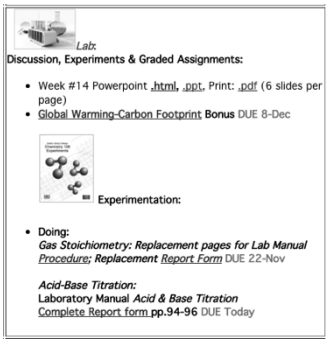
Chem 108: Lab

Week 14

Sign in / Pick up Papers and Handouts



Lab:

Discussion, Experiments & Graded Assignments:

- Week #14 Powerpoint .html, .ppt, Print: .pdf (6 slides per page)
- Global Warming-Carbon Footprint **Bonus** DUE 8-Dec

Experimentation:

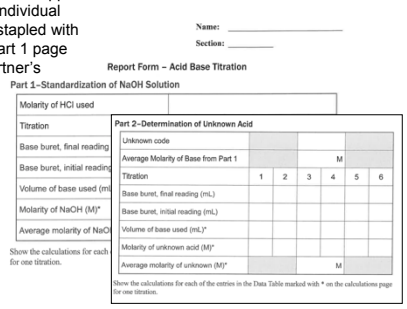
- **Doing:**
  Gas Stoichiometry: Replacement pages for Lab Manual
  Procedure; Replacement Report Form DUE 22-Nov

  Acid-Base Titration:
  Laboratory Manual *Acid & Base Titration*
  Complete Report form **pp.94-96** DUE Today

Chem 108: Lab

Due Today: Titrations
Complete Report form pp. 94-96. Turn in individual unknown page stapled with partners, and Part 1 page with yours & partner's name.

Include clear calculations with units.



Name: _____
Section: _____

Report Form – Acid Base Titration

Part 1–Standardization of NaOH Solution

Molarity of HCl used	
Titration	
Base buret, final reading	
Base buret, initial reading	
Volume of base used (ml	
Molarity of NaOH (M)*	
Average molarity of NaO	

Show the calculations for each for one titration.

Part 2–Determination of Unknown Acid

Unknown code						
Average Molarity of Base from Part 1				M		
Titration	1	2	3	4	5	6
Base buret, final reading (mL)						
Base buret, initial reading (mL)						
Volume of base used (mL)*						
Molarity of unknown acid (M)*						
Average molarity of unknown (M)*				M		

Show the calculations for each of the entries in the Data Table marked with * on the calculations page for one titration.

Calculations

QUESTION

A 35.00 mL sample of 0.2250 M HBr was titrated with 42.30 mL of KOH. What is the concentration of the KOH?

A. 0.0930 M
B. 0.3030 M
C. 0.2719 M
D. 0.1860 M
E. 0.3720 M

Answer

$$\underset{\text{acid}}{HBr_{(aq)}} + \underset{\text{base}}{KOH_{(aq)}} \longrightarrow \underset{\text{salt}}{KBr_{(aq)}} + \underset{\text{water}}{H_2O_{(l)}}$$

A 35.00 mL sample of 0.2250 M HBr was titrated with 42.30 mL of KOH. What is the concentration of the KOH?

$$?M_{KOH} = [M_{HBr} \times V_{HBr} / V_{KOH}\,][?\ mol_{KOH} / ?\ mol_{HBr}]$$

$$= \frac{0.2250\ mol_{HBr} \times 0.03500\ L_{HBr} \times 1\ mol_{KOH}}{L_{HNO3} \times 0.04230 L_{KOH} \times 1\ mol_{HBr}} = 0.1860\ M_{KOH}$$

Answer D.

Calculations

QUESTION

A 35.00 mL sample of 0.2250 M H_2SO_4 was titrated with 42.30 mL of KOH. What is the concentration of the KOH?

A. 0.0930 M
B. 0.3030 M
C. 0.2719 M
D. 0.1860 M
E. 0.3720 M

Answer

$$\underset{\text{acid}}{H_2SO_{4(aq)}} + 2\ \underset{\text{base}}{KOH_{(aq)}} \longrightarrow \underset{\text{salt}}{K_2SO_{4\ (aq)}} + 2\ \underset{\text{water}}{H_2O_{(l)}}$$

A 35.00 mL sample of 0.2250 M H_2SO_4 was titrated with 42.30 mL of KOH. What is the concentration of the KOH?

$$?M_{KOH} = [M_{H2SO4} \times V_{H2SO4} / V_{KOH}\,][?\ mol_{KOH} / ?\ mol_{H2SO4}]$$

$$= \frac{0.2250\ mol_{H2SO4} \times 0.03500\ L_{H2SO4} \times 2\ mol_{KOH}}{L_{H2SO4} \times 0.04230 L_{KOH} \times 1\ mol_{H2SO4}} = 0.3720\ M_{KOH}$$

Answer E.

