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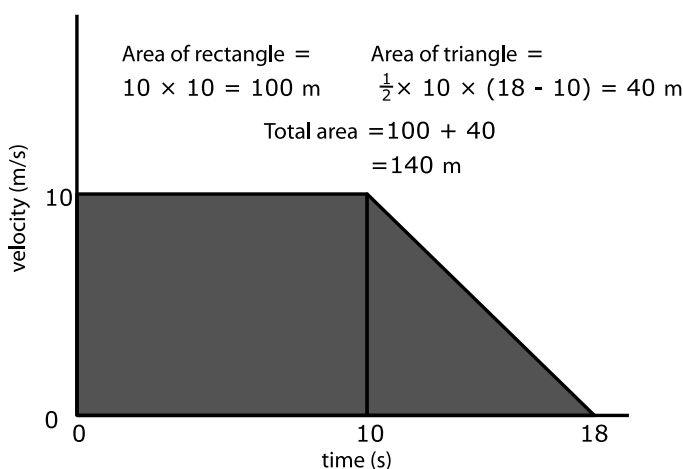
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isaacphysics.org/pages/covid19_gcse

12 Motion Graphs; Velocity–Time ($v-t$)

The displacement of an object moving with a constant velocity is equal to the product of the **velocity** and the amount of **time the object is in motion**.

To find the displacement when the velocity is changing, a velocity-time graph is needed. Normally, velocity is plotted on the **y -axis** (the **vertical** axis) and time is plotted on the **x -axis** (the **horizontal** axis).

The area under the line on a velocity-time graph is equal to the **displacement** of the object.



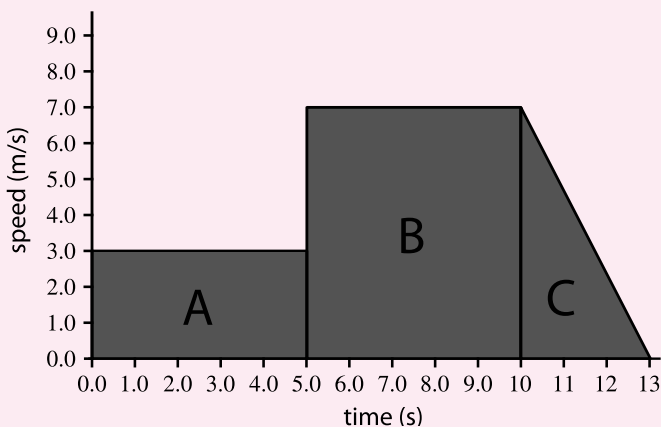
If the shape of the graph can be broken into simple geometric shapes, the total area under the line can be calculated by adding **the areas of those shapes**.

The area under a speed-time graph is the distance. Speed cannot be negative, and neither can the distance.

The area under a velocity-time graph is the displacement. Velocity can be negative if an object is moving backwards. The displacement can also be negative. An area beneath the x -axis has a negative value. An area above the x -axis has a positive value. Be careful when calculating the total displacement, when summing the displacements remember to **include** the **+** and **–** signs of the displacements.

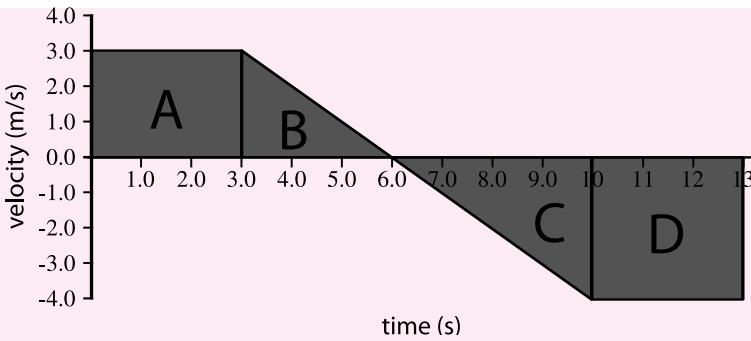
12.1 Using the following speed–time graph:

- (a) calculate the distance travelled in A;
- (b) calculate the distance travelled in B;
- (c) calculate the distance travelled in C;
- (d) calculate the total distance travelled.



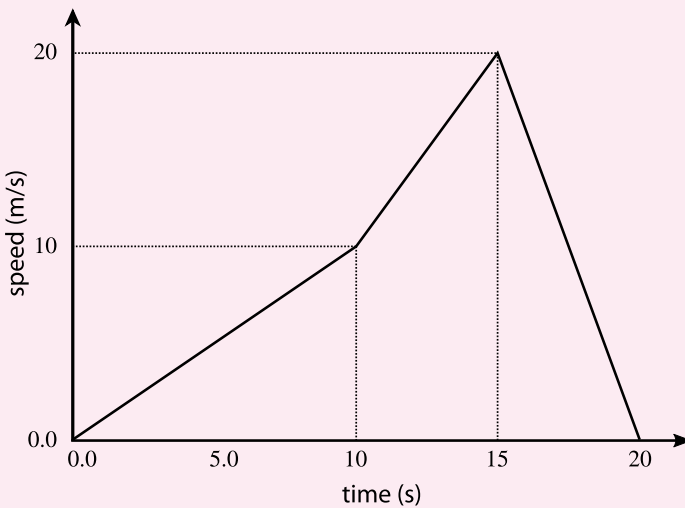
12.2 Using the following graph:

- (a) calculate the displacement in A;
- (b) calculate the displacement in B;
- (c) calculate the displacement in C;
- (d) calculate the displacement in D;
- (e) calculate the total displacement.



12.3 For the motion described by the following speed–time graph, calculate:

- (a) the distance moved in the first 10 s;
- (b) the distance moved in the first 15 s;
- (c) the total distance moved.
- (d) The acceleration between 0 and 10 seconds.
- (e) The acceleration between 10 and 15 seconds.
- (f) The acceleration between 15 and 20 seconds.



12.4 Calculate the displacement moved and the acceleration for the following velocity–time graphs.

