

Kinematics Practice Worksheet

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AP Physics 1 Unit 1 · 24 problems · Use $g = 9.8 \text{ m/s}^2$

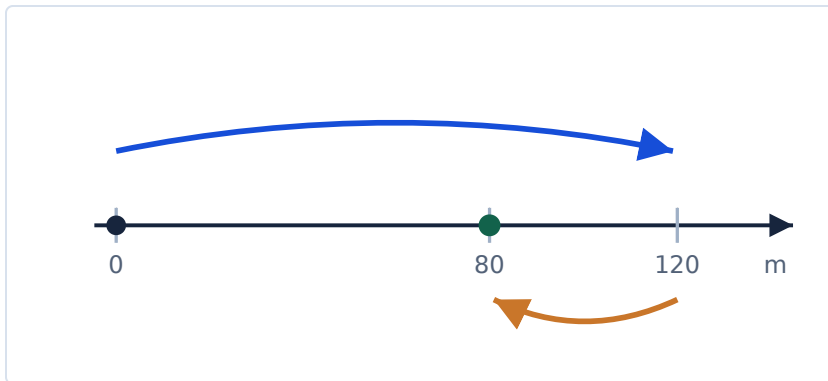
Name _____ Period _____ Date _____

Sketch the motion and mark a positive direction before you write any numbers. Give answers to two significant figures unless the given values say otherwise.

Part A: Reading motion and graphs

Definitions, motion diagrams, and getting information out of a graph.

1. A runner jogs 120 m east in 30 s, turns around, and jogs 40 m west in 10 s. Taking east as positive, find the displacement, the distance, the average velocity, and the average speed for the whole trip. The trip is sketched below.



■ **Left dot**

Start, at the origin

■ **Upper arrow**

First leg, 30 s

■ **Lower arrow**

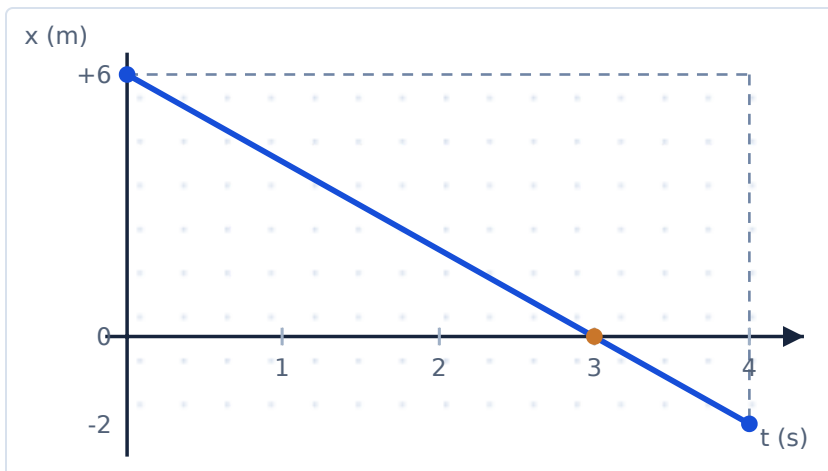
Second leg, 10 s

■ **Green dot**

Finish

Answer:

2. Use the graph below. Find the velocity and the displacement over the interval shown.



■ **Blue line**

Position, +6.0 m to -2.0 m

■ **Orange point**

Passes the origin

■ **Dashed guides**

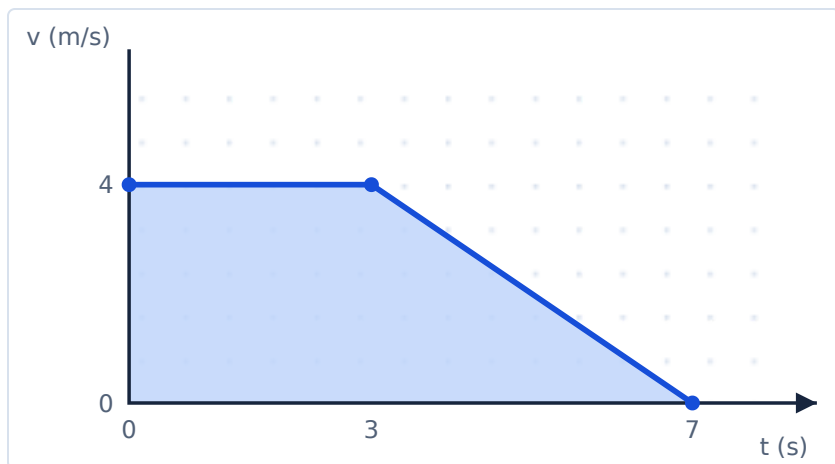
Read the endpoint values

Slope

The quantity you want first

Answer:

