And oh so much more!!!

Motion

physics is…..

- study of the principles that govern the *behavior* of the stuff in the universe
  - the study of energy & its effects

energy

- The stuff that makes stuff do stuff…
- The ability to do work.

the parts of the study

- Mechanics
  - the way stuff moves
- speed, velocity, acceleration, force, momentum

more…

- Thermal Physics
- temperature & heat

and more….

- Wave Physics
- sound & light

and finally…

- Electro-Magnetic Physics
- what do you think…

how do we know we're moving?

- reference points
  - stationary (or nearly) object that we use to gauge your position
- comparison of the relative position of 2 objects
  - the closer, the better

speed

- how far you go, given a certain amount of time
- speed = distance / time
- s = d/t
- units for speed are m/s (meters / seconds)

velocity?

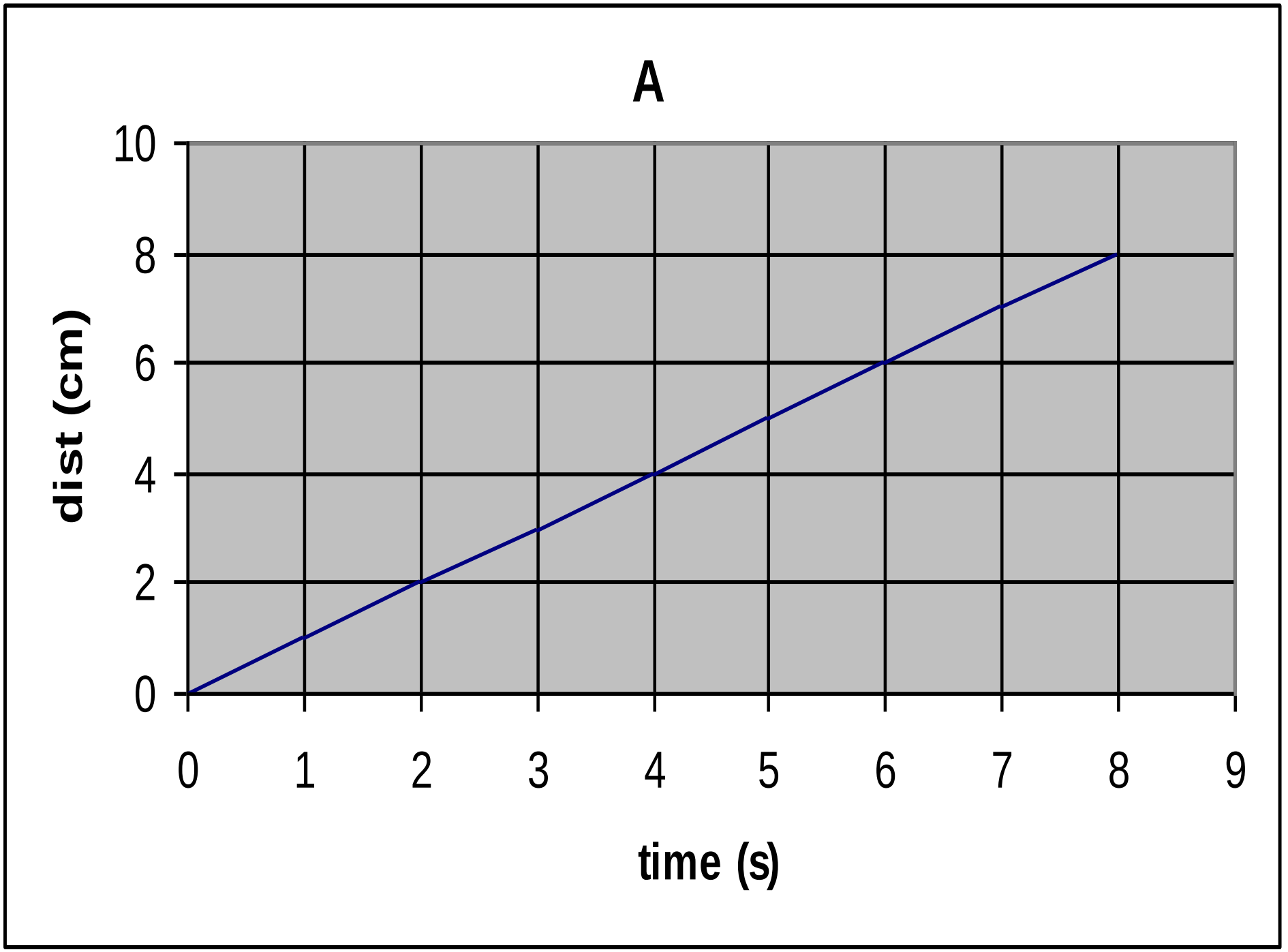
- same as speed except - velocity includes direction
- v = d/t ____
- so your answer must include a direction
  - ex: 25.4 m/s N
- velocity is a **vector quantity**

