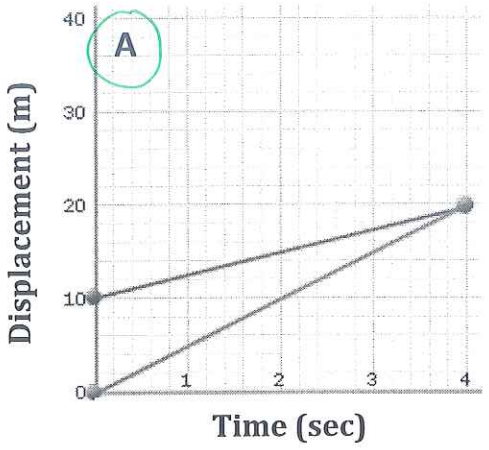
Motion Graphing Review – ANSWER KEY

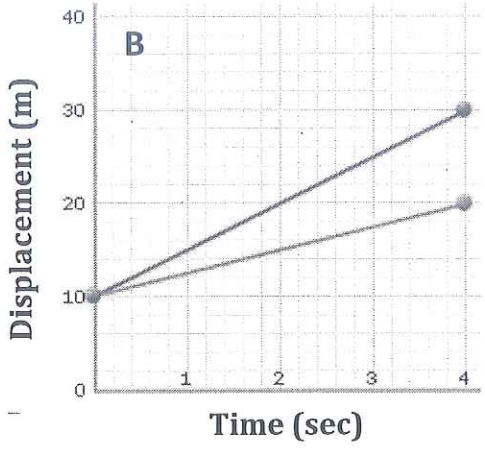
Lab Skills Practice:

1. What does it mean to say that a result is accurate?
   An accurate result is an indication of how close to the accepted value your result is.
2. What determines the precision of a data set? A measurement?
   - The precision of a data set is an indication of the consistency of the data set (how close together the points are). *A measurement's precision is determined by the measurement tool.
3. What is a manipulate variable? Responding variable?
   - The manipulated variable is the variable purposefully changed to elicit a result (could fill into table before lab)
   - The responding variable is what is measured in response to change in manipulated variable
4. Which variable is graphed on the vertical axis? Horizontal axis?
   - Horizontal axis = manipulated variable
   - Vertical axis = responding variable

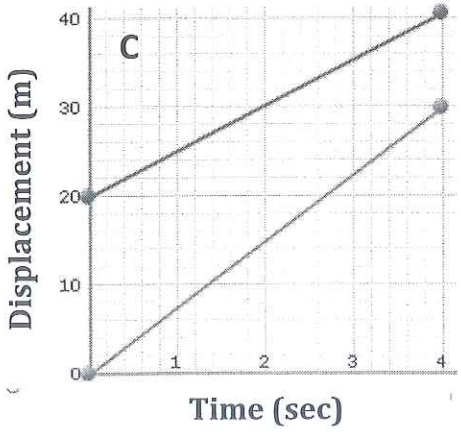
Practice with Displacement-Time Graphs:

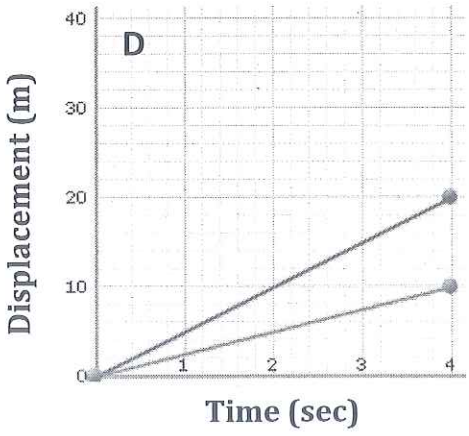
5. Which of the graphs shows that one of runners started 10 yards further ahead of the other? Explain your answer.



