CHE 213   Review of General Chemistry & Preparatory Assignment

Review of General Chemistry:
Use a general chemistry textbook (such as the one you used for general chemistry) to review
(1) bonding (including electronegativity, polarity of bonds, and hybrid orbitals) and Lewis Dot Structures (including resonance). Be able to use these structures to predict the shapes and polarities of molecules, and intermolecular forces (London dispersion forces, dipole forces, and hydrogen 'bonding').
(2) acids and bases, including K_a & K_b.
(3) fundamentals of thermodynamics.
(4) fundamentals of kinetics.

As far as our lab work, review significant figures, metric conversions, and stoichiometry (including limiting reactant problems).

Then do the following problems to be sure you understand these concepts. Answers are provided by a hyperlink. Neatly show all of your work to support your answers.

Review of General Chemistry Assignment:
Draw all Lewis dot structures to support your answers for questions 1 - 4.
1. In the Lewis dot structure for N_2, each N atom has
a) 1 bonding pair of electrons and 3 nonbonding pairs.
b) 2 bonding pairs of electrons and 2 nonbonding pairs.
c) 3 bonding pairs of electrons and 1 nonbonding pair.
d) none of these

2.Which of the following species -- BF_3, CO_3^{2-}, O_3 -- exhibits resonance?
a) CO_3^{2-} only.
b) CO_3^{2-} and O_3.
c) all of them
d) none of them

3. The shape of the SO_2 molecule is
a) linear
b) bent at about 109°.
c) bent at about 120°.
d) none of these.

4.The shape of the NH_3 molecule is
a) triangular pyramidal
b) trigonal (triangular) planar
c) T-shaped
d) none of these

5. Consider the molecule HC≡CCl. What hybrid orbitals are used by the carbon atoms?
a) sp
b) sp^2
c) sp^3
d) none of these

6. When an atom hybridizes its orbitals to sp^3 orbitals, how many are there?
a) two
b) three
c) four
d) none of these

7. What are the angles between sp^2 hybrid orbitals?
a) 120°
b) 109°
c) 180°
d) none of these

For each of the molecules in questions 8 – 13, draw its Lewis dot structure and then, considering a sample of the given substance, state the major intermolecular force among the molecules. (London dispersion force, dipole force, or hydrogen 'bonding').

8. I_2
9. NO
10. HCl
11. SO_3
12. CO_2
13. HF

For each pair of molecules in questions 14 – 16, predict which has the higher boiling point by considering the relative strengths of its intermolecular forces. (Draw Lewis dot structures for any molecules for which you have not already done so.)

14. HCl and HF
15. NO and O_2
16. H_2S and H_2Se

17. What is the pH of a 0.300 M HNO_3 solution?

18. What is the pH of a 0.10 M KOH solution?

19. What is the H^+ concentration of a solution whose pH = 3.25?

20. What is the K_a of an acid whose pK_a is 7.52?

Use the K_a table linked to the class page as needed for the following questions:

21. What is the pK_a of HF?

22. Rank the following acids from weakest to strongest: HNO_3, $HC_2H_3O_2$, $HCNO$, $HC_7H_5O_2$.

Prerequisite Skills Particularly Useful for Lab

Calculate the number of moles.
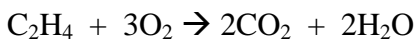23. 4.02 g of C_2H_5OH
24. 24.0 g of C_6H_6

Calculate the number of grams.
25. 4.0 moles of $CH_3(CH_2)_3CH_3$
26. 0.55 moles of $CH_2=CH_2$

Consider the following chemical reaction for questions 46 - 48:

$$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$$

27. Calculate the mass in grams of CO_2 produced from 10.0 g C_2H_4 reacting with excess O_2.

28. If 10.0 g of O_2 and 10.0 g of C_2H_4 react, which reactant will be the limiting reactant? How many grams of CO_2 could be produced (i.e., the theoretical yield)

29. If 8.11 g of CO_2 are actually produced in the scenario of #28, what is the percent yield?

30. Convert 0.427 L to mL.
31. Convert 75 g to kg.
32. Convert 0.451 cc to μL.
33. Convert 9.4×10^4 mg to kg.

Change the following numbers to 4 significant figures.
34. 2.35550
35. 2.35450
36. 0.000657030
37. 213.25
38. 3.2181×10^3

39. 12,341,123

How many significant figures are in each of the following numbers?
40. 3.141 m
41. 0.002004 kg
42. 23.123000 g
43. 149 mL
44. 1700 cm
45. 1900.00 g
46. 6.0231×10^{23} atoms

Give the answer with the correct number of significant figures.
47. 1.86 / 2.1 =
48. (37.2) (3.141) =
49. (998) (32.15) / 21 =
50. 4.51545 / 1.05 =
51. 621 / (3.151×10^{5}) =
52. 104 + 37.2 −18.57 =
53. 87.6 − 0.005 =
54. 6.23 + 915 − 1012.7 =
55. 87.9 + 11.3 + 9.6 =
56. 324.55 − (6104.5 / 22.3) =
57. [(31.8) (2.4) / 8.92] − 0.17 =
58. 1.32 + 0.006 + 34 /47 =