Name ____

By: John Sebranek, Green Bay Southwest High School, jsebrane@greenbay.k12.wi.us

Gas Lab

gas

Purpose

Students will be able to determine the formula weight of a pure sample with an accuracy of at least 92%. After successful completion of the lab, each student will answer questions, write a concise conclusion and take a practical lab quiz. Record temperatures using Easy Data and an Easy temp probe.

Introduction

1) Make enough balloon assemblies for your largest class (one per lab group). Prepare the balloon assemblies as follows:
Cut a piece of 1/4" latex hose 50 cm long. Take a glass eyedropper apart and place one end of the hose over the large end of a glass eye dropper. Place the small end of the eye dropper into a #0 one hole rubber stopper. Stretch a seven inch balloon over the small rubber stopper and fasten a pinch clamp on the 50 cm length of latex hose.

2) Make enough stopper assemblies for your largest class (one per lab group). Prepare the stopper assemblies as follows:
Cut two short pieces of glass tubing and slide them through the holes in a #4 or #5 two hole rubber stopper. You may need to smear some vaseline on the glass rods to get them through the rubber stoppers. Cut a piece of 1/4" latex hose 20 cm long and slide it over one of the glass rods. Put a pinch clamp on the hose and push the rubber stopper into the water filled acid bottle.

Procedure

1) Record the name of the element you are testing in the data table along with its known formula weight.)

2) Find the volume of the bottle by filling it with water and pouring the water into a graduated cylinder. (Record Value)
Refill the acid bottle completely full of tap water and set it aside.

3) Set up a ring stand with a 6 inch ring clamp fasten about 30 cm from the base. Fill a water trough partially full of water and place it under the ring on the ring stand.

4) Put the empty balloon assembly in a 250 mL beaker and mass it on a digital balance. (Record Value)

5) Fill the balloon with a compressed gas and clamp off the latex hose. Remass the balloon assembly. (Record Value)
This value represents part of the mass of the gas in the balloon. It does not account for the buoyancy of air factor which must be calculated later after the volume of the balloon is known.

6) Run the hose of the balloon assembly through the bottom of the six inch ring and slide it on the glass rod in the two hole rubber stopper in the bottle. Be sure the #4 rubber stopper in pushed securely into the acid bottle.

7) Turn the acid bottle over and gently set it into the six inch ring. <u>Be sure the set up is stable!</u>

8) While holding the short 20 cm latex hose under the water in the water trough, release the pinch clamp. A vacuum in the glass bottle will hold the water from pouring out.

9) Bubble the gas up through the water into the bottle releasing the pinch clamp on the balloon assembly. As the balloon empties, water will be forced out of the bottle into the water trough. Be sure there are no leaks. All the gas from the balloon must be collected over water vapor in the bottle. Squeeze the last few milliliters of gas out of the balloon into the bottle.
10) Once the balloon is empty, measure the height of the water column left in the bottle. Measure from the top of the stopper in the bottle to the surface of the water left in the bottle.

11) Measure the volume of water left in the bottle. (Record Value)
12) Record the temperature of the tap water in the bottle.
13) Record the temperature in the lab.
14) Record the barometric pressure in the lab.
15) Complete the calculations in the table.

MASS A GAS DATA TABLE		
#1	Volume of glass bottle in liters (procedure 2)	L
#2	Mass of balloon assembly, beaker and empty balloon (procedure 4)	g
#3	Mass of balloon assembly, beaker and filled balloon (procedure 5)	g
#4	Mass of gas in balloon without adjusting for the buoyancy factor (#3-#2)	g
#5	Height of water column in the glass bottle in millimeters of water (procedure 10)	mm
#6	Height of water column in equivalent millimeters of mercury, density of Hg = 13.6g/mL	mm
#7	Volume of water left in glass bottle in liters (procedure 11)	L
#8	Volume of the gas in the balloon in liters (#1 - #7)	L
#9	Temperature of the tap water in the bottle (procedure 12)	°C
#10	Water vapor pressure in mm of Hg (See Table) (use tap water temperature)	mm Hg
#11	Temperature in the lab in Kelvins (procedure 13)	K
#12	Barometric pressure in the lab in mm of Hg (procedure 14)	mm Hg
#13	V_1 = nonstandard volume of the balloon in liters (#8)	L
#14	P_1 = nonstandard pressure of the balloon in mm of Hg (#12 - #10 - #6)	mm Hg
#15	T_1 = nonstandard temperature of the lab in Kelvins (#11)	K
#16	T_2 = standard temperature in Kelvins (Constant)	K
#17	P_2 = standard pressure in mm of Hg (Constant)	mm Hg
#18	V_2 = standard volume of the balloon in liters (#13 * #14 * #16) divided by (#15 * #17)	L
#19	Amount of gas in the balloon in moles (#18) divided by 22.4 L/mol at STP	mol
#20	Buoyancy factor of gas filled balloon in g/L (See Table) (use lab room temperature and pressure)	g/L
#21	Actual mass of gas in balloon including buoyancy factor (#8* #20) + (#4)	g
#22	Formula weight of gas in balloon (#21) divided by (#19)	g/mol

