Fall 2016 CP-1 Exam 2 Chapters 4-6 50 points

Name _____

If you do NOT want your graded exam placed in the cardboard box outside my office, then please mark a cross here_____

(1-10) are True / False

1) The Law of Conservation of Energy states that the total quantity of energy in the universe is always increasing.

2) An aqueous solution is a solution where the dissolving medium is water.

3) ΔH for an exothermic reaction is positive.

4) Redox reactions are characterized by involving electron transfer.

5) Even though gases can vary tremendously in their chemical properties, essentially all (non-reacting) gases obey the same set of physical properties.

6) Weak electrolytes produce small concentrations of ions when they dissolve.

7) When 1 mole of ammonium sulfate $(NH_4)_2SO_4$ is dissolved in water, a total of three moles of ions are produced.

8) This is an example of a disproportionation reaction:

$$3\ HClO_3 \rightarrow HClO_4 + H_2O + 2\ ClO_2$$

9) Ions that are present but play no role in the reaction are called metathesis ions.

10) The relationship between change in internal energy (E), heat (q) and work (w) is expressed in the equation $\Delta E = q + w$.

11-12) For an ideal gas, PV=nRT, name these four inter-related physical properties.

13) What name is given to the reference point used to calculate properties under different conditions?
(It is that of a pure substance in its most stable form and physical state, at 1 atm pressure and at 25 °C, and is indicated by the superscript °)?

14-15) A container of 18.0 M hydrochloric acid has only 35.7 mL left in it. What will the new HCl concentration be if the solution is diluted to 250.0 mL?

16-17) For the following equation, balance it, and then provide the net ionic equation.

$$Cd(NO_3)_2(aq) + Na_2S(aq) \rightarrow CdS(s) + NaNO_3(aq)$$

18) For the following reaction, indicate which species is being oxidized.

$$Zn + 2\,HBr \rightarrow ZnBr_2 + H_2$$

The next set of questions involves this series:

Lithium	Li(s)	⟶	$Li^+(aq)$	+	e^-	
Potassium	K(s)	⟶	$K^+(aq)$	+	e^-	
Barium	Ba(s)	⟶	$Ba^{2+}(aq)$	+	$2e^-$	
Calcium	Ca(s)	⟶	$Ca^{2+}(aq)$	+	$2e^-$	
Sodium	Na(s)	⟶	$Na^+(aq)$	+	e^-	
Magnesium	Mg(s)	⟶	$Mg^{2+}(aq)$	+	$2e^-$	
Aluminum	Al(s)	⟶	$Al^{3+}(aq)$	+	$3e^-$	
Manganese	Mn(s)	⟶	$Mn^{2+}(aq)$	+	$2e^-$	
Zinc	Zn(s)	⟶	$Zn^{2+}(aq)$	+	$2e^-$	
Chromium	Cr(s)	⟶	$Cr^{3+}(aq)$	+	$3e^-$	
Iron	Fe(s)	⟶	$Fe^{2+}(aq)$	+	$2e^-$	
Cobalt	Co(s)	⟶	$Co^{2+}(aq)$	+	$2e^-$	
Nickel	Ni(s)	⟶	$Ni^{2+}(aq)$	+	$2e^-$	
Tin	Sn(s)	⟶	$Sn^{2+}(aq)$	+	$2e^-$	
Lead	Pb(s)	⟶	$Pb^{2+}(aq)$	+	$2e^-$	
Hydrogen	$H_2(g)$	⟶	$2H^+(aq)$	+	$2e^-$	
Copper	Cu(s)	⟶	$Cu^{2+}(aq)$	+	$2e^-$	
Silver	Ag(s)	⟶	$Ag^+(aq)$	+	e^-	
Mercury	Hg(l)	⟶	$Hg^{2+}(aq)$	+	$2e^-$	
Platinum	Pt(s)	⟶	$Pt^{2+}(aq)$	+	$2e^-$	
Gold	Au(s)	⟶	$Au^{3+}(aq)$	+	$3e^-$	

19) What is the name given to this series?

20) Provide the products in the following reaction.

$$Mg + Pt^{2+} \rightarrow$$

21) Would the following reaction proceed to the left or to the right ?

$$Cu + Zn^{2+} \rightleftharpoons Cu^{2+} + Zn$$

22) How many moles are contained in 500 mL of a 10 M solution?

