1. A train of mass 6.5 × 105 kg is at rest in a station.

At time *t* = 0 s, a resultant force acts on the train and it starts to accelerate forwards.

Fig. 1.1 is the distance-time graph for the train for the first 120 s.



**(a) (i)** Use Fig. 1.1 to determine:

**1.** the average speed of the train during the 120 s

 Average speed = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 **2.** the speed of the train at time *t* = 100 s.

 Speed = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 **(ii)** Describe how the acceleration of the train at time *t* = 100 s differs from the

acceleration at time *t* = 20 s.

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(b) (i)** The initial acceleration of the train is 0.50 m / s2.

Calculate the resultant force that acts on the train at this time.

Resultant force = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 **(ii)** At time *t* = 140 s, the train begins to decelerate.

State what is meant by *deceleration*.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. A lorry is travelling along a straight, horizontal road.

Fig. 1.1 is the distance-time graph for the lorry.



1. Using Fig. 1.1, determine:
2. the speed of the lorry at time *t* = 30 s

speed = ...........................................................

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

average speed = ...........................................................

1. At time *t* = 30 s, the total resistive force acting on the lorry is 1.4 × 104 N.
2. Using Fig. 1.1, determine the magnitude of the acceleration of the lorry at time *t* = 30 s.

acceleration = ...........................................................

1. Determine the forward force on the lorry due to its engine at time *t* = 30 s.

forward force = ...........................................................

**(c)** Describe the motion of the lorry between time *t* = 60 s and time *t* = 130 s.

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1. Fig. 1.1 is the distance-time graph for a moving car.



1. On Fig. 1.1, mark a point P where the acceleration of the car is zero.
2. Determine:
3. the speed of the car at time *t* = 15 s

speed = ...........................................................

1. the average speed of the car between time *t* = 30 s and time *t* = 45 s.

average speed = ...........................................................

**(c)** At time *t* = 45 s, the car starts to decelerate. At time *t* = 55 s and at a distance of 400 m from

the starting point, the car stops. It then remains stationary for 5.0 s.

On Fig. 1.1, draw a possible continuation of the distance-time graph.

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



The mass of the car is 1200 kg.

1. Calculate, for the first 20 s of the motion,
2. the distance travelled by the car,

distance = ...........................................................

1. the acceleration of the car,

acceleration = ...........................................................

1. the resultant force acting on the car.

resultant force = ...........................................................

**(b)** Describe the motion of the car in the period of time from 25 s to 40 s.

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