A Person Went For A Walk. They Walked North 6 Km At 6 Km/h And Then West 10 Km At 5 Km/h. Determine The

A Person Went For A Walk. They Walked North 6 Km At 6 Km/h And Then West 10 Km At 5 Km/h. Determine The walking distance, total time taken, and the overall displacement from the starting point. In this comprehensive guide, we will explore the process of analyzing such a walking scenario using basic principles of physics and mathematics, including concepts like distance, speed, time, and vector displacement. Whether you're a student learning about motion or someone interested in real-world applications of these concepts, this article aims to provide clear explanations, detailed calculations, and helpful insights.

Understanding the Scenario: Walking Directions and Speeds

Before diving into calculations, it's essential to understand the setup of the walk and what information is provided.

Details of the Walk

- The person walks northward for a distance of 6 km at a speed of 6 km/h.
- Then, they walk westward for a distance of 10 km at a speed of 5 km/h.

Goals of the Analysis

- Calculate the total time spent walking.
- Determine the total distance traveled.
- Find the displacement vector, i.e., the straight-line distance from the starting point to the ending point.
- Understand how the directions and speeds influence the overall motion.

Calculating Time for Each Segment of the Walk

Time calculation is straightforward when you know the distance and speed:

\[

$$
\text{Time} = \frac{\text{Distance}}{\text{Speed}}
$$

Time for the Northward Walk

- Distance: 6 km
- Speed: 6 km/h

$$
t_{\text{north}} = \frac{6\, \text{km}}{6\, \text{km/h}} = 1\, \text{hour}
$$

Time for the Westward Walk

- Distance: 10 km
- Speed: 5 km/h

$$
t_{\text{west}} = \frac{10\, \text{km}}{5\, \text{km/h}} = 2\, \text{hours}
$$

Total Time Spent Walking

Adding both times:

$$
T_{\text{total}} = t_{\text{north}} + t_{\text{west}} = 1\, \text{hour} + 2\, \text{hours} = 3\, \text{hours}
$$

Calculating Total Distance Traveled

The total distance is simply the sum of the distances traveled in each segment:

$$
D_{\text{total}} = 6\, \text{km} + 10\, \text{km} = 16\, \text{km}
$$

This is the actual path length, regardless of the direction.

Analyzing Displacement: The Straight-Line Distance

While total distance measures the path traveled, displacement considers the straight-line distance from the starting point to the ending point, which is crucial for understanding the net change in position.

Representing Movement Using Vectors

To determine displacement, we model each walk segment as a vector:

- The northward movement as vector $\vec{A}$.
- The westward movement as vector $\vec{B}$.

Assuming the starting point is at the origin $(0,0)$:

$$
\vec{A} = (0, 6\, \text{km})
$$
$$
\vec{B} = (-10\, \text{km}, 0)
$$

Note: Moving north increases the y-coordinate; moving west decreases the x-coordinate.

Calculating the Final Position

Adding the vectors:

$$
\vec{R} = \vec{A} + \vec{B} = (0 + (-10), 6 + 0) = (-10\, \text{km}, 6\, \text{km})
$$

- The x-coordinate: $-10\, \text{km}$ (west of the starting point).
- The y-coordinate: $6\, \text{km}$ (north of the starting point).

Finding the Displacement Magnitude

Displacement is the straight-line distance from the starting point to the ending point, calculated by:

$$
|\vec{R}| = \sqrt{(-10)^2 + 6^2} = \sqrt{100 + 36} = \sqrt{136} \approx 11.66\, \text{km}
$$

Therefore, the person’s net displacement from the starting point is approximately 11.66 km directed northwest.

Direction of Displacement

To specify the direction, we compute the angle relative to the west axis:

$$
\theta = \arctan\left(\frac{\text{northward component}}{\text{westward component}}\right) = \arctan\left(\frac{6}{10}\right) \approx 30.96^\circ
$$

Since the x-component is negative (west), and the y-component is positive (north), the displacement vector points northwest, approximately 31 degrees north of west.

Summary of Calculations and Results

Parameter	Calculation	Result
Time for northward walk	$6 / 6$	1 hour
Time for westward walk	$10 / 5$	2 hours
Total walking time	sum	3 hours
Total distance traveled	$6 + 10$	16 km
Displacement magnitude	$\sqrt{(-10)^2 + 6^2}$	approx. 11.66 km
Displacement direction	$\arctan(6/10)$	31° north of west

Practical Applications of Motion Analysis in Walking Scenarios

Understanding how to analyze walking paths is useful in various fields:

1. Navigation and Map Reading

- Calculating the shortest path between two points.
- Determining the actual displacement when following a route.

2. Fitness and Exercise Tracking

- Measuring total distance versus effective displacement.
- Optimizing walking routes for efficiency.