23) For the following reaction:

$$2\ NaOH + H_2SO_4 \rightarrow 2\ H_2O + Na_2SO_4$$

How many moles of sodium hydroxide would be needed to neutralize 50 moles of sulfuric acid?

24) Provide one aspect of the Kinetic-Molecular Theory of gases.

25) What is one of the assumptions we make for an "ideal gas"?

26-27) If a mixture of gases contains 0.15 mol N_2, 0.30 mol O_2 and 0.75 mol CO_2, what are the mole fractions of each component, expressed as percentages (i.e. as mole percents)?

28) The specific heat of ethanol (CH_3CH_2OH) is 2.45 J g^{-1} K^{-1}. How many Joules of heat are necessary to raise the temperature of 19.0 g of ethanol from 315.2 K to 335.2 K? *(If you cannot remember the relationship between heat, mass, specific heat and temperature change, the units of specific heat can help you figure it out).*

29) Based on the following reaction and energy change:

$CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(l)$ $\Delta H = -890$ kJ/mol

What would you predict for the ΔH of this reaction?

$CO_2(g) + 2\ H_2O(l) \rightarrow CH_4(g) + 2\ O_2(g)$

30) When a chemical reaction proceeds and energy is released, besides heat, state one other specific form or action that the released energy can take. (Your answer should be specific, not just "work").

(31-40) are multiple choice

31) Based on the following equation, what is the precipitate?

$$AgNO_3(aq) + KCl(aq) \rightarrow AgCl(s) + KNO_3(aq)$$

a) Silver Nitrate
b) Silver Chloride
c) KNO_3
d) There is no precipitate
e) Potassium Nitrate

32) Substances that are able to ionize in aqueous solutions to form a hydrogen ion (H^+) and thereby increase the concentration of $H^+_{(aq)}$ ions are called:

a) Elements
b) Acids
c) Isotopes
d) Ideal gases
e) Titrations

33) The units of Molarity are:

a) moles per liter
b) liters per mole
c) moles per mL
d) mL per mole
e) grams per month

34) Standard atmospheric pressure is the pressure (at 0 °C and sea level) that supports a column of mercury of what height?

a) 760 mm
b) 760 inches
c) 760 cm
d) 760 atm
e) 760 Pa

35) Ideal gas behavior is best observed under the following conditions:

a) lower pressures and temperatures
b) lower pressure and higher temperatures
c) higher pressure and temperatures
d) higher pressure and lower temperatures
e) none of the above

36) The change in what type of function only depends on the initial and final states of the system, and not how the change occurred?

a) Process function
b) State function
c) Private function
d) Malfunction
e) Ideal function

37) A freshly baked mushroom pizza is taken out of the oven and placed on a plate in the kitchen to cool down before it is served. Which statement best describes this situation?

a) The pizza is the system and loses heat to the surroundings
b) The pizza is the system and gains heat from the surroundings
c) The pizza is the surroundings and gains heat from the surroundings
d) The pizza is the surroundings and loses heat to the system
e) None of the above since science cannot be applied to food

38) Vitamin C ($C_6H_8O_6$) is a diprotic acid. When a vitamin C tablet was analyzed by titration using 0.125 M NaOH(aq), it required 29.5 mL of the base to neutralize the acid in one tablet. How many mg of Vitamin C are there in one tablet?

a) 325 mg
b) 100 mg
c) 162 mg
d) 649 mg
e) 273 mg

39) Which sequence of numbers is the correct listing of the oxidation states of Hydrogen in H_2, HBr and NaH?

a) 0, 1, 1
b) 2, 81, 24
c) 0, -1, +1
d) 0, +1, -1
e) +1, +1, +1

40) Under the same conditions, which gas molecules would have the larger velocity (diffuse and effuse faster)?

a) N_2
b) CO_2
c) Cl_2
d) F_2
e) All would have the same speed

41-43) The combustion of ammonia (NH_3) is described by the following equation:

$4\ NH_3(g) + 5\ O_2(g) \rightarrow 4\ NO(g) + 6\ H_2O(g) \qquad \Delta H^\circ_{rxn} = -904.8 kJ/mol$

The enthalpies of formation of NO(g) = +90.4 kJ/mol and $H_2O(g)$ = -241.8 kJ/mol, therefore calculate the enthalpy of formation of ammonia ?

