Polytechnic Tutoring Center
Midterm I REVIEW – CM 1004, 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.

1. Determine number of significant figures and proper units of: $(8.3801g - 2.576g)/1.2L^{-1}s$
   a. 2, gL/s
   b. 4, gL/s
   c. 2, L/s
   d. 4, L/s
   e. 5, gs/L

2. Which one of the following is most likely to be an ionic compound?
   a. HNF_2 because nitrogen and fluorine both have negative charges
   b. H_2CO because of the double ionic bond between carbon and oxygen
   c. N_2H_4 because hydrogen can bond ionically and covalently
   d. $CaCl_2$ because it contains a halogen and alkali earth metal
   e. CH_3Cl because the ionic element of chlorine creates a dipole moment

3. What is the percent mass of iron in $Fe_4[Fe(CN)_6]_3$? (Hint: Find molecular weight of molecule)

4. Assume that magnesium consists of three isotopes having the abundances and masses given below. According to the data, what is the average atomic mass of magnesium?

Isotope	Abundance	Mass
^{24}Mg	78.70%	23.985 amu
^{25}Mg	10.13%	24.986 amu
^{26}Mg	11.17%	25.983 amu

   a. 25.00 amu
   b. 24.31 amu
   c. 24.97 amu
   d. 24.75 amu

5. Which of the following is an example of a physical property?
   a. Polymerization of DNA creates a double helix shape

   b.   Proteins are synthesized by ribosomes in plants and transport macromolecules.
   c.   Water corrodes an iron tank and changes color to orange
   d.   Lithium battery explodes when punctured
   e.   Heated water turns into steam at 100C, but condenses again at high pressure

6.   Zinc metal reacts with hydrochloric acid to produce zinc chloride and hydrogen gas.
   How many grams of hydrogen gas would be produced if 0.25 L of 1.0 M HCl solution
   were allowed to react with enough zinc such that all of the HCl reacted? If this amount of
   H2 gas were at 0 oC and 1 atm, what would the volume be?

   Zn + 2**HCl** = H2 + ZnCl2
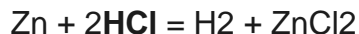
   a. 0.50 g, 2.8 L
   b. 0.25 g, 284 L
   c. 0.36 g, 0.36 L
   d. 0.25 g, 2.8 L
   e. 0.50 g, 5.6 L

7.   A 20.0 mL sample of an element with a density of 3.0 g/mL contains 4×10^{23} atoms.
   What is the atomic weight (in g/mol) of this element?
      a.   300
      b.   40
      c.   60
      d.   90
      e.   None of the above

8.   After balancing the combustion reaction shown, what is the coefficient for O_2?
   $C_7H_{14} + O_2 \rightarrow CO_2 + H_2O$
      a.   42
      b.   21
      c.   11
      d.   10

9.   Which set of elements below contains, respectively, an alkali metal, a halogen, a noble
   gas and a transition metal?
      a.   Rb, Br, He, Ag
      b.   H, F, Kr, V
      c.   Li, S, La, Fe
      d.   Ca, Kr, Tc, Mn

10. What is the correct chemical name of $CoCl_3$?
   a.   cobaltous chloride

    b. cobalt trichloride

    c. cobalt(III) chloride

    d. cobalt(III) trichloride

11. How many protons and electrons are present in a Ca^{2+} ion?

    a. 20 protons and 18 electrons

    b. 18 protons and 20 electrons

    c. 20 protons and 21 electrons

    d. 20 protons and 19 electrons

    e. 22 protons and 20 electrons

12. What binary compound would be formed from barium ions and fluoride ion?

    a. Ba_2F_3

    b. BaF

    c. Ba_2F

    d. BaF_2

    e. BaF_3

13. A 9.4-g sample of titanium was added to a graduated cylinder originally containing 6.8 mL of water. After addition of the titanium, the water level in the graduated cylinder was 8.9 mL. What is the density of titanium?

    a. $1.4 \ g/cm^3$

    b. $4.5 \ g/cm^3$

    c. $1.1 \ g/cm^3$

    d. $0.22 \ g/cm^3$

14. Write out the correct net ionic equation for the reaction that occurs when solutions of $Pb(ClO_3)_2$ and Na_2SO_4 are mixed.