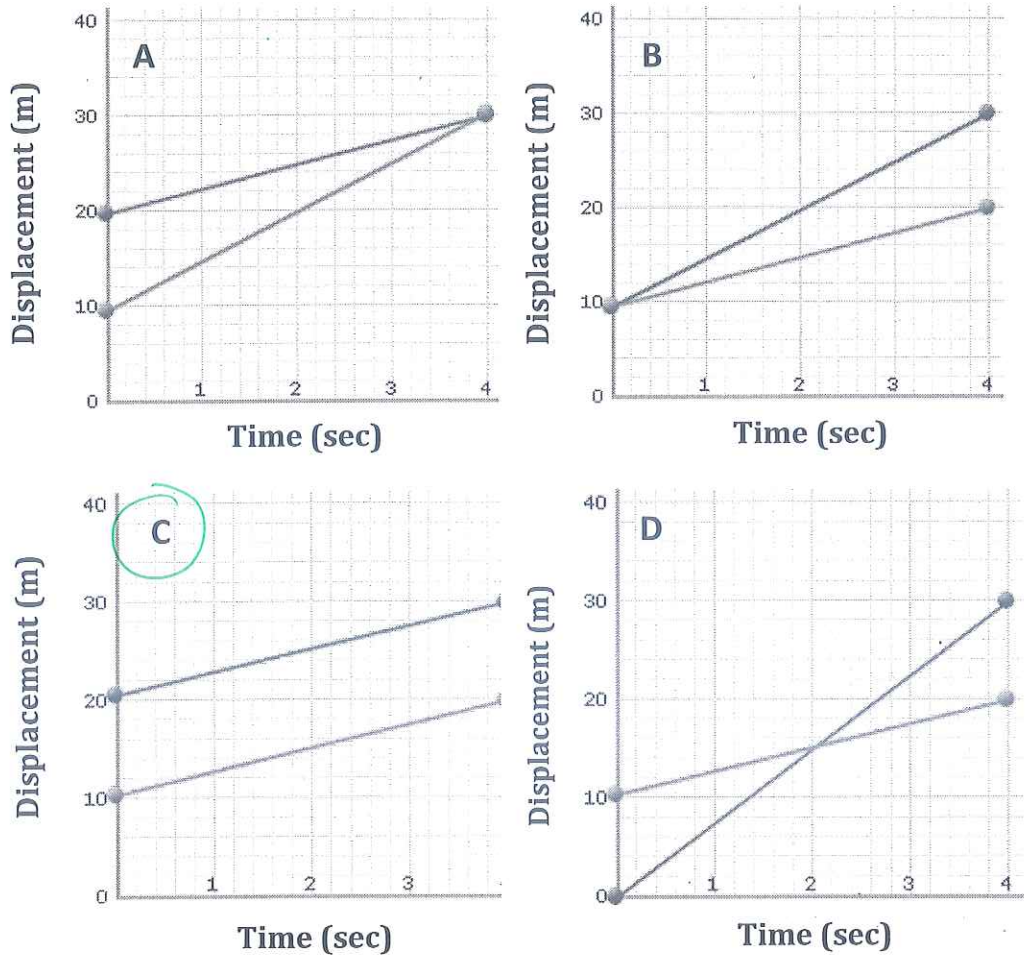


At t=0s, Graph A show a runner @ 0m and another @ 10m.





6. In which of the following graphs below are both runners moving at the same velocity? Explain your answer.



Graph C ⇒ velocity is indicated by the slope ($v = \frac{\Delta d}{\Delta t}$)

Graph C has two lines with the same slope therefore both runners are running with the same velocity.

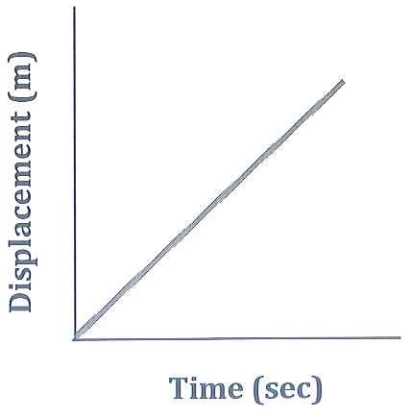
7. The displacement-time graphs below represent the motion of a car. Match the descriptions with the graphs. Explain your answers.

Descriptions:

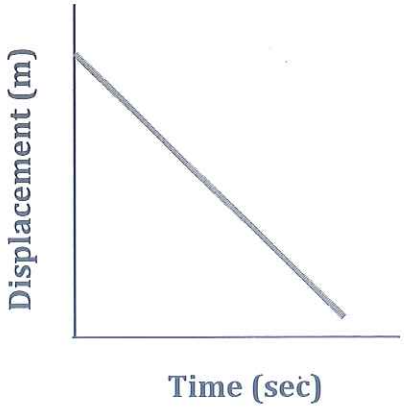
I. The car is stopped
II. The car is traveling at a constant velocity
III. The speed of the car is decreasing
IV. The car is coming back to its starting position

slope = $\frac{\Delta d}{\Delta t}$ ↑ velocity!

