US 110 Exam 2, Wednesday October 21

Name_____

By submitting this exam, I certify that I have neither given nor received unauthorized aid on this assignment.

Useful information: $c = 3.00 \times 10^{8}$ m/s, $\lambda\nu = c$, $E=h\nu$, $\lambda = \frac{h}{mv}$, $h = 6.626 \times 10^{-34}$ Js, 6.626×10^{-34} kgm^2/s, $N_A = 6.022 \times 10^{23}$ 1/mole

(1) Write the definitions for the following

(a) Arrhenius Acid:

(b) Arrhenius Base:

(c) Brønstead-Lowry Acid

(d) Brønstead-Lowry Base

(2)(4 points) Write the balanced ionic and net ionic equations for the following reactions

(a) $Ca(ClO_4)_{2(aq)} + (NH_4)_3PO_{4(aq)}$-------->

(b) $NaOH_{(aq)} + SrCl_{2(aq)}$ ------>

(3)(2 points) Classify the following as weak electrolytes, strong electrolytes, or nonelectrolytes

(a) HF

(b) CF_4

(4)(4 points) Complete the following neutralization reactions and balance them for a complete neutralization (all acidic protons neutralized, all basic units neutralized).

(a) $HF_{(aq)} + KOH_{(aq)}$ ------->

(b) $NH_{3(aq)} + H_2SO_{4(aq)}$ ------>

(5)(2 points) Write the ground state electron configurations (ie $1s^2 2s^2 2p^6$...) for the following species. Don't use the noble gas formalism.

(a) S

(b) Ti

(6)(4 points) List the oxidation state for each element in the following compounds

(a) PbO_2

(b) $Cr_2O_7^{2-}$

(8)(8pts) Balance the following half-reactions in base

(a) Cr^{3+} ----> $Cr_2O_7^{2-}$

(b) PbO_2 ------> PbO

(9)(4 pts) Balance the following reaction in base (see the previous question).

$$Cr^{3+} + PbO_2 \text{ -------> } Cr_2O_7^{2-} + PbO$$

(10)(2 pts) A radio station broadcasts at 101.1 MHz (1 MHz = 10^6 1/s). What is the wavelength of the light broadcast by the radio station?

(11)(4 pts) Put the following atoms in order from smallest to largest:

P, Cs, Cl, Sr, He

(12) (4 pts) Define the following:

(a) Hund's Rule

(b) The Aufbau Principle

(12)(4 points) Answer the following questions about quantum numbers.

(a) If l=2, how many electrons can the subshell hold?

(b) What is the fist shell that can have a g subshell and why?

(13)(2 points) Draw a picture of the orbital with the following quantum numbers: n=4, l=1, m_l=0.

(14)(6 points) Using the following reactivity data, construct an activity series for Ru, Au, Al, and Fe.

Strips of each metal were placed in solutions of each metal nitrate. The results for the reactions are shown below in table 1.
Example: $Fe(NO_3)_3$ + Au ---> NR

Table 1. Reactivity results

Salt\metal	**Ru**	**Au**	**Al**	**Fe**
$Ru(NO_3)_3$	NR	NR	Ru + Al^{3+}	Ru + Fe^{3+}
$Au(NO_3)_3$	Au + Ru^{3+}	NR	Au + Al^{3+}	Au + Fe^{3+}
$Al(NO_3)_3$	NR	NR	NR	NR
$Fe(NO_3)_3$	NR	NR	Fe +Al^{3+}	NR

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Extra Credit (4 points):

Currently, chemistry is seen as the "central science". The essential explanations in biology have been reduced to chemical reactions and chemistry has the basic concepts used to describe material science and some physics. This central spot has not always been seen as the place of chemistry, however. In "Science and Modern Thought" in *The Outline of Science*, what discipline was seen as "the central science"?