Motion

Question Paper

Course	CIE IGCSE Physics
Section	1. Motion, Forces & Energy
Topic	Motion
Difficulty	Medium

Time Allowed 90

Score /67

Percentage /100

Question 1a

Model trains move along a track passing through two model stations. Students analyse the motion of a train. They start a digital timer as the train starts to move. They record the time that it enters Station A and the time it enters Station B.

Fig 1.1 below shows the time on entering Station A and the time on entering Station B.

Fig. 1.1

Calculate the time taken from the train entering Station A to the train entering Station B.
State your answer in seconds.

time taken = ... s

[1 mark]

Question 1b

A faster train takes 54 s to travel from Station A to Station B. The distance between the stations is 120 m.

Calculate the average speed of this train.

average speed = ... m/s

[3 marks]

Question 1c

Fig. 1.2 shows the speed-time graph for a train travelling on a different part of the track.

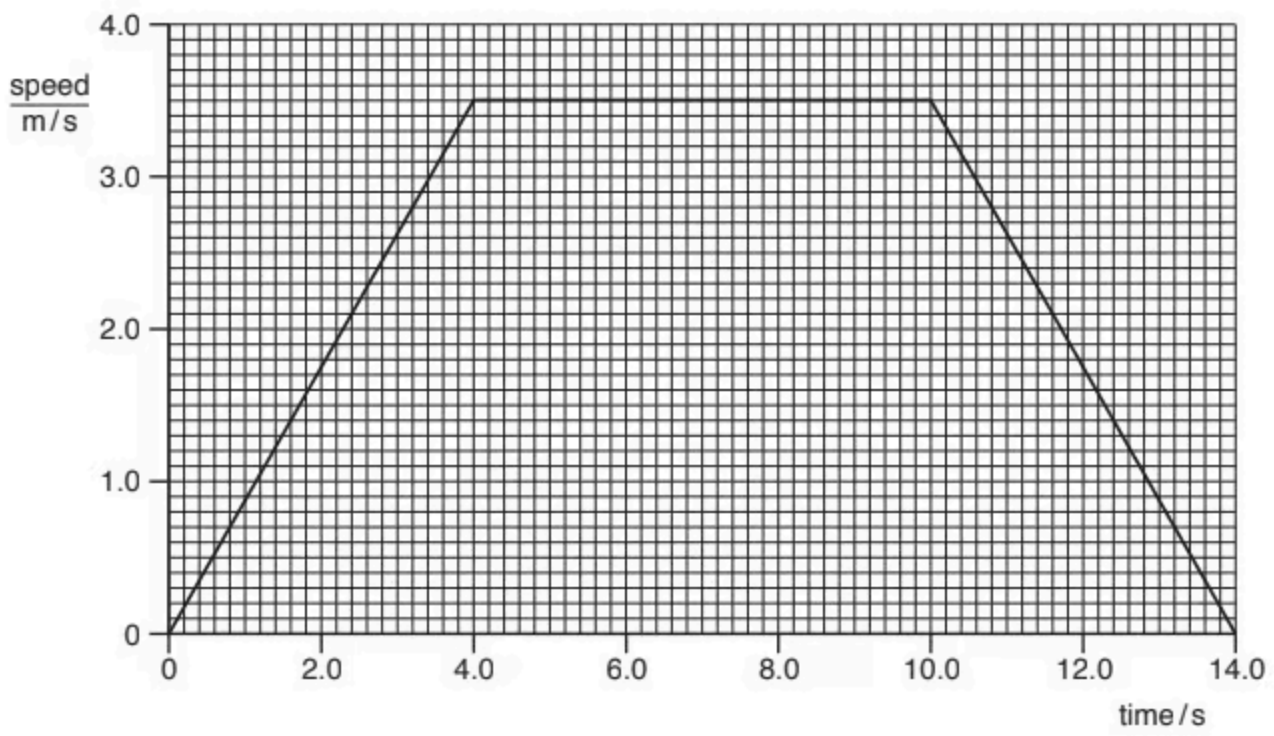


Fig. 1.2

Determine the total distance travelled by the train on this part of the track.

distance = ... m

[4 marks]

Question 2a

Extended tier only

Define acceleration.

[1 mark]

Question 2b

Extended tier only

Fig. 1.1 shows the speed-time axes for the graph of the motion of a car.