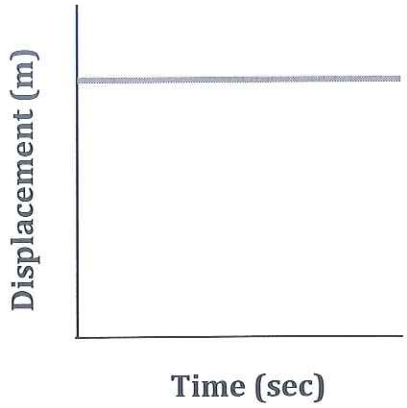
A



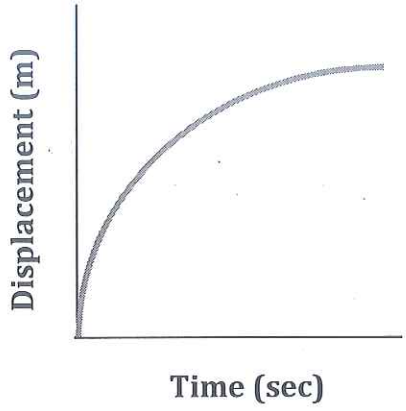
B



C



D



Graph A matches description II because the slope is constant

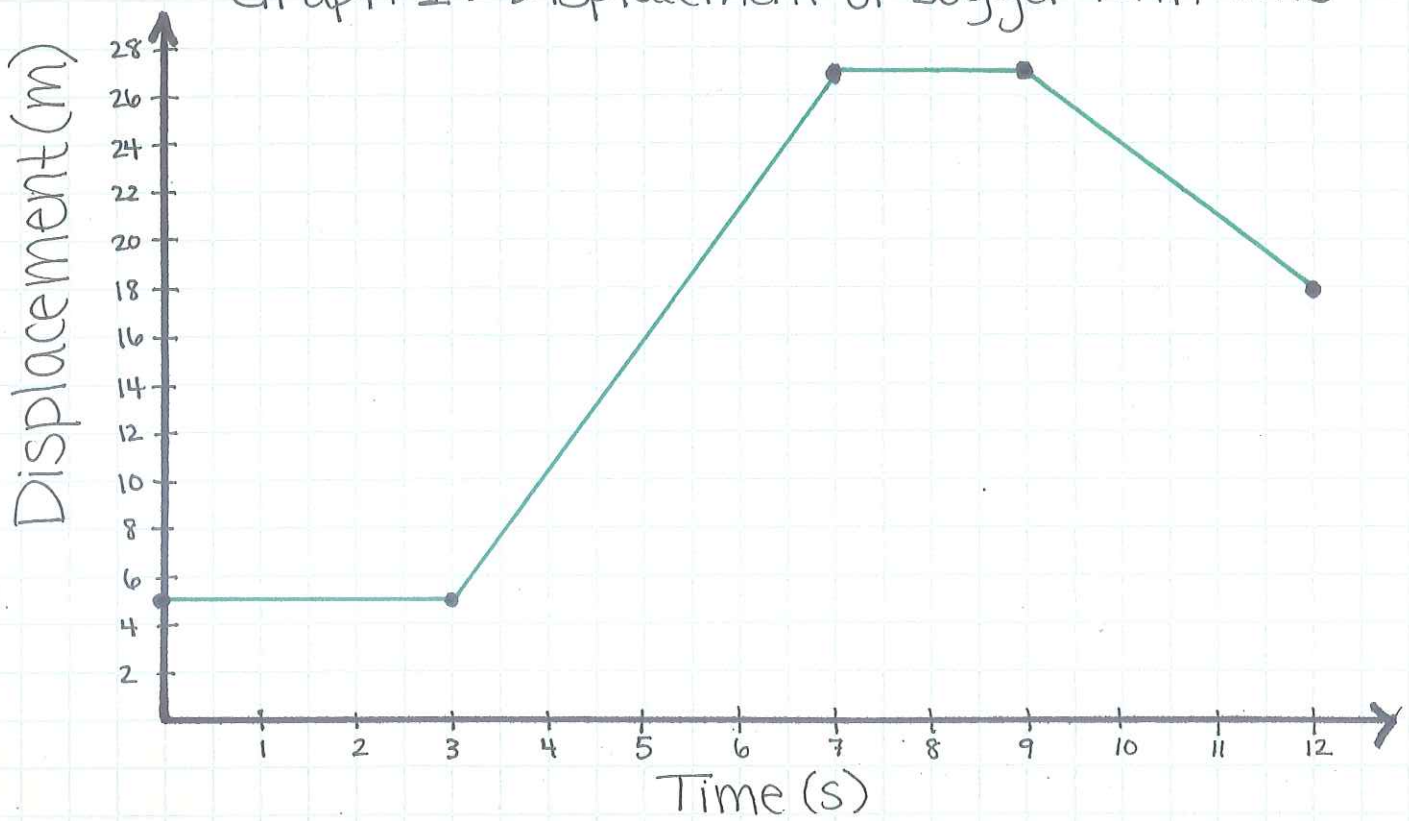
Graph B matches description II + IV because the slope is constant + negative

