KEY CONCEPTS FROM ST LABS

1. How to Distinguish Between Metals, Metalloids and Nonmetals.

- Metals usually react with acid to produce a gas; metalloids and non metals do not.
- If a metal reacts with water or oxygen, it will leave behind a base
- Non metals are poor conductors; metalloids conduct but usually not as well as most metals.
- Metals are malleable; metalloids and and non metals are not.
- Some nonmetals and metalloids can sparkle but they won't have that almost mirror-like luster that most metals have.

Example:

Match column 1 with column 2

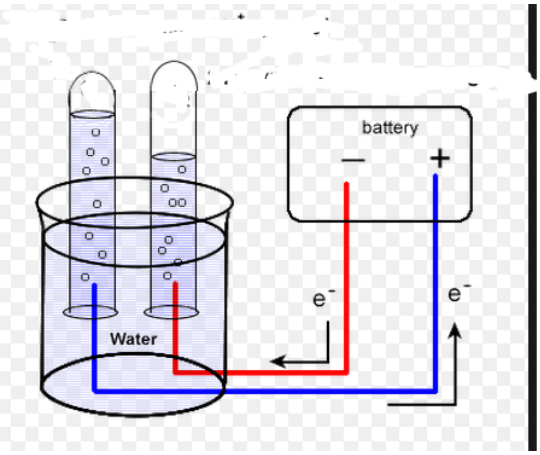
COLUMN 1	COLUMN 2
A solid that conducts electricity_____	a) Inconclusive; need more tests
A yellow-gold, shiny crystal_____	b) Definitely a metal
Malleable and bubbles when placed in acid___	c) Definitely a metalloid
Not malleable_____	d) Definitely a non metal.
Does not leave a base after being palced in water_____	

2. Electrolysis of Water $2\ H_2O \rightarrow 2\ H_2 + O_2$

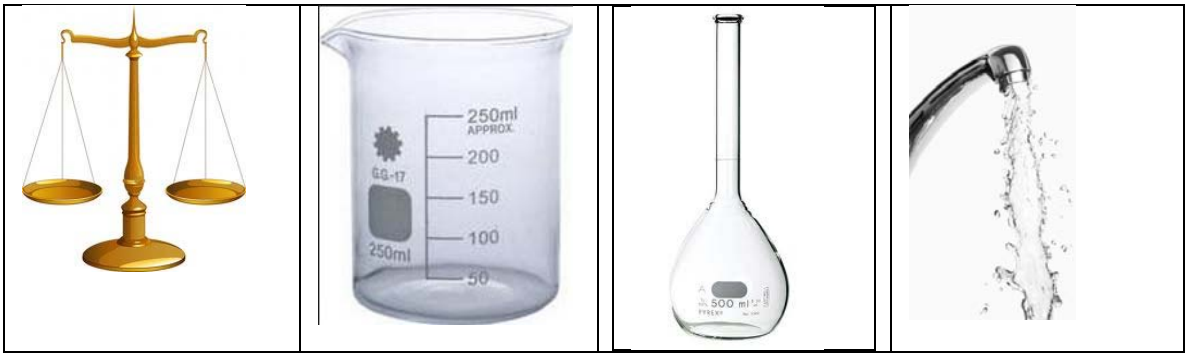
- Water can be split with electricity and the help of acid or salt
- Electrodes connected to a battery are inserted into separate test tubes. Each one will collect a different gas.
- When it dissociates, in theory, it should give a 2: 1 ratio of H_2 and O_2 gases to reflect the balanced equation
- But because of competing impurities inthe water, usually less oxygen is produced.

Example:

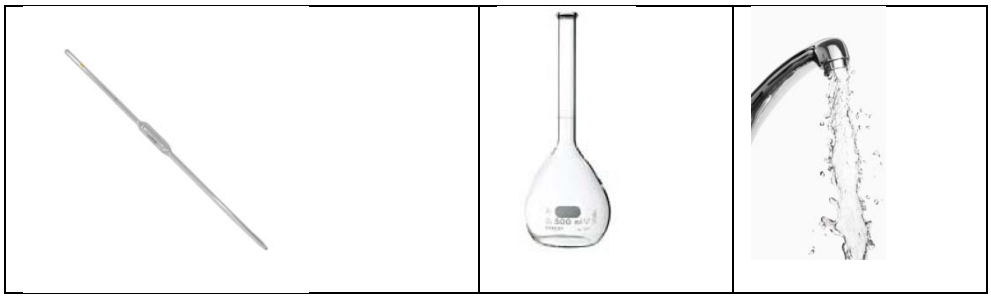
Identify the test tube containing oxygen and find the approximate percent of oxygen in that test tube. Use a ruler.



