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Chemistry I Spring Final Review: Unit 8-9
Stoichiometry and Molecular Geometry

compound → element + element

Unit 8: Stoichiometry

1) What is the correct balanced equation that shows the decomposition of lithium chloride?
   A) $LiCl \rightarrow Li + Cl$
   B) $LiClO_3 \rightarrow LiCl + O_3$
   C) $2LiCl \rightarrow 2Li + Cl_2$
   D) $4LiClO_3 \rightarrow Li_2O_3 + Cl_2$

$Li^{+1}Cl^{-1}$ ↓ $2LiCl \rightarrow 2Li + Cl_2$ (diatomic)

2) How many liters of ethane (C_2H_6) at STP, will react with 8.50 L O_2 to form CO_2 and water? * Use mole map!

?L 8.50L
$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$

A) 15.8 L (B) 2.43 L C) 0.687 L D) 45.6 L

$$8.50\,L\ O_2 \cdot \frac{1\,mol\ O_2}{22.4\,L\ O_2} \cdot \frac{2\,mol\ C_2H_6}{7\,mol\ O_2} \cdot \frac{22.4\,L\ C_2H_6}{1\,mol\ C_2H_6} = 2.428\,L\ C_2H_6$$

3) How many grams of nitric acid are needed to react with 35.0g of iron (III) chloride according to the following equation?

?g 35.0g
$3HNO_3 + FeCl_3 \rightarrow Fe(NO_3)_3 + 6HCl$

MM: $FeCl_3 = 162.2\ g/mol$
$HNO_3 = 63.0\ g/mol$

A) 13.6 g B) 11.7 g C) 4.53 g (D) 40.8 g

$$35.0\,g\ FeCl_3 \cdot \frac{1\,mol\ FeCl_3}{162.2\,g\ FeCl_3} \cdot \frac{3\,mol\ HNO_3}{1\,mol\ FeCl_3} \cdot \frac{63.0\ g\ HNO_3}{1\,mol\ HNO_3} = 40.78\ g\ HNO_3$$

4) How many moles of aluminum are needed to react completely with 1.2 mol of FeO?

?mol 1.2mol
$2Al(s) + 3FeO(s) \rightarrow 3Fe(s) + Al_2O_3(s)$

(A) 0.80 mol B) 2.4 mol C) 4.8 mol D) 1.6 mol

$$1.2\,mol\ FeO \cdot \frac{2\,mol\ Al}{3\,mol\ FeO} = 0.8\,mol$$

5) The reactant that is completely used up and determines how much product can be made is called the _____.

LR
(A) limiting reactant B) excess reactant C) percent yield D) theoretical

6) Determine how many grams of calcium is found in 20 grams of calcium chloride. *Hint: 2 steps!

% comp.
A) 5.5 g
(B) 7.2 g
C) 12.7 g
D) 15.3 g

$CaCl_2$

Ca: $40.08\ g/mol$
$CaCl_2$: $110.98\ g/mol$

$$\%\ comp = \frac{40.08}{110.98} \cdot 100\% = 36.11\%\ Ca$$

mass of calcium = % (total mass)
(% in decimal)
$= (0.3611)(20.0) = 7.22\,g$

LR problem. 1st do stoic 2x. 2nd choose the smaller answer.

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7) When 15 g of magnesium is burned in 20 g of oxygen, how many grams of magnesium oxide can be produced max? (MM: Mg = 24.31 g/mol, O_2 = 32 g/mol, MgO = 40.31 g/mol)

$2Mg\ (s) + O_2\ (g) \rightarrow 2MgO\ (s)$

A) 24.8 g B) 50.4 g C) 41.5 g D) 63.0 g

$15\,g\ Mg \cdot \frac{1\,mol\ Mg}{24.31\,g\ Mg} \cdot \frac{2\,mol\ MgO}{2\,mol\ Mg} \cdot \frac{40.31\,g\ MgO}{1\,mol\ MgO} = 24.8\ g\ MgO$

$20\,g\ O_2 \cdot \frac{1\,mol\ O_2}{32\,g\ O_2} \cdot \frac{2\,mol\ MgO}{1\,mol\ O_2} \cdot \frac{40.31\,g\ MgO}{1\,mol\ MgO} = 50.4\ g\ MgO$

8) What is the limiting reactant in the question above?

A) Magnesium B) Oxygen C) Both reactants D)None

← Runs out 1st

9) When a chemist decomposes 4.7 g of lead(II) nitrate by heating, 0.78 g of nitrogen dioxide, NO_2, is actually produced in the lab. What is the ~~percent yield of the~~ decomposition reaction?