Graph C matches description I because the slope is zero

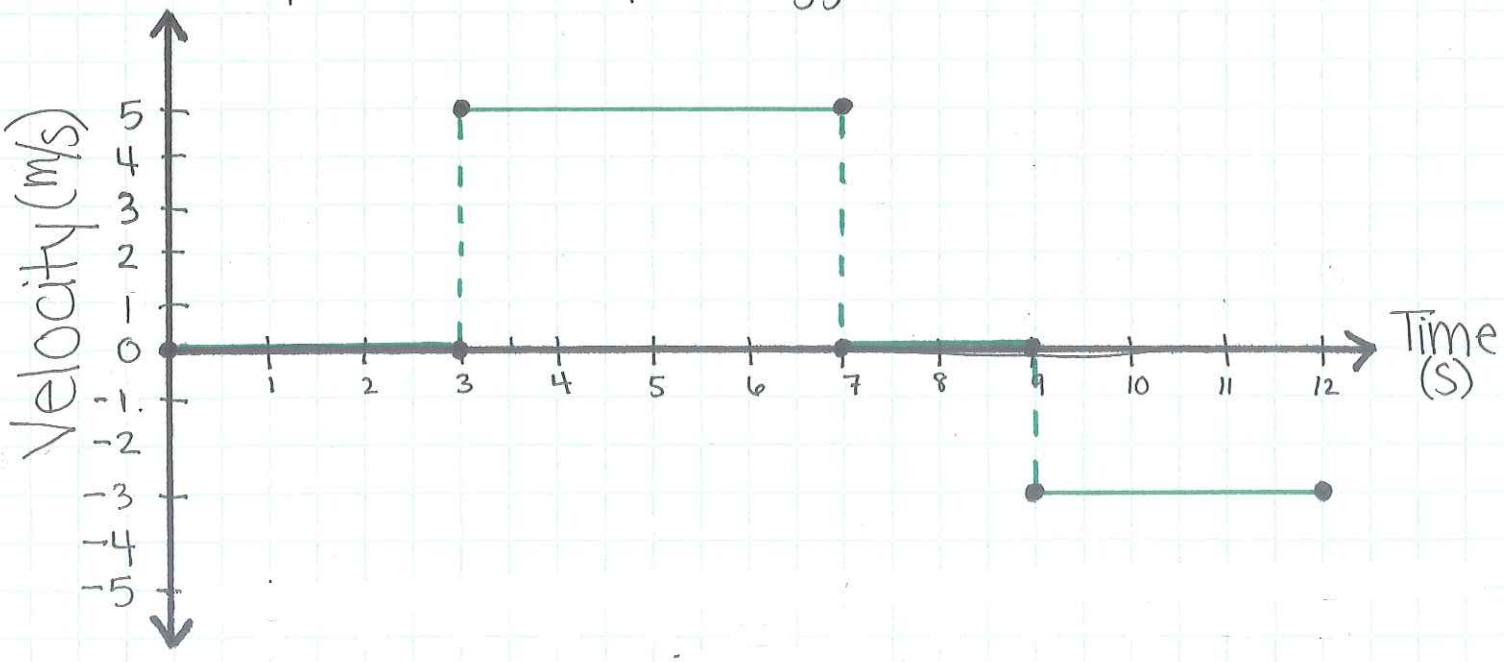
Graph D matches description III because the slope decreases with time

8. Starting 7m away from the detector, stand still for 3 seconds, *then...*
   Walk away from the detector with a constant speed of 5 $^{m}/_{s}$ for 4 seconds, *then...*
   Stand still for 2 seconds, *then...*
   Walk toward the detector at a constant 3 $^{m}/_{s}$ for 3 seconds