3. Preparing a Solution WDTA for a solid after using m = CV



and PTA for dilution



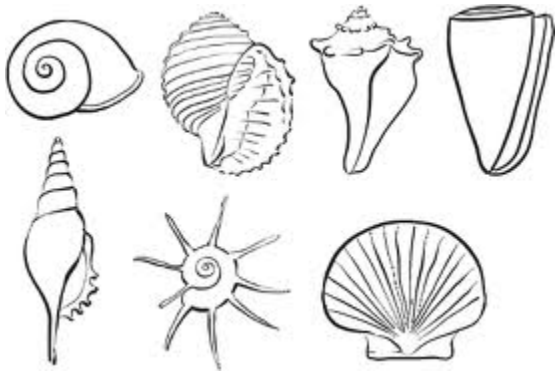
Examples:

1. a) How would you prepare 5.0 ml of a 3.0 g/L solution?

b) What if there was no 5.0 ml volumetric flask. What could you use instead?

c) What would you have to do to make the solution 1000 times more dilute? Assume that there is no micropipette in the lab but that there is an IV medicinal drip, which is adjusted to deliver 10 drops from each 1.0 ml.

4. Carbon Cycle Lab



- By blowing into water or any aqueous solution we represented what happens when carbon dioxide from the atmosphere encounters water:

$H_2O + CO_2 \rightarrow H_2CO_3$

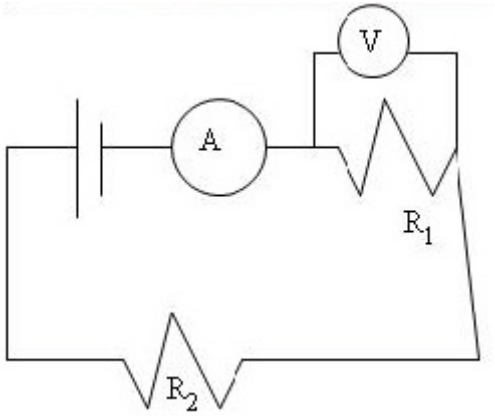
- In the presence of base (high pH) and calcium ions, the ions from the H_2CO_3 react and form calcium carbonate, which is found in shells.
- Both vinegar and H_2CO_3 are acids, so both change the colour of bromothymol blue towards yellow. But since H_2CO_3 is a weaker acid, it only goes to the in-between colour of green.

Example: a) How do you test for the presence of carbon dioxide in breath?

b) Why does the cloudiness go away if you keep blowing into it?

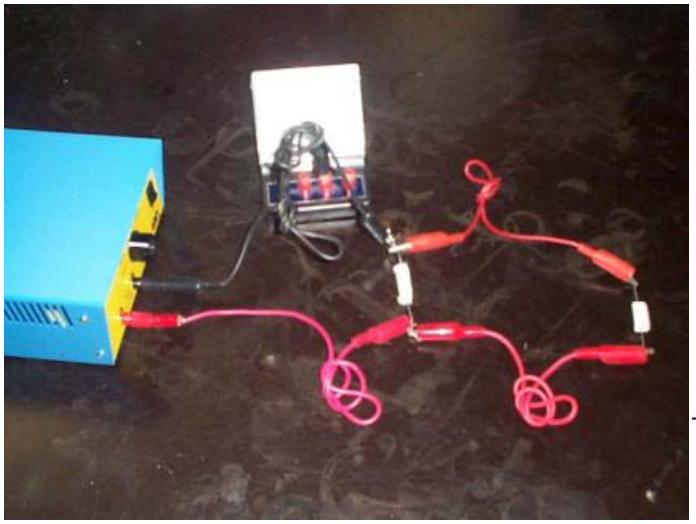
5. How to Build Circuits

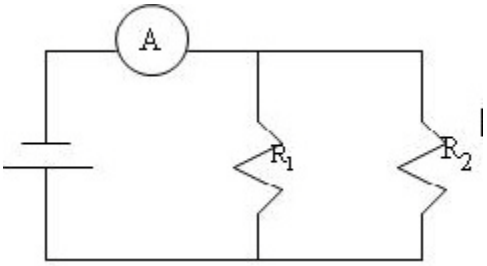
Case 1: Series Circuit (Note how the voltmeter is connected to each end of the resistor. The ammeter is only connected to one end.



