



PHYSICS

VELOCITY-TIME GRAPHS

Learning Goals

B2.3 - Use a v-t graph to derive the equation for average velocity and the equations for displacement.

Success Criteria

- How does a VT graph relate to a DT graph?
- What does the slope on a VT graph represent?
- What does the area under the VT graph represent?
- What would a horizontal line on a VT graph represent?
- What would a positive slope represent on a VT graph?
- What would a negative slope represent on a VT graph?
- What would a curved line represent on a VT graph?



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VELOCITY-TIME GRAPHS

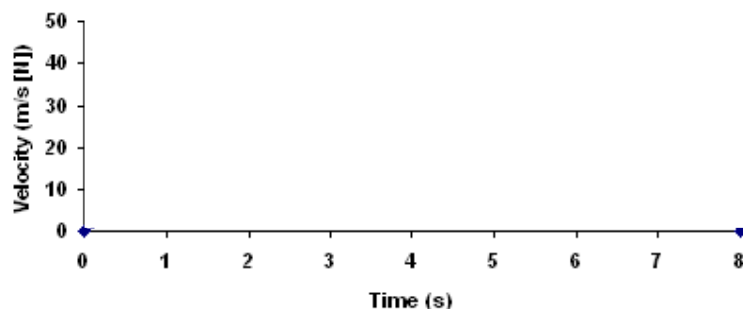
VELOCITY-TIME GRAPHS AND ACCELERATION

Recall: A position-time graph, or a distance-time graph, plots an object's displacement versus the time it takes that object to achieve that displacement.

In the same way, a velocity-time graph plots an object's velocity versus time, with the velocity on the y-axis and the time on the x-axis.

Ex: An object starting from rest is moving at the following velocities

Velocity (m/s [N])	0	10	20	30	40	40	40	20	0
Time (s)	0	1	2	3	4	5	6	7	8

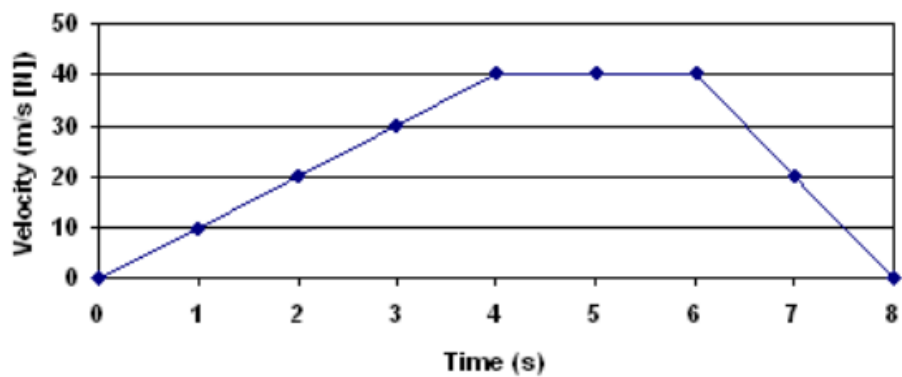




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VELOCITY-TIME GRAPHS

We can use this v-t graph to find the acceleration and displacement



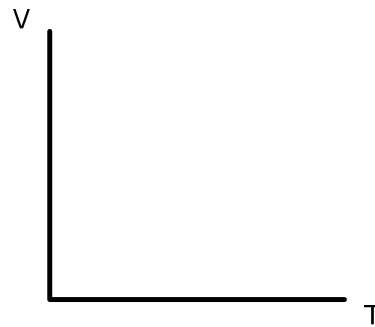
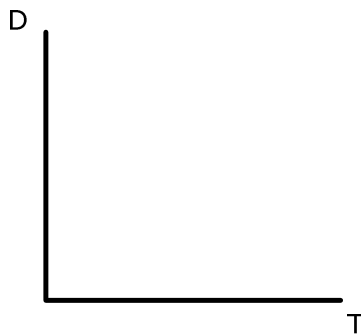


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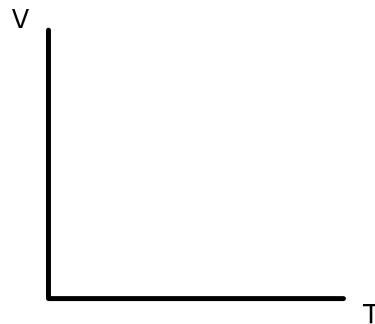
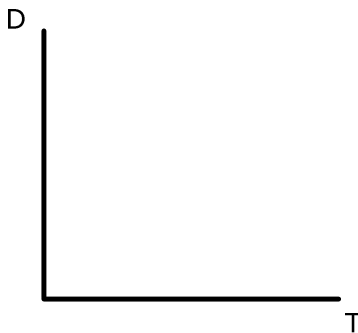
VELOCITY-TIME GRAPHS

