Polytechnic Tutoring Center

Midterm II REVIEW – CM 1014, Fall 2020

Disclaimer: **This mock exam is only for practice**. *It was made by tutors in the Polytechnic Tutoring Center and is not representative of the actual exam given by the Academic Department.*

The Exam is designed to test concepts, not exact knowledge so please do not worry if some questions seem outside of what you have learned. Watch the solution video when uploaded to see the method of solving each of these problems. The main focus is to understand the approach to problem solving

Section 1: Long Response Problems

1. A solution of K_3PO_4 and $Ca[NO_3]_2$ are mixed.
    a. What kind of reaction is this?

    b. What is the ionic equation?

    c. What is the net ionic equation?

2. During titration the following data were collected. A 50 mL portion of an H2SO4 solution was titrated with 0.50 M NaOH. It required 240 mL of the base to neutralize the sample.
    a. Write the balanced chemical equation describing the acid - base neutralization reaction that occurs
    b. Determine the molarity of the H2SO4 solution.

3. A student mixes 25.0 mL of 1.0 M HBr(aq) and 25.0 mL of 1.0 M KOH (aq) in a coffee cup (constant pressure) calorimeter. The temperature of the solution is increased from 25°C to 31.7°C. Calculate the ΔH per mole of HBr of the acid-base neutralization reaction that occurs? (You may assume that the density of the solution is equal to the density of water, and that the specific heat of the solution is equal to the specific heat of water.)

Section 2:Multiple-Choice Problems

1. Deviation from the ideal gas law are greatest at:

A) Low temperature and low pressures
B) Low temperature and High pressures
C) HIgh temperature and High pressures
D) High temperature and low pressures
E) Pressure and temperature deviations apply for individual gases

2. From the following data at 25°C:

H_2 (g) + Cl_2 (g) → 2 HCl; ΔH = -185 KJ

$2H_2$ (g) + O_2 (g) → 2 H_2O; ΔH = -483.7 KJ

Calculate ΔH at 25°C for the reaction below:

4HCl (g) + O_2 (g) → 2 Cl_2 (g) + $2H_2O$ (g)

A) +114 kJ
B) +299 KJ
C) -299 KJ
D) -114 KJ
E) -86.8 KJ

3. The combustion of butane (C_4H_{10}) produces heat according to the equation:

2 C_4H_{10}(g) + 13O_2(g) → 8CO_2(g) + 10H_2O(l) ΔH = -5,314 KJ

How much heat is produced from the combustion of 1.00 gram of butane?

A)32.5 kJ
B)45.7 KJ
C)91.5 KJ
D)2656 KJ
E)15440 KJ

4. The oxidation number of N in $NaNO_3$ is:

A)+6
B)+5
C)+3
D)-3
E)+4

5. Copper metal has a specific heat of 0.385 J/g^{o}C and has a melting point of 1083^{o}C. Calculate the amount of heat required to raise the temperature of 22.8 g of Cu from 20.0^{o}C to 875^{o}C
A)1.97 x 10^{-5} J
B)1.00 x 10^{-2} J
C)329 J
D)7.51 KJ
E)10.5 KJ

6. Which of the following is an acid-base neutralization reaction?

A)$2Al\ (s) + 3H_2SO_4\ (aq) \rightarrow Al_2(SO_4)_3\ (aq) + 3H_2\ (g)$

B)$SO_2\ (g) + H_2O\ (l) \rightarrow H_2SO_3\ (g)$

C)$LiOH(aq) + HNO_3(aq) \rightarrow LiNO_3\ (aq) + H_2O\ (l)$

D)$2KBr(aq) + Cl_2(g) \rightarrow 2KCl(aq) + Br_2(l)$

E)$CaBr_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HBr$

7.Calculate the volume occupied by 225.2 g of CO_2 at 0.84 atm and 25^{o}C. Assume ideal gas
A)60 L
B)134 L
C)149 L
D)24.2 L
E)734 L

8.The gas pressure in an aerosol can is 1.80 atm at 25^{o}C. If the gas is an ideal gas, what pressure would develop in the can if it were heated to 475^{o}C?
A)0.0950 atm
B)0.717 atm
C)3.26 atm
D)4.52 atm

E)34.2 atm

9. Which of the following compounds is a strong electrolyte?
A)H2O
B)N2
C)KI
D) CO2
E)CaCO3
10. A mixture of three gases has a total pressure at 298 K of 1380 Torr. The mixture is analyzed and is found to contain 1.27 mol CO_2, 3.04 mol CO, and 1.50 mol Ar. What is the partial pressure of Ar in the sample?
A)258 torr
B)301 Torr
C)356 Torr
D)5345 Torr
E)8020 Torr

11. If 40.0 mL of H_3PO_4 solution is titrated to the end point with 67.5 mL of 0.50 M NaOH, what is the molarity of the H_3PO_4 solution?

H_3PO_4 (aq) + 3NaOH (aq) → Na_3PO_4(aq) + 3H2O (l)

A)0.10 M
B)0.28 M
C)0.30 M
D)0.84 M
E)0.95 M

12. What is the molarity of a solution in which 26.0 grams of $BaCl_2$ (molar mass=208.2g/mol) are dissolved in enough water to make 450.0 mL of solution?
A)0.278 M
B)0.617 M
C)1.00 M
D)3.41 M
E)12.0 M

13. A system absorbs 5 J of heat from the surroundings and does 10 J of work on the surroundings. What is the change in energy of the system?
A) +15J
B)+5 J
C).5 J
D) -5 J
E)-15 J

14. Which of the following is the correct net ionic equation for the reaction that occurs when solutions of $Pb(NO_3)_2$ and NH_4Cl are mixed?

A)$Pb(NO_3)_2$(aq) + 2NH_4Cl(aq) → NH_4NO_3(aq) + $PbCl_2$ (s)

B)Pb^{+2} (aq) + $2Cl^{-}$(aq) → $PbCl_2$ (s)

C)Pb^{+2}(aq) + $2NO_3^-$ (aq) + $2NH_4^+$(aq) + $2Cl^-$(aq) → $2NH_4^+$ (aq) + $2NO_3^-$(aq) + $PbCl_2$(s)

D)NH_4^+(aq) + NO_3^-(aq) → $2NH_4NO_3$(aq)

15. Which of the following gases will have the lowest density when they are all compared at the same temperature and pressure?
A)H_2
B)O_2
C)N_2
D)Cl_2
E)All have the same

16. Which element is oxidized in the following reaction?

$3Cu + 8HNO_3 \rightarrow Cu(NO_3)_2 + 2NO + 4H_2O$

A)Cu
B)H
C)N
D)O
E)Cannot be determined

17. In which of the following gases do molecules have the highest average speed at 25°C
A)H_2
B)O_2
C)N_2
D)Cl_2
E)All have the same

18. Given the standard enthalpies of formation for the following compounds, calculate ΔH, the reaction enthalpy, for the following reaction:

$Fe_3O_4(s) + CO(g) \rightarrow 3FeO(s) + CO_2(g)$

ΔH_f for Fe_3O_4 = -1118 KJ
ΔH_f for CO = -110.5 KJ
ΔH_f for FeO = -272 KJ
ΔH_f for CO_2 = -393.5 KJ
A)54 KJ
B)19 KJ
C)-263 KJ
D) -50 KJ
E)109 KJ