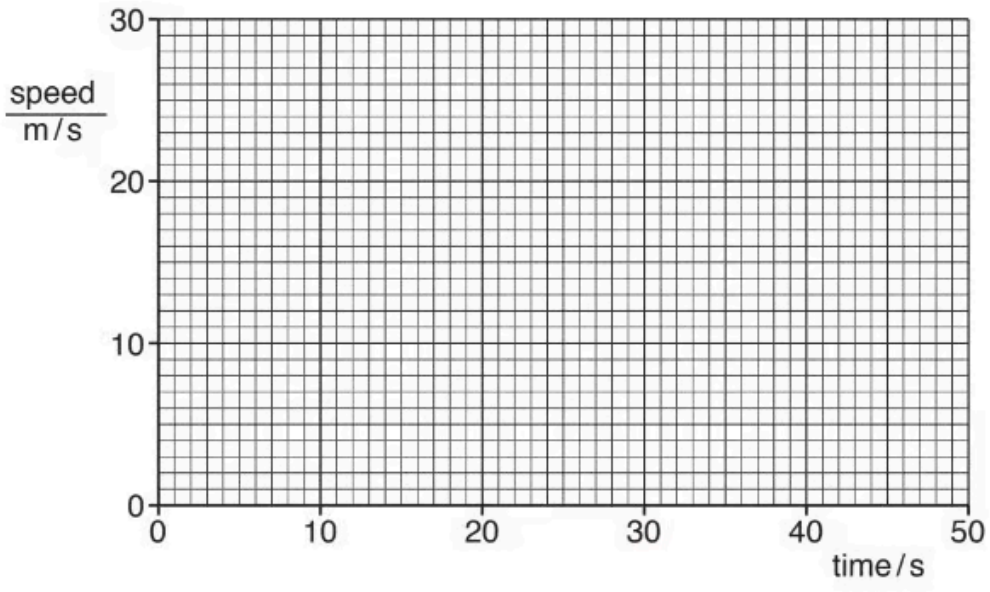


Fig. 1.1

(i) The car starts from rest.

From time = 0 to time = 15 s, the car has a constant acceleration to a speed of 28 m/s.

From time = 15 s to time = 32 s, the car has a constant speed of 28 m/s.

From time = 32 s, the car has a constant deceleration of 2.0 m/s^2 until it comes to rest.

On Fig. 1.1, draw the graph, using the space below for any calculations.

[5]

(ii) From time = 15 s to time = 32 s, the path of the car is part of a circle.