Recall that $\Delta H^\circ_{rxn} = \Sigma\ n\ \Delta H^\circ_f(\text{products}) - \Sigma\ m\ \Delta H^\circ_f(\text{reactants})$.

44-46) Calculate the volume occupied by 14.0 g of N_2 gas at 15 °C and 0.976 atm. (The ideal gas constant R = 0.08206 L atm mol^{-1} K^{-1}, and Kelvin = 273.15 + °C)

47-50) Calculate the concentration of an aqueous KCl solution if 50.00 mL of the solution gives 0.430 g of AgCl when treated with excess $AgNO_3$.

The balanced equation is: $KCl(aq) + AgNO_3(aq) \rightarrow AgCl(s)\downarrow + KNO_3(aq)$

*****Bonus Questions for +1 points each*****

Guess the numerical value for the Standard Enthalpy of Formation for diatomic Fluorine gas in kJ/mol (1 point for exact, ½ point for within ± 3).

What does Graham's Law of Diffusion/Effusion have to do with the enrichment of nuclear fuels?

Provide a "real world" example or application that exists as a consequence of the very large specific heat capacity of water.

1 IA												13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 H 1.01	2 IIA																2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.1	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.6	53 I 126.9	54 Xe 131.29
55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac^ (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (264)	108 Hs (265)	109 Mt (268)	110 Ds (271)	111 Rg (272)							

*	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
^	90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Fall 2016 **CP-1** **Exam 2** **Chapters 4-6** **50 points**

Name CATion because it's PAWSitively Charged

If you do NOT want your graded exam placed in the cardboard box outside my office, then please mark a cross here_____

(1-10) are True / False

1) The Law of Conservation of Energy states that the total quantity of energy in the universe is always increasing. false

2) An aqueous solution is a solution where the dissolving medium is water. T

3) ΔH for an exothermic reaction is positive. False

4) Redox reactions are characterized by involving electron transfer. T

5) Even though gases can vary tremendously in their chemical properties, essentially all (non-reacting) gases obey the same set of physical properties. T

6) Weak electrolytes produce small concentrations of ions when they dissolve. T

7) When 1 mole of ammonium sulfate $(NH_4)_2SO_4$ is dissolved in water, a total of three moles of ions are produced. T

8) This is an example of a disproportionation reaction: T

$$3\ \underset{+5}{HClO_3} \rightarrow \underset{+7}{HClO_4} + H_2O + 2\ \underset{+4}{ClO_2}$$

9) Ions that are present but play no role in the reaction are called metathesis ions. False

10) The relationship between change in internal energy (E), heat (q) and work (w) is expressed in the equation $\Delta E = q + w$. T

11-12) For an ideal gas, PV=nRT, name these four inter-related physical properties.

Pressure, Volume, amount (in moles), Temperature.
or "number"

13) What name is given to the reference point used to calculate properties under different conditions?
(It is that of a pure substance in its most stable form and physical state, at 1 atm pressure and at 25 °C, and is indicated by the superscript °)?

(Thermodynamic) Standard State

14-15) A container of 18.0 M hydrochloric acid has only 35.7 mL left in it. What will the new HCl concentration be if the solution is diluted to 250.0 mL?

$M_1V_1 = M_2V_2 \Rightarrow M_2 = \frac{M_1V_1}{V_2} = \frac{18.0 \times 35.7}{250.0}$

$= 2.5704$

$= 2.57\ M$ (3 sig figs)

16-17) For the following equation, balance it, and then provide the net ionic equation.

$Cd(NO_3)_2(aq) + Na_2S(aq) \rightarrow CdS(s) + 2\,NaNO_3(aq)$

$Cd^{2+}_{(aq)} + 2NO_3^-{}_{(aq)} + 2Na^+_{(aq)} + S^{2-}_{(aq)} \rightarrow CdS_{(s)} + 2Na^+_{(aq)} + 2NO_3^-{}_{(aq)}$

Cancel Spectator ions

$\Rightarrow$ NET IONIC $Cd^{2+}_{(aq)} + S^{2-}_{(aq)} \rightarrow CdS_{(s)}$

18) For the following reaction, indicate which species is being oxidized.

