

Kinematics Formative Quiz

Time: 25 min. 6 questions.

Instructions

Answer all six questions in the space provided. Show all steps for calculations, including formulas and units. For multiple choice questions, circle or write the letter of the best answer. Read each question carefully before responding.

Questions

1. Which of the following best describes the difference between a scalar quantity and a vector quantity?

- A) A scalar has direction only; a vector has magnitude only
- B) A scalar has magnitude only; a vector has both magnitude and direction
- C) A scalar and a vector both require direction to be fully described
- D) A scalar changes with time; a vector does not

[\(Outcome\)](#)

2. Define displacement, velocity, and acceleration, and explain how each quantity differs from the others in terms of what it describes about an object's motion.

[\(Outcome\)](#)

3. True or false: On a velocity-time graph, the acceleration of an object is represented by the slope of the line, and the displacement of the object is represented by the area under the line.

[\(Outcome\)](#)

4. A velocity-time graph shows an object accelerating uniformly from 2.0 m/s to 10.0 m/s over a time interval of 4.0 s. Using the area under the velocity-time graph, calculate the displacement of the object, in metres.

[\(Outcome\)](#)

5. A canoeist paddles at 3.0 m/s [E] relative to the water. The river flows at 1.5 m/s [S] relative to the shore. Which of the following correctly describes how to determine the canoeist's velocity relative to the shore?

- A) Subtract the two velocities as scalars
- B) Add the two velocities as vectors, accounting for their directions
- C) Multiply the two velocities together
- D) Use only the canoeist's velocity, since the river's flow does not affect motion relative to the shore

[\(Outcome\)](#)

6. A ball is launched from the ground with an initial velocity that has both a horizontal and a vertical component. Explain, using vector components, how the horizontal and vertical motions of the ball can be analyzed separately to describe its overall two-dimensional motion in the vertical plane.

[\(Outcome\)](#)

Curriculum coverage

Question	Outcome alias
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Answer key

1. B) A scalar has magnitude only; a vector has both magnitude and direction. This matches the operational definition and comparison of scalar and vector quantities required by the outcome ([Outcome](#)).
2. Displacement is the change in position of an object, including direction; velocity is the rate of change of displacement over time, including direction; acceleration is the rate of change of velocity over time. Each builds on the previous quantity, moving from position to rate of change of position to rate of change of that rate ([Outcome](#)).
3. True. On a velocity-time graph, the slope gives acceleration, and the area between the line and the time axis gives displacement ([Outcome](#)).
4. 24 m. Displacement equals the area of the trapezoid under the graph: $(2.0 \text{ m/s} + 10.0 \text{ m/s}) \div 2 \times 4.0 \text{ s} = 24 \text{ m}$ ([Outcome](#)).
5. B) Add the two velocities as vectors, accounting for their directions. Motion of one object relative to another requires vector addition of displacement or velocity vectors, not scalar treatment ([Outcome](#)).
6. The horizontal and vertical components of the initial velocity are treated independently: the horizontal component determines constant-velocity motion (no horizontal acceleration, ignoring air resistance), while the vertical component undergoes uniform acceleration due to gravity. Combining the two component analyses describes the ball's full two-dimensional path ([Outcome](#)).