1.) In the combustion of butane (C4H10) in excess O2 to give CO2 and H2O, how many moles of CO2 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,

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

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.

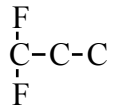
D) The total number of moles.

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

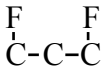
5.) Which of the following contains the most *molecules*?

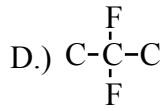
A) 5.0 g CO_2 B) 5.0 g O_3 **C) 5.0 g H_2O** D) 5.0 g CO E) 5.0 g Xe

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

A.) 

B.) 

C.) 

D.) 

7.) 10) Which of the following compounds contains **at least one** purely covalent bond (≈ 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 x 10^{22} molecules of BF_3 0.5 mole of O_2 gas 3.2 grams of H_2O

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

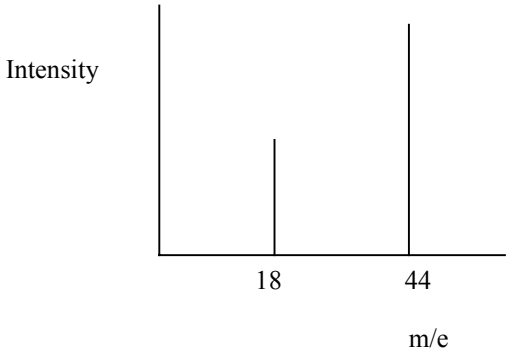
greatest mass smallest mass

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

Shapes
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)**
PCL6-		**6**	**G**	**N**
BeCl2		**2**	**A**	**N**
SiH4		**4**	**E**	**N**
ClO4-		**4**	**E**	**N**
NO2-		**3**	**B**	**Y**
ClF3		**5**	**H**	**Y**

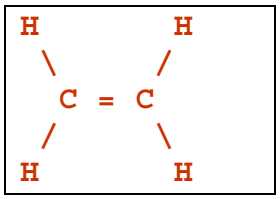
3.) A hydrocarbon of molecular weight 26 is burned to yield CO2 and H2O. The mass spectrum of the products is shown below:



A. Write a balanced equation for the reaction.

$C_2H_2 + {}^3/_2\, O_2 \rightarrow 2\, CO_2 + H_20$

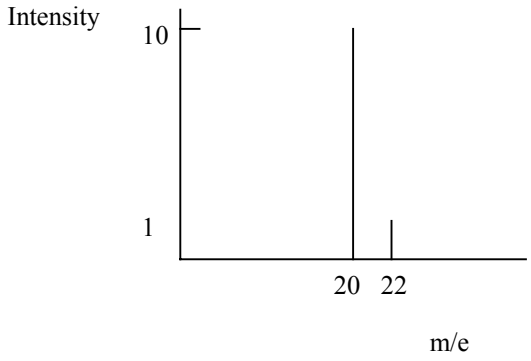
B. Draw the Lewis Electron Dot Structure for the hydrocarbon.



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

The molecule is planar. All six atoms are 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.

First peak: Atomic number 10, 10 protons, 10 neutrons
Second peak: Atomic number 10, 10 protons, 12 neutrons

B. What is the atomic weight of the naturally abundant element?

20.180

C. What is the element?

neon (Ne)