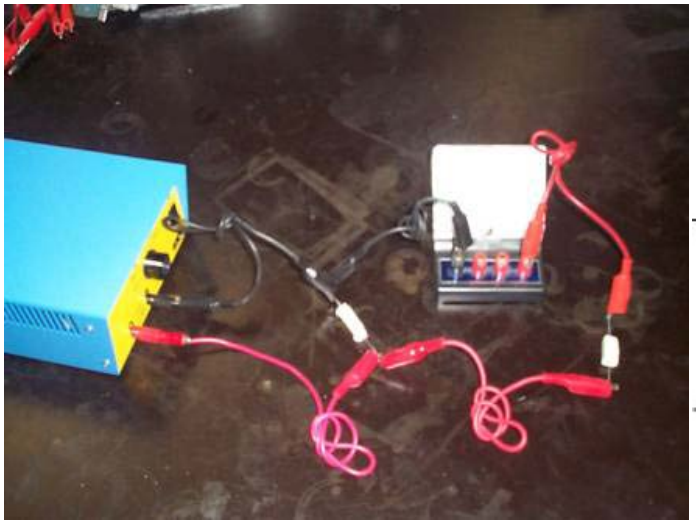
Case 2: Parallel Circuit

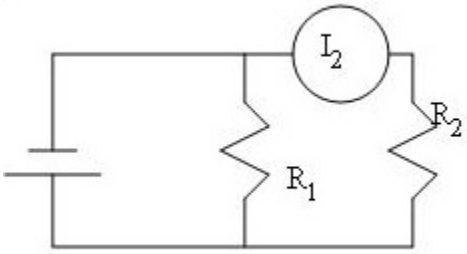
a. Ammeter Positioned to Measure Total Current



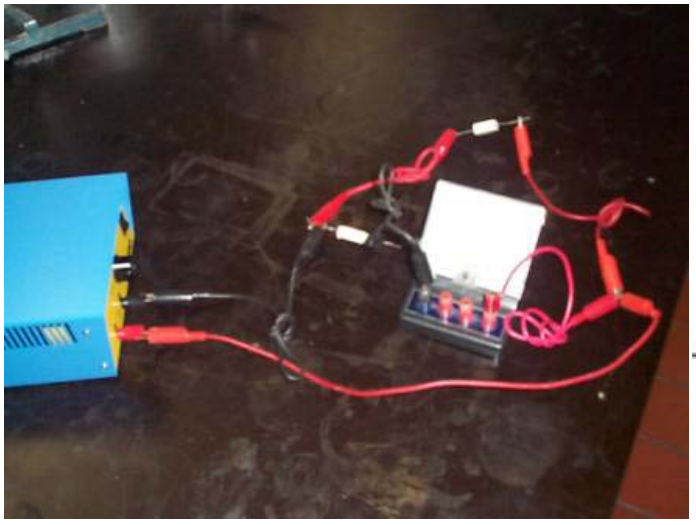


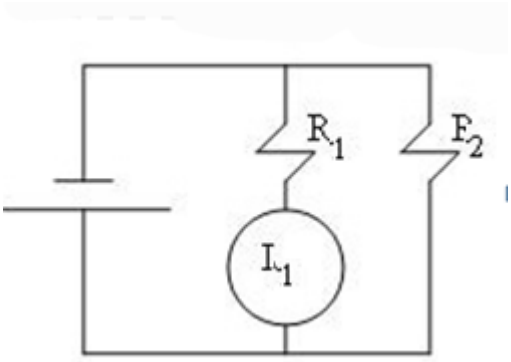
b. Ammeter Positioned to Measure I_2





c. Ammeter Positioned to Measure I_1





6. Gears: Practical Concepts

A) In order to have a velocity ratio greater than 1, you need to have the larger gear as the input.

B) To further increase the ratio, a gear box can be used.

C) In order to maintain same direction for the output as input, you need:

(1) An odd number of gears in a gear train.

(2) Or use a chain between two gears

(3) Or use a belt between two grooved wheels.

Example: Draw a set up in which a pair of 6-toothed gears and a pair of 2-toothed gears are rearranged to create a gear ratio of 9.

7. Transformation Systems

You can transform circular motion to linear motion with

(1) Rack and pinion
(2) Cam and follower
(3) Crank-slider

Example:

a) Which transformation system is this?
b) What can be attached to make it more practical?