**Name:** _____

# CHM 101 Exam 3 Spring 2017

**Multiple Choice**
*Identify the choice that best completes the statement or answers the question.*

_____ 1. Which is the correct orbital diagram for a *Nitrogen* atom?

a. $\frac{\uparrow\uparrow}{1s} \quad \frac{\uparrow\uparrow}{2s} \quad \frac{\uparrow}{} \frac{\uparrow}{} \frac{\uparrow}{2p}$   b. $\frac{\uparrow\downarrow}{1s} \quad \frac{\uparrow\downarrow}{2s} \quad \frac{\uparrow}{} \frac{\uparrow}{} \frac{\uparrow}{2p}$   c. $\frac{\uparrow\downarrow}{1s} \quad \frac{\uparrow\downarrow}{2s} \quad \frac{\uparrow\downarrow}{} \frac{\uparrow}{} \frac{}{2p}$

_____ 2. Which of the following statements applies to *s* subshells?

a. they contain two *s* orbitals
b. they can hold a total of 14 electrons
c. their orbitals have a spherical shape
d. all of these

_____ 3. Which of the following *best* explains the *relative sizes* of the $K^+$ and $Cl^-$ *ions.*

a. chlorine is to the right of potassium on the Periodic Table.
b. potassium has a greater molar mass than chlorine
c. potassium is farther down on the Periodic Table
d. chlorine has a smaller nuclear charge, so can't hold electrons as tightly
e. they have a different number of electrons

_____ 4. Which of these would be the *biggest?* (Have the *largest* radius?)

a. $Mg^{2+}$ ion   b. $F^-$ ion   c. $Al^{3+}$ ion   d. $O^{2-}$ ion   e. all same size

_____ 5. Which is the correct *shorthand* electron configuration for $1s^2 2s^2 2p^6 3s^2$?

a. $[Ne]\,3s^2$   b. $[Ar]\,3s^2$   c. $[He]\,3s^2$   d. none of these

_____ 6. Atoms or ions are *isoelectronic* if they have

a. the same electron configuration
b. the same number of neutrons
c. the same number of *valence* electrons
d. the same number of protons
e. none of these

_____ 7. Which of the following statements applies to *d* subshells?

a. their orbitals have a cloverleaf shape
b. they contain three *d* orbitals
c. they can hold a total of 6 electrons
d. all of these

**Short Answer**

8. A cylinder with 2.24 liter volume contains 3.20 g $O_2$(g). At $0^oC$, how many grams $O_2$ must be added to make the pressure 2.00 atm ?

.

9. A calorimeter contains 150.0 g $H_2O$ at 25.00 ºC. When 1.00 g $BaCl_2$ is added, the temperature increases to 27.33 ºC. Calculate the heat produced.

.

.

10. Calculate ΔH for the following reaction from the standard enthalpies of formation;

$$Fe_2O_3(s) \; + \; 3\,CO(g) \; \rightarrow \; 2\,Fe(l) \; + \; 3\,CO_2(g)$$
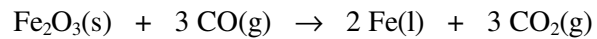
$\Delta H^0_f$ (kJ/mol)
$Fe_2O_3(s)$ -912.2
$CO(g)$ -105.0
$Fe(l)$ 9.7
$CO_2(g)$ -393.5

.

11. An electron relaxes from the sixth shell to the third shell. Calculate the energy of the transition.

.

12. What fraction of the total number of electrons in Si are in p subshells?

.

13. Write the symbol of the element of the lowest atomic number that has more than 6 electrons in its 3d subshell.

   .

14. How many unpaired electrons in Br?

   .

15.
   What is the frequency of electromagnetic radiation that has a wavelength of
   8.80 m?  How much energy, in joules does one photon of this em have?

      .

16.
   At STP it was found that 1.19 L of a gas weighed 3.99 g. What is its molecular mass?

      .

17. Calculate the standard enthalpy of formation of SiF$_4$ .

$SiO_2(s)$  +  4 HF(g)    -->    2 H$_2$O(g)  +  SiF$_4$(g)   ΔH = -97.8 kJ
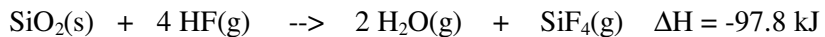
ΔH°$_f$  (kJ/mol)

$SiO_2(s)$   -709.4
HF(g)      -268.6
H$_2$O(g)   -241.8

.

18. Consider the three elements N, C, Si. Using the Periodic table, predict <u>and explain why</u> which of the three elements has;

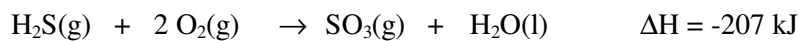a) the largest atomic radius
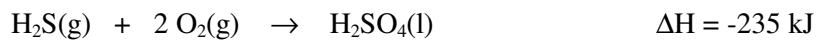
b) the smallest atomic radius

c) the largest ionization energy

d) the smallest ionization energy

.

19. Find ΔH for the reaction below, given the following reactions and ΔH values:

$H_2SO_4(l) \rightarrow SO_3(g) + H_2O(g)$

Given;

$H_2S(g) + 2 O_2(g) \rightarrow H_2SO_4(l)$                 ΔH = -235 kJ

$H_2S(g) + 2 O_2(g) \rightarrow SO_3(g) + H_2O(l)$       ΔH = -207 kJ

$H_2O(l) \rightarrow H_2O(g)$                            ΔH = 44 kJ

.

20. A gas at a temperature of 108 °C occupies a volume of 60.1 L. What will the volume be if the temperature is changed to °0 C?