$\overset{0}{Zn} + 2\,\overset{+1}{H}\overset{-1}{Br} \rightarrow \overset{+2}{Zn}\overset{-1}{Br_2} + \overset{0}{H_2}$

Zn is being oxidized from $Zn^0 \rightarrow Zn^{2+}$

The next set of questions involves this series:

Lithium	$Li(s)$	$\longrightarrow$	$Li^+(aq)$	+	e^-	
Potassium	$K(s)$	$\longrightarrow$	$K^+(aq)$	+	e^-	
Barium	$Ba(s)$	$\longrightarrow$	$Ba^{2+}(aq)$	+	$2e^-$	
Calcium	$Ca(s)$	$\longrightarrow$	$Ca^{2+}(aq)$	+	$2e^-$	
Sodium	$Na(s)$	$\longrightarrow$	$Na^+(aq)$	+	e^-	
Magnesium	$Mg(s)$	$\longrightarrow$	$Mg^{2+}(aq)$	+	$2e^-$	
Aluminum	$Al(s)$	$\longrightarrow$	$Al^{3+}(aq)$	+	$3e^-$	
Manganese	$Mn(s)$	$\longrightarrow$	$Mn^{2+}(aq)$	+	$2e^-$	
Zinc	$Zn(s)$	$\longrightarrow$	$Zn^{2+}(aq)$	+	$2e^-$	
Chromium	$Cr(s)$	$\longrightarrow$	$Cr^{3+}(aq)$	+	$3e^-$	
Iron	$Fe(s)$	$\longrightarrow$	$Fe^{2+}(aq)$	+	$2e^-$	
Cobalt	$Co(s)$	$\longrightarrow$	$Co^{2+}(aq)$	+	$2e^-$	
Nickel	$Ni(s)$	$\longrightarrow$	$Ni^{2+}(aq)$	+	$2e^-$	
Tin	$Sn(s)$	$\longrightarrow$	$Sn^{2+}(aq)$	+	$2e^-$	
Lead	$Pb(s)$	$\longrightarrow$	$Pb^{2+}(aq)$	+	$2e^-$	
Hydrogen	$H_2(g)$	$\longrightarrow$	$2H^+(aq)$	+	$2e^-$	
Copper	$Cu(s)$	$\longrightarrow$	$Cu^{2+}(aq)$	+	$2e^-$	
Silver	$Ag(s)$	$\longrightarrow$	$Ag^+(aq)$	+	e^-	
Mercury	$Hg(l)$	$\longrightarrow$	$Hg^{2+}(aq)$	+	$2e^-$	
Platinum	$Pt(s)$	$\longrightarrow$	$Pt^{2+}(aq)$	+	$2e^-$	
Gold	$Au(s)$	$\longrightarrow$	$Au^{3+}(aq)$	+	$3e^-$	

19) What is the name given to this series?

The Electrochemical series; Activity series; Reactivity Series

20) Provide the products in the following reaction.

$$Mg + Pt^{2+} \rightarrow Mg^{2+} + Pt$$

21) Would the following reaction proceed to the left or to the right ?

$$Cu + Zn^{2+} \rightleftharpoons Cu^{2+} + Zn$$

To the left.

"Higher up the list gives the cation"

22) How many moles are contained in 500 mL of a 10 M solution?

10 M means 10 Moles per liter = 10 Moles per 1,000 mL

So 500 mL means 5 Moles.

23) For the following reaction:

$$2\ NaOH + 1\ H_2SO_4 \rightarrow 2\ H_2O + Na_2SO_4$$

50

How many moles of sodium hydroxide would be needed to neutralize 50 moles of sulfuric acid?

Ratio is 2:1, so 100 Moles of NaOH for 50 H_2SO_4.

24) Provide one aspect of the Kinetic-Molecular Theory of gases.

It provides a molecular description of Pressure & Temperature.
Pressure is related to collisions on the walls of the container by atoms/molecules.
Temperature is related to the average kinetic Energy of the gas atoms/molecules.

25) What is one of the assumptions we make for an "ideal gas"?

- No interactions between the gaseous atoms/molecules.
- The atoms/molecules have negligible volume compared to the container.