Graph 1: Displacement of Jogger with Time

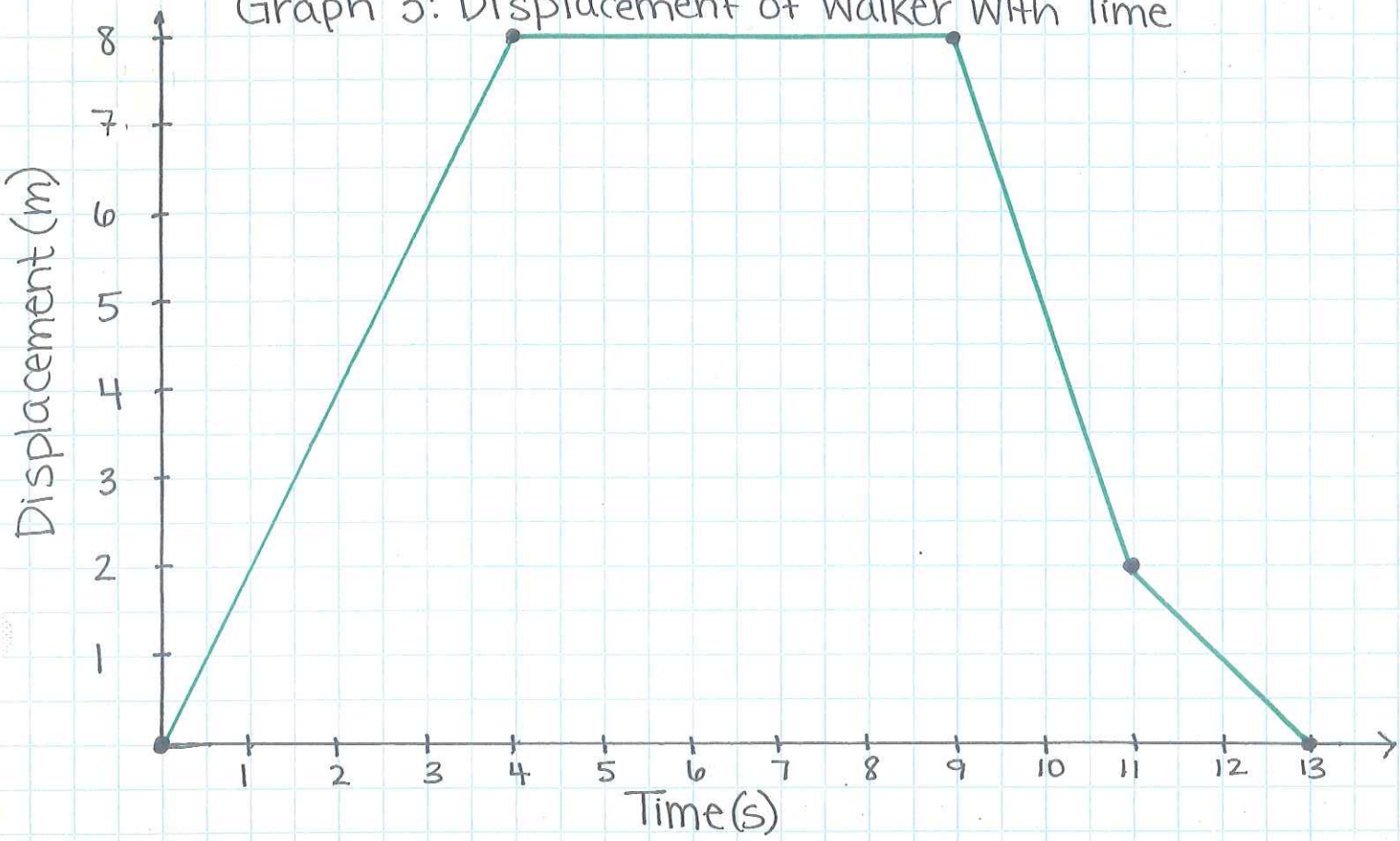


Graph 2: Velocity of Jogger with Time

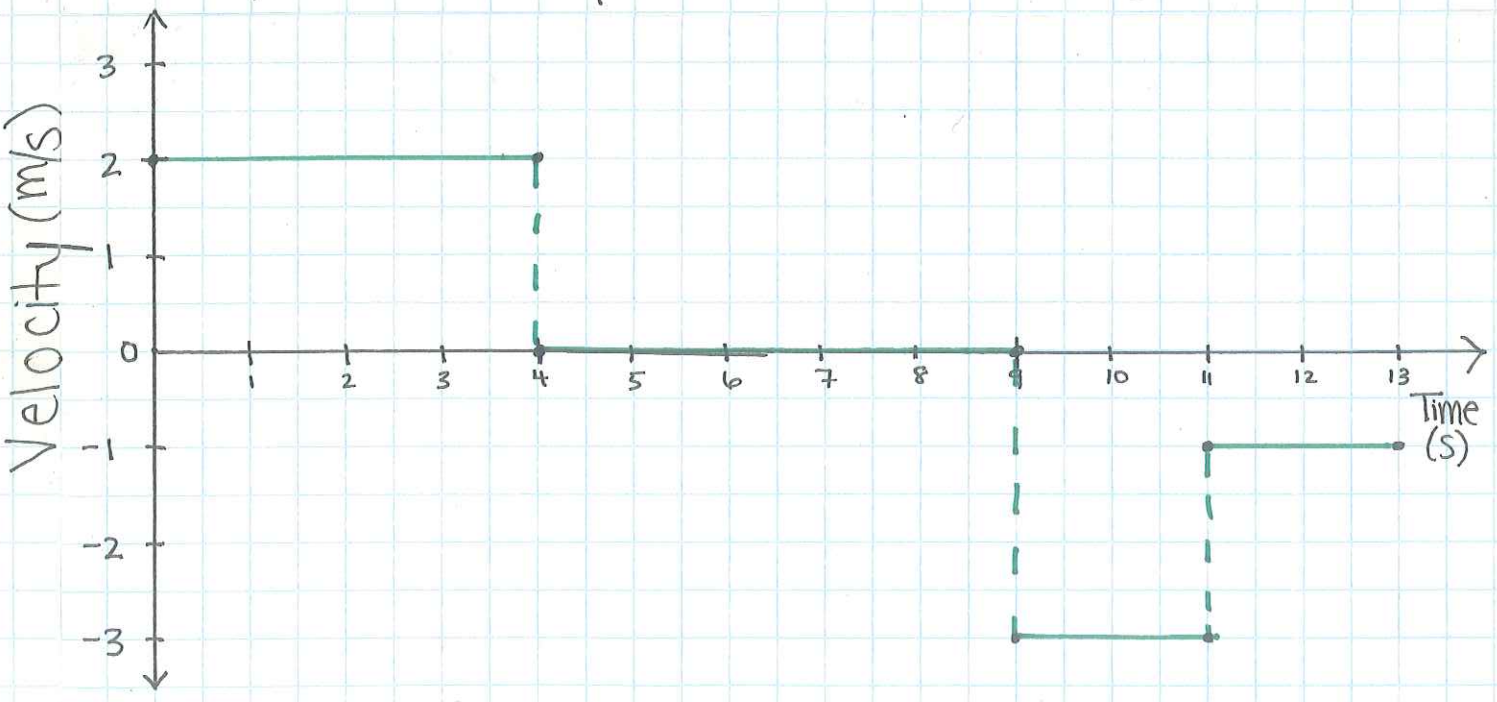


9. Walk away from the detector with constant speed of 2 $^{m}/_{s}$ for 4 seconds, *then...*
   Stand still for 5 seconds, *then...*
   Walk towards the detector with a constant speed of 3 $^{m}/_{s}$ for 2 seconds, *then...*
   Slow down to a constant speed of 1 $^{m}/_{s}$ for 2 seconds

Graph 3: Displacement of Walker with Time



Graph 4: Velocity of Walker with Time



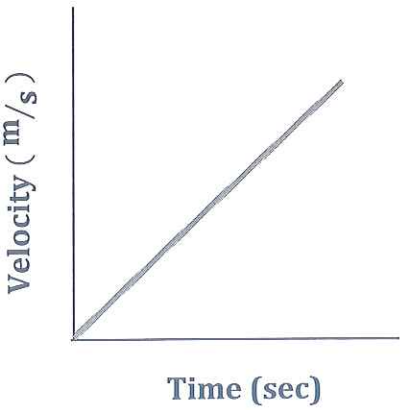
10. The Velocity-time graphs below represent the motion of a car. Match the descriptions with the graphs. Explain your answers.

