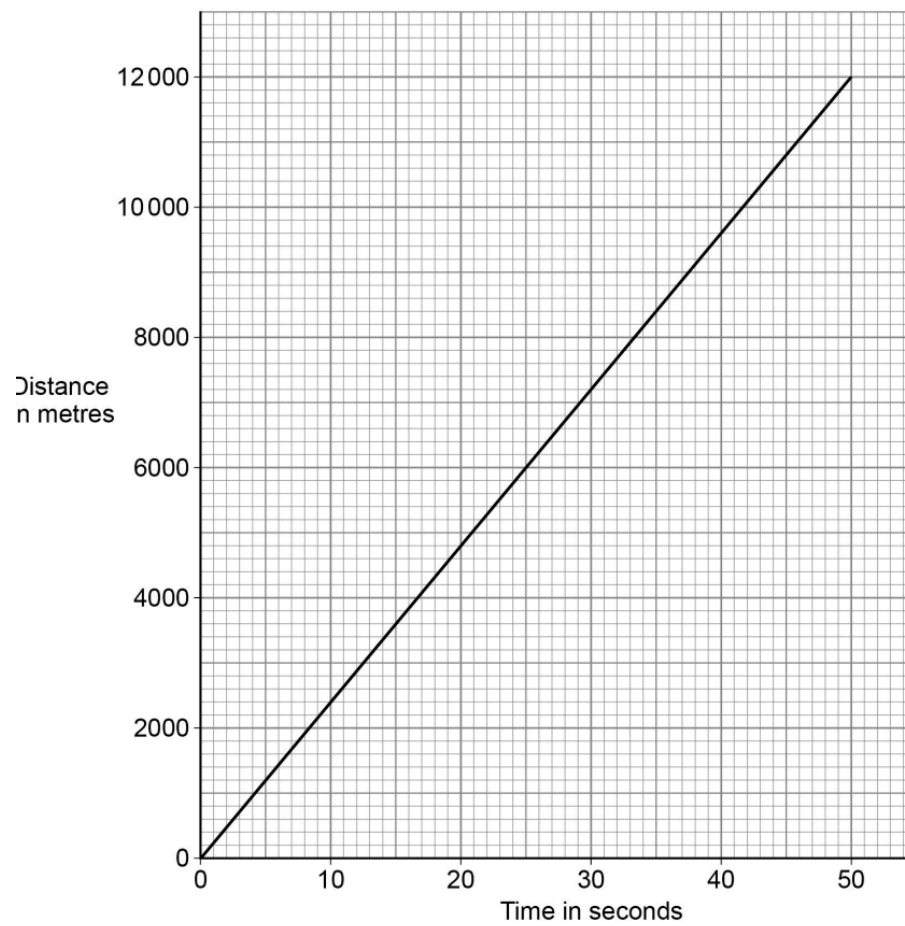
Explain the effect this has on the engine.

[2 marks]

c)

Figure 12 shows a distance-time graph for the aircraft.

Figure 12



Determine the speed of the aircraft.

[3 marks]

Speed = _____ m/s

d)

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

[1 mark]

e)

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]

f)

Write down the equation that links distance (s), force (F) and work done (W).

[1 mark]

g)

When the aircraft landed, it travelled 2000 m before stopping.

The work done to stop the aircraft was 140 000 000 J.

Calculate the mean force used to stop the aircraft.

[3 marks]

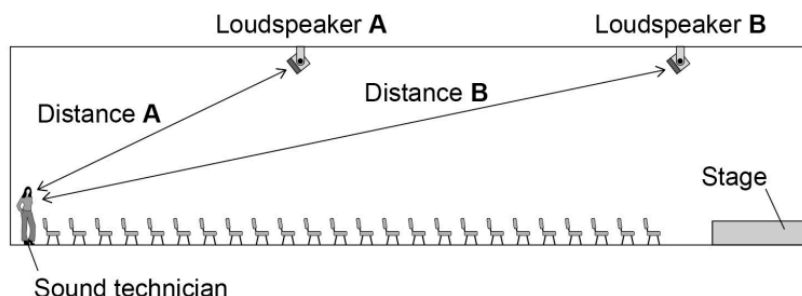
Mean force = _____ N

Q3.(2022)

a)

Figure 14 shows the arrangement of two loudspeakers at a concert venue.

Figure 14



The loudspeakers in **Figure 14** are tested by playing the same song through both loudspeakers.

A sound technician listens to the song.

Use the Physics Equations Sheet to answer questions **07.6** and **07.7**.

Write down the equation which links distance (s), speed (v) and time (t).

[1 mark]

b)

Distance **A** on **Figure 14** is 13.2 m.

speed of sound = 330 m/s

Calculate the time taken for the sound to travel from loudspeaker **A** to the technician.

[3 marks]

Time taken = _____ s

c)

The sound from each loudspeaker travels at the same speed.

For the sound technician to hear the song clearly, the sound from loudspeaker **B** should be emitted slightly before the sound from loudspeaker **A**.

Explain why.

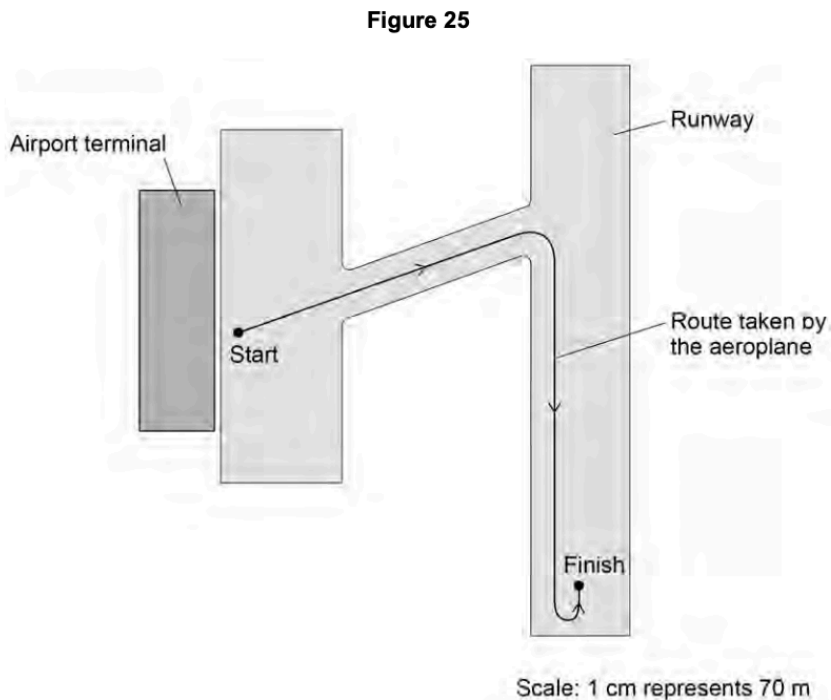
[3 marks]

Q4.(2023)

a)

Figure 25 shows the route an aeroplane takes as it travels from an airport terminal to the runway.

Figure 25 has been drawn to scale.



Determine the magnitude of the aeroplane's displacement from the start point to the finish point on **Figure 25**.

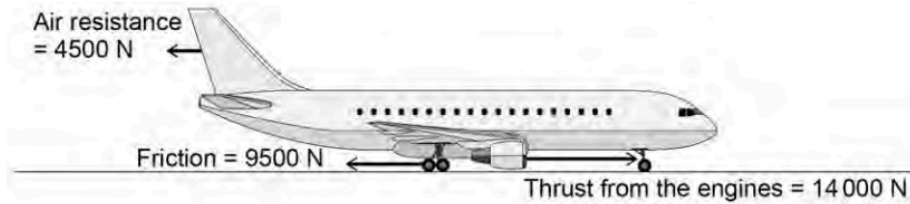
[2 marks]

Displacement = _____ m

b)

Figure 26 shows the direction of the horizontal forces acting on the aeroplane as it moves in a straight line towards the runway.