vector quantity

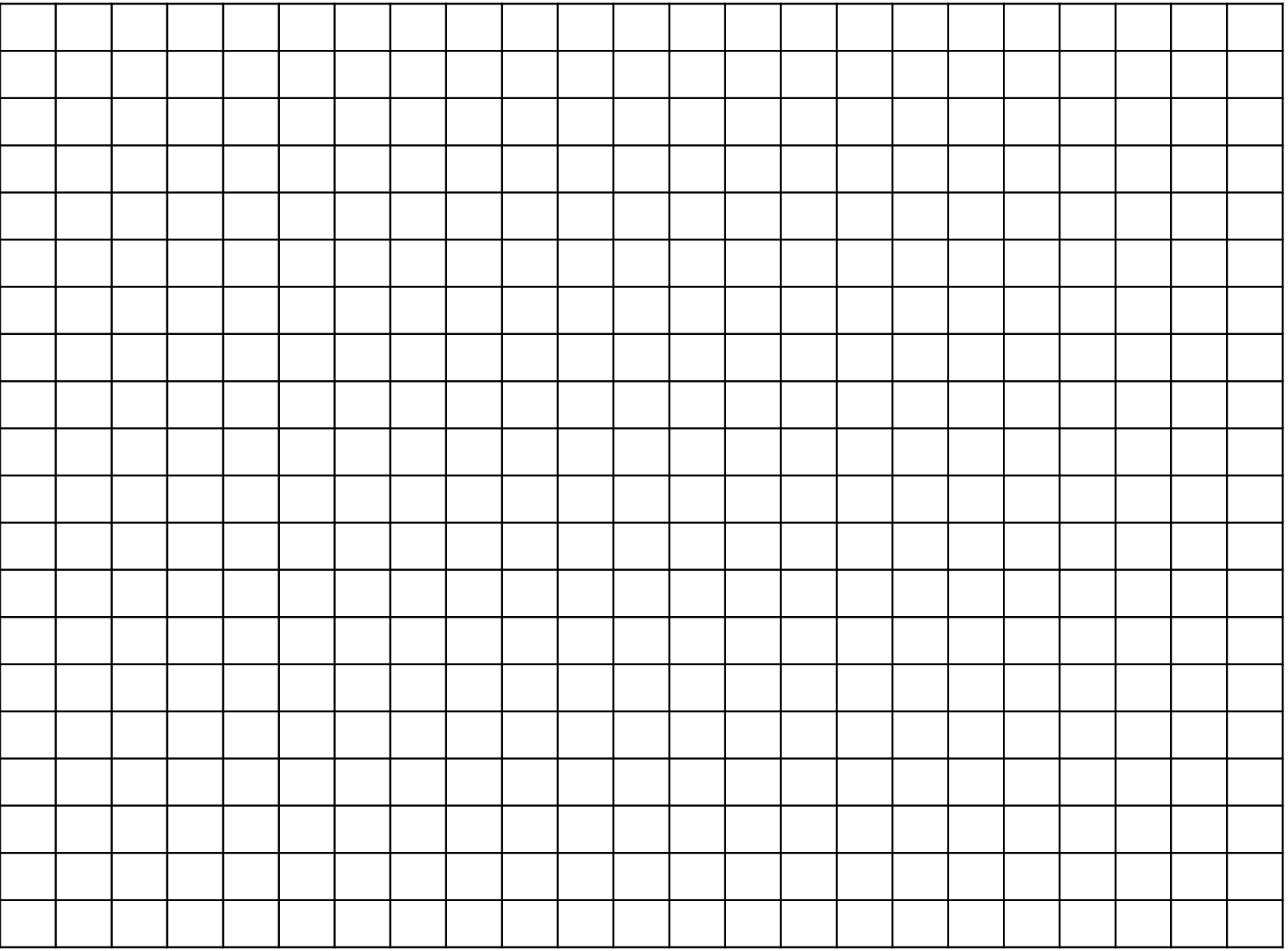
- any measurement that includes a direction
  - vector = direction
  - quantity = amount