Difference between DT Graphs and VT Graphs

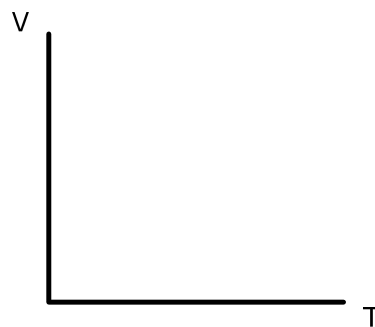
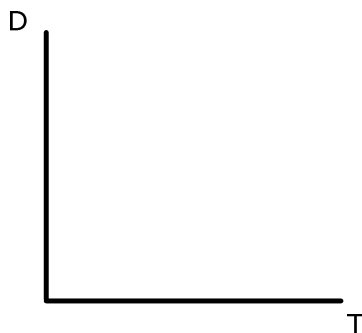
Constant Speed



Stopped



Acceleration



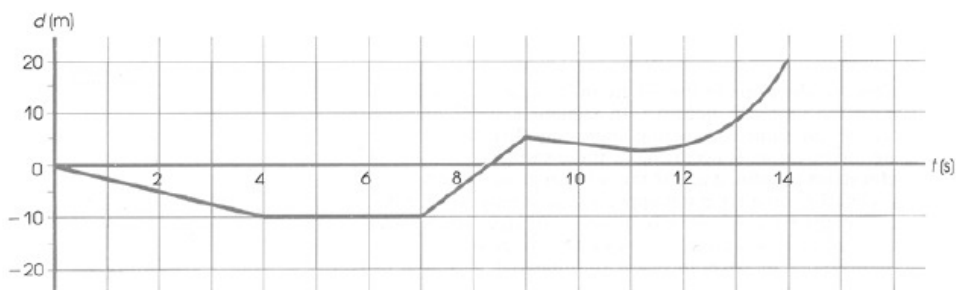
1.10 - Velocity-Time Graphs



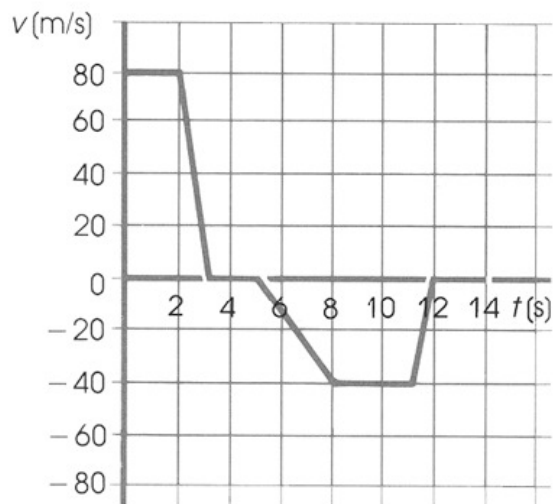
PHYSICS

HOMWORK

4. The following graph is that of an object moving in a straight line. East is considered as the positive direction.
- Determine the position of the object after 7.0 s . (-10 m)
 - The graph shows five distinct sections. Briefly, and in general terms, describe the motion of the object in each of these sections.
 - Considering the whole journey, calculate the average velocity. (1.4 m/s)
 - Find the instantaneous velocity at $t = 13\text{ s}$. (8 m/s)
 - Using an appropriate scale, draw a velocity-time graph from the position-time graph.



5. This graph below describes the motion of an object moving in a straight line. At the beginning it is going east. From the graph determine each of the following.
- the object's displacement in the first 3.0 s (200 m [E])
 - the object's displacement between $t = 3.0\text{ s}$ and $t = 5.0\text{ s}$ (0)
 - the total displacement of the object in 14 s (0)
 - the average velocity of the object from $t = 0$ to $t = 8.0\text{ s}$ (17.5 m/s [E])