For this motion, state

1. the direction of the resultant force on the car,

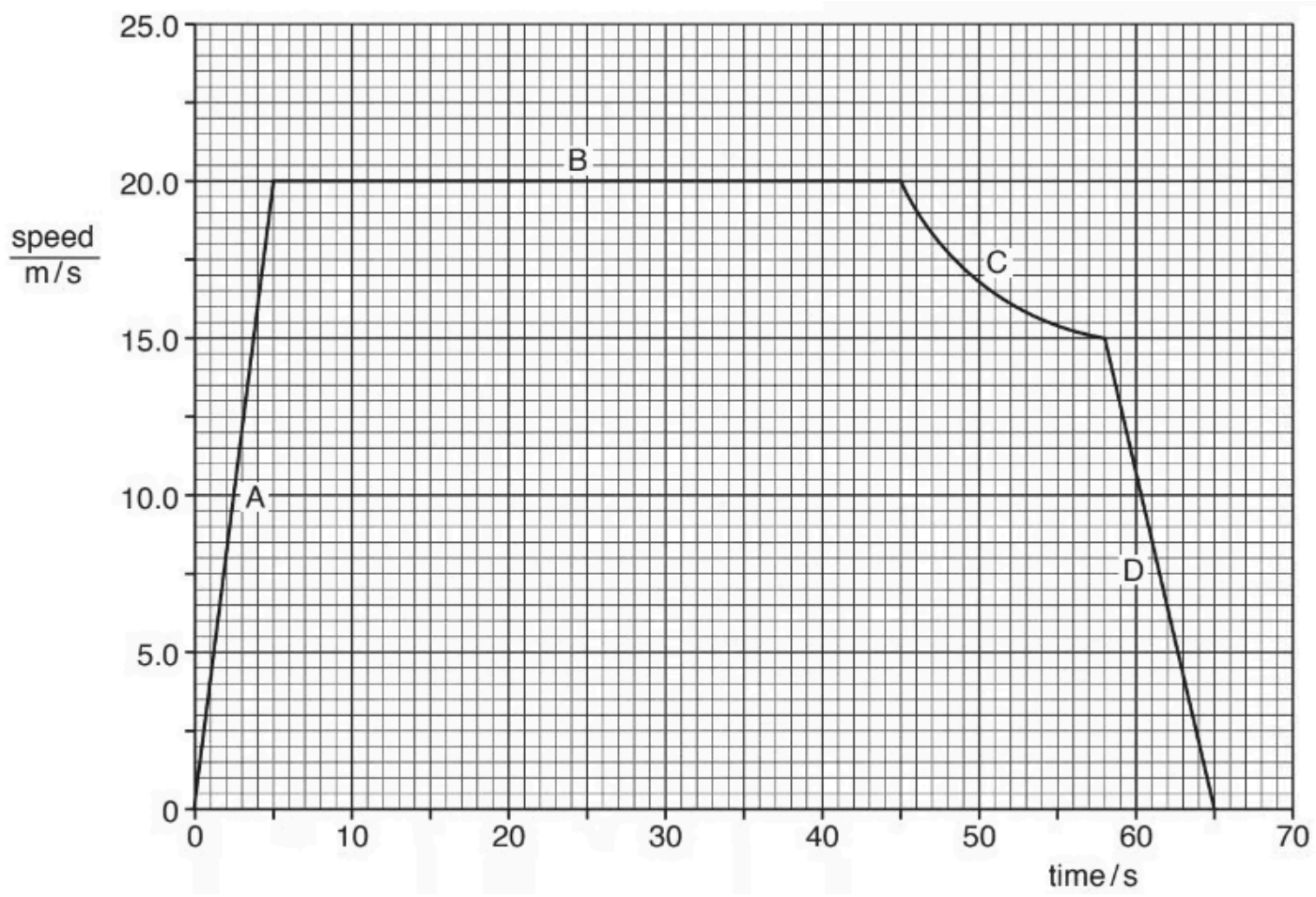
2. what happens to the velocity of the car.

[2]
[7 marks]

Question 3a

Some cyclists are racing around a track.

Fig.2.1 shows the speed-time graph for one cyclist.



(i) Tick the box that represents the cyclist travelling at constant speed.

- ☐ A
- ☐ B
- ☐ C
- ☐ D

[1]

(ii) Calculate the distance travelled by the cyclist in the first 5 seconds.

distance = ... m [3]

[4 marks]

Question 3b

The length of the track is 250m.

Another cyclist goes around the track four times (four laps). This takes 80.0 seconds.

(i) Calculate the average speed of this cyclist.

average speed = ... m/s [4]

(ii) A friend of the cyclist starts a stopwatch at the beginning of the race.

Fig.2.2 shows the reading on the stopwatch when the cyclist has gone around the track **once**.

Fig.2.3 shows the reading on the stopwatch when the cyclist has gone around the track **twice**.

Fig. 2.2

Fig. 2.3

Calculate the time taken for the cyclist to go around the track during the second lap.

time = ... s [1]

[5 marks]

Question 4a

Fig. 1.1 shows the speed–time graph of a person on a journey.

On the journey, he walks and then waits for a bus. He then travels by bus. He gets off the bus and waits for two minutes. He then walks again. His journey takes 74 minutes.