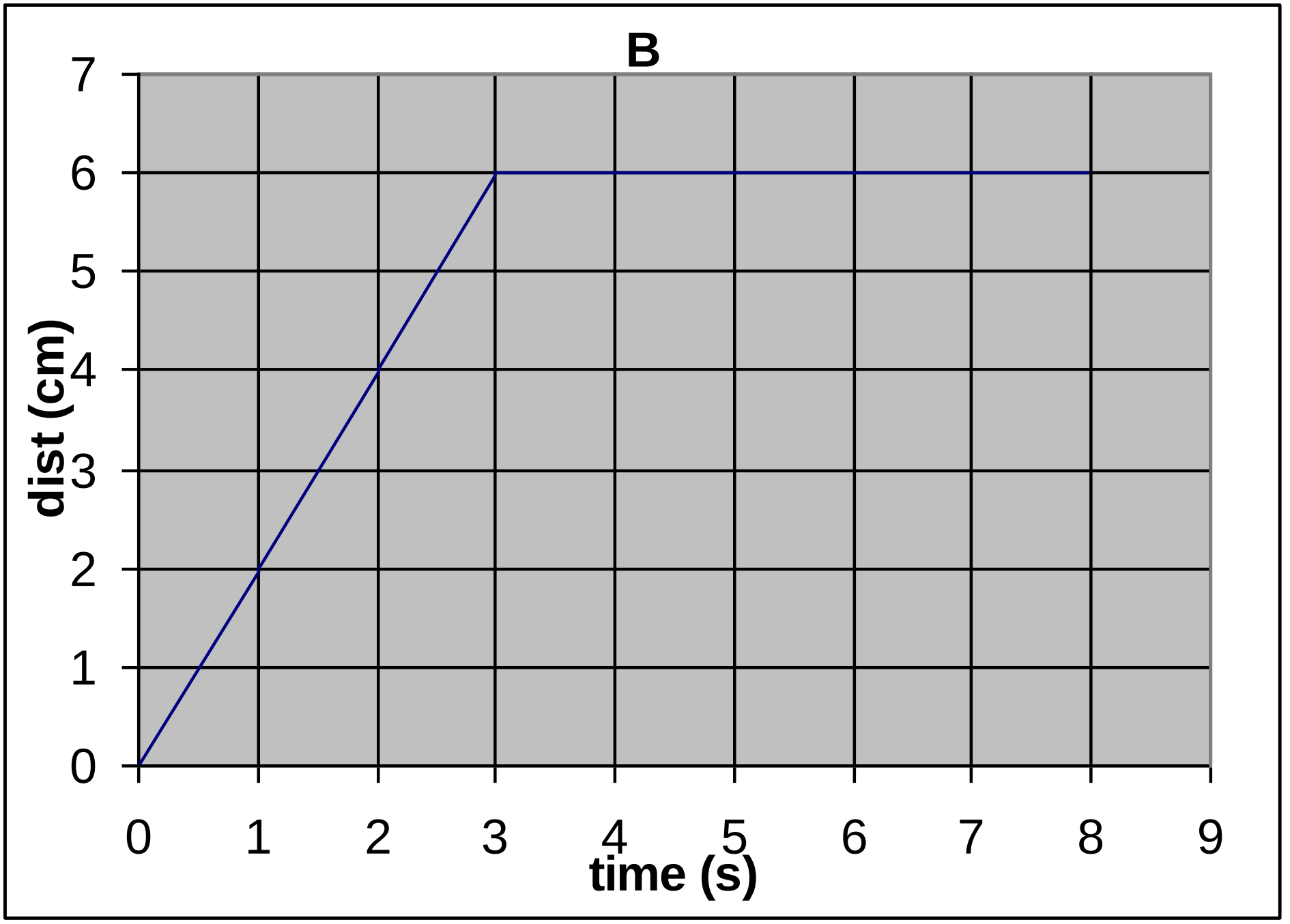
scalar quantity

- any measurement that does not include direction
  - just the number


A
10
8
6
4
2
0
dist (cm)
0
1
2
3
4
5
6
7
8
9
time (s)

What's it look like??