Calculations

QUESTION

A 35.00 mL sample of hydrochloric acid of unknown concentration was titrated with 42.30 mL of 0.2250 M KOH. What is the concentration of the HCl?

A. 0.0930 M
B. 0.3030 M
C. 0.2719 M
D. 0.1860 M
E. 0.3720 M

Answer

$$\underset{\text{acid}}{HCl_{(aq)}} + \underset{\text{base}}{KOH_{(aq)}} \longrightarrow \underset{\text{salt}}{KCl_{(aq)}} + \underset{\text{water}}{H_2O_{(l)}}$$

A 35.00 mL sample of HCl of unknown concentration was titrated with 42.30 mL of 0.2250 M KOH. What is the concentration of the HCl?

$$?M_{HCl} = [M_{KOH} \times V_{KOH} / V_{HCl}\,] [? mol_{HCl} / ? mol_{KOH}]$$

$$= \frac{0.2250\ mol_{KOH} \times 0.04230\ L_{KOH} \times 1\ mol_{HCl}}{L_{KOH} \times 0.03500\ L_{HCl} \times 1\ mol_{KOH}} = 0.2719\ M_{HCl}$$

Answer C.

Acidification Effects

Acid-Base Reactions & Behavior of Gases

Handout

Stoichiometry / Limiting Reactant / Ideal Gas Law

___ HCl (aq) + ___ $NaHCO_3(s)$ → ___ $CO_2(g)$ + ___ $H_2O(l)$ + ___ NaCl (aq)

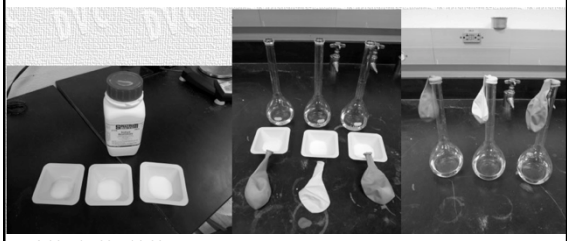
hydrochloric acid *sodium bicarbonate*

Acid-Base Reactions & Behavior of Gases

Stoichiometry / Limiting Reactant / Ideal Gas Law

___ HCl (aq) + ___ $NaHCO_3(s)$ → ___ $CO_2(g)$ + ___ $H_2O(l)$ + ___ NaCl (aq)

hydrochloric acid *sodium bicarbonate*



2.00 g / 4.00 g / 6.00 g 70.0mL 1.0 M $_{HCl}$

Acid-Base Reactions & Behavior of Gases

Stoichiometry / Limiting Reactant / Ideal Gas Law

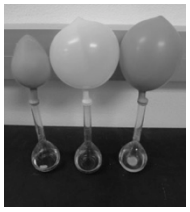
___ HCl (aq) + ___ $NaHCO_3(s)$ → ___ $CO_2(g)$ + ___ $H_2O(l)$ + ___ NaCl(aq)

hydrochloric acid *sodium bicarbonate*

1. a. Balance the above equation.

1.b. Record your observations of what you see in the flasks.

Observation (Green))	Observation (Yellow)	Observation (Blue)



Acid-Base Reactions & Behavior of Gases

Stoichiometry / Limiting Reactant / Ideal Gas Law

1 HCl (aq) + 1 $NaHCO_3(s)$ → 1 $CO_2(g)$ + 1 $H_2O(l)$ + 1 NaCl (aq)

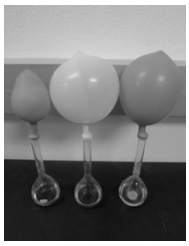
hydrochloric acid *sodium bicarbonate*

1.c. Using your observations, if possible, identify the limiting reactant in each flask. Record the name of the limiting reactant and its formula in the table below. If you cannot determine which was limiting write NA.

Limiting Reactant (Green	Limiting Reactant (Yellow)	Limiting Reactant (Blue)

Rank the flasks in order of the amount of CO_2 produced, using > (more than), < (less than), = equal

Green ___ Yellow ___ Blue ___



Acid-Base Reactions & Behavior of Gases

Stoichiometry / Limiting Reactant / Ideal Gas Law

Molar Mass = 84.00 g/mol

1 ___ HCl (aq) + 1 ___ $NaHCO_3(s)$ → 1 ___ $CO_2(g)$ + 1 ___ $H_2O(l)$ + 1 ___ NaCl (aq)

hydrochloric acid *sodium bicarbonate*

2. Calculate the number of moles of sodium bicarbonate that were added to the respective flasks. (The moles of hydrochloric acid in all 3 flasks is equal to its molarity (1.0 mol / L) x 70.0 ml x 1.0 L / 1,000. mL)

mol_{HCl} = 1.0 mol/L x 1.00L/1,000mL x 70.0mL

Moles of $NaHCO_3$ in Green:_____

Moles of $NaHCO_3$ in Yellow: _____

Moles of $NaHCO_3$ in Blue: _____

mol = 2.00 g / 84.00 g/mol | mol = 4.00 g / 84.00 g/mol | mol = 6.00 g / 84.00 g/mol