15. Which of the following compounds is most likely to dissolve in water?

    a. $BaSO_4$

    b. $AgBr$

    c. $CaCO_3$

    d. Na_2S

    e. None of the above.

16. What kind of reaction is the following? (FeCl3 is also aqueous)

$$KOH(aq) + FeCl_3 \longrightarrow KCl(aq) + Fe(OH)_3 (s)$$
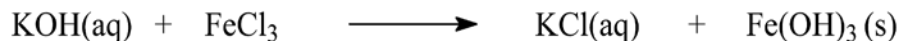
   a. Neutralization, because K is being neutralized by Cl
   b. Acid-base, because KOH is a strong base and CL is the conjugate base to a strong acid
   c. Precipitation, because $Fe(OH)_3$ was precipitated
   d. Combustion, because OH ions can combine with H to form water

17. How many moles of oxygen gas will react with 12.4 mol aluminum?

   Equation: $4Al + 3O_2 \rightarrow 2Al_2O_3$
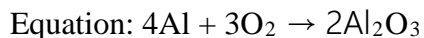
   a. 0.24 mol
   b. 0.42 mol
   c. 4.8 mol
   d. 9.3 mol
   e. 16.8 mol

18. What mass of copper (II) nitrate would be produced from the complete reaction of 45.6 g of copper, according to the chemical reaction shown below?

   $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2 Ag$
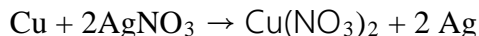
19. The correct Stock system name for $CuSO_4 \cdot 5H_2O$ is
   a. cuprous sulfate pentahydrate
   b. copper (II) sulfate pentahydrate
   c. copper (II) sulfate hydrate
   d. copper (I) sulfate pentahydrate
   e. copper sulfate pentahydrate

20. $C_{graphite}$ and $C_{diamond}$ are examples of:
   a. isotopes of carbon because of the differences in atomic level
   b. allotropes of carbon because of the differences in physical structure
   c. the law of definite proportions because each will have the same fixed ratio
   d. different carbon ions because carbon is able to form different bond based on physical structure
   e. Tautomers because carbon can form double and triple bonds

21. Solid sulfur and oxygen gas react to produce sulfur trioxide as shown below. In a particular experiement, 5.0 g of O2 are reacted with 6.0 g of S_8

   S_8 (s)+ O_2 (g) $\rightarrow$ SO_3(g)
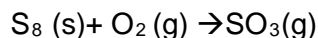
a) Determine the limiting reagent and the mass of the product in grams

b) What is the % yield of SO_3 if 7.9g SO_3 are isolated?

22. Which of the following is an example of a metal displacement reaction?
   a. $2 P(s) + 3 Cl_2(g) \rightarrow 2 PCl_3(g)$
   b. $CaBr_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2 HBr(aq)$
   c. $2 Na(s) + 2 H_2O(l) \rightarrow 2 NaOH(aq) + H_2(g)$
   d. $C_3H_8(g) + 5 O_2(g) \rightarrow 3 CO_2(g) + 4 H_2O(g)$
   e. $Fe_2O_3(s) + 2 Al(s) \rightarrow 2 Fe(s) + Al_2 O_3(s)$

23. **Show work:** In an experiment, 0.200 moles of $Ba(OH)_2$ are treated with 0.500 moles of $HClO_3$ according to the chemical reaction shown below:

   $Ba(OH)_2 + HClO_3 \rightarrow Ba(ClO_3)_2 + H_2O$
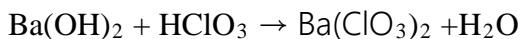
a) Balance the chemical reaction.
b) Determine which species is the limiting reagent.
c) Calculate the grams of H_2O formed.
d) Determine which species is in excess and by how much (in grams).