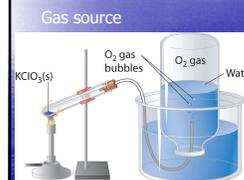


## Gas Identification

### Gas collection

- Gases can be very difficult to collect, because we it is hard to separate them from the rest of the air around us.
- Gas collection in water is a common method.
- A container is filled with water and flipped upside down in a container of water.
- A hose is then used to bubble the gas into the upside down container in the water.

### Gas collection over water



- This container was originally full of water. The gas slowly displaces the water.

### Gas collection over water

- The gas that is collected is fairly pure. There is, however, water vapor in the air.
- The amount of water vapor present in the air is dependent on temperature.
- This means if it is 20°, 2.3 kPa of the pressure of the gas collected is from water vapor

Table 18-2  
Vapor Pressure of Water

Temperature (°C)	Pressure (kPa)	Temperature (°C)	Pressure (kPa)	Temperature (°C)	Pressure (kPa)
1	0.6	21	2.3	80	12
5	0.9	25	2.8	90	14
10	1.2	28	3.0	95	15.5
15	1.6	32	3.2	100	16.9
18	1.8	35	3.4	105	17.7
20	2.1	38	3.6	110	18.3
25	2.3	40	4.0	115	19.1

### Reactivity

- Flame tests
- **Hydrogen**- *POPS* in the presence of a flame
- **Helium**- puts flame out
- **Carbon Dioxide**- puts flame out
- **Nitrogen**- Puts flame out
- **Oxygen**- reignites flame if it is smoldering
- **Methane**- produces a larger flame (burns)

### What makes gases float

- Gases float in air if their density is less than that of air, and sink if it is more.
- Air is composed of 78% Nitrogen (N<sub>2</sub>), 21 % Oxygen (O<sub>2</sub>) and 1 % Argon (Ar); with other gases in trace amounts.
- Density = mass/volume
- One mole of ANY gas is 22.4 L
- The mass of one mole is the molar mass.

### Gases that float

- Very few gases are actually lighter than air and do float.
- Air has a density of 1.28 g/L (28.672g/22.4L)
- **Hydrogen** (H<sub>2</sub>) is the least dense gas at .09 g/L (2.016 g/22.4 L)
- **Helium** (He) is .179 g/L (4.008 g /22.4 L)
- **Methane** (CH<sub>4</sub>) is .716 g/L (16.042 g/22.4 L)
- **Ammonia** (NH<sub>3</sub>) is .760 g/L (17.032 g/22.4 L)

### Gases that sink

- Most gases are actually more dense than air and will sink
- Carbon Dioxide, Oxygen, Ozone, krypton, xenon, radon, and butane.
- Propane heated houses can possibly blow up if a propane leak fills up the basement of the house, that eventually ignites.
- If propane was less dense it would float to the attic which almost always has a vent in it.
- Radon is a radioactive gas that also collects in the basement of houses if there is a source.

### Colored Gas

- If you see one...
- **Run** they are all poisonous!!
- **Fluorine**- A VERY pale yellow color which is difficult to see. It is the most reactive nonmetal on the planet and is incredibly toxic.
- **Chlorine**- A green gas which will react nearly everything and is good at killing people.
- **Bromine**- A vapor that is very intense red-orange color. It is pretty, but will kill you.
- **Nitrogen Dioxide**- A brown gas which is VERY good at killing people.
- **Iodine**- A pale violet color, inhaling the vapor can cause lung damage and could kill you.

### Gases and Vapors

- Vapors are gases!
- A vapor is a substance that is normally a solid or a liquid at the current conditions (temperature and pressure), however, it is kind of dissolved in the air.
- Water that has evaporated is a vapor, rubbing alcohol readily evaporates into a vapor, so do bromine and iodine

### Water Vapor

- Water Vapor is invisible to the human eye.
- You can see steam because some tiny droplets of the water are condensing (turning back into liquid water) and forming a mini-cloud.
- You can see your breath when it is cold for the same reason

### Distinct Odor

- Ammonia
- Ozone
- Mercaptan- odor in natural gas. Natural gas by itself is odorless, this is added so you know if there is a leak.
- Hydrogen Sulfide- smells like rotten eggs