1. Which of these is a **vector**?

   ☐ time

   ☐ mass

   ☐ temperature

   ☐ velocity

2. You jog once around a 400 m track and stop where you began. What is your displacement (in m)?

   _____ m

3. On a position-versus-time graph, the slope represents the...

   ☐ displacement

   ☐ acceleration

   ☐ distance

   ☐ velocity

4. You walk forward at 1.5 $\frac{\text{m}}{\text{s}}$ in a train moving at 25 $\frac{\text{m}}{\text{s}}$. Your speed relative to the ground (in m/s)?

   _____ m/s

5. A ball is thrown horizontally from a 5 m table ($g = 10$). How long until it lands (in s)?

   _____ s

6. Select **all** scalars.

   ☐ speed

   ☐ force

   ☐ displacement

   ☐ energy

   Tick every correct option.

7. If position is $x(t)$, how do you get the acceleration?

   ☐ integrate x once

   ☐ differentiate x once

   ☐ differentiate x twice

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8. A velocity-time graph is a flat line at 5 $\frac{\text{m}}{\text{s}}$ for 6 s. What displacement does it show (in m)?

   _____ m

9. Now you walk **backward** at 1.5 $\frac{\text{m}}{\text{s}}$ in the same 25 $\frac{\text{m}}{\text{s}}$ train. Your speed relative to the ground (in m/s)?

   _____ m/s

10. A ball dropped from a height and one thrown horizontally from the same height hit the ground at the same time.

    ☐ True ☐ False

1. **velocity**

   Velocity has a size and a direction, so it is a vector. Temperature, mass, and time are scalars.

2. **0 m**

   Displacement is start-to-finish. You end where you began, so it is 0 – though the distance was 400 m.

3. **velocity**

   Slope of position vs time is dx/dt – the velocity.

4. **26.5 m/s**

   Same direction, so add them, $1.5 + 25 = 26.5$ $\frac{\text{m}}{\text{s}}$.

5. **1 s**

   Looking at the vertical direction, $5 = \frac{1}{2}(10)t^2$, so $t^2 = 1$ and $t = 1$ s. The horizontal speed does not matter for the time.

6. **speed; energy**

   Speed and energy are scalars (size only). Force and displacement are vectors.

7. **differentiate x twice**

   $v = dx/dt$ and $a = dv/dt$, so a is the *second* derivative of position.

8. **30 m**

   Displacement is the area under the graph, $5 \times 6 = 30$ m.

9. **23.5 m/s**

   Opposite directions subtract, $25 - 1.5 = 23.5$ $\frac{\text{m}}{\text{s}}$.

10. **True**

    Horizontal and vertical motion are independent – both have the same vertical drop, so the same fall time.

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