B
dist (cm)
0
1
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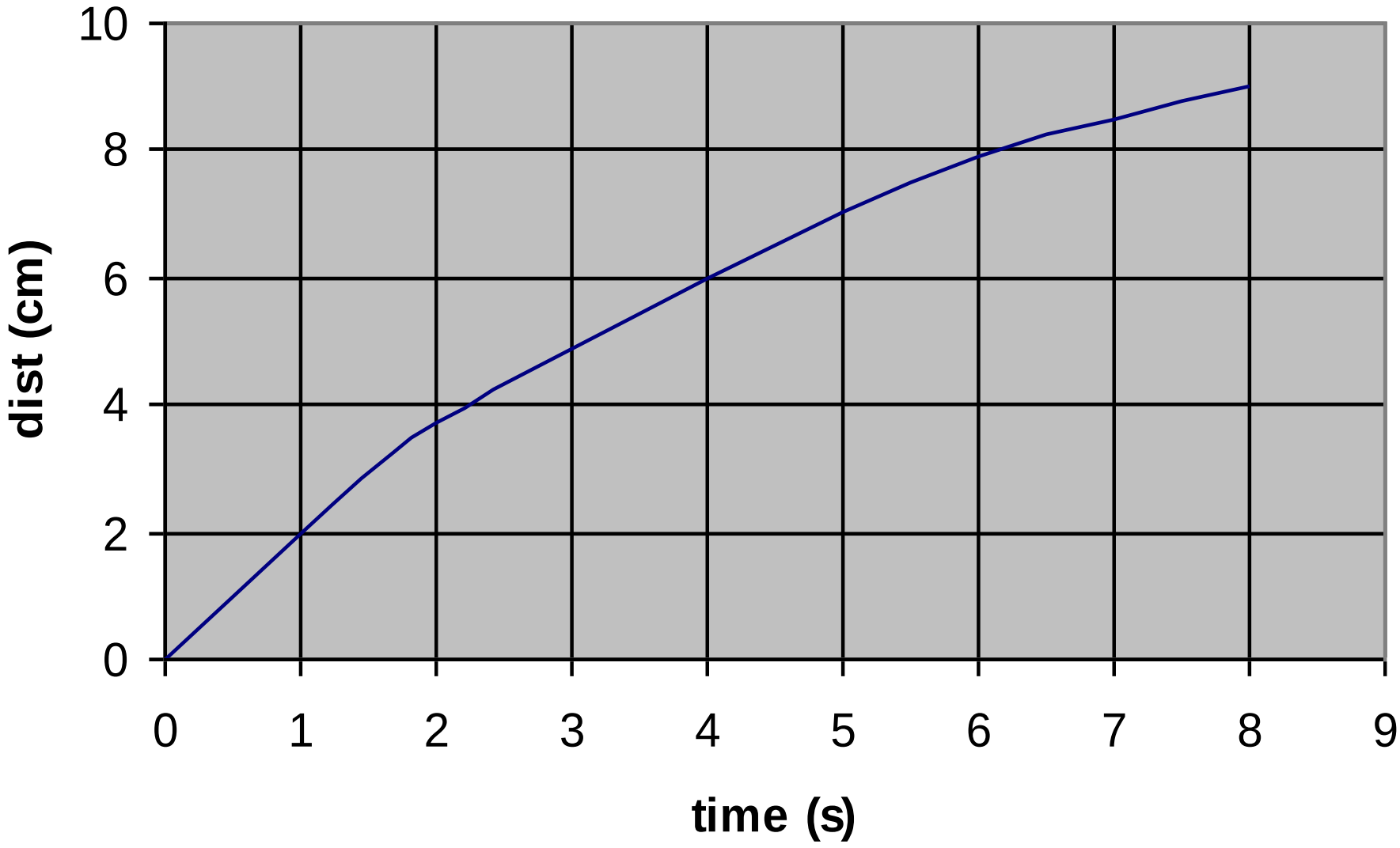
8
9
time (s)

C



What if…

- What is v if: you are in a boat moving 30km/hr E when the current of the river you are on is 10km/hr W??

