9Adv

Chapter (4)

Chapter 4: forces in 1 dimension

PHYSICS

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Carve your name on the moon!

Section 1: Acceleration

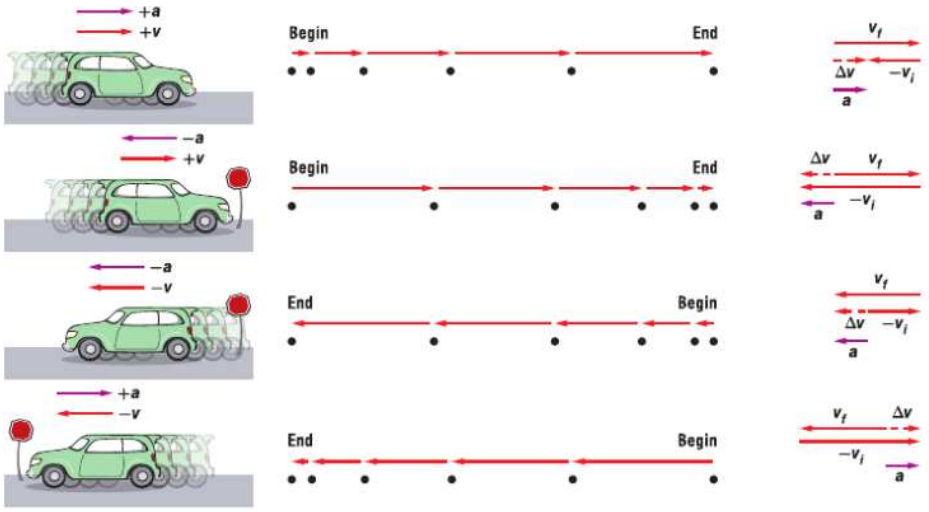
- There are three cases for acceleration to happen
    1. Velocity is **increasing** (***acceleration***)
    2. Velocity is **decreasing** (***deceleration***)
    3. **Direction** of velocity is changing (example the velocity was 3 m/s east then became 3 m/s west)

Direction of acceleration:

Note: if velocity is **increasing** ⟹ the direction of acceleration is the **same** as direction of motion (velocity)

Note: if velocity is **decreasing** ⟹ the direction of acceleration is the **opposite** of direction of motion (velocity)

	Velocity is increasing (acceleration)	Velocity is decreasing (deceleration)
velocity is to the right (+)	Acceleration has the same direction (right) (+)	Acceleration has the opposite direction (left) (-)
velocity is to the left (-)	Acceleration has the same direction (left) (-)	Acceleration has the opposite direction (right) (+)



See page 61 if you need explanation.

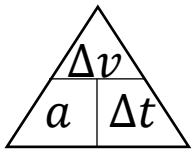
Velocity time graphs:

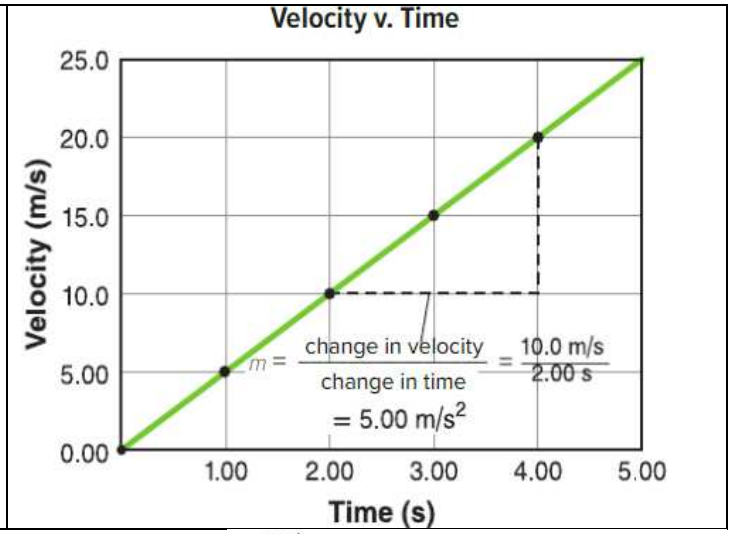
The slope(الميل) of the velocity time graph is the velocity.
x-axis >>>> time (t)
y-axis >>>> velocity (v)

$$m = \frac{\Delta y}{\Delta x} \quad \Rightarrow \quad a = \frac{\Delta v}{\Delta t}$$

The unit for acceleration is (m/s^2)
Other units (cm/s^2, mm/s^2, km/hr^2, ft/s^2 .....)
(distance/time^2)

$$a = \frac{\Delta v}{\Delta t}$$





Q what is the acceleration of A & E?
- A Zero (the slope is zero)

Q Are A&E not moving (at rest)?
- A No, A & E are moving with constant velocity A has bigger velocity and moving east (+) where E is moving west(-) with less velocity

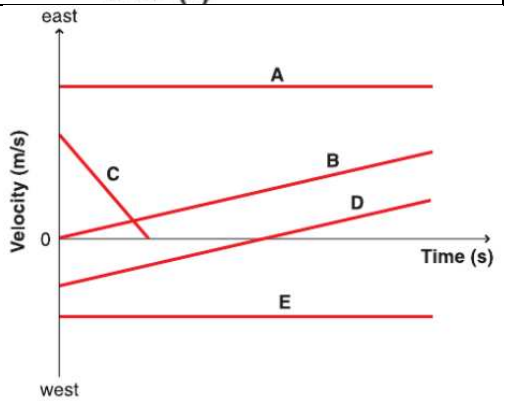
Q Is the velocity of B negative or positive?
- A Positive(east)

Q Is the acceleration of B positive or negative?
- A Positive (slope is positive, going up)

  Note: because both the velocity and acceleration are positive B is increasing speed

Q Is the velocity of C positive or negative>?
- A Positive (east)

Q Is the acceleration of C positive or negative?
- A Negative (slope is negative, going down)



Note: because the acceleration and velocity are in opposite directions C is slowing down until it stops completely (v=0)

Q Is the acceleration of D positive or negative?
- A Positive(slope is positive, going up)

Q Is the velocity of D positive of negative?
- A The velocity at the start is negative (west) but because the acceleration is positive (opposite) the velocity is getting smaller and smaller until it reaches zero then becomes positive (east) after that because now acceleration and velocity have the same direction the velocity is getting bigger and bigger.

Please see the book questions on this topic

Section 2: motion with constant acceleration

Keywords to use these equations: constant acceleration, uniform motion, moving uniformly, with acceleration = $5m/s^2$ (5 or any number), the velocity is changing at a constant rate (constant acceleration), find the acceleration,,,, and many others (most of acceleration questions are constant acceleration unless the question says something else)

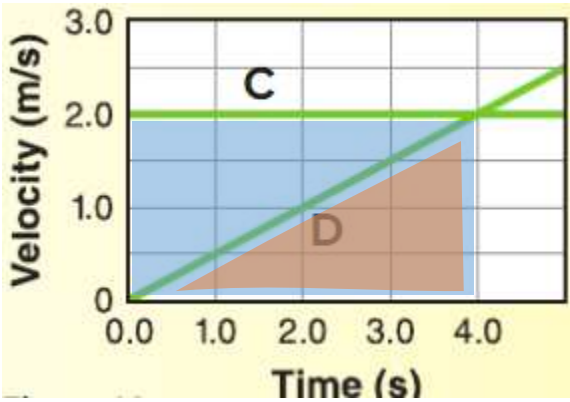
We have 3 equations:

$v_f = v_i + at$	If no mention of the initial velocity usually $v_i = 0$

$\Delta x = v_i t + \frac{1}{2} a t^2$	In many questions $\Delta x = d\ (distance) or\ we\ use\ \Delta x = x_f - x_i$
$v_f^2 = v_i^2 + 2a\Delta x$	Use when there is no information about the time (t) in the question

- Very important note: we can calculate the displacement from velocity time graphs by finding the area.

  Example: what are the displacements of C and D during the 4s interval shown if they both are moving south?



  C: the area under line C is a rectangle (blue)

$$\Delta x = area = length * width = 4 * 2 = 8\ m\ south$$

  D: the area under line D is a triangle (red)

$$\Delta x = area = \frac{1}{2} base * height = \frac{1}{2} * 4 * 2 = 4\ m\ south$$

  Please solve all the questions on worksheets given on this topic and from your book

Section 3: free fall

Galileo Galilei discovered that if we remove air resistance all objects fall with the same acceleration.

On earth this acceleration is g=9.8 m/s^2 downward or g= - 9.8 m/s^2.

In free fall questions we use the same 3 equations as before only in this section the acceleration is always -9.8 m/s^2

- If a body is thrown upward it will reach a maximum height (أقصى ارتفاع) then will fall back down.
  1. When the body reaches the maximum height ⟹ $v_f = 0$
  2. To find the maximum height use the third equation: $v_f^2 = v_i^2 + 2a\Delta x$ and find Δx
  3. To find the time of the flight use the first equation: $v_f = v_i + at$ remember that $v_f = 0$ And find t
  4. Multiply the time by 2 ⟹ $t \times 2$ (if you need to find the time for going up and down)

Please solve all the questions on the book for this section.