Values for the vapor pressure of water at various temperatures in the CRC handbook, D-190.
Values for the buoyancies of air at various temperatures and pressures is in the CRC handbook, F-9, Table IV

Values for the vapor pressure of water at various temperatures in the CRC handbook, D-190.
Values for the buoyancies of air at various temperatures and pressures is in the CRC handbook, F-9, Table IV

	MASS A GAS DATA TABLE	
#1	Volume of glass bottle in liters	L
#2	Mass of balloon assembly, beaker and empty balloon	g
#3	Mass of balloon assembly, beaker and filled balloon	g
#4	Mass of gas in balloon without buoyancy factor	g
#5	Height of water column in the glass bottle in mm of water	mm
#6	Height of water column in equivalent millimeters of Hg	mm
#7	Volume of water left in glass bottle in liters	L
#8	Volume of the gas in the balloon in liters	L
#9	Temperature of the tap water in the bottle	°C
#10	Water vapor pressure in mm of Hg	mm Hg
#11	Temperature in the lab in Kelvins	K
#12	Barometric pressure in the lab in mm of Hg	mm Hg
#13	V_1 = nonstandard volume of the balloon in liters	L
#14	P_1 = nonstandard pressure of the balloon in mm of Hg	mm Hg
#15	T_1 = nonstandard temperature of the lab in Kelvins	K
#16	T_2 = standard temperature in Kelvins	K
#17	P_2 = standard pressure in mm of Hg	mm Hg
#18	V_2 = standard volume of the balloon in liters	L
#19	Amount of gas in the balloon in moles	mol
#20	Buoyancy factor of gas filled balloon in g/L	g/L
#21	Actual mass of gas in balloon including buoyancy factor	g
#22	Formula weight of gas in balloon	g/mol

	Names:	
	QUIZ PRACTICE - GAS LAB	
#1	Volume of glass bottle in liters	L
#2	Mass of balloon assembly, beaker and empty balloon	g
#3	Mass of balloon assembly, beaker and filled balloon	g
#4	Mass of gas in balloon without buoyancy factor	g
#5	Height of water column in the glass bottle in mm of water	mm
#6	Height of water column in equivalent millimeters of Hg	mm
#7	Volume of water left in glass bottle in liters	L
#8	Volume of the gas in the balloon in liters	L
#9	Temperature of the tap water in the bottle	°C
#10	Water vapor pressure in mm of Hg	mm Hg
#11	Temperature in the lab in Kelvins	K
#12	Barometric pressure in the lab in mm of Hg	mm Hg
#13	V_1 = nonstandard volume of the balloon in liters	L
#14	P_1 = nonstandard pressure of the balloon in mm of Hg	mm Hg
#15	T_1 = nonstandard temperature of the lab in Kelvins	K
#16	T_2 = standard temperature in Kelvins	K
#17	P_2 = standard pressure in mm of Hg	mm Hg
#18	V_2 = standard volume of the balloon in liters	L
#19	Amount of gas in the balloon in moles	mol
#20	Buoyancy factor of gas filled balloon in g/L	g/L
#21	Actual mass of gas in balloon including buoyancy factor	g
#22	Formula weight of gas in balloon	g/mol

Values for the vapor pressure of water at various temperatures in the CRC handbook, D-190.
Values for the buoyancies of air at various temperatures and pressures is in the CRC handbook, F-9, Table IV