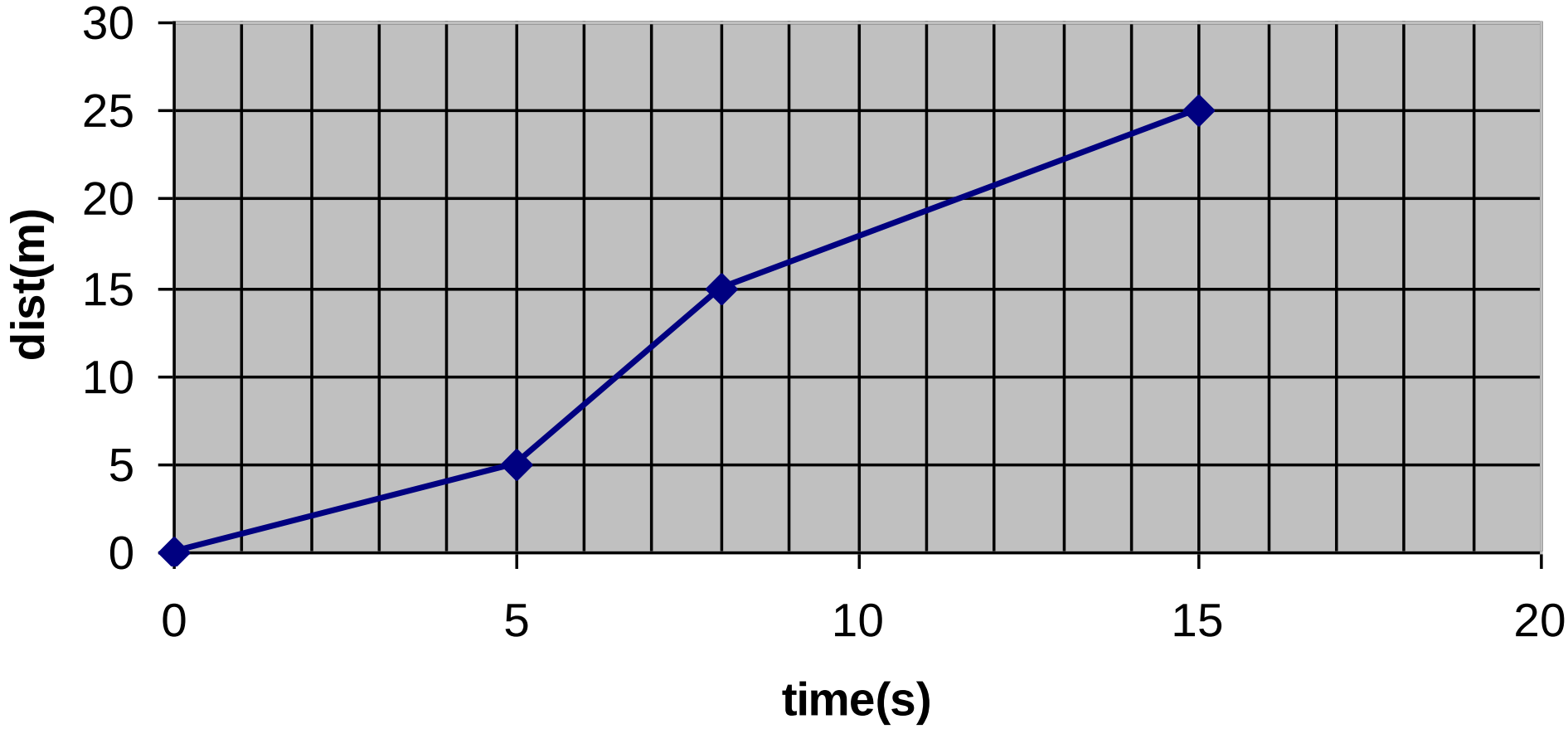
Combined velocities…

- If the v's have the same vector you add them
- If the v's have different vectors you subtract them.