3. Use the graph below. Find the total displacement over the full 7.0 s and the acceleration during the second phase.



Blue line

Velocity

Shaded region

Area = displacement

First phase

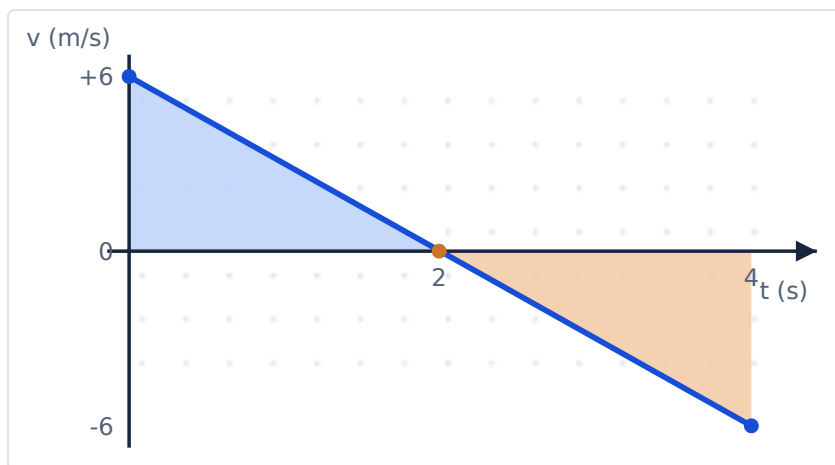
Constant, 0 to 3.0 s

Second phase

Straight to zero at 7.0 s

Answer:

4. Use the graph below. Find the acceleration, the displacement, and the distance traveled over the 4.0 s.



Blue line

Velocity, +6.0 to -6.0 m/s

Orange point

Velocity reverses here

Upper region

Positive area

Lower region

Negative area

Answer:

5. An object has negative velocity and positive acceleration. Is it speeding up or slowing down? Explain in one sentence.

Answer:

6. An object starts from rest and has a constant acceleration of $+2.0 \text{ m/s}^2$ for 5.0 s . Find its final velocity and its displacement.

Answer:

7. A motion diagram shows dots every 0.10 s with gaps of 2.0 , 4.0 , 6.0 , and 8.0 cm . Is the acceleration constant? If so, what is it?

Answer:

8. An object starts from rest under constant acceleration. Measurements give $\Delta x = 0.75 \text{ m}$ at 1.0 s , 3.0 m at 2.0 s , and 6.75 m at 3.0 s . Find the slope of Δx against t^2 , then find the acceleration.

Answer:

Part B: Constant acceleration in one dimension

Choosing the right equation, and handling motion that comes in stages.

9. A car starts from rest and accelerates at 3.0 m/s^2 for 5.0 s . Find its final speed and the distance covered.

Answer:

10. A car traveling at 25 m/s brakes uniformly to a stop in 40 m . Find the acceleration.

Answer:

11. For the car in problem 10, how long does the stop take?

Answer:

12. An object is launched along a track at $+8.0 \text{ m/s}$ with a constant acceleration of -2.0 m/s^2 . When does it return to its starting point, and what is its velocity then?

Answer:

13. A cyclist accelerates from rest at 2.0 m/s^2 for 6.0 s , then holds that speed for 10 s . Find the total distance.

Answer:

14. A train moving at 30 m/s decelerates at 1.2 m/s^2 . How far does it travel in the first 5.0 s , and how far during the fifth second alone?

Answer:

15. Object A starts from rest at the origin with $a = 2.0 \text{ m/s}^2$. Object B passes the origin at the same instant moving at a constant 6.0 m/s . When and where does A catch B?

Answer:

16. A rocket sled accelerates uniformly from 50 m/s to 150 m/s over 500 m . Find the acceleration and the elapsed time.

Answer:

Part C: Free fall and projectiles

Two directions, one clock. Sketch the axes before you write anything.

17. A ball is dropped from rest from a height of 20 m. Find the time to fall and the speed on impact.

Answer:

18. A ball is thrown straight up at 15 m/s. Find the time to reach the top, the maximum height above the launch point, and the total time to return to launch height.

Answer:

19. A ball is thrown straight up at 12 m/s from a hand 1.5 m above the ground. Find its speed when it hits the ground and the total time in the air.

Answer:

20. A stone is thrown horizontally at 20 m/s from a 45 m cliff. Find the time in the air, the horizontal distance, and the impact speed.

Answer:

21. A projectile is launched at 25 m/s at 40° above the horizontal from level ground. Find the time of flight, the range, and the maximum height.

Answer:

22. Two projectiles are launched at 25 m/s from level ground, one at 30° and one at 60° . Compare their ranges and their maximum heights, with numbers.

Answer:

23. A plane flying horizontally at 60 m/s at an altitude of 500 m releases a package. Find the time to fall and the horizontal distance. Where is the plane when the package lands, assuming it holds its velocity?

Answer:

24. From a 3.0 m height, one ball is dropped from rest and another is launched horizontally at 5.0 m/s. Which lands first, and how far from the base does the second one land?

Answer: