Uniform Motion

September 5, 2015 7:48 AM

Kinematics is the study of how objects move: cars, bikes, our planet, the solar system, everything. As we have been learning motion is the measure of how far something travels in a period of time.

Displacement
Symbol: $\vec{d}$
SI Unit: meter (m direction)

Distance
Symbol: d
SI Unit: meter (m)

Time
Symbol: t
Si Unit: second (s)

The change in distance or displacement over a period of time is referred to as the speed or velocity of an object.

Velocity
Symbol: $\vec{v}$
SI Unit: meter per second (m/s   direction)

Speed
Symbol: v
SI Unit: meter per second (m/s)

Constant Velocity

If the velocity of an object is not changing then it has a constant velocity and we can use the definition of velocity to create this equations.

$$\boxed{\vec{\boldsymbol{v}} = \frac{\vec{\boldsymbol{d}}}{\boldsymbol{t}}}$$

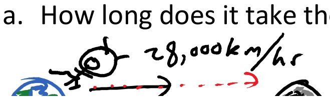
*Question: if an object has no motion does it have a constant velocity?

Yes

Example:

A space monkey leaves earth traveling at 28,000 km/hr towards the moon which is 384400km away.

a. How long does it take the space monkey to get to the moon?



Step 1: Draw a picture
Step 2: List knowns and unknowns

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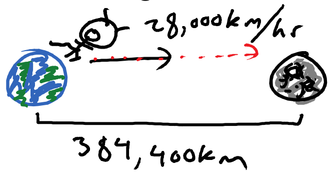
a. How long does it take the space monkey to get to the moon?



$d = 384{,}400 km$

$v = 28{,}000 km/hr$

$d = v \cdot t$

$\frac{d}{v} = t$

$\frac{384400 km}{28000 km/hr} = t$

$t = 13.7 hr$

$t = 13 hr\ 43 min : 42.9 sec$

$\boxed{t = 14 hr}$ sig figs

b. How fast would the monkey have to go to make this trip in 10 hrs?

$d = 384400 km$

$t = 10 hr$

$v = ?$

$v = \frac{d}{t}$

$v = \frac{384400 km}{10 hr}$

$\boxed{v = 38{,}440 km/hr}$

Parkland is 32km north from my house in Victoria.

a. What constant speed would I have to travel to arrive in 35 minutes? velocity?

$t = 35 min$
$= 2100 sec$

$d = 32 km$
$= 32000 m$

$v = \frac{d}{t} = \frac{32000}{2100} = 15.2 m/s$

$\vec{v} = \frac{\vec{d}}{t} = \frac{32000 \text{ North}}{2100} = 15.2 m/s$ North

b. How long would it take if I were traveling at a constant speed of 100km/hr?

$v = 100 km/hr = 100 \times \frac{1000 m}{3600 s} = 27.8 m/s$

$d = v \cdot t$

$t = \frac{d}{v} = \frac{32000}{27.8} = 1152 sec$
$= 19.2 mins$

c. How far could I travel in an hour if I were traveling at the speed of light ($3.00 \times 10^8 m/s$)?

$1 hr = 3600 sec$

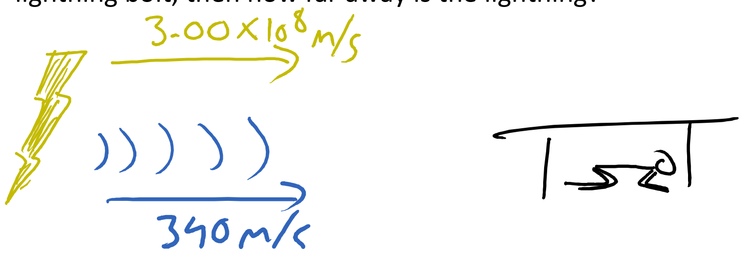
$d = v \cdot t$

$d = (3 \times 10^8)(3600)$

$= 1.08 \times 10^{12} m$

$= 1.08 \times 10^9 km$

The speed of sound is approximately 340 m/s. The speed of light is approximately 3.00×10^8 m/s. If hear thunder 3 seconds after you see the lightning bolt, then how far away is the lightning?



Lightning

$v_L = 3 \times 10^8 \, m/s$

$d =$

$t_L =$

Sound

$v_S = 340 \, m/s$

$d =$

$t_s = t_L + 3$

$$d = v \cdot t$$

$$d = (3 \times 10^8)\, t_L \qquad d = (340)(t_L + 3)$$

Substitute

$$(340)(t_L + 3) = (3 \times 10^8)\, t_L$$

$$340 t_L + 1020 = (3 \times 10^8)\, t_L$$

$$1020 = 3 \times 10^8 \, t_L - 340 t_L$$

$$\frac{1020}{(3 \times 10^8 - 340)} = \frac{\cancel{\left[(3 \times 10^8) - 340\right]}\, t_L}{\cancel{(3 \times 10^8 - 340)}}$$

$$t_L = \frac{1020}{3 \times 10^8 - 340}$$

$$t_L = 3.4 \times 10^{-6} \, \text{sec}$$

$$d = (3 \times 10^8)(3.4 \times 10^{-6})$$

$$d = 1020 \, m$$

$$\boxed{d = 1.02 \, km}$$

Class Activity

Predict how long it will take a tumble car to drive down the hallways. Make some test runs in class to find the speed of the car then measure the hallway distance, predict and race! (You should do three attempts and average the results to find the average time)