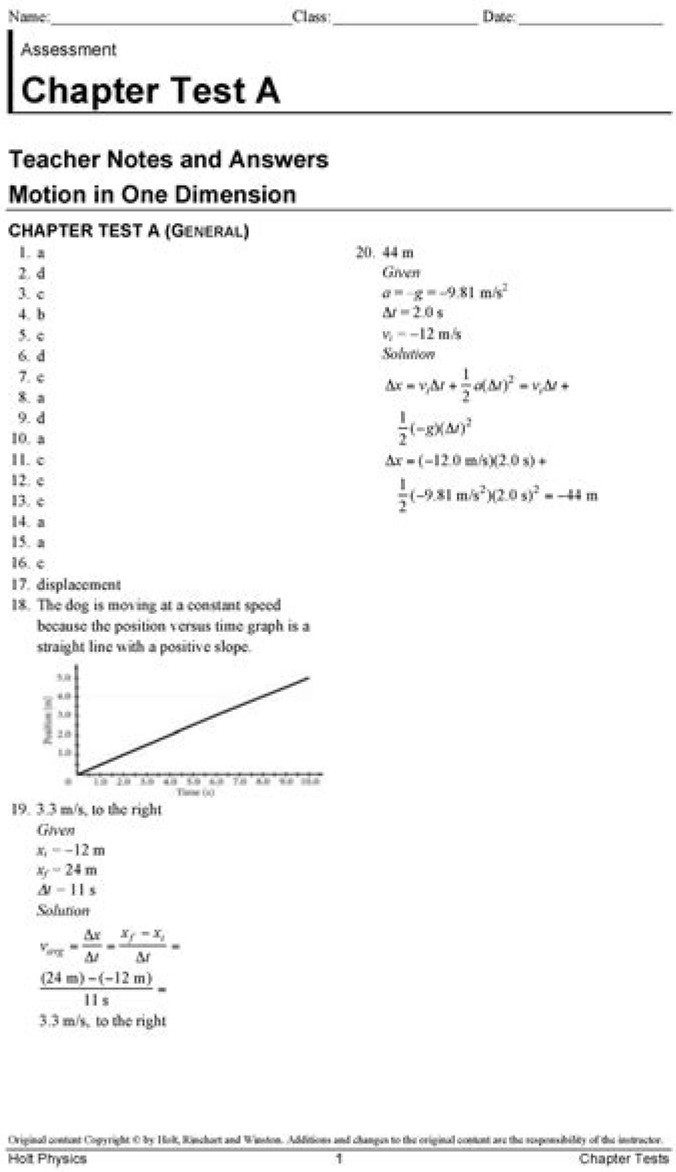
Chapter 2 Motion In One Dimension Answer Key



Name:______________ Class:__________ Date:__________

Assessment

Chapter Test A

Teacher Notes and Answers

Motion in One Dimension

CHAPTER TEST A (GENERAL)

1. a
2. d
3. c
4. b
5. c
6. d
7. c
8. a
9. d
10. a
11. c
12. c
13. c
14. a
15. a
16. c
17. displacement
18. The dog is moving at a constant speed because the position versus time graph is a straight line with a positive slope.
19. 3.3 m/s, to the right

    Given

    $x_i = -12$ m

    $x_f = 24$ m

    $\Delta t = 11$ s

    Solution

    $v_{avg} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{\Delta t} =$

    $\frac{(24 \text{ m}) - (-12 \text{ m})}{11 \text{ s}} =$

    3.3 m/s, to the right
20. 44 m

    Given

    $a = -g = -9.81 \text{ m/s}^2$

    $\Delta t = 2.0$ s

    $v_i = -12$ m/s

    Solution

    $\Delta x = v_i \Delta t + \frac{1}{2} a(\Delta t)^2 = v_i \Delta t + \frac{1}{2}(-g)(\Delta t)^2$

    $\Delta x = (-12.0 \text{ m/s})(2.0 \text{ s}) + \frac{1}{2}(-9.81 \text{ m/s}^2)(2.0 \text{ s})^2 = -44$ m

Chapter 2 Motion in One Dimension Answer Key is a crucial resource for students studying physics, particularly in understanding the fundamental concepts of motion. This chapter typically covers the basics of kinematics, which involves the study of motion without considering the forces that cause it. In this article, we will explore the key concepts, equations, and problem-solving techniques related to motion in one dimension. We will also provide an answer key to common problems found in this chapter, offering explanations and insights into each solution.

Understanding Motion in One Dimension

Motion in one dimension refers to the movement of an object along a straight line. This concept can be broken down into several key components:

- **Displacement:** The change in position of an object. It is a vector quantity, meaning it has both magnitude and direction.
- **Distance:** The total length of the path traveled by an object. Unlike displacement, distance is a scalar quantity and only has magnitude.
- **Speed:** The rate at which an object covers distance. It is a scalar quantity and is calculated as distance divided by time.
- **Velocity:** The rate at which an object changes its position. It is a vector quantity, calculated as displacement divided by time.
- **Acceleration:** The rate at which an object changes its velocity. It can be positive (speeding up) or negative (slowing down) and is also a vector quantity.

Understanding these fundamental concepts is essential for solving problems related to motion in one dimension.