average speed or velocity

- speed during a trip…
- $v_{avg} = \Delta d / \Delta t$ or $v_{avg} = d_f - d_i / t_f - t_i$

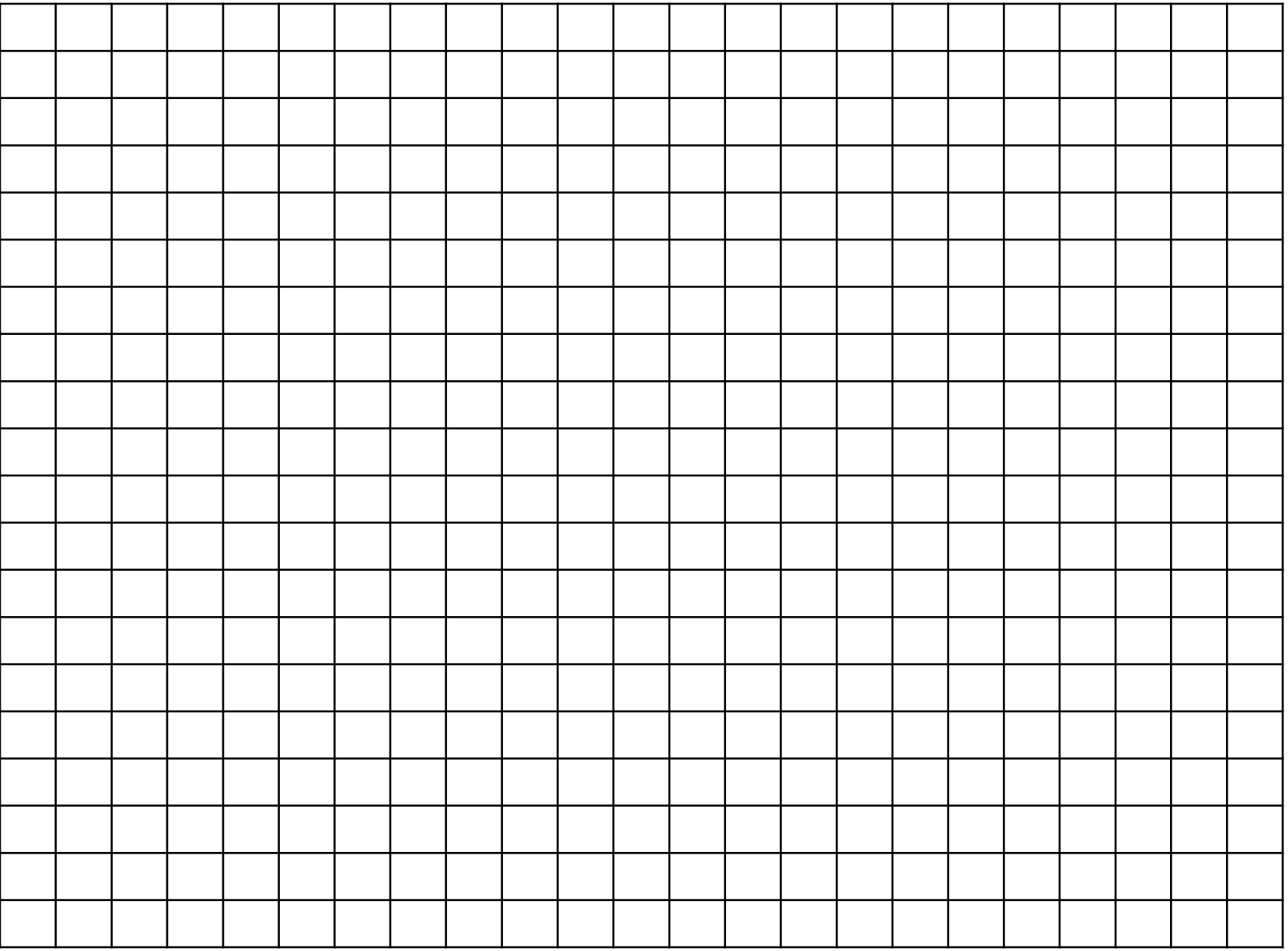
4.1



Acceleration…

- Is a change in velocity (over time)
- Does not mean only "getting faster"!
- Positive or negative acceleration and/or a change in direction
- a=v/t
- Unit: m/s/s or m/s^2

What's it look like??