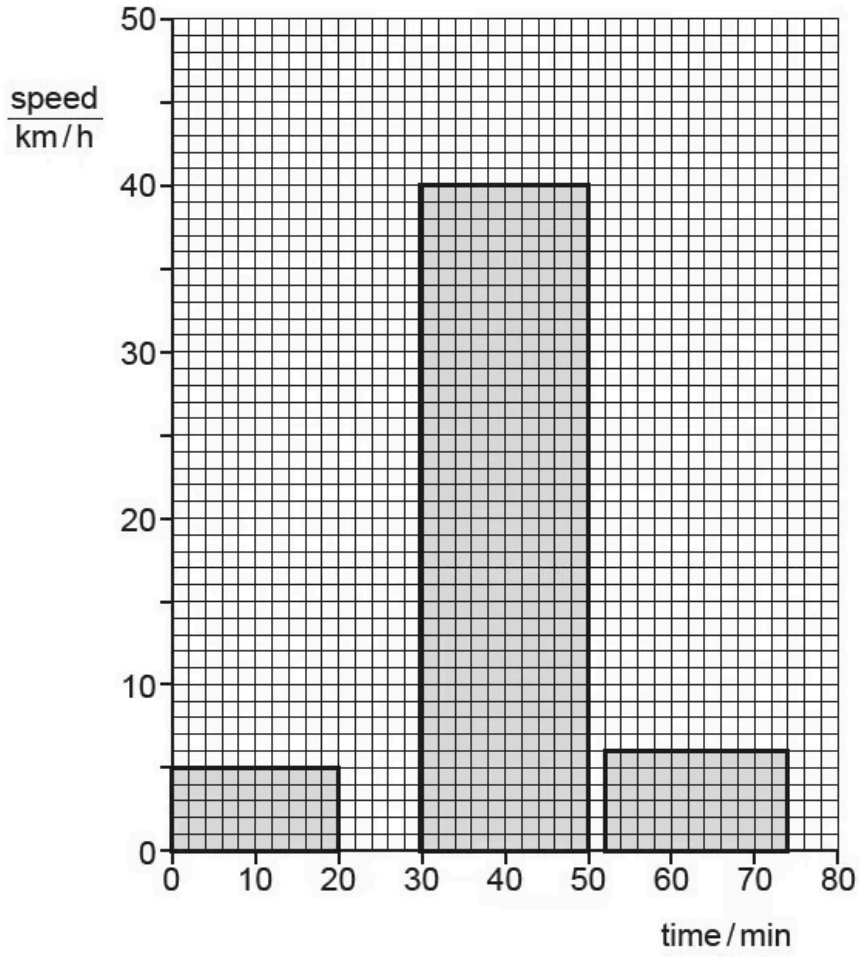


Fig. 1.1

For the whole journey calculate:

(i) the distance travelled

distance = ... [3]

(ii) the average speed.

average speed = ... [2]

[5 marks]

Question 4b

Extended tier only

State and explain which feature of a speed–time graph shows acceleration.

[2 marks]

Question 4c

Extended tier only

State and explain the acceleration of the person at time = 40 minutes.

[2 marks]

Question 5a

A person on roller skates makes a journey. Fig. 1.1 shows the speed-time graph for the journey.

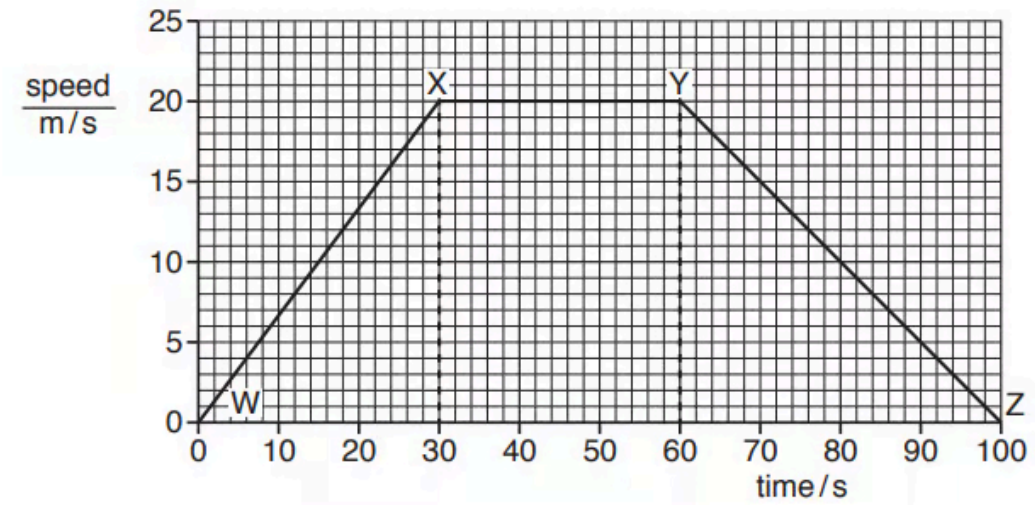


Fig. 1.1

The graph shows three types of motion.

Complete the table to show when each type of motion occurs. Use the letters shown on Fig. 1.1. Add a letter to each of the blank spaces. The first row is done for you.

motion	start of motion	end of motion
acceleration	W	X
deceleration		
constant speed		

[2 marks]

Question 5b

Calculate the distance travelled between 60 s and 100 s.

distance = ... m

[3 marks]

Question 5c

The size of the acceleration is greater than the deceleration.