Descriptions:

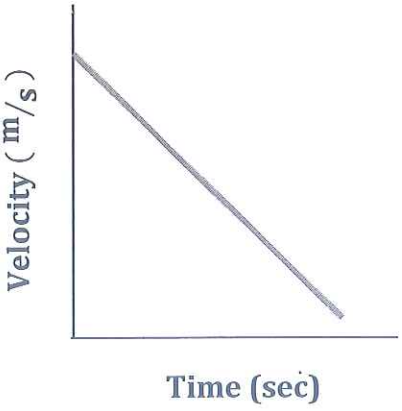
I. The car is stopped
II. The car is traveling at a constant velocity
III. The car is accelerating
IV. The car is slowing down

slope = $\frac{\Delta V}{\Delta t}$ ⇑ acceleration!

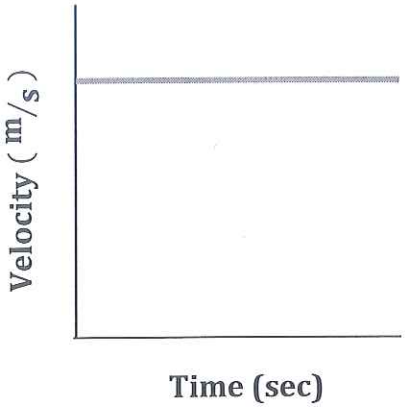
E



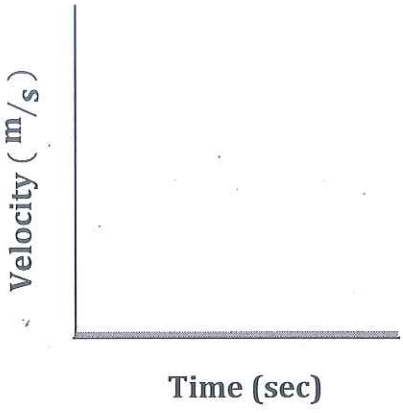
F



G



H



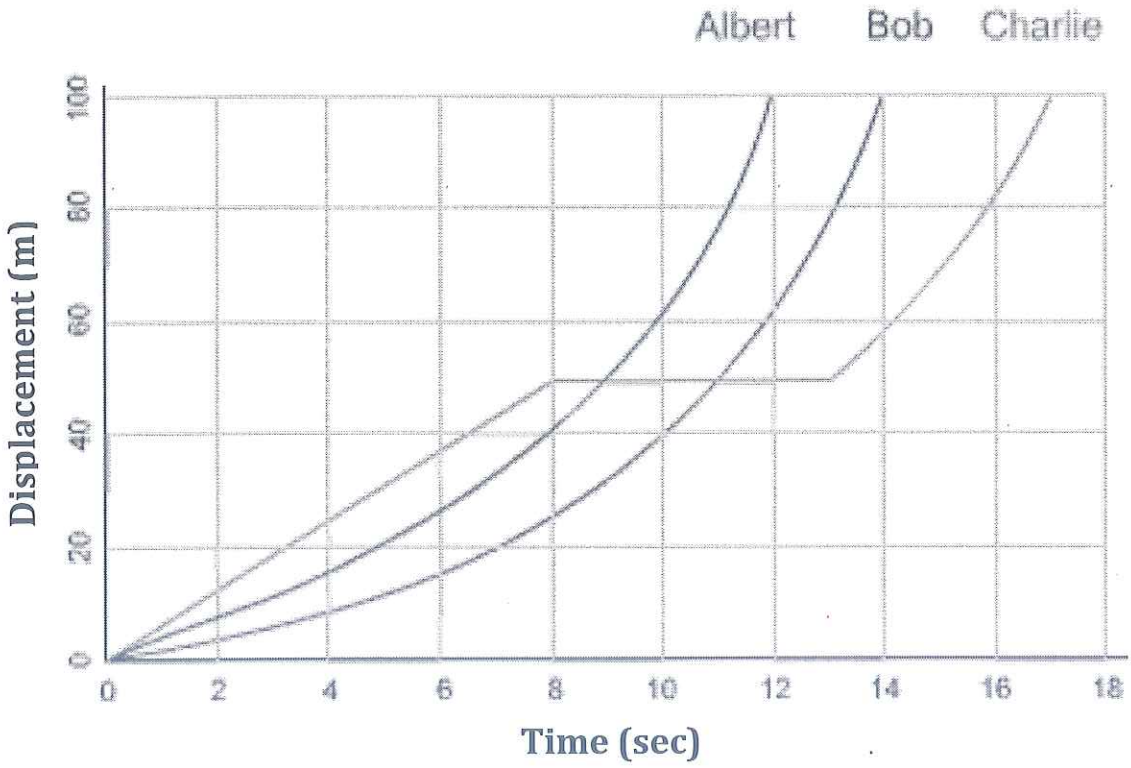
Graph E matches description III because the slope is constant (acceleration) (+v, -a)

Graph F matches description IV because the slope is constant + opposite sign (acceleration)

Graph G matches description II because the graph is horizontal → slope=0

Graph H matches description I because velocity is zero

Look at the graph below. It shows how three runners ran a 100.0 meter race.