Newton's Laws of Motion…

1

- An object in motion will remain in motion at constant velocity (speed & direction) until acted on by an unbalanced force.
- An object at rest will remain at rest until acted on by an unbalanced force.
- Inertia (lazy): things like to keep doing what they are already doing…

2

- Force = mass x acceleration

Force…

- More NRG stuff… Like Momentum…
- $F=m \cdot a$
- Unit… kgm/s/s or kgm/s^2 or Newton (N)

3

- For every force action, there is an equal and opposite force reaction.

Play time…

Newton Circus

Like Measurement Circus

- Nine (9) stations
- About 10 (ten) minutes per station
- Read – Do – Think – Answer
- Everybody writes everything
- Final product is **your own work**

Last Q on at each station…

- **Explain which of Newton's three laws this station is *best* demonstrating. Be complete by discussing what you did, you saw, you measured, etc. In other words, explain yourself as if the reader knew nothing about this station, or Newton's Laws for that matter.**

Get to Work…


F
C

Centripetal Force

- "center seeking force"
- Force that forces objects (in motion) toward the center of circles
- This is a real force…

Centrifugal Force

- NOT a real force
- Called an apparent force – it is what you FEEL not what is actually happening…
- You feel like you are being pushed to the outside of a circle – but you are actually being pushed in…

Centripetal acceleration

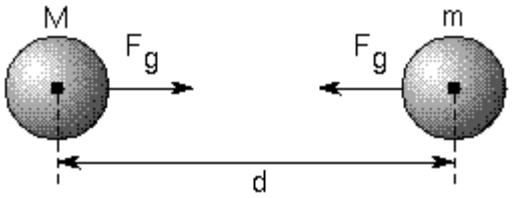
$$a_c = \frac{v^2}{r}$$

Heavy stuff…

Gravity

Gravity is…

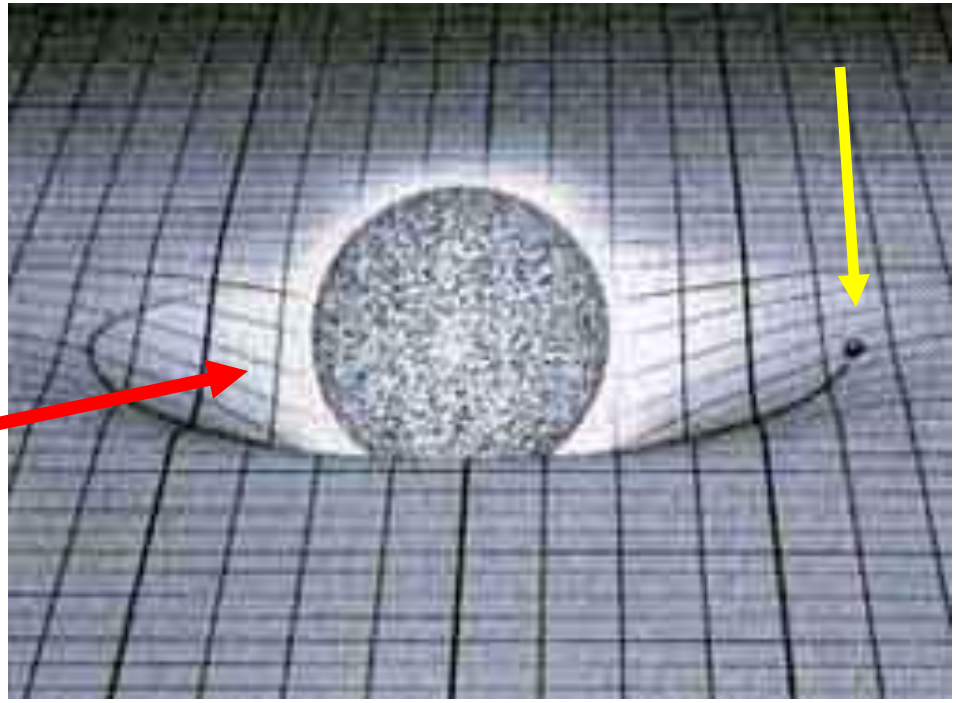
- Force of attraction b/t ALL objects in the universe
- Depends on the mass of the 2 objects and the distance b/t them



$$F_g = \frac{GMm}{d^2}$$

But what is it really??

