

Practice with the 3 Formulas

$$\textcircled{1} \quad v_f = v_i + a \Delta t$$

$$\textcircled{2} \quad \Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$\textcircled{3} \quad v_f^2 = v_i^2 + 2a \Delta x$$

v_f = final velocity (m/s)

v_i = initial velocity (m/s)

a = acceleration (m/s²)

Δt = time (s)

Δx = displacement (m)

For each problem, write your given information, then choose which formula to use based on what you know and what you are trying to solve.

Example ①

A truck starts from rest and accelerates uniformly at 2 m/s² for 8 seconds. How far does it travel?

Given:

$$v_i = 0$$

$$a = 2 \text{ m/s}^2$$

$$\Delta t = 8 \text{ s}$$

$$\Delta x = ?$$

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$\Delta x = 0 + \frac{1}{2} (2) (8)^2$$

$$\boxed{\Delta x = 64 \text{ m}}$$

Example ②

A car traveling at 30 m/s slams on its brakes and slows down at a rate of 5 m/s². How far does it travel before stopping?

Given:

$$v_i = 30 \text{ m/s}$$

$$a = -5 \text{ m/s}^2$$

$$v_f = 0$$

$$\Delta x = ?$$

$$v_f^2 = v_i^2 + 2a \Delta x$$

$$0 = 30^2 + 2(-5) \Delta x$$

$$-900 = -10x$$

$$\boxed{x = 90 \text{ m}}$$

Example ③

A person walking in a dark alley accelerates at 0.8 m/s^2 for 4 seconds after hearing a noise behind him. If his final velocity is 5.2 m/s , what was his initial walking speed?

Given:

$$a = 0.8 \text{ m/s}^2$$

$$\Delta t = 4 \text{ s}$$

$$v_f = 5.2 \text{ m/s}$$

$$v_i = ?$$

$$v_f = v_i + a \Delta t$$

$$5.2 = v_i + 0.8(4)$$

$$5.2 = v_i + 3.2$$

$$\begin{array}{r} -3.2 \\ -3.2 \end{array}$$

$$\boxed{v_i = 2.0 \text{ m/s}}$$

Example ④

A ball starts from rest and rolls down a 3 meter long ramp and attains a final velocity of 4.2 m/s .

A) What is the ball's average velocity?

Given:

$$v_i = 0$$

$$\Delta x = 3 \text{ m}$$

$$v_f = 4.2 \text{ m/s}$$

$$\bar{v} = ?$$

$$\bar{v} = \frac{v_i + v_f}{2} = \frac{0 + 4.2}{2} = \boxed{2.1 \text{ m/s}}$$

B) What is the ball's acceleration down the ramp?

Given:

$$v_i = 0$$

$$\Delta x = 3 \text{ m}$$

$$v_f = 4.2 \text{ m/s}$$

$$a = ?$$

$$v_f^2 = v_i^2 + 2a\Delta x$$

$$4.2^2 = 0 + 2a(3)$$

$$17.6 = 6a$$

$$\boxed{a = 2.9 \text{ m/s}^2}$$

* You can also solve c) first and then use

$$a = \frac{\Delta v}{\Delta t}$$

C) How long does it take the ball to roll down the ramp?

Given:

$$v_i = 0$$

$$\Delta x = 3 \text{ m}$$

$$v_f = 4.2 \text{ m/s}$$

$$\bar{v} = 2.1 \text{ m/s}$$

$$a = 2.9 \text{ m/s}^2$$

Option 1

$$v_f = v_i + a\Delta t$$

$$4.2 = 0 + 2.9\Delta t$$

$$\Delta t = 1.4 \text{ s}$$

Option 2

$$\bar{v} = \frac{\Delta x}{\Delta t} \rightarrow \Delta t = \frac{\Delta x}{\bar{v}}$$

$$\Delta t = \frac{3}{2.1} = 1.4 \text{ s}$$

Answers

- 64 m
- 90 m
- 2 m/s
- 2.1 m/s, 2.9 m/s², 1.4 s