PHYSICS 534

ANSWERS

EXE -27 Kinematics Part-4/ 4

Robert Millikan received the Nobel prize for physics in 1923 for his investigations into the elementary charge of electricity.

MILLIKAN

1. A car travels at a constant velocity of 100 km/h for 30 minutes. Determine:
(↳ ***Note***: Express the velocity in km/h)

a) The initial velocity **100 km/h**

b) The final velocity **100 km/h**

c) The average velocity **100 km/h**

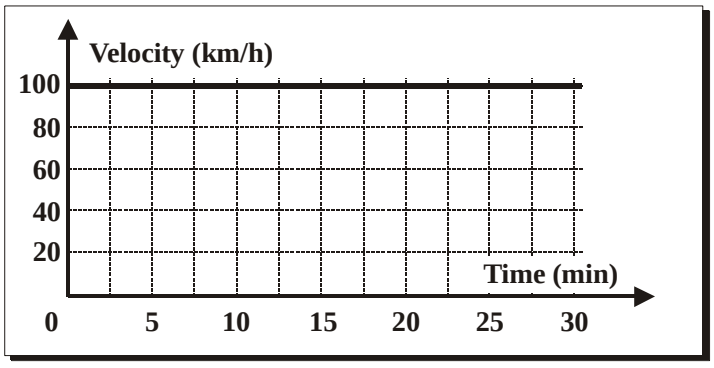
d) The distance traveled **50 km**

e) The acceleration **0**

f) In a velocity vs time graph, what does the slope represent? **Acceleration**

g) In a velocity vs time graph, what does the area under the curve represent? **Distance traveled**

h) Plot the velocity vs time for the car.



i) What is the slope of the curve you plotted?

0

j) What does the slope of your curve represent?

Acceleration

2. Starting from rest, a vehicle accelerates uniformly at a rate of 10 m/s^2 for 12 s. Determine the following: (↳ ***Note***: Express the velocity in m/s)

a) The initial velocity **0**

b) The final velocity **120 m/s** $a = \frac{\Delta v}{t}$ or $a = \frac{v_f - v_i}{t}$

$\therefore v_f = at + v_i = (10\ m/s^2)(12\ s) + 0 = 120\ m/s$

c) The average velocity **60 m/s** $v_a = \frac{v_f + v_i}{2} = \frac{120\ m/s + 0}{2} = 60\ m/s$

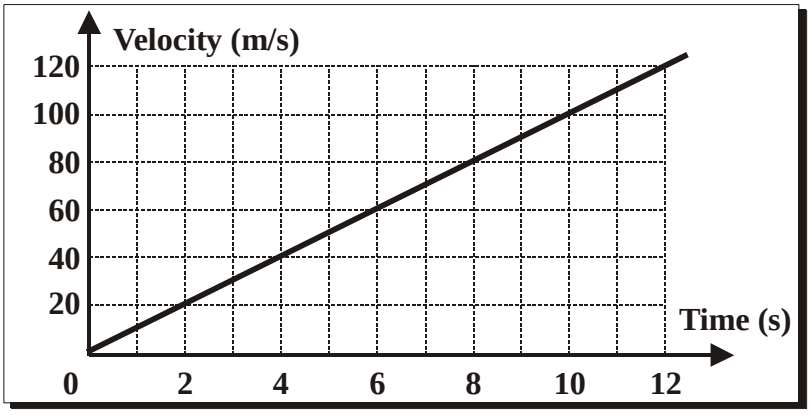
d) The distance traveled **720 m** $s = v_a t = (60\ m/s)(12\ s) = 720\ m$

e) The acceleration **10 m/s^2** (Given)

f) In a velocity vs time graph, what does the slope represent? **Acceleration**

h) In a velocity vs time graph, what does the area under the curve represent? **Distance traveled**

h) Plot the velocity vs time for the car



i) What is the slope of the curve you plotted? **10**

3. Starting from rest, a vehicle accelerates uniformly at 12 m/s^2. After 10 seconds, calculate:

a) The final velocity.

$$a = \frac{\Delta v}{t} \quad \text{or} \quad a = \frac{v_f - v_i}{t}$$

$$\therefore v_f = at + v_i = (12\ m/s^2)(10\ s) + 0 = 120\ m/s$$

b) The average velocity.

$$v_a = \frac{v_f + v_i}{2} = \frac{120\ m/s) + 0}{2} = 60\ m/s$$

c) The distance the car traveled.

$$s = v_a\, t = (60\ m/s)(10\ s) = 600\ m$$

4. Starting from rest, a truck reaches a speed of 50 km/h in 10 seconds. What is the acceleration of the truck in km/h/s?

$$a = \frac{\Delta v}{t} = \frac{v_f - v_i}{t} = \frac{50\ km/h - 0}{10\ s} = 5\ km/h/s$$

5. A vehicle traveling at 45 m/s accelerates for 5 seconds to a speed of 60 m/s. Find:

a) The average velocity.

$$v_a = \frac{v_f + v_i}{2} = \frac{60\ m/s + 45\ m/s}{2} = 52.5\ m/s$$

b) The distance it traveled during the acceleration.