Figure 26



Determine the magnitude of the resultant horizontal force on the aeroplane.

[1 mark]

Resultant horizontal force = _____ N

c)

Describe the motion of the aeroplane as it moves towards the runway.

[1 mark]

d)

Air resistance and friction are contact forces.

Give **one** other example of a contact force.

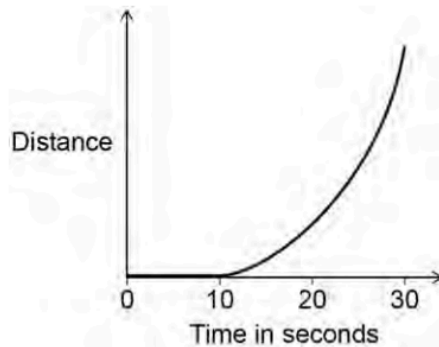
[1 mark]

e)

The aeroplane stops for a short time and then accelerates along the runway.

Figure 27 shows a distance–time sketch-graph for this stage of the journey.

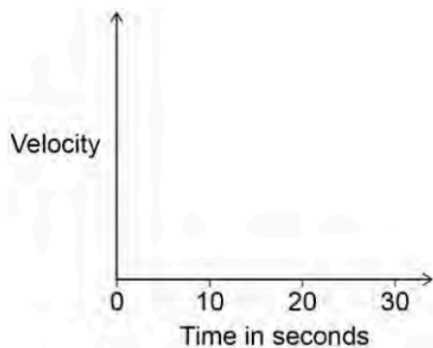
Figure 27



Draw the velocity–time sketch-graph for this stage of the journey on **Figure 28**.

[2 marks]

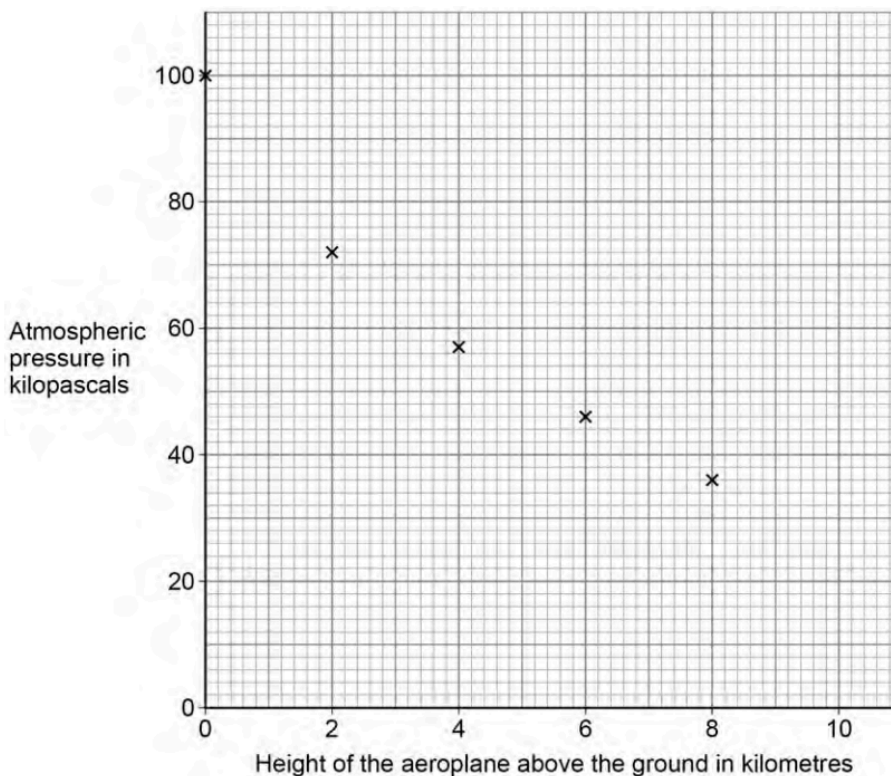
Figure 28



f)

The aeroplane takes off from the runway, so its height above the ground increases.