26-27) If a mixture of gases contains 0.15 mol N_2, 0.30 mol O_2 and 0.75 mol CO_2, what are the mole fractions of each component, expressed as percentages (i.e. as mole percents)?

Total moles = 0.15 + 0.30 + 0.75
= 1.20

Mole fraction of N_2 = $\frac{0.15}{1.20}$ = 0.125 = 12.5% = 13% to 2 sig figs.

Mole fraction of O_2 = $\frac{0.30}{1.20}$ = 0.25 = 25%

Mole fraction of CO_2 = $\frac{0.75}{1.20}$ = 0.625 = 62.5% = 63% to 2 sig figs.

28) The specific heat of ethanol (CH_3CH_2OH) is 2.45 J g^{-1} K^{-1}. How many Joules of heat are necessary to raise the temperature of 19.0 g of ethanol from 315.2 K to 335.2 K? *(If you cannot remember the relationship between heat, mass, specific heat and temperature change, the units of specific heat can help you figure it out).*

heat = M S Δt

= 19.0 × 2.45 × 20.0

= 931 J

Heat is J
M is g
Δt is K

$J\,g^{-1}K^{-1}$ = $\frac{\text{heat}}{M\,\Delta t}$

Specific heat

Δt = 335.2 − 315.2

= 20.0 K

29) Based on the following reaction and energy change:

$CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(l)$ $\Delta H = -890$ kJ/mol

What would you predict for the ΔH of this reaction?

$CO_2(g) + 2\ H_2O(l) \rightarrow CH_4(g) + 2\ O_2(g)$

Reverse of above so +890 kJ/mol

30) When a chemical reaction proceeds and energy is released, besides heat, state one other specific form or action that the released energy can take. (Your answer should be specific, not just "work").

Sound; light; expansion against a pressure; apply a force to an object, . . .

(31-40) are multiple choice

31) Based on the following equation, what is the precipitate?

$$AgNO_3(aq) + KCl(aq) \rightarrow AgCl(s) + KNO_3(aq)$$

a) Silver Nitrate
b) Silver Chloride
c) KNO_3
d) There is no precipitate
e) Potassium Nitrate

32) Substances that are able to ionize in aqueous solutions to form a hydrogen ion (H^+) and thereby increase the concentration of $H^+_{(aq)}$ ions are called:

a) Elements
b) Acids
c) Isotopes
d) Ideal gases
e) Titrations

33) The units of Molarity are:

a) moles per liter
b) liters per mole
c) moles per mL
d) mL per mole
e) grams per month

34) Standard atmospheric pressure is the pressure (at 0 ^oC and sea level) that supports a column of mercury of what height?

a) 760 mm
b) 760 inches
c) 760 cm
d) 760 atm
e) 760 Pa

35) Ideal gas behavior is best observed under the following conditions:

a) lower pressures and temperatures
b) lower pressure and higher temperatures
c) higher pressure and temperatures
d) higher pressure and lower temperatures
e) none of the above.

36) The change in what type of function only depends on the initial and final states of the system, and not how the change occurred?

a) Process function
b) State function
c) Private function
d) Malfunction
e) Ideal function

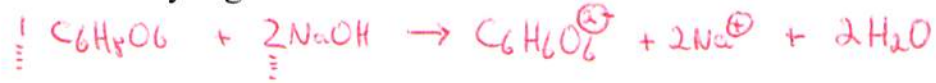
37) A freshly baked mushroom pizza is taken out of the oven and placed on a plate in the kitchen to cool down before it is served. Which statement best describes this situation?

a) The pizza is the system and loses heat to the surroundings
b) The pizza is the system and gains heat from the surroundings
c) The pizza is the surroundings and gains heat from the surroundings
d) The pizza is the surroundings and loses heat to the system
e) None of the above since science cannot be applied to food.

