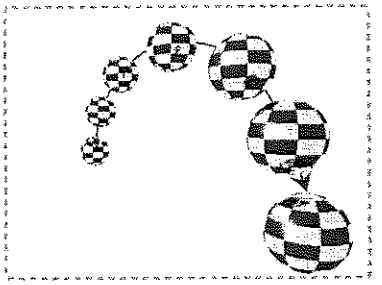
Unit 0 Introduction Notes

Warm Up- Write the question and answer in your notes

What does the term system mean to you? Provide at least one example in your notes. Be prepared to share out.

Systems



ergopedia Essential Physics

Objectives

- Define a system
- Understand the components and roles within a system
- Differentiate between an open and closed system

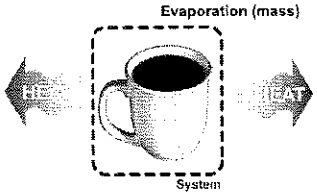
Key Terms

- System
- Open system
- Closed system
- Boundaries
- Components
- Interactions
- Inputs/Outputs

Open and closed systems

A *system* is a group of interacting objects and influences, such as forces.

In an *open system*, energy and matter can pass through the imaginary *system boundary* and leave the system.

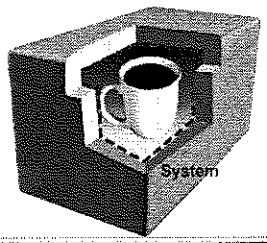


Open and closed systems

A *system* is a group of interacting objects and influences, such as forces.

In an *closed system*, no energy and matter can pass through the *system boundary*.

The energy in a closed system cannot change.



Boundaries

Boundaries are defined by the observer who is studying the system.

Boundaries can be artificial such as the Great wall of China or natural such as the Mississippi River.

Components

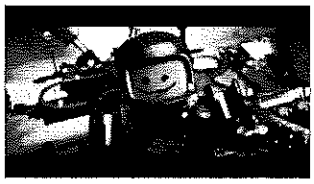
Components are the things that a system is made up of.

There are three basic kinds of components:

- Matter- anything that has mass (objects)
- Energy- causes change
- Forces- push or a pull

Interaction

Interactions are what systems do. They interact with the world outside of the system and the components within a system.



Inputs and Outputs

Inputs- matter or energy added into the system

Output- matter or energy taken away from a system

Discussion: If an earthquake occurred on the Great Wall would it be energy or forces or both added into the system?

- Think, pair, share

Activity

- Individually, take 2 minutes to think about and diagram your home as a system.
  - What do you consider the boundaries of your home system to be?
  - What components are included in your home system?
  - What kinds of interactions occur in your home system?
  - What are the inputs and outputs of your home system?

  *** Show energy transfer with an empty arrow ⇨ and matter moving to new locations with a solid arrow ➡

In your groups discuss..

- How might you describe what happens with matter in your home system? Is the amount of matter stable or is the amount of matter always changing? Does it cycle around and around or does it flow into and out of your home system?

- How might you describe what happens with energy in your home system? Is the amount of energy stable or is the amount of energy always changing? Does it cycle around and around or does it flow into and out of your home system?

Homework

- Diagram another system and label the boundaries, components, interactions, inputs/outputs.
- Is the system you chose is an open system or a closed system? Why?
- Complete the Frayer Model System Worksheet

Exit Slip- Write the question and answer in your notes

- What example was most helpful?
- What concept are you still wrestling with?
- What is something new you learned for today?

Measurement Systems

- What is the name of the measurement system we use every day in the USA?

English System

Empirical System / Standard System (outdated) /United States Customary System

- What is the name of the system the rest of the world uses?

Metric System

System Comparison

	English System	Metric System
Length	Inch/Foot/Mile	Meter
Volume	Gallon, pint, cup, fl. oz., Tbsp, tsp...	Liter
Mass	Slug	Kilogram
Weight	Ounce, pound	Newton

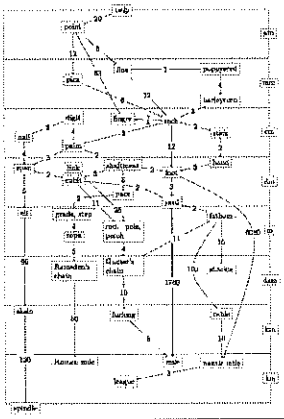
Which system do you like better?

