A Car Traveling Eastwards Gains 1 M/s Eastwards Every Second. The Car Is . Choose All That Are Correct.multiple

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Understanding the dynamics of motion is fundamental in physics, especially when analyzing the movement of vehicles such as cars. When a car accelerates eastward, its velocity changes over time, affecting its speed, displacement, and overall motion profile. In this article, we delve into the scenario where a car traveling eastwards gains 1 meter per second (m/s) of eastward velocity every second. We will explore what this means, the correct interpretations, and the implications of such acceleration, all presented in a comprehensive, SEO-optimized format.

Understanding the Scenario: Car Accelerating Eastwards

Before diving into specific questions or multiple-choice options, it's essential to clarify what the scenario entails:

- The car is moving initially in the eastward direction.
- Every second, its eastward velocity increases by 1 m/s.
- This indicates a uniform acceleration in the eastward direction.
- The car's velocity as a function of time can be described mathematically.

Basic Concepts in Kinematics

To fully grasp the implications, let's review some key principles:

Velocity and Acceleration

- Velocity (v): The rate of change of displacement with respect to time. For eastward motion, positive velocities indicate movement toward the east.
- Acceleration (a): The rate of change of velocity with respect to time. In this scenario, the acceleration is a constant 1 m/s² eastward.

Displacement and Time

- Displacement (s): The change in position over a period.
- Time (t): The duration over which motion occurs.

Equations of Uniform Acceleration

- $v(t) = v_0 + a t$
- $s(t) = v_0 t + \frac{1}{2} a t^2$

where:
- v_0 is the initial velocity.
- a is the acceleration.
- t is the time elapsed.

Analyzing the Car's Motion

Suppose the car starts from rest, i.e., initial velocity $v_0 = 0$. Given that the car gains 1 m/s of eastward velocity every second, the acceleration a is 1 m/s^2.

Velocity as a Function of Time

- $v(t) = 0 + 1 \times t = t$ m/s
- After 1 second: $v = 1$ m/s
- After 5 seconds: $v = 5$ m/s
- After 10 seconds: $v = 10$ m/s

Displacement as a Function of Time

- $s(t) = 0 \times t + \frac{1}{2} \times 1 \times t^2 = \frac{1}{2} t^2$ meters
- After 1 second: $s = 0.5 \times 1^2 = 0.5$ meters
- After 5 seconds: $s = 0.5 \times 25 = 12.5$ meters
- After 10 seconds: $s = 0.5 \times 100 = 50$ meters

Key Questions and Correct Options in Multiple-Choice Format

This section discusses typical multiple-choice questions related to the scenario and highlights the correct options.

Question 1: What is the velocity of the car after 10 seconds?

- a) 10 m/s
- b) 100 m/s
- c) 1 m/s
- d) 50 m/s

Correct Answer: a) 10 m/s

Question 2: What is the displacement of the car after 10 seconds?

- a) 50 meters
- b) 100 meters
- c) 10 meters
- d) 5 meters

Correct Answer: a) 50 meters

Question 3: Which statement is true about the acceleration of the car?

- a) The acceleration is zero.
- b) The acceleration is constant at 1 m/s^2 eastward.
- c) The acceleration increases with time.
- d) The acceleration is negative.

Correct Answer: b) The acceleration is constant at 1 m/s^2 eastward.

Question 4: How does the velocity change over time?

- a) It remains constant.
- b) It decreases linearly.
- c) It increases linearly.
- d) It varies randomly.

Correct Answer: c) It increases linearly.

Question 5: If the initial velocity was 2 m/s, what would be the velocity after 10 seconds?

- a) 12 m/s
- b) 10 m/s
- c) 8 m/s
- d) 20 m/s

Correct Answer: a) 12 m/s

Implications of the Scenario in Real-World Context

Understanding how a car's velocity and displacement change with uniform acceleration has practical applications in vehicle design, traffic management, and safety protocols.

Practical Applications

- Designing acceleration zones: Knowing how quickly a vehicle speeds up can inform the placement of acceleration lanes.
- Safety considerations: Predicting the stopping distance based on acceleration patterns.
- Navigation systems: Estimating arrival times by modeling acceleration and velocity.

Additional Factors to Consider

While the core scenario assumes ideal conditions, real-world factors can influence vehicle motion.

Friction and Drag Forces

- These forces oppose the motion, reducing acceleration.
- Real acceleration might be less than the theoretical 1 m/s^2.