Figure 29 shows how atmospheric pressure varies with the height of the aeroplane above the ground.

Figure 29

Estimate the atmospheric pressure when the height of the aeroplane above the ground is 10 km.

[2 marks]

Atmospheric pressure = _____ kPa

g)

What happens to the air surrounding the aeroplane as the height of the aeroplane above the ground increases?

[1 mark]

Tick (✓) **one** box.

The average density of the air above the aeroplane decreases.

☐

The mass of air above the aeroplane increases.

☐

The temperature of the air increases.

☐

The volume of air below the aeroplane decreases.

☐

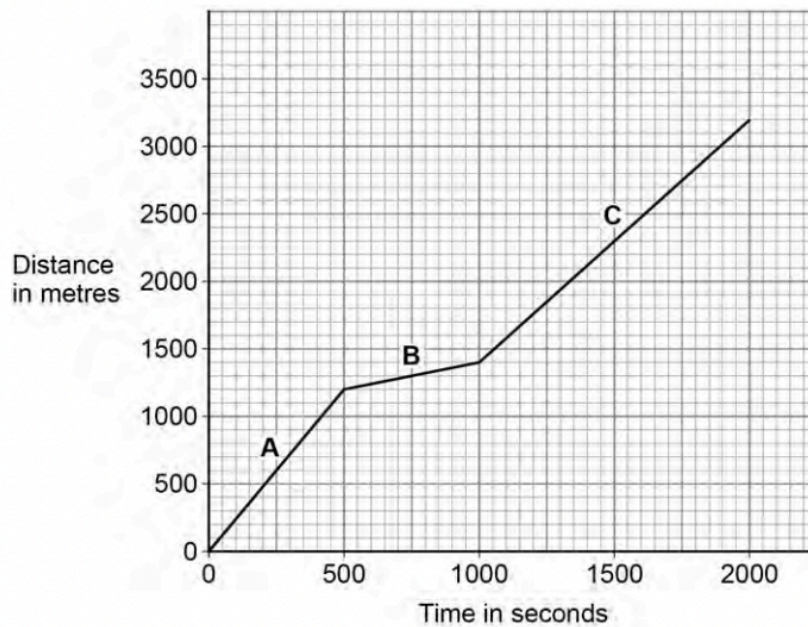
Q5.(2024)

a)

A person has been for a walk.

Figure 9 shows the distance–time graph for the walk.

Figure 9



Some quantities are scalar quantities and others are vector quantities.

Which of the following are scalar quantities?

[2 marks]

Tick (✓) **two** boxes.

- | | |
|--------------|--------------------------|
| Displacement | ☐ |
| Distance | ☐ |
| Force | ☐ |
| Speed | ☐ |
| Velocity | ☐ |

b)

What was the total distance walked by the person in 2000 seconds?

[1 mark]

Total distance = _____ m

c)

Calculate the average speed of the person during the 2000 seconds.

Use your answer to Question 05.2

Use the equation:

$$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$$

[2 marks]

Average speed = _____ m/s

d)

Which section of **Figure 9** shows the person walking the slowest?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

A ☐ B ☐ C ☐

Reason _____

e)

The person walked slowest when going up some steps.

Complete the sentence.

Choose the answer from the box.

[1 mark]

air resistance

friction

gravity

When walking up the steps, the person did more work against the force of _____.

f)

On another day, the person ran the same route.

What is a typical speed for a person running?

[1 mark]

Tick (✓) **one** box.

0.3 m/s

☐

3.0 m/s

☐

30 m/s

☐