Which system do you think is better for Science?

Why do we use the metric system?

Base 10 makes it simpler!

The rest of the world uses metric



Activity: Measurement Worksheet

1) Estimate the length of each object
2) Measure the actual length of each object using a meter stick
3) Move around to each station and compare/contrast the objects

Qualitative Observation

- It is observed, not measured
- Description or characteristic of an object
- Example: color, texture, smell, taste, appearance

Quantitative Observation

- Measured Observations
- Uses numbers
- Think quantity or amount
- Examples: length, height, area, volume, weight, time, temperature, cost, age etc.

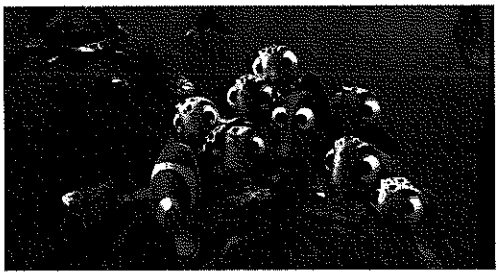
Activity:

- In your notebooks...
  - Make 5 Qualitative Observations
  - Make 5 Quantitative Observations

Exit Slip

- http://youtu.be/wwK7jc4b77U?t=13m52s
- While watching the video list one qualitative observation and one quantitative observation in your notebooks

What is one quantitative observation and one qualitative observation from this picture?



Dimensional Analysis

- The skill of using a conversion factor to convert from one unit to another. This is done through multiplication

DA involves 4 steps

1. Determine what units the problem is given in
2. Find what units the answer will be in
3. Choose the proper conversion factor
4. Multiply through and cancel out the unwanted units

- **Equality** – 2 values that are equal to each other
  - 1 kilometer = 1000 meters
  - 4 qts = 1 gal
- **Conversion factor** – a fraction that is always equal to 1 (so the value of the number doesn't change)

$$\frac{1\text{ km}}{1000\text{ m}} \quad \text{or} \quad \frac{1000\text{ m}}{1\text{ km}}$$

Remember from math…

- Dividing a number by itself equals?
- Dividing a number by 1 equals?

Any value multiplied by 1 doesn't change the value!

- So, dividing a unit by itself equals?

Examples:

- How many seconds are in 5 minutes?
- Convert 7 feet to meters.
- How many Seconds are in 1 week?

Try a few in your notes…

- Convert 400 seconds to minutes.
- How many kilometers are in 14 miles?
- Convert 55 miles/hour to meters/second

Converting between **metric** units

Kilo hecto deka base deci centi milli

K h da base d c m

Base units include meter, liter, gram, etc.

To move from one prefix to another…

- Simply move the decimal point the same number of times you shift on the chart

K h da base d c m

Example – How many milligrams in a kilogram?

- You move 6 spots on the chart
- Move your decimal 6 spots
  - From 1. kg to 1000000.

Try these: Write in Notes

1. 700 cm = _____ m
2. 800 g = _____kg
3. 500 mm = _____cm
4. 8.5 kg = _____g
5. 150 m = _____mm
6. 3.44 km = _____cm
7. 2 km = _____m

Ch. 1 Notes

3 Aspects of Physics

1) Describing the universe's organization
2) Understanding natural laws
3) Deducing & applying natural laws

Natural Law - tells you how or why something happens the particular way it does

Experiment - situation you carefully set up to see what happens under controlled conditions

Mass - amount of matter that makes up an object

matter - anything that has mass

energy - the ability to make things change

Variable - factor that affects the behavior of a system

Scale of a system

- systems show different things at the macroscopic & microscopic scale

macroscopic - large enough observations you can see

microscopic - need a tool to observe (very small)

Scientific Method

- way to conduct an experiment

Independent Variable - you change in experiment

Dependent Variable - responds to the change in the experiment

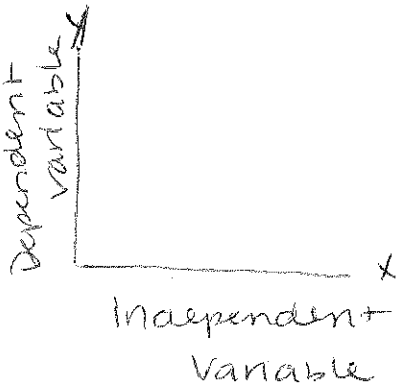
hypothesis - educated guess that predicts relationship between the independent & dependent variable

control - variable that is kept the same

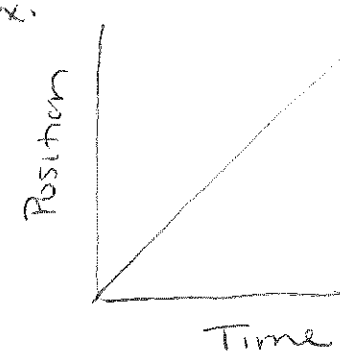
experimental variable - variable that is changed (synonym for indep. variable)