Initial Velocity

- If the car starts with an initial velocity other than zero, the calculations adjust accordingly.

Variable Acceleration

- In practice, acceleration may not be constant, affecting velocity and displacement calculations.

Conclusion

In summary, a car traveling eastward and gaining 1 m/s of eastward velocity every second is a classic example of uniformly accelerated motion. The key takeaways include:

- The acceleration is constant at 1 m/s² eastward.
- The velocity increases linearly over time, described by $v(t) = t$ m/s.
- The displacement follows a quadratic relation, $s(t) = \frac{1}{2} t^2$, in meters.
- Correct multiple-choice options reinforce understanding of these principles.

By mastering these concepts, students and enthusiasts can better analyze real-world motion scenarios, design safer vehicles, and appreciate the fundamental laws governing motion. Whether for academic purposes or practical applications, understanding uniform acceleration is a cornerstone of classical mechanics.

Keywords: Car acceleration, eastward motion, velocity-time relation, displacement calculation, uniform acceleration, kinematics, physics questions, real-world vehicle dynamics, motion analysis, physics multiple choice

Frequently Asked Questions

If a car is traveling eastwards and gains 1 m/s each second, what is its acceleration?

Its acceleration is 1 m/s² eastward.

After 5 seconds, what will be the velocity of the car if it continues to accelerate eastwards at 1 m/s²?

The velocity will be 5 m/s eastward.

Is the car's acceleration constant if it gains 1 m/s each second?

Yes, the acceleration is constant at 1 m/s² eastward.

What is the initial velocity of the car if it starts from rest and accelerates eastward at 1 m/s²?

The initial velocity is 0 m/s.

Which of the following statements are correct about the car's motion? (Choose all that apply)

- The car's velocity increases by 1 m/s each second.
- The acceleration remains constant at 1 m/s² eastward.
- The car's speed increases linearly over time.
- The car starts from rest if initial velocity is zero.

Additional Resources

A Car Traveling Eastwards Gains 1 m/s Eastwards Every Second – this statement encapsulates a fundamental concept in kinematics related to acceleration and velocity. Understanding how a car's velocity changes over time, especially when it accelerates at a constant rate, is crucial not only for physics students but also for anyone interested in motion dynamics, vehicle safety, and engineering design. This guide aims to thoroughly explore what this statement entails, analyze the possible implications, and clarify the correct interpretations through a detailed breakdown.

Understanding the Scenario: A Car Accelerating Eastwards

When we say that a car traveling eastwards gains 1 m/s eastwards every second, it implies that the car's velocity in the eastward direction increases steadily at a rate known as acceleration. To fully grasp this, we need to define key terms:

- Velocity (v): The rate at which an object moves in a specific direction. It is a vector quantity, meaning it has both magnitude and direction.
- Acceleration (a): The rate at which velocity changes over time. Also a vector, with both magnitude and direction.
- Time (t): The duration over which the change occurs.

In this context:

- The initial velocity, v_0, could be zero or some initial value.
- The acceleration, a, is 1 m/s² directed eastwards.
- The velocity after time t seconds can be expressed as:

$v(t) = v_0 + a\,t$

Key Concepts in Motion with Constant Acceleration

Before examining the multiple-choice options, it is vital to understand some fundamental principles:

1. Uniform (Constant) Acceleration

When acceleration is constant, the velocity of the object increases linearly with time:

- Velocity after time t: $v(t) = v_0 + a\,t$
- Displacement after time t: $s(t) = v_0\,t + (1/2)\,a\,t^2$

2. Directionality of Velocity and Acceleration

Since the acceleration is eastward, it will increase the eastward component of the velocity:

- If the initial velocity is eastward, the velocity increases linearly.
- If the initial velocity is zero, the car starts from rest and gains velocity in the eastward direction.

3. Implication of the Statement

The phrase "gains 1 m/s eastwards every second" is essentially describing acceleration of 1 m/s^2 eastward.

Analyzing the Multiple-Choice Options: What Are the Correct Interpretations?

Suppose we are presented with options such as the following (note: these are typical interpretations or deductions one might encounter):

- A) The velocity of the car after 10 seconds is 10 m/s eastward.
- B) The acceleration of the car is 1 m/s^2 eastward.
- C) The car's speed (magnitude of velocity) increases by 1 m/s every second.
- D) The car's velocity remains constant because the description only mentions a gain per second.