- Weak force
- Einstein later explains that gravity is a *warp* in the "fabric of space-time"



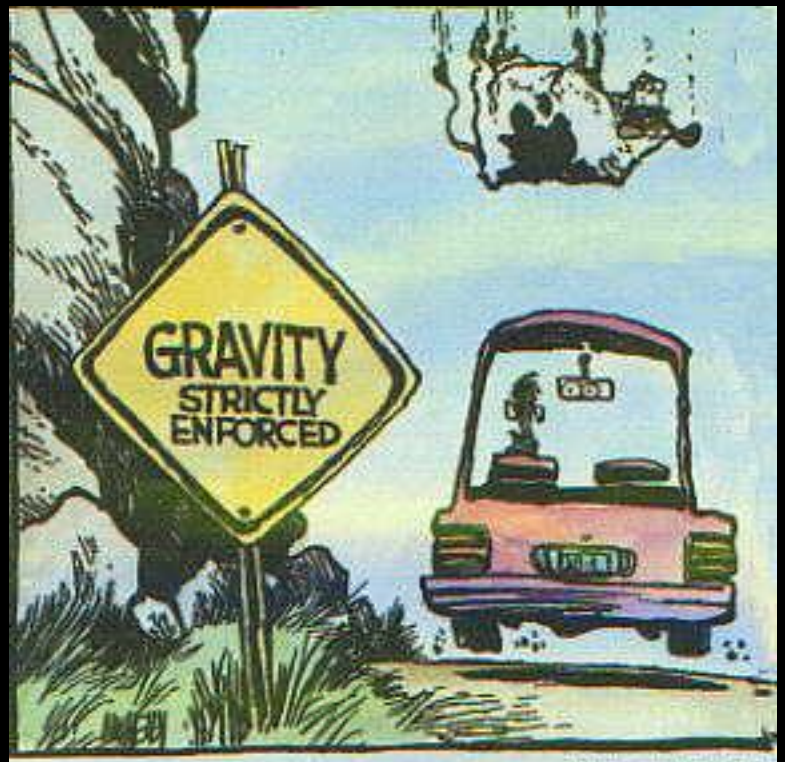


Illustration by Jeff Mechelly

Gravity is a contributing factor in nearly 73 percent of all accidents involving falling objects. And yet the so-called 'federal government' does nothing!

The stuff that makes stuff do stuff…

NRG

5 Main Forms of NRG

- Mechanical
- Thermal
- Chemical
- Electromagnetic
- Nuclear

Conservation of Energy

- Conservation of matter and energy…
- Cannot create or destroy matter or energy
- NRG lost by one thing must be gained by another –

  NEVER destroyed – just MOVED around…
- TRANSFER of ENERGY or TRANSFORMATION of ENERGY

Momentum

- A measure of ENERGY
- Like a force
- $M=m \cdot v$
- Unit… gm/s or kgm/s

Different from Force?

- Think of force as a **verb**.
  - The bat forced the ball to move
- Think of momentum as a **noun**
  - The ball had a large momentum – it didn't want to stop.

Remember…

- Energy cannot be created or destroyed
  - it must be conserved
- Or it may be transferred or transformed

NRG…

- Energy: the ability to do work
- work = force x distance
- W=Fd
- Units: Nm = $\frac{kgm^2}{s^2}$ or 1 Joule (J)

Potential Energy (E_p)

- Energy of Position (no motion)
- What effects the potential??
- Mass, Gravity, Height
- So… $E_p = mgh$
- Units???

Kinetic Energy (E_k)

- Energy of motion
- What affects the energy of a moving object??
- Mass & Velocity (what else is new??)
- $E_k = .5mv^2$
- Units???

Power!

- Energy (used/transferred) over time
- P=W/t
- Unit = J/s or the Watt (W)

Do this now…

- Get together w/ your NEW lab partners
- Create a procedure that will allow you determine the if the mass of bob, drop height or length of cord affect the period of a pendulum.
- Remember what is required for a good procedure…
- Questions??