

AP Physics C: Mechanics

Name: \_\_\_\_\_ Score: \_\_\_\_\_

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

- ☐ temperature
- ☐ velocity
- ☐ mass
- ☐ time

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...

- ☐ acceleration
- ☐ velocity
- ☐ displacement
- ☐ distance

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
- ☐ energy
- ☐ force
- ☐ displacement

*Tick every correct option.*7. If position is  $x(t)$ , how do you get the acceleration?

- ☐ differentiate  $x$  once
- ☐ differentiate  $x$  twice
- ☐ integrate  $x$  once

☐ multiply  $x$  by  $t$

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

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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.