Describe how Fig. 1.1 shows this.

[1 mark]

Question 6a

Fig. 1.1 shows a water tank that is leaking. Drops of water fall from the tank at a constant rate.

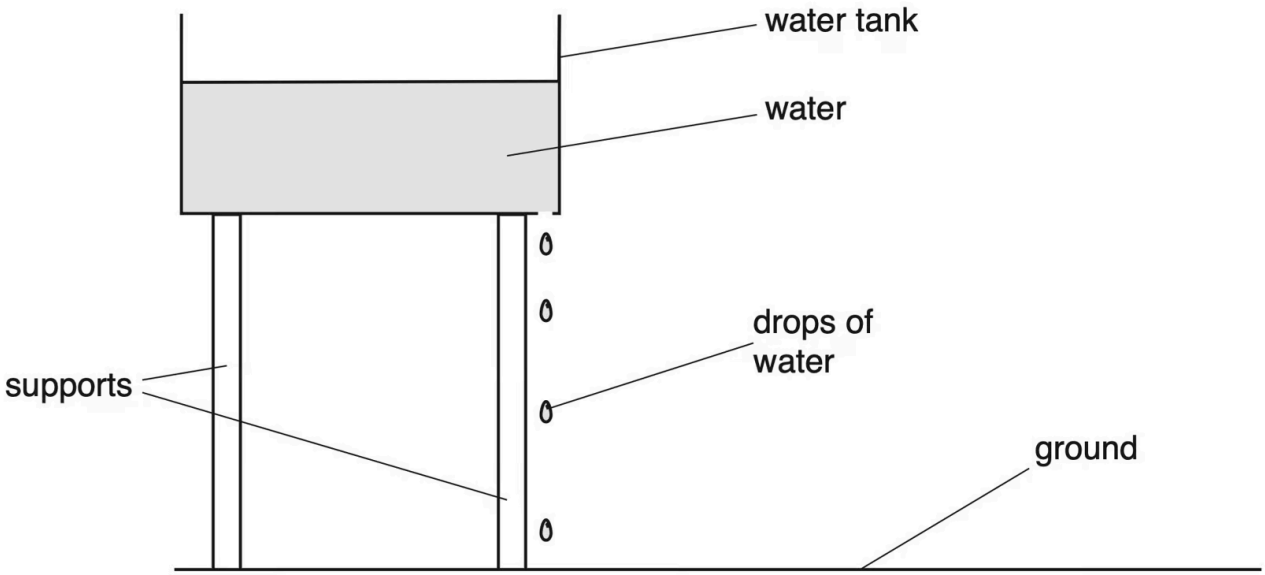


Fig. 1.1 (NOT to scale)

A student uses a stopwatch to determine the time between two drops hitting the ground.

He sets the stopwatch to zero. He starts the stopwatch when the first drop hits the ground.

He stops the stopwatch after a further 30 drops have hit the ground.

The reading on the stopwatch is recorded and shown in Fig. 1.2.

Fig. 1.2

(i) State the time taken for 30 drops to hit the ground.

time = ... s [1]

(ii) Calculate the average time between two drops hitting the ground.

time = ... s [2]

(iii) Explain why the student measures the time for 30 drops to hit the ground instead of measuring the time for one drop to hit the ground.

[1]

[4 marks]

Question 6b

Extended tier only

Fig. 1.1 shows that the drops get further apart as they get close to the ground.

State why the drops get further apart.

[1 mark]

Question 6c

In another experiment the student determines the speed of a falling weight at different times. The speed–time graph for his results is shown in Fig. 1.3.