11. Which runner won the race? Explain your answer.

Albert: he reached the finish line (100m) in only 12 seconds (Bob → 14s, Charlie → 17s)

12. Which runner stopped for a rest? Explain your answer.

Charlie: his displacement was 50m from 8–13s. (His position was the same for 5 seconds)

13. How long was the stop? Explain your answer.

5 seconds: slope is zero from 8-13s

14. How long did Bob take to complete the race? Explain your answer.

Bob finish in 14 seconds: (14, 100)

15. Calculate Albert's average velocity. (Figure the displacement and the time first!)

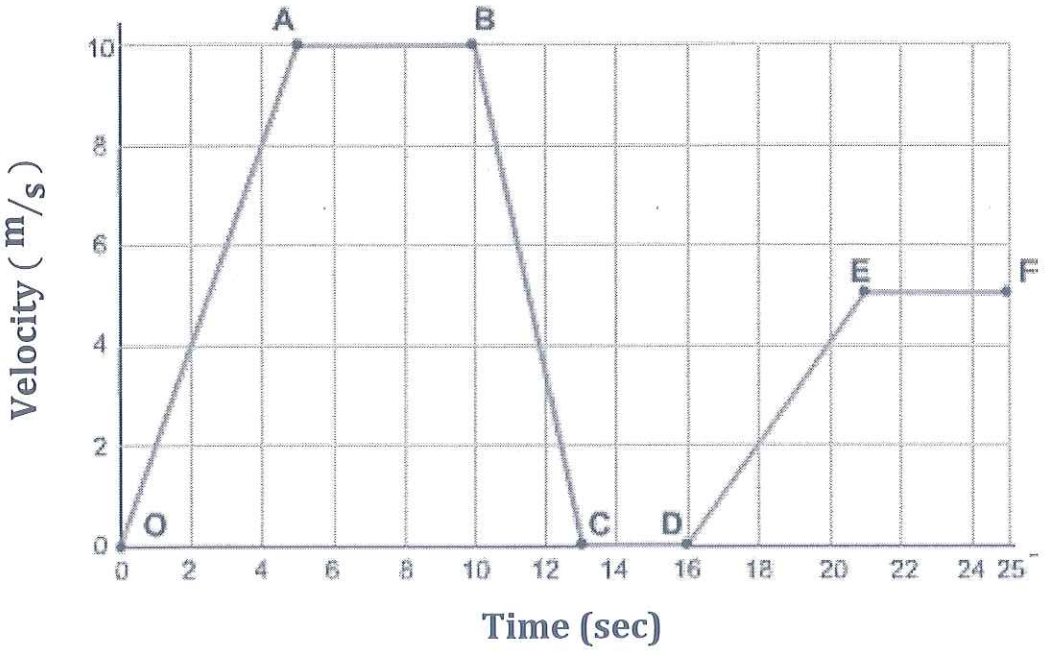
Total displacement = 100.0m

Total time = 12s

$$\bar{V} = \frac{\Delta d}{\Delta t} = \frac{100.0\text{m}}{12\text{s}}$$

$$\boxed{\bar{V} = 8.3\text{m/s}}$$

The graph below shows how the velocity of a bus changes during part of a journey



Fill in the blanks by choosing from the options below for each segment:

- Speeding up (accelerating)
- Slowing down (decelerating)
- Moving at a constant velocity
- At rest

16. **Segment O-A:** The bus is speeding up
    a. Its velocity changes from 0m/s to 10m/s in 5 seconds
17. **Segment A-B:** The bus is moving at a constant velocity
    a. Its velocity is 10m/s for 5 seconds
18. **Segment B-C:** The bus is slowing down
    a. Its velocity changes from 10m/s to rest in 3 seconds
19. **Segment C-D:** The bus is at rest
    a. Its velocity is 0m/s for 3 seconds
20. **Segment D-E:** The bus is speeding up
    a. Its velocity changes from 0m/s to 5m/s in 5 seconds
21. **Segment E-F:** The bus is moving at constant velocity
    a. Its velocity is 5m/s for 4 seconds