$\%\ yield = \frac{actual}{theoretical} \cdot 100$

$2\ Pb(NO_3)_2\ (s) \rightarrow 2\ PbO\ (s) + 4\ NO_2\ (g) + O_2\ (g)$

4.7 g ? g

(MM: $Pb(NO_3)_2$ = 331.2 g/mol, PbO = 223.2 g/mol, NO_2 = 46 g/mol, O_2 = 32 g/mol)

A) 44 %
B) 60 %
C) 67 %
D) 82 %

convert to the same substance as the actual!

$4.7\,g\ Pb(NO_3)_2 \cdot \frac{1\,mol\ Pb(NO_3)_2}{331.2\,g\ Pb(NO_3)_2} \cdot \frac{4\,mol\ NO_2}{2\,mol\ Pb(NO_3)_2} \cdot \frac{46\,g\ NO_2}{1\,mol\ NO_2} = 1.3\ g\ NO_2$ (Theo.)

$\% = \frac{A}{T} \cdot 100 \Rightarrow \frac{0.78\,g\ NO_2}{1.3\,g\ NO_2} \cdot 100 = 60\ \%$

10) Name the following hydrate: $MnSO_4 \cdot 7H_2O$

A) Manganese (II) sulfate heptahydrate
B) Manganese (II) sulfite septahydrate
C) Magnesium sulfite hexahydrate
D) Manganese (I) sulfate pentahydrate

7 = hepta

$Mn^{x}(SO_4)^{-2}$ → $Mn = +2$ must put (II)

Unit 9: Molecular Geometry

11) Diamonds have many unique properties and are made of carbon chains. What specific type of solid is this macromolecule?

A) polar molecular B) non-polar molecular C) metallic D) covalent network

12) Determine which of the following compounds does not obey the **general octet** rule.

A) CO_2 B) Br_2 C) CCl_4 D) BF_3

Boron only needs 6

13) What is the shape of H_2O?

A) linear B) bent C) trigonal pyramidal D) trigonal planar

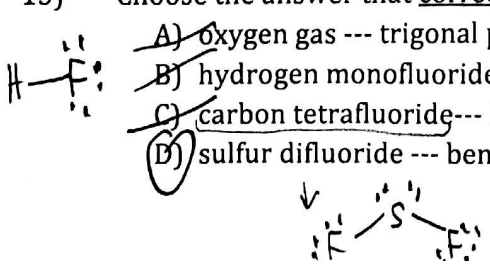
14) Which represents a polar molecule?

A) C_2H_6 B) HF C) Cl_2 D) CF_4

Polar
↳ hydrocarbon = NP
↳ diatomics = NP
Tetrahedral shape → NP

15) Choose the answer that correctly matches the molecule with its corresponding VSEPR shape.

A) oxygen gas --- trigonal planar
B) hydrogen monofluoride --- bent
C) carbon tetrafluoride --- trigonal pyramidal
D) sulfur difluoride --- bent



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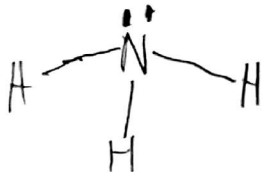
NH_3

16) How many shared and unshared electron pairs are found on the central atom of ammonia?

A) 1 shared electron pair, 3 lone pairs
B) 2 shared electron pairs, 2 lone pairs
C) 3 shared electron pairs, 1 lone pair
D) 4 shared electron pairs, 0 lone pair
E) 3 shared electron pairs, 0 lone pair

N: 1(8) + 3(2) = 14
A: 1(5) + 3(1) = 8
S: 14 − 8 = 6 → 3
L: 8 − 6 = 2 → 1



17) What is the only possible molecular geometry for a compound XY_4?

A) linear B) bent C) trigonal pyramidal D) tetrahedral

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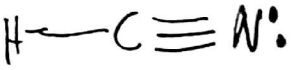
18) The VSEPR theory states that electrons tend to _____.

A) repel and spread as far from each other as possible
B) attract and get as close to each other as possible
C) repel and spread out to form 45 degree angles
D) attract and form bonds

19) HCN is a _____ and has a _____ shape.

A) nonpolar molecule; linear
B) polar molecule; linear
C) nonpolar molecule; bent
D) polar molecule; bent



Polar b/c different atoms attached to central element.

20) A delocalized "sea of electrons" allows for electrical conductivity and malleability of _ compounds.

A) molecular non-polar
B) metallic
C) ionic
D) covalent network

properties of metals