3. Physics and Engineering Education

- Demonstrating vector addition and motion principles.
- Applying concepts of speed, distance, and time to real-world situations.

4. Outdoor Activities and Adventure Planning

- Planning routes considering displacement and total distance.
- Estimating travel time based on walking speeds.

Advanced Topics: Incorporating Variable Speeds and Directions

While this analysis assumes constant speeds and straight-line directions, real-world walking often involves variable speeds and directions. Some advanced considerations include:

- Variable Speeds: How changing pace affects total time.
- Curved Paths: Calculating displacement when paths are not straight.
- Elevation Changes: Considering uphill or downhill walking effects.
- Environmental Factors: Wind, terrain, and obstacles influencing movement.

In such cases, more complex mathematical tools like calculus and vector calculus are employed to model the motion accurately.

Conclusion: Putting It All Together

Analyzing a simple walking scenario involves understanding key concepts such as distance, speed, time, and displacement. In the case where a person walks north 6 km at 6 km/h, then west 10 km at 5 km/h, the calculations reveal that:

- The total walking time is 3 hours.
- The total distance traveled along the path is 16 km.
- The net displacement from the starting point is approximately 11.66 km directed northwest at about 31° north of west.

This analysis demonstrates how basic physics principles can be applied to practical situations, providing insights into movement patterns and spatial relationships. Whether for educational purposes, navigation, or personal fitness, understanding these concepts enhances our ability to interpret and analyze movement in everyday life.

Keywords for SEO Optimization:
walking scenario, displacement calculation, total walking time, vector addition, physics of walking, navigation, motion analysis, distance and displacement, walking speeds, real-world physics applications

Frequently Asked Questions

What is the total distance traveled by the person during their walk?

The person traveled a total of 6 km north and 10 km west, so the total distance is 6 km + 10 km = 16 km.

How long did the person take to walk north?

Walking 6 km at 6 km/h took 6 km / 6 km/h = 1 hour.

What was the time taken to walk west?

Walking 10 km at 5 km/h took 10 km / 5 km/h = 2 hours.

What is the total time spent walking?

Total time = 1 hour (north) + 2 hours (west) = 3 hours.

What is the straight-line distance from the starting point to the ending point?

Using the Pythagorean theorem, the distance is $\sqrt{(6^2 + 10^2)} = \sqrt{(36 + 100)} = \sqrt{136} \approx 11.66$ km.

In which direction is the person from their starting

point after the walk?

The person is approximately 11.66 km away in a direction northeast of the starting point.

What is the average speed of the person during the entire walk?

Total distance is 16 km over 3 hours, so average speed = 16 km / 3 hours ≈ 5.33 km/h.

Can you determine the person's final coordinates if they started at the origin?

Yes. Starting at (0,0), after walking north 6 km, they are at (0,6). Then, walking west 10 km, they end at (-10,6).

Additional Resources

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Introduction

Walking is a fundamental activity that combines physical exercise with orientation and navigation skills. From daily commutes to leisurely strolls, understanding the details behind even simple walks can reveal insights into distance, speed, direction, and time. In this article, we delve into a specific scenario: a person embarks on a walk involving two legs—first heading north, then turning west. Our goal is to analyze this journey comprehensively, calculating various parameters such as total time taken, the resultant displacement, and the overall distance traveled. This detailed exploration not only enhances our understanding of basic kinematics but also exemplifies how mathematical principles apply to real-world movements.

Understanding the Scenario

Overview of the Walk

The scenario involves a person performing a two-stage walk:

- First Stage: Walking north for 6 km at a speed of 6 km/h.
- Second Stage: Walking west for 10 km at a speed of 5 km/h.

The primary objective is to determine what? While the prompt is incomplete, typical questions in such problems relate to:

- Total time spent on the entire walk.
- The overall displacement from the starting point.
- The straight-line distance from the starting point to the endpoint.
- The direction of the resultant displacement.
- Possibly, the total distance traveled, and average speed.

Given the context, we will analyze these aspects step by step.

Breaking Down the Walk: Stage-by-Stage Analysis

First Stage: Walking North

Distance and Speed

- Distance (d_1): 6 km
- Speed (v_1): 6 km/h

Time Calculation

Time taken for the first stage can be determined using the fundamental relation:

$$ t_1 = \frac{d_1}{v_1} $$

Plugging in the values:

$$ t_1 = \frac{6\, \text{km}}{6\, \text{km/h}} = 1\, \text{hour} $$

Interpretation: The person spends exactly 1 hour walking north.

Second Stage: Walking West

Distance and Speed

- Distance (d_2): 10 km
- Speed (v_2): 5 km/h

Time Calculation

Similarly:

$$ t_2 = \frac{d_2}{v_2} = \frac{10\, \text{km}}{5\, \text{km/h}} = 2\, \text{hours} $$

Interpretation: The second leg of the walk lasts 2 hours.