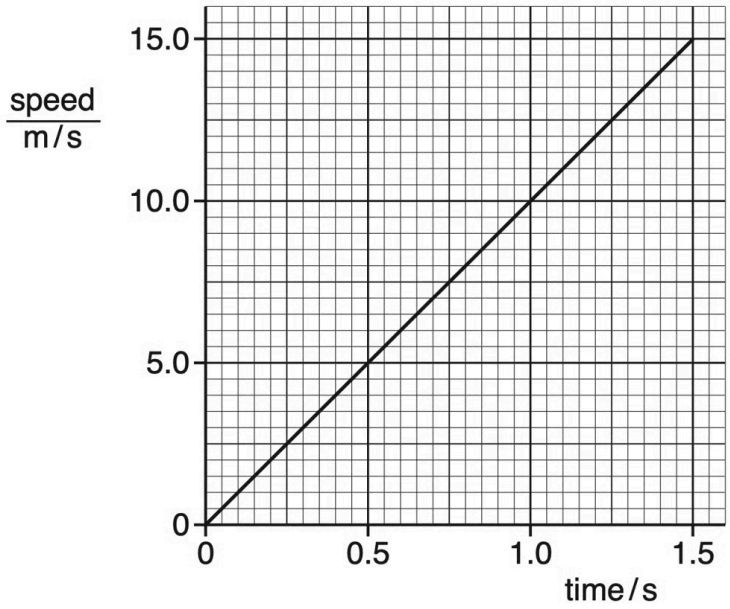


Fig. 1.3

Calculate the distance fallen by the weight in the first 1.5 s.

distance = ... m

[3 marks]

Question 7a

A lorry is travelling along a straight, horizontal road.
Fig. 1.1 is the distance-time graph for the lorry.

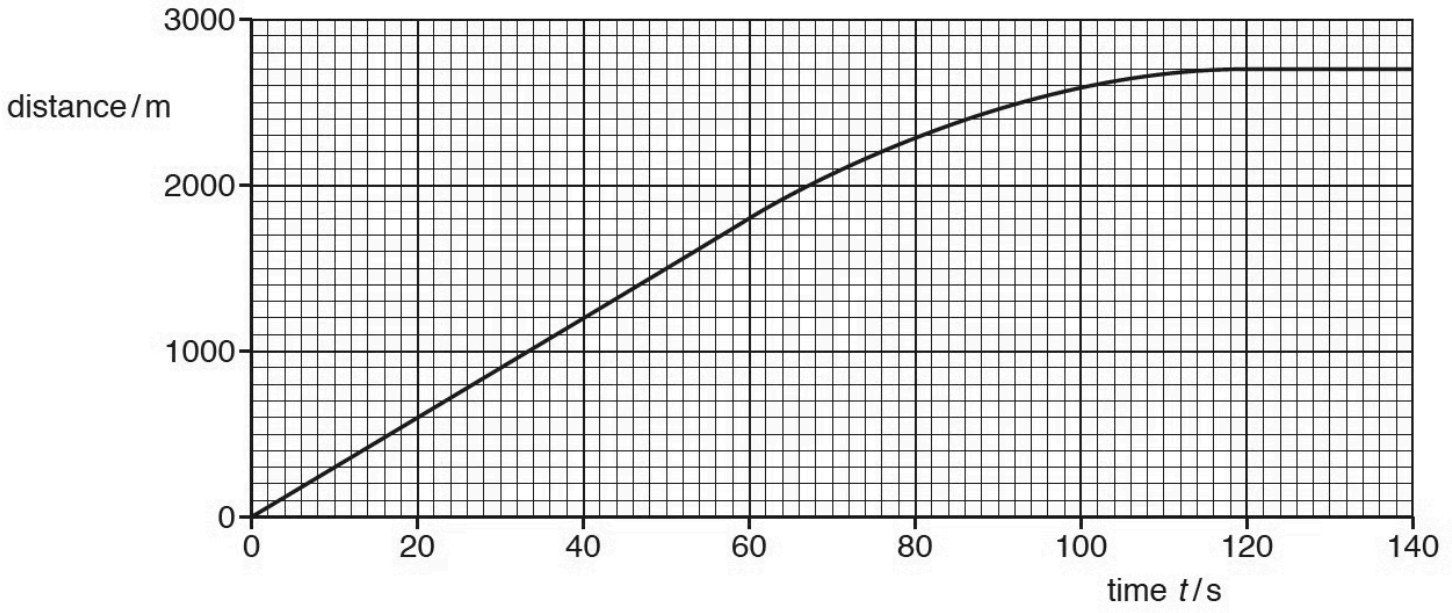


Fig. 1.1

Using Fig. 1.1, determine:

(i) the speed of the lorry at time t = 30 s

speed = ...[2]

(ii) the average speed of the lorry between time t = 60 s and time t = 120 s.

average speed = ...[2]

[4 marks]

Question 7b

At time t = 30s, the total resistive force acting on the lorry is 1.4×10^4 N.