$$s = v_a t = (52.5\ m/s)(5\ s) = 262.5\ m$$

6. Starting from rest, an object is given an acceleration of 5 m/s^2 for 3 seconds. Determine:

a) Its speed at the end of the three seconds.

$$a = \frac{\Delta v}{t} \quad \text{or} \quad a = \frac{v_f - v_i}{t}$$
$$\therefore v_f = at + v_i = (5\ m/s^2)(3\ s) + 0 = 15\ m/s$$

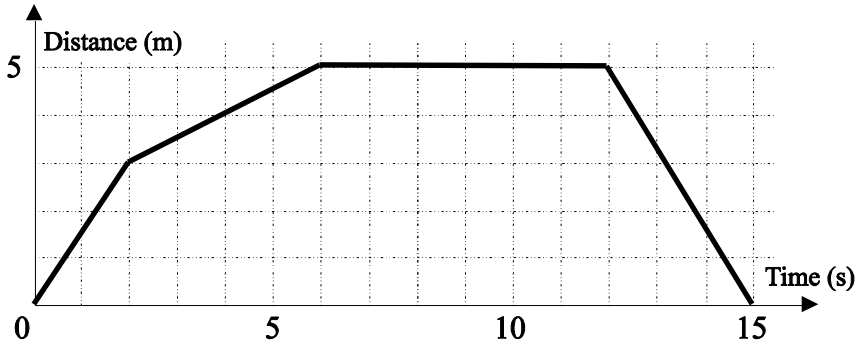
b) The distance traveled during the ***second*** second.

Note: During the second second means from $t_i = 1\ s$ to $t_f = 2\ s$

At t_i, $v_i = 5\ m/s$ and at t_f, $v_f = 10\ m/s$

$$\text{Since, } v_a = \frac{v_f + v_i}{2} = \frac{10\ m/s + 5\ m/s}{2} = \frac{15\ m/s}{2} = 7.5\ m/s$$
$$\therefore\ s = v_a t = (7.5\ m/s)(1\ s) = 7.5\ m$$

7. The following graph represents the ***distance-time*** curve of a cart.
With reference to this graph, answer the questions below:



