

Question 1

The velocity-time graph shown models the motion of a parachutist falling vertically. There are four stages in the motion:

- falling freely with the parachute closed,
- decelerating at a constant rate with the parachute open,
- falling with constant speed with the parachute open,
- coming to rest instantaneously on hitting the ground.

(i) Show that the total distance fallen is 1048 m. [2]

The weight of the parachutist is 850 N.

(ii) Find the upward force on the parachutist due to the parachute, during the second stage. [5]

Question 2

A walker travels along a straight road passing through points *A* and *B* on the road with speeds 0.9 m/s and 1.3 m/s respectively. The walker's acceleration between *A* and *B* is constant and equal to 0.004 m/s².

- (i) Find the time taken by the walker to travel from *A* to *B*.
- (ii) Find the distance *AB*.

Question 3

A car of mass 1200 kg moves in a straight line along horizontal ground. The resistance to motion of the car is constant and has magnitude 960 N.

(i) If the driving force on the car is $F = 1440$ N, calculate the acceleration of the car.

The car passes through the points *A* and *B*. While the car is moving between *A* and *B* it has constant speed.

(ii) Calculate the driving force for this instance.

At the instant that the car reaches *B*, its speed is 18 m/s, and the engine is switched off and subsequently provides no driving force. The car continues along the straight line until it comes to rest at the point *C*. The time taken for the car to travel from *A* to *C* is 52.5 s.

(iii) Find the distance AC.

Question 4

A particle P starts from a fixed point O at time $t = 0$, where t is in seconds, and moves with constant acceleration in a straight line. The initial velocity of P is 1.5 m/s and its velocity when $t = 10 \text{ s}$ is 3.5 m/s . Find the displacement of P from O when $t = 10 \text{ s}$. [2]

Question 5

A particle is initially travelling at a speed of 2 m s^{-1} and immediately accelerates at 3 m s^{-2} for 10 seconds; it then travels at a constant speed before decelerating at a 2 m s^{-2} until it stops.

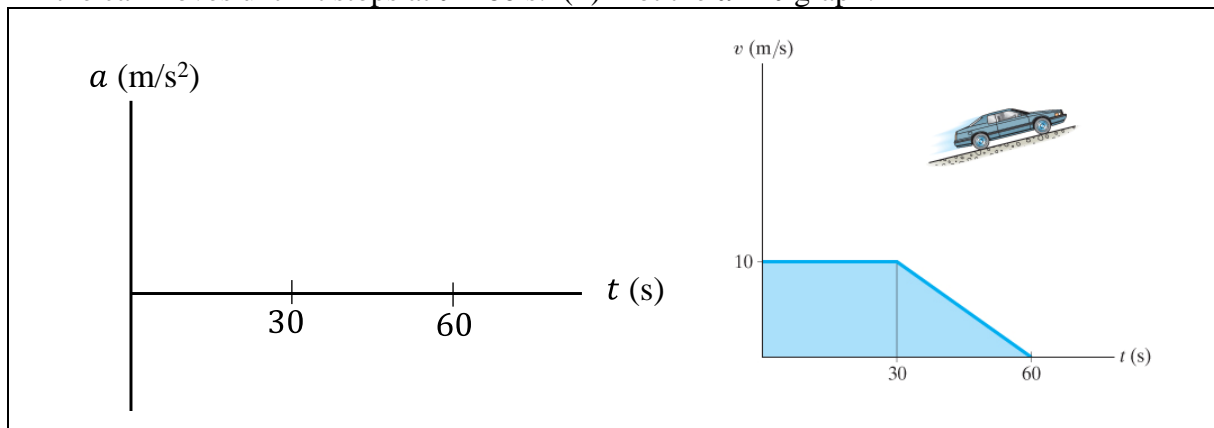
- Find the maximum speed and the time spent decelerating
- Sketch a speed-time graph.
- If the total distance travelled is 1130 metres, find the time spent travelling at a constant speed.

Question 6

A balloon at a height of 300 m is descending at 10 m/s and decelerating at a rate of 0.4 m/s^2 . How long will it take for the balloon to stop descending, and what will its height be then?

Question 7

- a) A car travels up a hill with the speed shown in the graph. (i) Compute the total distance the car moves until it stops at $t = 60 \text{ s}$. (ii) Plot the $a - t$ graph.



Question 8

Three coplanar forces of magnitudes $F \text{ N}$, 12 N and 15 N are in equilibrium acting at a point P in the directions shown in the diagram. Find α and F .