(i) Using Fig. 1.1, determine the magnitude of the acceleration of the lorry at time t = 30 s.

acceleration = ...[1]

(ii) Determine the forward force on the lorry due to its engine at time t = 30 s.

forward force = ...[1]

[2 marks]

Question 7c

Extended tier only

Describe the motion of the lorry between time t = 60 s and time t = 130 s.

[2 marks]

Question 8a

A student reviews some data about athletes and footballers.

An athlete runs 12 km in 1.5 hours.

Calculate the athlete's average speed in km/h.

average speed = ... km/h

[3 marks]

Question 8b

Fig. 2.1 shows the speed-time graph for a footballer for the first 15.0 seconds of a game.

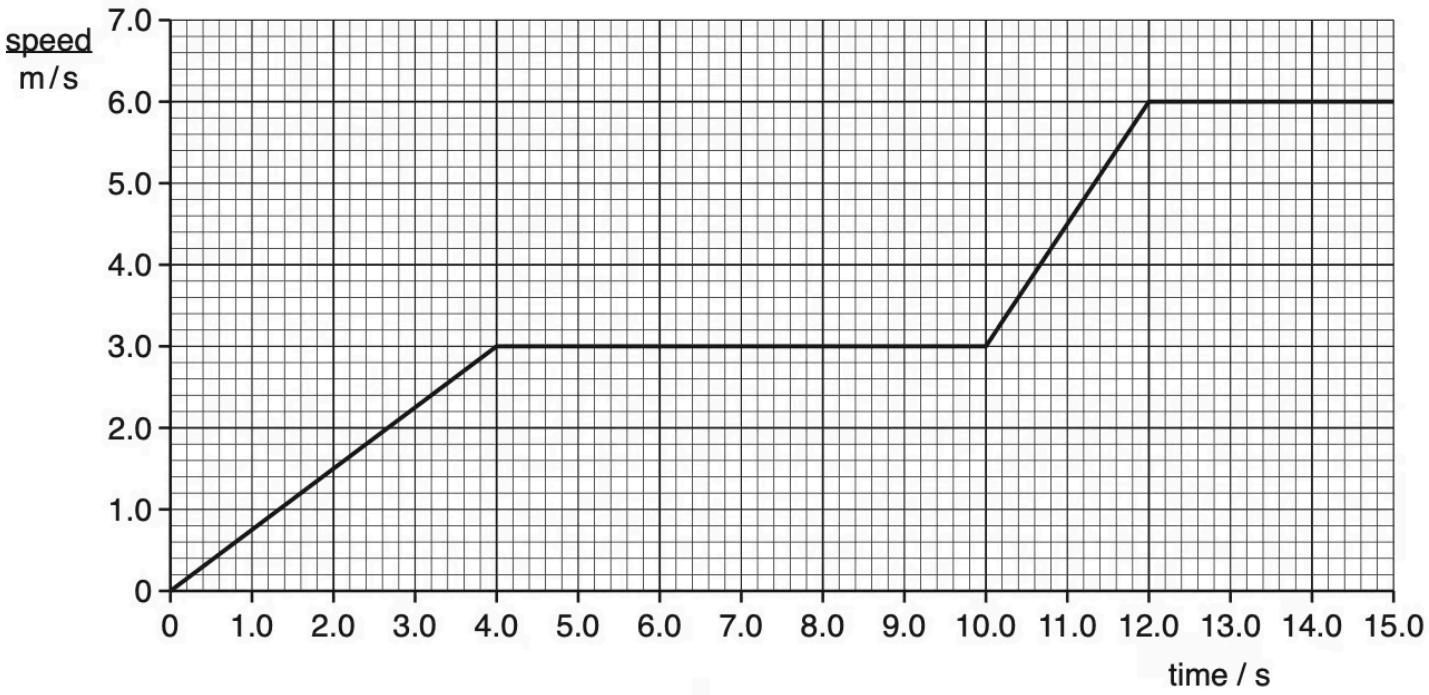


Fig. 2.1

(i) Use the graph in Fig. 2.1 to calculate the distance travelled by the footballer during the first 4.0 seconds.

distance = ... m [3]

(ii) Use the graph in Fig. 2.1 to determine when the footballer is moving with greatest acceleration.

Between ..... s and ..... s.

Give a reason for your answer.

[2]

[5 marks]

Question 8c

Another footballer has a mass of 72kg.

Calculate the weight of this footballer.

weight = ... N

[3 marks]