Kinematic Equations

Kinematics provides a set of equations that relate displacement, velocity, acceleration, and time. These equations are critical for solving problems involving uniformly accelerated motion. The four main kinematic equations are:

1. $v = u + at$
Where:
- v = final velocity
- u = initial velocity
- a = acceleration
- t = time

2. $s = ut + \frac{1}{2}at^2$
Where:
- s = displacement

3. $v^2 = u^2 + 2as$

4. $s = \frac{(u + v)}{2} t$

These equations allow students to analyze motion under various conditions, such as constant acceleration.

Common Problems and Solutions in Motion

In Chapter 2, students often encounter a variety of problems that test their understanding of motion in one dimension. Below are some common types of problems along with their solutions.

1. Calculating Displacement

Problem: A car starts from rest and accelerates uniformly at $2 \, \text{m/s}^2$ for 5 seconds. What is the displacement of the car during this time?

Solution:
Using the equation:
$$ s = ut + \frac{1}{2}at^2 $$
Where:
- $u = 0 \, \text{m/s}$ (initial velocity)
- $a = 2 \, \text{m/s}^2$
- $t = 5 \, \text{s}$

Plugging in the values:
$$ s = 0 \cdot 5 + \frac{1}{2} \cdot 2 \cdot (5)^2 $$
$$ s = 0 + 0.5 \cdot 2 \cdot 25 $$
$$ s = 25 \, \text{m} $$

The displacement of the car is $25 \, \text{m}$.

2. Finding Final Velocity

Problem: A cyclist is traveling at a speed of $10 \, \text{m/s}$ and accelerates at a rate of $1 \, \text{m/s}^2$ for 4 seconds. What is the cyclist's final velocity?

Solution:
Using the equation:
$$ v = u + at $$

Where:
- $u = 10 \, \text{m/s}$
- $a = 1 \, \text{m/s}^2$
- $t = 4 \, \text{s}$

Plugging in the values:
$$ v = 10 + 1 \cdot 4 $$
$$ v = 10 + 4 $$
$$ v = 14 \, \text{m/s} $$

The final velocity of the cyclist is $14 \, \text{m/s}$.

3. Calculating Acceleration

Problem: A train moving at $20 \, \text{m/s}$ comes to a stop in 10 seconds. What is the acceleration of the train?

Solution:
Using the equation:
$$ a = \frac{v - u}{t} $$

Where:
- $v = 0 \, \text{m/s}$ (final velocity)
- $u = 20 \, \text{m/s}$
- $t = 10 \, \text{s}$

Plugging in the values:
$$ a = \frac{0 - 20}{10} $$
$$ a = \frac{-20}{10} $$
$$ a = -2 \, \text{m/s}^2 $$

The acceleration of the train is $-2 \, \text{m/s}^2$, indicating it is decelerating.

Important Tips for Solving Motion Problems

1. Identify Known and Unknown Variables: Before solving a problem, identify what is given and what you need to find. This will help you choose the appropriate kinematic equation.

2. Use a Consistent Unit System: Ensure that all your measurements are in compatible units (e.g., meters for distance, seconds for time).

3. Draw a Diagram: For complex problems, drawing a diagram can help visualize the situation and clarify the relationships between different quantities.

4. Check Your Work: After obtaining a solution, review your calculations and ensure that your answer makes physical sense in the context of the problem.

Conclusion

Chapter 2 Motion in One Dimension Answer Key is not just a list of answers but a guide to understanding the principles of motion. Mastering the concepts of displacement, velocity, acceleration, and the kinematic equations is essential for solving problems in physics. By practicing these types of problems and following the tips outlined in this article, students can strengthen their grasp of motion in one dimension and prepare effectively for assessments in physics.

Frequently Asked Questions

What is the definition of motion in one dimension?

Motion in one dimension refers to the movement of an object along a straight line, where only one coordinate is needed to describe its position.

What are the key equations of motion in one dimension?

The key equations include: 1) $v = u + at$, 2) $s = ut + 1/2\ at^2$, 3) $v^2 = u^2 + 2as$, where v is final velocity, u is initial velocity, a is acceleration, s is displacement, and t is time.

How do you calculate displacement in one-dimensional motion?

Displacement can be calculated using the formula $s = ut + 1/2\ at^2$, where 's' is displacement, 'u' is initial velocity, 'a' is acceleration, and 't' is time.

What is the difference between speed and velocity?

Speed is a scalar quantity representing how fast an object moves, while velocity is a vector quantity that includes both speed and direction.

What does uniform acceleration mean?

Uniform acceleration means that the object's acceleration remains constant over time as it moves in one dimension.

How can graphical representations help in understanding motion in one dimension?

Graphs, such as position-time and velocity-time graphs, visually represent the motion, allowing for easy interpretation of speed, direction, and changes in motion.

What is free fall and how does it relate to motion in one dimension?

Free fall refers to the motion of an object under the influence of gravity alone, typically modeled as one-dimensional motion with constant acceleration downwards.

What role does time play in one-dimensional motion?

Time is a crucial variable in one-dimensional motion equations, affecting displacement, velocity, and acceleration calculations.

How do initial and final velocities affect motion in one dimension?

Initial and final velocities are used in motion equations to determine the change in speed and the displacement of an object over time.

What are the implications of negative acceleration in one-dimensional motion?

Negative acceleration implies that the object is slowing down, which can indicate a deceleration in the direction of motion or an increase in speed in the opposite direction.

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