1.) In the combustion of butane (C_4H_{10}) in excess O_2 to give CO_2 and H_2O, how many moles of CO_2 are formed from each mole of butane?

A) 1   B) 2   C)3   D)4   E)5

2.) If 1 mole of glucose ($C_6H_{12}O_6$) reacts with 1 mole of O_2, according to the reaction below,

$$C_6H_{12}O_6 \quad + \quad 6\,O_2 \longrightarrow 6\,CO_2 \quad + \quad 6\,H_2O$$

which is the limiting reagent in the reaction?

A) $C_6H_{12}O_6$ B) O_2 C) CO_2 D) H_2O E) none of these

3.) Which of the following compounds exhibit ionic bonding? Mark all that apply.

A) Cl_2 B) CO_2 C) CH_4 D) RbCl   E) $MgBr_2$

4.) 6.) Which of the following must be the same before and after a chemical reaction? Mark all that apply.

         A) The total mass.

         B) The total pressure.

         C) The total number of molecules.

         D) The total number of moles.

         E) The total number of atoms (including those in molecules).

5.) Which of the following contains the most *molecules*?

A) 5.0 g CO_2 B) 5.0 g O_3 C) 5.0 g H_2O D) 5.0 g CO   E) 5.0 g Xe

6.) Which difluoropropane ($C_3H_6F_2$) molecule is chiral? (note: the H atoms are not shown)

A.) F–C–C–C with F below   B.) F F above C–C–C   C.) F and F above C–C–C   D.) F above C–C–C with F below

7.) 10) Which of the following compounds contains **at least one** purely covalent bond ($\approx$ 0 % ionic character)?

A) $CHCl_3$ B) MnO_4^{2-} anion   C) NaI   D) HSO_2 E)N_3^- anion

8.) The H-N-H angle in ammonia (NH_3) is:

a) $< 100°$
b) $> 120°$
c) $= 109.5°$
d) between $109.5°$ and $120°$
e) between $100°$ and $109.5°$
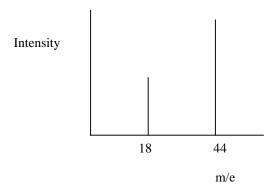
9.) The H-N-H angle in the ammonium cation (NH_4^+) is:

   a) $< 100°$
   b) $> 120°$
   c) $= 109.5°$
   d) between $109.5°$ and $120°$
   e) between $100°$ and $109.5°$

10.) Which of the following is isoelectronic with N_2?

   a) NaCl
   b) O_2
   c) Cl_2
   d) CO
   e) H_2

Short Answer:

1.) Arrange the following in order of decreasing mass:

   4.85×10^{22} molecules of BF_3 0.5 mole of O_2 gas   3.2 grams of H_2O

   _____ > _____ > _____
   greatest mass   smallest mass

2.) For each molecule indicate the steric # of the central atom, the shape, and the
presence or absence of a dipole moment:

         A. Linear
         B. V-shaped/Bent
         C. Trigonal Planar
         D. Pyramidal
         E. Tetrahedral
         F. Trigonal Bipyramidal
         G. Octahedral
         H. T-shaped

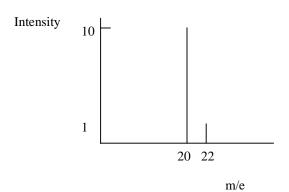| Molecule	Workspace	Steric #	Shape	Dipole (Y or N)
PCl_6^-				
$BeCl_2$				
SiH_4				
ClO_4^-				
NO_2^-				
ClF_3				

3.) A hydrocarbon of molecular weight 26 is burned to yield CO_2 and H_2O. The mass spectrum of the products is shown below:

Intensity

18   44

m/e

A. Write a balanced equation for the reaction.

B. Draw the Lewis Electron Dot Structure for the hydrocarbon.

C. Use VSEPR to determine the shape of the molecule. In this molecule, what is the largest number of atoms in a single plane?

4.) A naturally abundant sample of an element is analyzed in a mass spectrometer, yielding the following spectrum:

A. For each peak, what are the Atomic Number, the number of protons and the number of neutrons.
B. What is the atomic weight of the naturally abundant element?
C. What is the element?

5.) Consider three beams of light (A, B, C) with equal intensity but the different wavelengths shown here:

    A) 800 nm   B) 500 nm   C) 300 nm

A. Which beam(s) will eject an electron from the metal whose profile is shown below.

B. Which beam(s) will eject electrons with the greatest kinetic energy? Explain in 20 words or less.

C Which beam(s) eject the greatest number of electrons from the metal?
Explain in 20 words or less.