Total Time Spent

Adding both stages:

$$ T_{total} = t_1 + t_2 = 1\, \text{hour} + 2\, \text{hours} = 3\, \text{hours} $$

Implication: The entire walk consumes three hours.

Calculating Total Distance Traveled

While the individual distances are given, the total distance traveled is simply the sum:

$$ D_{total} = d_1 + d_2 = 6\, \text{km} + 10\, \text{km} = 16\, \text{km} $$

Note: This is the actual path length, not the straight-line distance between start and end points.

Analyzing Displacement: Final Position Relative to the Starting Point

Concept of Displacement

Displacement refers to the shortest straight-line distance from the initial position to the final position, considering direction. It’s a vector quantity characterized by both magnitude and direction.

Step-by-Step Coordinate Approach

To analyze displacement, we model the walk on a coordinate system:

- Initial Point: Origin, (0,0)
- First Movement: North 6 km → Moves from (0,0) to (0,6)
- Second Movement: West 10 km → Moves from (0,6) to (-10,6)

Resultant Coordinates:

- Start: (0, 0)
- End: (-10, 6)

Calculating the Displacement Vector

The displacement vector $\vec{D}$ is from (0,0) to (-10,6):

$$
\vec{D} = (-10, 6)
$$

Magnitude of Displacement

Using the Pythagorean theorem:

$$
|\vec{D}| = \sqrt{(-10)^2 + 6^2} = \sqrt{100 + 36} = \sqrt{136} \approx 11.66\, \text{km}
$$

\]

Interpretation: The person’s final position is approximately 11.66 km away from the starting point in a direction that can be described relative to the coordinate axes.

Direction of Displacement

To specify the direction:

\[
\theta = \arctan{\left(\frac{\text{opposite}}{\text{adjacent}}\right)} = \arctan{\left(\frac{6}{-10}\right)} \approx \arctan(-0.6)
\]

Since the x-component is negative and y-component positive, the displacement points northwest.

Calculating:

\[
\theta \approx -30.96^\circ
\]

From the positive x-axis, the vector points approximately 30.96° north of west.

Additional Analytical Aspects

Average Speed Over the Entire Walk

Total distance:

\[D_{total} = 16\, \text{km} \]

Total time:

\[T_{total} = 3\, \text{hours} \]

Average speed:

\[
V_{avg} = \frac{D_{total}}{T_{total}} = \frac{16\, \text{km}}{3\, \text{hours}} \approx 5.33\, \text{km/h}
\]

Insight: Despite varying speeds during different segments, the overall average speed is approximately 5.33 km/h.

Total Work and Energy Considerations

While not explicitly requested, understanding the energy expenditure during such walks can be insightful:

- Walking at 6 km/h for 1 hour involves moderate exertion.
- Walking at 5 km/h for 2 hours indicates sustained activity.
- Total energy depends on factors such as body weight, terrain, and walking efficiency, but this scenario emphasizes the importance of pace and duration.

Practical Implications and Real-World Applications

Navigation and Orientation

Knowing how to analyze such walks is crucial in navigation, especially in outdoor activities like hiking or orienteering. Calculating displacement helps determine how far one has moved from a starting point and in which direction.

Fitness Tracking

Modern fitness devices often record speed, distance, and time. Understanding these parameters allows individuals to optimize their walking routines and set realistic goals.

Planning and Safety

When planning walks or hikes, understanding your pace and estimating arrival times and distances can enhance safety and efficiency.

Educational Significance

This problem exemplifies basic physics and mathematics principles:

- Kinematics: Relationship between distance, speed, and time.
- Vector Analysis: Combining movements in different directions.
- Coordinate Geometry: Calculating displacement vectors and their magnitudes.
- Trigonometry: Determining directions and angles.

By working through such problems, students develop critical thinking skills and practical knowledge applicable in daily life.

Conclusion

Analyzing a simple walk involving multiple directions offers a rich understanding of fundamental concepts in physics and mathematics. In this scenario, the person’s journey of 6 km north followed by 10 km west accumulates to a total distance of 16 km and a total time of 3 hours, with an average speed of approximately 5.33 km/h. Their displacement—measured as roughly 11.66 km northwest—illustrates how combining

vectors provides a complete picture of movement. Such analyses are vital in navigation, fitness, and understanding real-world motion. Whether for academic purposes or practical applications, mastering these calculations enhances our ability to interpret and plan physical movements effectively.

Note: The missing part of the original prompt, "Determine The," likely refers to determining total time, displacement, or some combination thereof. Based on the provided data, this comprehensive analysis addresses key parameters that such a question might encompass.

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