Chemistry1100 Practice Exam 4

Choose the best answer for questions 1-20. You must show your work for all questions to receive credit. Be sure to include units and correct numbers of significant figures. Calculators cannot be shared.

pico p 10^{-12}	nano n 10^{-9}
micro µ 10^{-6}	milli m 10^{-3}
centi c 10^{-2}	kilo k 10^{3}
mega M 10^{6}	giga G 10^{9}
NA = 6.022×10^{23}/mol	d = m/V

2 points each for questions 1-20.

1. How many milliliters of water will overflow from a full container of water if a 66.7 gram sample of vanadium (density = 6.11 g/mL) is carefully placed in the container so there is no splashing, just overflowing?
a. 11.9 mL
b. 9.92 mL
c. 60.6 mL
d. 10.9 mL
e. 0.0916 mL

2. The number, 0.0030600, is properly expressed in scientific notation as
a. 3.0600×10^{-2}
b. 0.30600×10^{-2}
c. 0.306×10^{-2}
d. 3.06×10^{-3}
e. 3.0600×10^{-3}

3. A number resulting from a measurement was properly expressed in scientific notation as 3.170×10^{-2} meters. The number could also be correctly written as
a. 0.0317 m
b. 0.03170 m
c. 0.032 m
d. 317 m
e. 317.0 m

4. The diameter of an atom was determined and a value of 2.35×10^{-8} cm was obtained. How many nanometers is this?
a. 2.35 x 101 nm
b. 2.35 x 10-19 nm
c. 2.35 x 10-15 nm
d. 2.35 x 10-1 nm
e. 2.35 x 10-10 nm

5. The atomic mass of chromium is 51.996 g. How many moles of Cr are there in a 5.44 g sample of chromium?
a. 0.0875 moles
b. 0.0907 moles
c. 0.105 moles
d. 0.220 moles
e. 2.33 moles

6. What is the mass of a phosphorus sample which contains 0.585 moles of phosphorus atoms?
a. 17.3 g
b. 18.1 g
c. 22.3 g
d. 26.5 g
e. 34.2 g

7. The molar mass of $Ni(H_2O)_6Cl_2$ is
a. 157.69 g
b. 193.00 g
c. 227.61 g
d. 237.69 g
e. 296.83 g

8. How many moles of carbon atoms are combined with 11.2 moles of hydrogen atoms in a sample of the compound, C_3H_8?
a. 3.00
b. 5.60
c. 4.20
d. 6.02×10^{23}
e. 29.9

9. What is the percent, by mass, of chromium in K_2CrO_4, to the proper number of significant digits?
a. 26.776 %
b. 31.763 %
c. 40.268 %
d. 42.241 %
e. 51.996 %

10. Magnetite is a binary compound containing only iron and oxygen. The percent, by weight, of iron is 72.360 %. What is the empirical formula of magnetite?
a. FeO
b. FeO_2
c. Fe_3O_4
d. Fe_2O_3
e. Fe_2O_5

11. A compound has an empirical formula CH_{2}. An independent analysis gave a value of 70 for its molar mass. What is the correct molecular formula?
a. C_2H_4
b. C_3H_6
c. C_4O_8
d. C_5H_{10}
e. C_5H_{11}

12. Given the balanced chemical equation, $C_4H_4 + 5\ O_2 \rightarrow 4\ CO_2 + 2\ H_2O$. If 0.3618 moles of C_4H_4 are allowed to react with 1.818 moles of O_2, and this is the only reaction which occurs, what is the maximum quantity of carbon dioxide that could be produced?
a. 1.447 moles
b. 1.454 moles
c. 1.456 moles
d. 2.180 moles
e. 0.3978 moles

13. Given the balanced chemical equation, $C_4H_4 + 5\ O_2 \rightarrow 4\ CO_2 + 2\ H_2O$. If 0.3618 moles of C_4H_4 are allowed to react with 1.818 moles of O_2, and this is the only reaction which occurs, what is the maximum quantity of water that could be produced?
a. 11.02 g
b. 13.04 g
c. 13.20 g
d. 19.64 g
e. 65.50 g