1 ___ HCl (aq) + 1 ___ $NaHCO_3(s)$ → 1 ___ $CO_2(g)$ + 1 ___ $H_2O(l)$ + 1 ___ NaCl (aq)

hydrochloric acid *sodium bicarbonate*

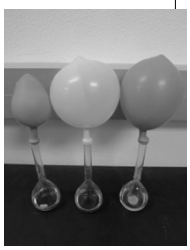
3. Calculate the number of moles of CO_2 theoretically produced and then calculate the respective theoretical volume of CO_2 produced in each flask assuming STP (Standard Temperature and Pressure) and that 1 mole of gas equals 22.4 liters.

Volume of CO_2 in Green:_____

Volume of CO_2 in Yellow: _____

Volume of CO_2 in Blue:_____

• "STP"
- For 1 mole of a gas at STP:
- P = 1 atmosphere
- T = 0°C (273.15 K)
- The molar volume of an ideal gas is *22.42* liters at STP



1 ___ HCl (aq) + 1 ___ $NaHCO_3(s)$ → 1 ___ $CO_2(g)$ + 1 ___ $H_2O(l)$ + 1 ___ NaCl (aq)

hydrochloric acid *sodium bicarbonate*

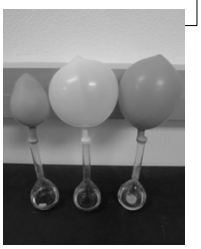
4. If unreactive sodium bicarbonate is seen in any of the flasks, calculate the amount left over. If there is none, write none. Show a clear, labeled example of your calculation for one of the flasks with left over sodium bicarbonate.

The amount left over in each flask, which should agree with your qualitative observations:

Amount remaining in Green:_____

Amount remaining in Yellow:_____

Amount remaining in Blue:_____



http://chemconnections.org/general/chem108/Magnesium-Zinc-wo.1.mov

Experimentally Determining Moles of Hydrogen

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

$$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

Using Partial Pressures
the Ideal Gas Law & Stoichiometry
Dr. Ron Rusay

Related Quiz Questions

Experimentally Determining Moles of Hydrogen

QUESTION

The density of an unknown atmospheric gas pollutant was experimentally determined to be 1.964 g/ L @ 0 °C and 760 torr.

- *What is the molar mass of the gas?*
- *What might the gas be?*

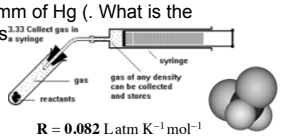
A) CO B) SO_2 C) H_2O D) CO_2

QUESTION

Freon-12, CF_2Cl_2, a "safe" compressible gas, was widely used from 1935-1994 as a refrigerant in refrigerators, freezers, and air conditioning systems. However, it had been shown to be a greenhouse gas and to catalytically destroy the ozone layer in a ratio of >14,000:1. It was phased out and banned.

200. ml of Freon-12 was collected by syringe. It weighed 0.927 grams, had a temperature of 30.0°C (303.1K), and a pressure of 730 mm of Hg (. What is the experimental molar mas

A. 12.1 g/mol
B. 84 g/mol
C. 92.7 g/mol
D. 115 g/mol
E. 121. g/mol



$\mathbf{R} = \mathbf{0.082}$ L atm $K^{-1} mol^{-1}$

QUESTION

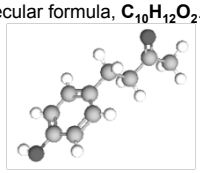
0.0820 grams of a volatile compound in the gas phase, which smells like fresh raspberries, was trapped in a syringe. It had a volume of 12.2 mL at 1.00 atmosphere of pressure and 25.0°C. What is the molar mass of this pleasant smelling compound ?

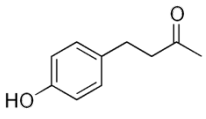
A) 13.8 g/mol
B) 164 g/mol
C) 40.9 g/mol
D) 224 g/mol

QUESTION

For the compound that smells like fresh raspberries, the following structure matches its molecular formula, $\mathbf{C_{10}H_{12}O_2}$.

A) TRUE
B) FALSE





QUESTION

Which sequence represents the gases in order of increasing density at STP?

A) Fluorine < Carbon monoxide < Chlorine < Argon
B) Carbon monoxide < Fluorine < Argon < Chlorine
C) Argon < Carbon monoxide < Chlorine < Fluorine
D) Fluorine < Chlorine < Carbon monoxide < Argon

QUESTION

Real gases exhibit their most "ideal" behavior at which relative conditions?

A) Low temperatures and low pressures
B) High temperatures and high pressures
C) High temperatures and low pressures
D) Low temperatures and high pressures