Distance - amount of space between two points
→ measured in units of length
(ex. inches, meters, centimeters, meters

English system vs. Metric system → see attached PowerPoint



ex.



Speed - distance the object travels over a given time

constant speed - same distance traveled every second

per - means "for every" or "for each". In math it means to divide

$V = \frac{d}{T}$ ← distance (m)

↑ Velocity (m/s) ← time (s)

Chapter 2

Acceleration - change in speed over time

Ex. units $mi/h/s$

$mi/s/s = mi/s^2$

$m/s/s = \frac{\frac{m}{s}}{s} = m/s^2$

$km/h/s$

$km/s/s = km/s^2$

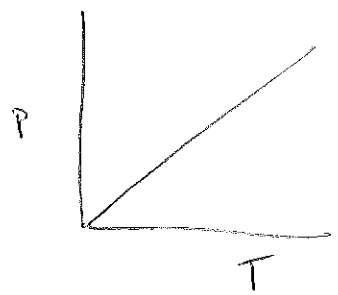
$a = \frac{V_2 - V_1}{t}$ ← V_2: Final velocity (m/s); V_1: Initial velocity (m/s); t: time (s)

a: acceleration (m/s^2)

deceleration - object slowing down

Slope - $\frac{Y_2 - Y_1}{X_2 - X_1}$ (change in Y units over change in X units)

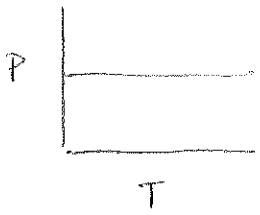
Position vs Time Graphs



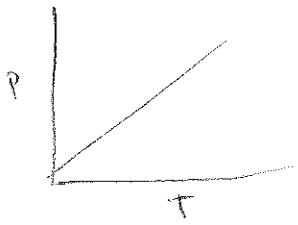
- Slope represents velocity

  Units of slope $\frac{m}{s}$

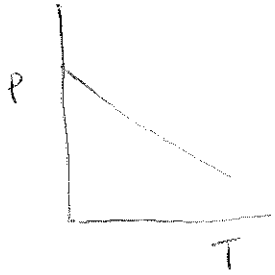
- Curve of a slope on PvT graph shows acceleration