14. An acid-base neutralization is the reaction of
a. H_2(g) with O_2(g) to form H_2O(l)
b. H_2(aq) with OH^-(aq) to form H_2O(l)
c. H^+(aq) with O_2(g) to form H_2O(l)
d. H^+(aq) with OH^-(aq) to form H_2O(l)
e. Na^+(aq) with OH^-(aq) to form NaOH(aq)

15. The equation for the reaction,
$Pb(NO_3)_2$(aq) + NaCl(aq) $\rightarrow$ $PbCl_2$(s) + $NaNO_3$(aq)
can be written as an ionic equation. In this ionic equation, the spectator ions are
a. Na^+ and Pb^{2+}
b. Na^+ and Cl^-
c. Pb^{2+} and Cl^-
d. Pb^{2+} and NO_3^-
e. Na^+ and NO_3^-

16. Which one of the following compounds produces 4 ions per formula unit by dissociation when dissolved in water?
a. $K_2C_2O_4$
b. $Al(NO_3)_3$
c. $Hg_2(NO_3)_2$
d. $NaBrO_3$
e. $Na_2S_2O_3$

17. 66.7 mL of 18.0 molar sulfuric acid solution was dissolved in enough water to make 500 mL of solution. The molarity of the diluted mixture is
a. 36.0 molar
b. 0.135 molar
c. 2.40 molar
d. 9.00 molar
e. 0.00741 molar

18. Potassium nitrate, KNO_3, has a formula weight of 101.10. What is the molar concentration of a solution prepared by dissolving 7.58 grams of potassium nitrate in enough water to prepare 250 mL of the solution?
a. 0.0937 molar
b. 0.300 molar
c. 1.895 molar
d. 3.065 molar
e. 3.34 molar

19. What is the oxidation number of each sulfur atom in the $S_2O_8^{2-}$ ion?
a. -2
b. +1
c. +3
d. +5
e. +7

20. In a chemical reaction, zinc metal reacts with nitric acid solution to produce zinc nitrate(in solution), ammonium nitrate (in solution), and water. The species being oxidized in this reaction is
a. HNO_3(aq)
b. NH_4^+(aq)
c. Zn^{2+}(aq)
d. Zn(s)
e. $Zn(NO_3)_2$(aq)

END PART 1. BEGIN PART 2 ON THE NEXT PAGE.

Part 2: Answer all questions and show your work.

1. 6 points. Balance the following reaction in acidic solution.
HNO_2(aq) + MnO_4^-(aq) → $Mn^{+}2$(aq) + NO_3^-(aq)

H^+ + $2MnO_4^-$ + $5HNO_2$→ $5NO_3^-$ + $2Mn^{+2}$ + $3H_2O$

2. 6 points. Consider the following reaction:
$Pb(NO_3)_2$(aq) + 2KOH(aq) → $Pb(OH)_2$(s) + $2KNO_3$(aq)
Suppose that 2.500 g of each reactant is added together. Calculate the number of grams of the KNO_3 that will be produced. Then identify the Limiting Reagent and the Excess Reagent.
0.0151 mol KNO3 from Pb(NO3)3 so the lead nitrate is the limiting reagent 0.0446 mol KNO_3 from KOH so the KOH is the excess reagent

mass of KNO_3 = 1.527 g from 0.0151 mol

3. 6 points. A titration between KOH and a solution of $HC_2H_3O_2$ takes place. The concentration of KOH is 0.1005 M and 23.05 mL is required to fully neutralize the acetic acid. If 25.00 mL of acetic acid solution is used calculate the mass percent of the acetic acid solution. The density of the acetic acid solution is 1.02 g/mL.

$$\text{mass} = \frac{\text{mass solute x100}}{\text{mass solution}}$$

4. 6 points. Consider the following reaction. Write the balanced (a) molecular, (b) complete ionic, (c) net ionic equations. Be sure to include states of matter.

$Co(NO_3)_3$(aq) + KOH(aq) →

Molecular: $Co(NO_3)_3$(aq) + 3KOH(aq) → $Co(OH)_3$(s) + $3KNO_3$(aq)
Complete ionic: Co^{+3}(aq) + $3NO_3^-$(aq) + $3K^+$(aq) + $3OH^-$(aq) → $Co(OH)_3$(s) + 3K+(aq) + $3NO_3^-$(aq)
Net ionic: Co^{+3}(aq) + $3OH^-$(aq) → $Co(OH)_3$(s)