

2d kinematics problems with solutions pdf

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2D Kinematics Problems with Solutions

Kinematics is the branch of physics that deals with the motion of objects without considering the forces that cause the motion. 2D kinematics problems involve the motion of objects in two dimensions, typically the horizontal and vertical directions.

Question 1: A ball is thrown horizontally with a speed of 10 m/s. What is the vertical component of its velocity after 2 seconds? ($g = 9.8 \text{ m/s}^2$)

Answer: The vertical component of velocity is given by:

$$v = u + at$$

where:

- v is the final velocity
- u is the initial velocity
- a is the acceleration due to gravity (9.8 m/s^2)
- t is the time

Substituting the values:

$$v = 0 + (9.8 \text{ m/s}^2) * 2 \text{ s}$$

$$v = 19.6 \text{ m/s}$$

Question 2: A car travels at a constant speed of 60 km/h for 2 hours. What is the distance traveled by the car?

Answer: Distance traveled is given by:

$$\text{distance} = \text{speed} * \text{time}$$

Converting the speed to meters per second:

$$\text{speed} = 60 \text{ km/h} * (1000 \text{ m/km}) * (1 \text{ h}/3600 \text{ s})$$

$$\text{speed} = 16.67 \text{ m/s}$$

Substituting the values:

$$\text{distance} = 16.67 \text{ m/s} * 2 \text{ h} * (3600 \text{ s/h})$$

$$\text{distance} = 120,000 \text{ m}$$

Question 3: A projectile is launched at an angle of 60 degrees to the horizontal with a speed of 50 m/s. What is its horizontal displacement after 1 second?

Answer: Horizontal displacement is given by:

$$\text{horizontal displacement} = \text{speed} * \text{time} * \cos(\text{angle})$$

Substituting the values:

$$\text{horizontal displacement} = 50 \text{ m/s} * 1 \text{ s} * \cos(60^\circ)$$

$$\text{horizontal displacement} = 25 \text{ m}$$

Question 4: A ball is dropped from a height of 50 meters. What is its velocity just before it hits the ground? ($g = 9.8 \text{ m/s}^2$)

Answer: Velocity just before hitting the ground is given by:

$$v = \sqrt{2gh}$$

where:

- v is the velocity
- g is the acceleration due to gravity (9.8 m/s^2)
- h is the height

Substituting the values:

$$v = \sqrt{2 * 9.8 \text{ m/s}^2 * 50 \text{ m}}$$

$$v = 31.3 \text{ m/s}$$

Question 5: A car is traveling at a speed of 50 km/h when it applies the brakes. The car comes to a stop in 10 seconds. What is the acceleration of the car?

Answer: Acceleration is given by:

$$\text{acceleration} = (\text{final velocity} - \text{initial velocity}) / \text{time}$$

Converting the speed to meters per second:

$$\text{speed} = 50 \text{ km/h} * (1000 \text{ m/km}) * (1 \text{ h}/3600 \text{ s})$$

$$\text{speed} = 13.89 \text{ m/s}$$

Substituting the values:

$$\text{acceleration} = (0 - 13.89 \text{ m/s}) / 10 \text{ s}$$

$$\text{acceleration} = -1.39 \text{ m/s}^2$$

The negative sign indicates that the car is decelerating.

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