FW = 176.14

38) Vitamin C ($C_6H_8O_6$) is a diprotic acid. When a vitamin C tablet was analyzed by titration using 0.125 M NaOH(aq), it required 29.5 mL of the base to neutralize the acid in one tablet. How many mg of Vitamin C are there in one tablet?

a) 325 mg
b) 100 mg
c) 162 mg
d) 649 mg
e) 273 mg



Moles of NaOH = $\frac{29.5}{1000} \times 0.125 = 0.003687$ moles

Moles of $C_6H_8O_6$ = $\frac{1}{2} \times 0.003687 = 0.0018437$ moles = $0.0018437 \times 176.14 = 0.324758 = 0.325$ mg

39) Which sequence of numbers is the correct listing of the oxidation states of Hydrogen in H_2, HBr and NaH?

a) 0, 1, 1
b) 2, 81, 24
c) 0, –1, +1
d) 0, +1, –1
e) +1, +1, +1

40) Under the same conditions, which gas molecules would have the larger velocity (diffuse and effuse faster)?

a) N_2 = 28 g/mol
b) CO_2 = 44 g/mol
c) Cl_2 = 71 g/mol
d) F_2 = 38 g/mol
e) All would have the same speed.

$\frac{1}{2}m_1v_1^2 = \frac{1}{2}m_2v_2^2$, so lower mass = higher velocity

41-43) The combustion of ammonia (NH_3) is described by the following equation:

$4\ NH_3(g) + 5\ O_2(g) \rightarrow 4\ NO(g) + 6\ H_2O(g)$ $\quad \Delta H^\circ_{rxn} = -904.8 kJ/mol$

The enthalpies of formation of NO(g) = +90.4 kJ/mol and $H_2O(g)$ = -241.8 kJ/mol, therefore calculate the enthalpy of formation of ammonia ?

$\Delta H^\circ_{rxn} = \sum n\ \Delta H^\circ_{f(prods)} - \sum m\ \Delta H^\circ_{f(s.m.)}$

$-904.8 = [(4 \times 90.4) + (6 \times -241.8)] - [(4 \times \Delta H^\circ_{f(NH_3)}) + (5 \times 0)]$

$-904.8 = [361.6 + (-1450.8)] - [4\ \Delta H^\circ_{f(NH_3)}]$

$\Delta H^\circ_{f(NH_3)} = \frac{-1089.2 + 904.8}{4}$

$= -46.1$ kJ/mol

FW = 28.02 g/mol

44-46) Calculate the volume occupied by 14.0 g of N_2 gas at 15 °C and 0.976 atm. (The ideal gas constant R = 0.08206 L atm mol^{-1} K^{-1}, and Kelvin = 273.15 + °C)

288.15 K

$PV = nRT$

$V = \frac{nRT}{P}$ =

14.0 g = $\frac{14.0}{28.02}$ = 0.5000 moles.

$= \frac{0.5 \text{ moles} \times 0.08206 \frac{\text{L atm}}{\text{mol K}} \times 288.15 \text{ K}}{0.976 \text{ atm}}$

= 12.1135 L

= 12 L (to 2 sig figs)

47-50) Calculate the concentration of an aqueous KCl solution if 50.00 mL of the solution gives 0.430 g of AgCl when treated with excess $AgNO_3$.

FW = 107.87 + 35.45 = 143.32 g/mol

The balanced equation is: $1\,KCl(aq) + AgNO_3(aq) \rightarrow 1\,AgCl(s)\downarrow + KNO_3(aq)$

0.430 g = $\frac{0.430}{143.32}$ = 0.00300 moles

Moles of AgCl = moles of KCl

= 0.00300 moles.

Molarity = $\frac{\text{Moles}}{\text{Volume}}$ = $\frac{0.003 \text{ moles}}{50/1000 \text{ Liters}}$ = 0.0600 M

= 6.00×10^{-2} M (3 sig figs)

*****Bonus Questions for +1 points each*****

Guess the numerical value for the Standard Enthalpy of Formation for diatomic Fluorine gas in kJ/mol (1 point for exact, ½ point for within ±3).

F_2 is an element in its most stable form, so $\Delta H_f^\circ = 0$ kJ/mol

What does Graham's Law of Diffusion/Effusion have to do with the enrichment of nuclear fuels?

Uranium exists as isotopes that include ^{235}U and ^{238}U. Only ^{235}U is capable of nuclear fission. A volatile form of Uranium is UF_6, so $^{235}UF_6$ and $^{238}UF_6$ can be separated since they diffuse at different speeds.

Provide a "real world" example or application that exists as a consequence of the very large specific heat capacity of water.

- Very effective liquid for cooling (e.g cars, humans, etc)
- Very useful heat source (gives out a lot of heat as it cools) - eg radiators
- Coastal climates