

CHEM 1054 Exam 2.**Name** _____

I affirm that I have neither given nor received unauthorized aid on this assignment.

Useful information: Formal Charge = $E_{\text{valence}} - (E_{\text{nonbonding}} + \#_{\text{bonds}})$, $\lambda\nu = c$, $c = 3.00 \times 10^8$ m/s,

$$E = h\nu \quad \lambda = \frac{h}{mv}, \quad \frac{1}{\lambda} = R_H \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right), \quad R_H = 0.01097 \text{ nm}^{-1}, \quad 1 \text{ Hz} = 1/\text{s}, \quad h = 6.626 \times 10^{-34} \text{ Js},$$

(1)(4 points) How much CaCl_2 (in g) is in a 375 mL of 0.100 M CaCl_2 solution?

(2)(4 points) A 0.500 M solution, 20.0 L in size needs to be prepared from a 14.5 M stock solution. How would you do this?

(3)(6 points) $\text{H}_3\text{PO}_4 + 3\text{NaOH} \rightarrow \text{Na}_3\text{PO}_4 + 3\text{H}_2\text{O}$

(a) A 25.00 mL solution of H_3PO_4 was titrated with 15.55 mL of 0.1000 M NaOH. What is the concentration of the H_3PO_4 solution?

(b) What mass of H_3PO_4 is in 1.00 L of solution?

(4)(4 points) Define the following

(a) the Pauli Exclusion Principle

(b) the Aufbau Principle

(5)(4 points) List the four quantum numbers for an electron and the name of the quantum number

(6)(3 points) List the possible quantum numbers for the following orbitals (may be a range for some quantum numbers)

(a) 3s

(b) 5p

(c) 4d

(7)(4 points) Write out the ground state electron configuration for the following atoms or ions (do not use the noble gas shortcut)

(a) O

(b) S²⁻

(c) Na⁺

(d) Br

(8)(2 points) Label each of the following as a ground state, an excited state, or an impossible electron configuration

(a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

(b) $1s^2 2s^2 2p^6 3s^1 3p^2$

(9)(2 points) Which of the following should have the largest first ionization energy?

Al, Sc, O, C, K

(10) (2 points) Place the following in order of increasing electronegativity

K, F, Li, O, Cs

(11)(4 pts) Certain ham radio's are called '10 meter rigs'. This refers to a wavelength of 10 meters. What is the frequency of the radio?

(12₃)(2 pts) How do we know that light is composed of particles called photons?

(13)(4 points) What wavelength of light is emitted when an electron falls from the $n=6$ level to the $n=3$ level of a hydrogen atom?

(14)(9 points) Draw the best Lewis Dot Structure for each of the following species.

(a) AlF_3

(b) SF_2

(c) SO_3^{2-}

(Extra Credit) (4 points) Draw the best Lewis Dot Structure and all resonance contributors for NO_3^-