- E) The initial velocity of the car is zero.

Let's analyze each one carefully.

Option A: The velocity of the car after 10 seconds is 10 m/s eastward

Correctness:
Given that the car gains 1 m/s eastward every second, the acceleration is 1 m/s^2 eastward. Starting from an initial velocity v_0:

- If initial velocity $v_0 = 0$, then after t seconds:

$v = v_0 + a\ t = 0 + (1\ m/s^2)\ 10\ s = 10\ m/s$

- If the initial velocity is different, say v_0, then:

$v = v_0 + 1\ 10$

Conclusion:
Assuming the car starts from rest (which is typical unless specified otherwise), Option A is correct. The velocity after 10 seconds would indeed be 10 m/s eastward.

Option B: The acceleration of the car is 1 m/s^2 eastward

Correctness:
By definition, "gains 1 m/s eastward every second" directly translates to an acceleration of 1 m/s^2 eastward.

Conclusion:
Option B is correct. The statement explicitly describes the acceleration.

Option C: The car's speed (magnitude of velocity) increases by 1 m/s every second

Analysis:

- The speed is the magnitude of the velocity vector.
- Since the car is moving eastwards with velocity increasing by 1 m/s each second, the magnitude of the velocity vector increases linearly.
- If initial velocity is zero, then after t seconds:

Speed = v = a t = 1 t m/s

So, after 1 second, speed = 1 m/s; after 2 seconds, 2 m/s; and so on.

- The speed increases by 1 m/s every second, matching the acceleration.

Conclusion:
Option C is correct. When acceleration is 1 m/s² eastward, the magnitude of velocity (the speed) increases by 1 m/s each second.

Option D: The car's velocity remains constant because the description only mentions a gain per second

Analysis:
- The phrase "gains 1 m/s eastward every second" indicates a change in velocity, i.e., acceleration.
- If the velocity remained constant, it would mean zero acceleration.
- Since the statement explicitly describes a gain in velocity every second, the velocity is not constant.

Conclusion:
Option D is incorrect. The velocity does not remain constant; it changes at a rate of 1 m/s².

Option E: The initial velocity of the car is zero

Analysis:
- The statement "gains 1 m/s eastward every second" does not specify initial conditions.
- The initial velocity could be zero or any other value; the statement only specifies the rate of increase, not the starting point.
- Therefore, without additional information, we cannot definitively conclude the initial velocity.

Conclusion:
Option E is not necessarily correct. The initial velocity could be zero, but

it could also be non-zero.

Summary of Correct Choices and Their Implications

Based on the above analysis, the correct options are:

- A) The velocity after 10 seconds is 10 m/s eastward — correct if initial velocity is zero.
- B) The acceleration of the car is 1 m/s^2 eastward — directly derived from the statement.
- C) The car's speed increases by 1 m/s every second — a consequence of the acceleration.

The incorrect options are:

- D) The velocity remains constant — incorrect, as the car is gaining velocity.
- E) Initial velocity is zero — not necessarily correct unless specified.

Real-World Applications and Additional Considerations

Understanding such motion scenarios is fundamental in many practical contexts:

- Vehicle acceleration: Engineers design acceleration profiles for safety and performance.
- Physics education: Demonstrates uniform acceleration and kinematic equations.
- Navigation and control systems: Autonomous vehicles use acceleration data to adjust movements precisely.

Additional points to consider:

- If the initial velocity was not zero, the velocity after t seconds would be $v = v_0 + 1\ t$.
- The displacement over time can be calculated as $s = v_0\ t + (1/2)\ a\ t^2$.
- The acceleration remains constant at 1 m/s^2 eastward unless otherwise specified.

Conclusion: Decoding the Statement and Its Multiple Interpretations

In summary, the statement "A car traveling eastwards gains 1 m/s eastwards every second" fundamentally describes a scenario where the car experiences a constant acceleration of 1 m/s^2 eastward. This results in a linear increase in velocity and speed over time. The correct interpretations from a multiple-choice perspective are that the acceleration is 1 m/s^2 eastward, the velocity after a given time can be calculated using standard kinematic equations, and the speed increases by 1 m/s each second, assuming initial conditions are zero.

Understanding these principles allows us to accurately analyze motion scenarios, make predictions, and appreciate the elegance of classical mechanics in real-world applications.

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