a) The distance at time t = 2 s. **3 m**

b) The distance at time t = 4 s. **4 m**

c) The distance at time t = 6 s. **5 m**

d) The distance at time t = 10 s. **5 m**

e) The distance at time t = 15 s. **0**

Read from the y-axis

f) The velocity at time t = 1 s. **1.5 m/s**

g) The velocity at time t = 3 s. **0.5 m/s**

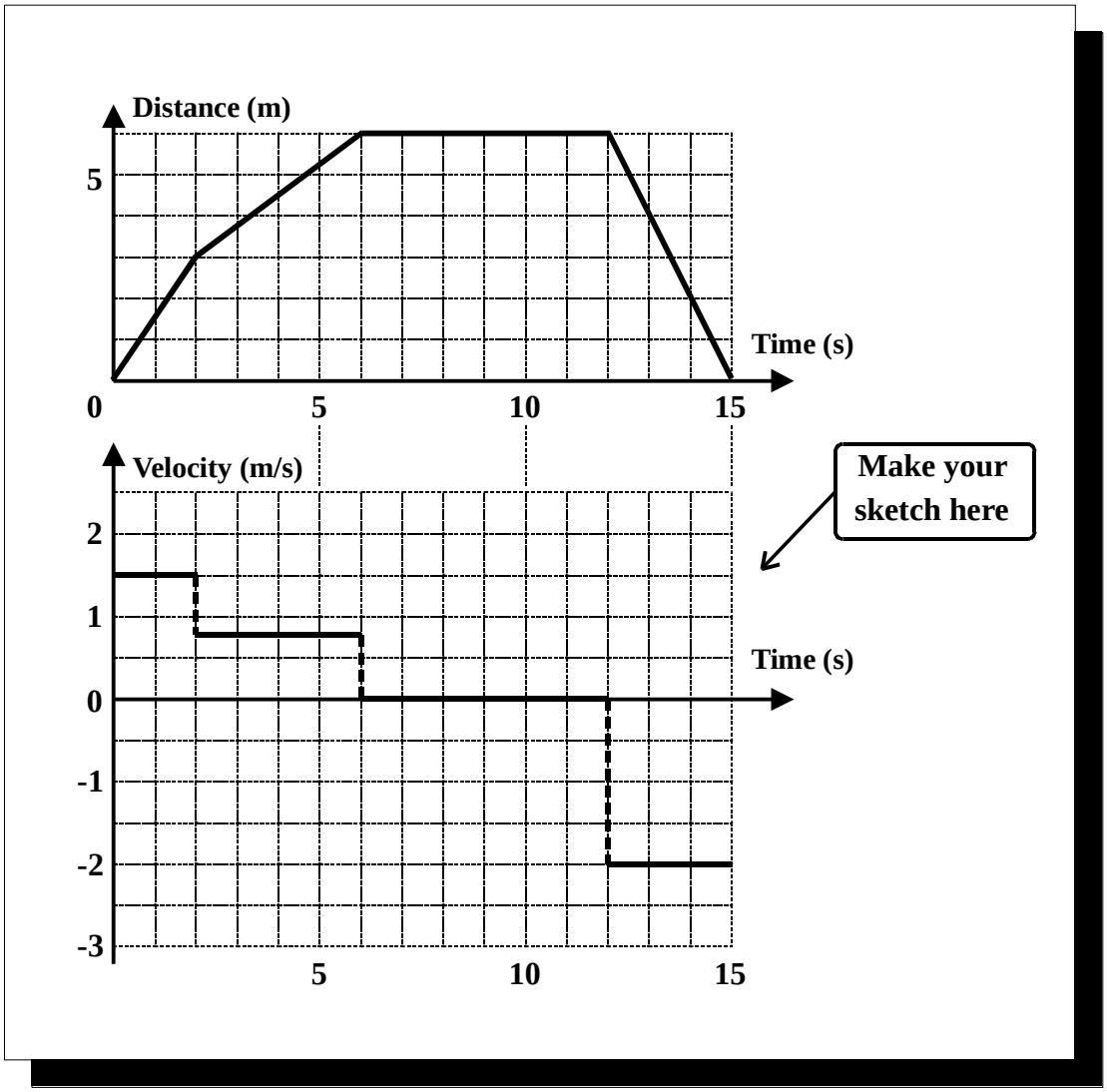
h) The velocity at time t = 7 s. **0**

i) The velocity at time t = 10 s **0**

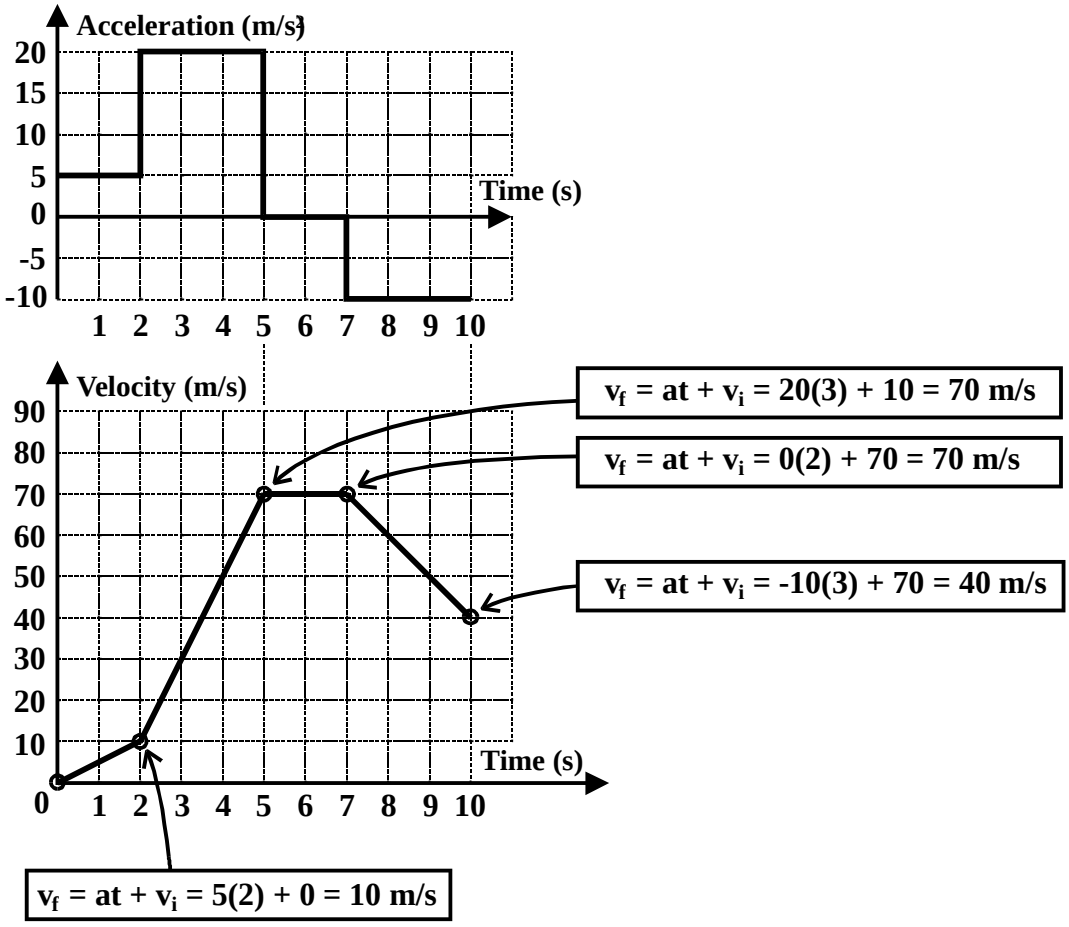
j) The velocity at time t = 14 s. **-1.6 m/s**

Find the slope

8. Using the distance-time graph from the previous problem, sketch the ***velocity-time*** curve of the cart.



9. Starting from rest, the motion of a vehicle has the following ***acceleration-time*** graph. With reference to this graph, sketch the ***velocity-time*** curve of this vehicle.



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