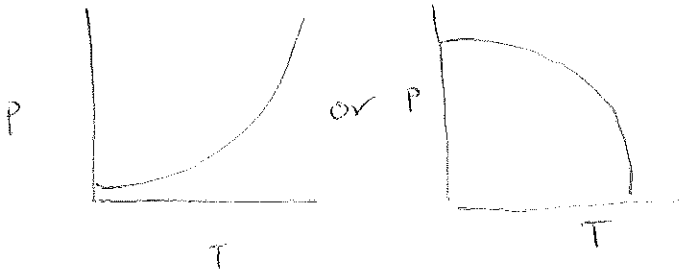
Obj. stopped



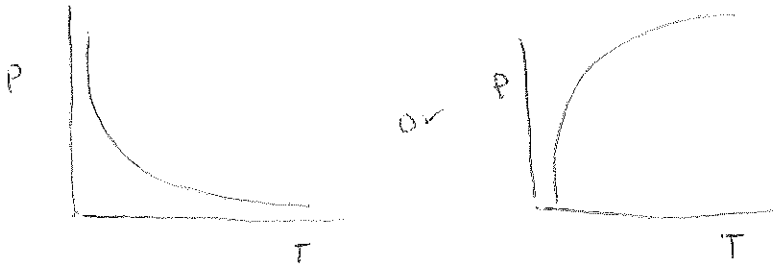
constant speed to the right



Constant speed to the left

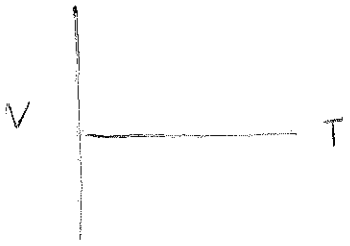


Acceleration

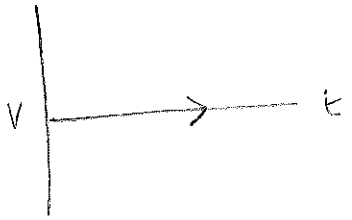


Deceleration

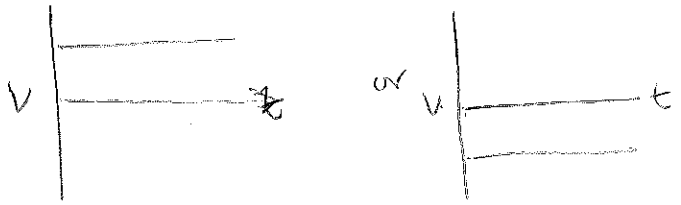
Velocity vs. Time Graphs



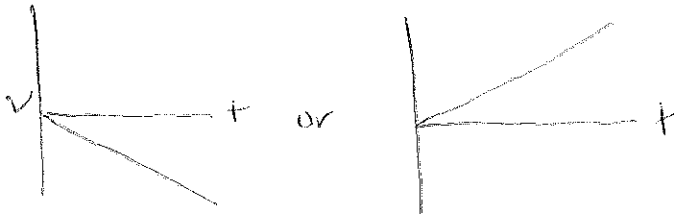
Slope represents acceleration



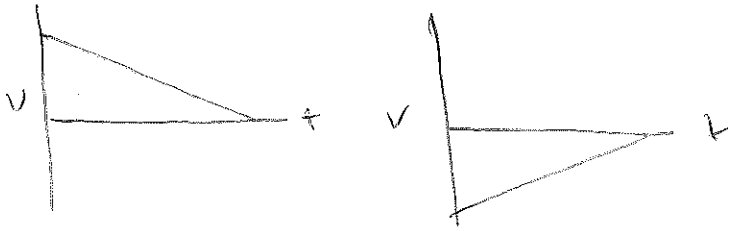
Stopped



Constant speed

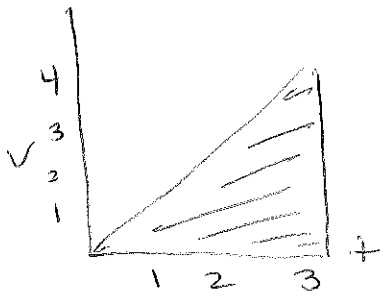


Acceleration



Deceleration

To find position from the velocity vs. time graph- solve for the area between the slope line and x axis



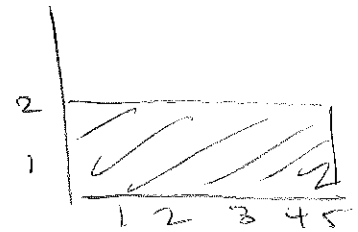
base 3s

height- 4m/s

$\frac{bh}{2}$

$\frac{3s(4m/s)}{2} = \frac{12m}{2} = 6m$

Obj. traveled 6m.



base 5s

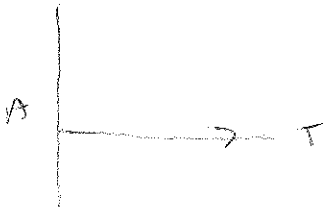
height 2 m/s

$b \cdot h$

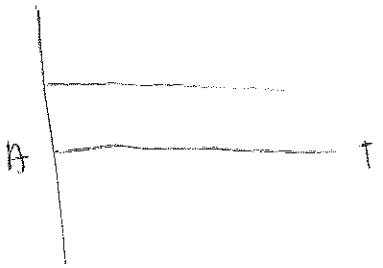
$\cdot 5s(2m/s) = 10m$

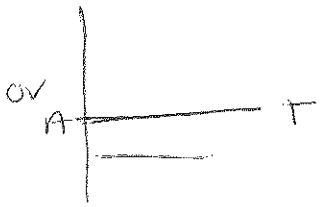
Obj- traveled 10m

Acceleration vs. Time Graph



Obj. stopped or moving at a constant speed. No acceleration present.





Obj. in constantly accelerating