1.10 - Velocity-Time Graphs

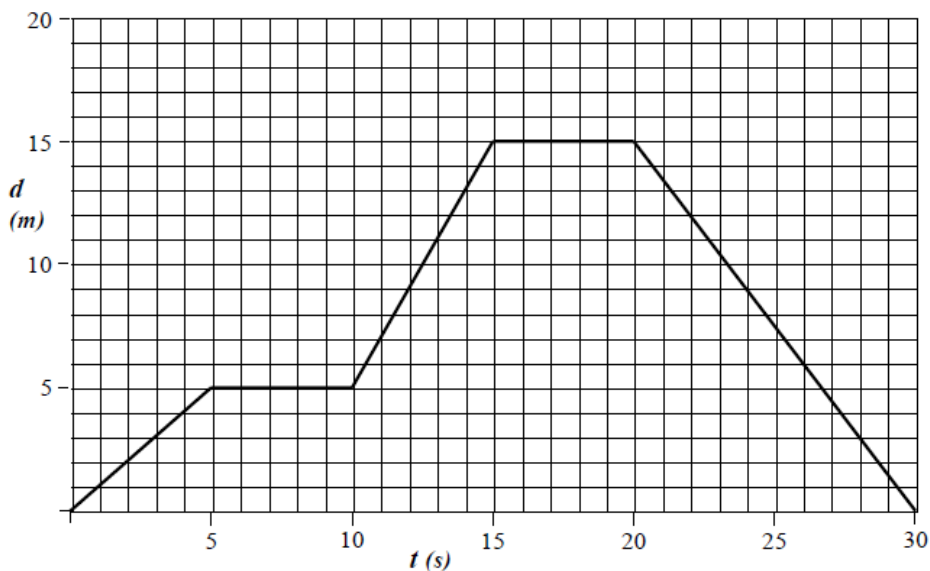


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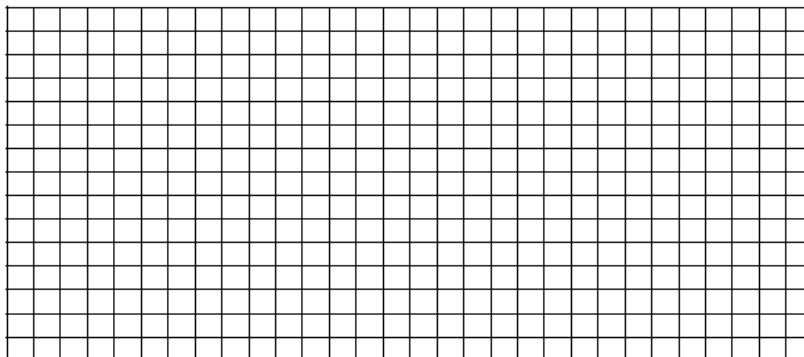
HOMWORK

7. The **slope** of the **displacement-time** graph is _____.
8. The **slope** of the **velocity-time** graph is _____.
9. The **area under** the **acceleration-time** graph is _____.
10. The **area under** the **velocity-time** graph is _____.

Answer the next series of questions using the following **displacement-time** graph.



11. How far does the object travel during the first 5 seconds (1 to 5 s)? _____
12. How far does the object travel during the second 5 seconds (5 to 10 s)? _____
13. How far does the object travel during the third 5 seconds (10 to 15 s)? _____
14. How far does the object travel during the fourth 5 seconds (15 to 20 s)? _____
15. How far does the object travel during the last 10 seconds (20 to 30 s)? _____
16. During which time interval(s) is the object standing still?
17. Does the car ever accelerate in this scenario?
18. Draw the velocity time graph for the above scenario.



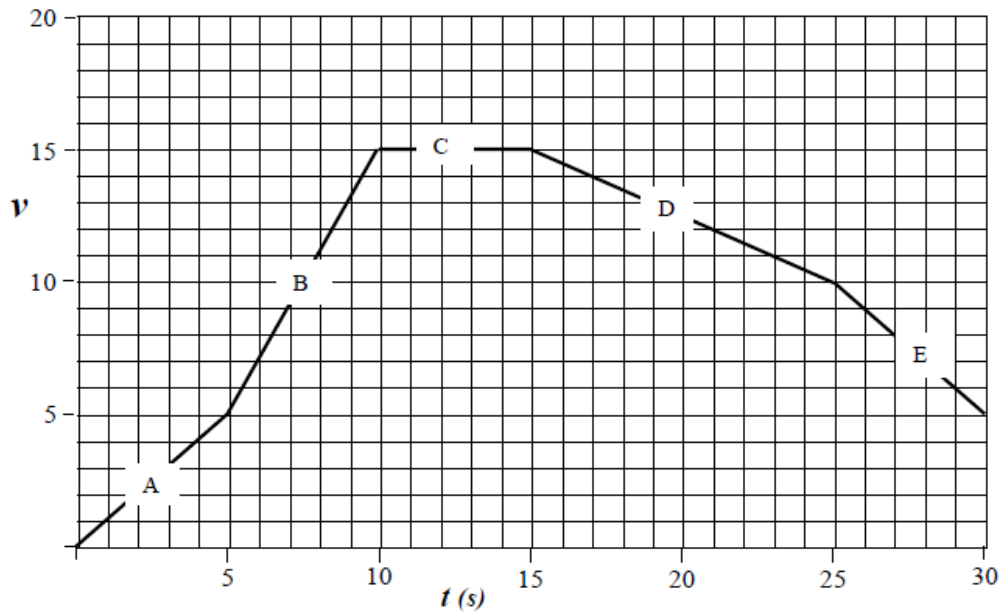
1.10 - Velocity-Time Graphs



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HOMEWORK

Answer the next series of questions using the following **velocity-time** graph.



- 19. During which interval(s) is the object accelerating? _____
- 20. During which interval(s) is the acceleration the greatest? _____
- 21. During which interval(s) is the object standing still? _____
- 22. During which intervals does the object have the same speed? _____
- 23. What is the displacement during interval **A**? _____
- 24. What is the displacement during interval **B**? _____
- 25. What is the displacement during interval **C**? _____
- 26. What is the displacement during interval **D**? _____
- 27. What is the displacement during interval **E**? _____

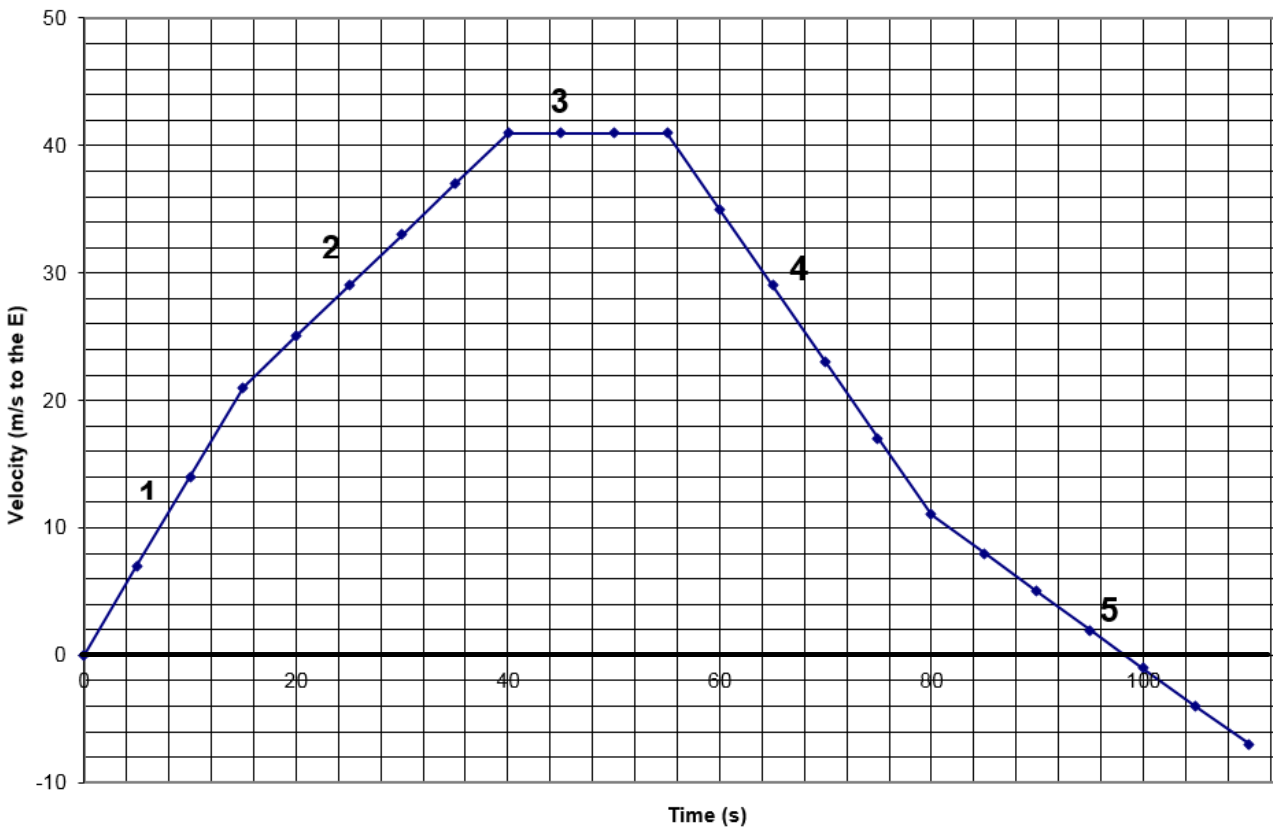
1.10 - Velocity-Time Graphs



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HOMEWORK

Velocity-Time Graph



1. What are the accelerations of this object throughout this motion. In section 5, how would you describe the acceleration before 98 seconds versus after 98 seconds?
2. What is the total displacement of this object?

1.10 - Velocity-Time Graphs



SPH4C