Chem 60 Final, Sp 2013   Name : _____

Info: $PV = nRT$ R = 0.0821 L atm, mole^{-1}K^{-1} or 62.4 L torr mole^{-1} K^{-1} STP = 1 atm = 101 kPa = 760 mm Hg @ 273 K
$Q = m c \Delta T$ c$_{H2O}$ = 1 cal g^{-1} K^{-1} or 4.184 J g^{-1} K^{-1} Avog # = 6.022 x 10^{23} molar volume of gas @ STP = 22.4 L
Electronegativities: B : 2.0, H : 2.1, C : 2.5, N : 3.0, O : 3.5, F : 4.0 .   Cl : 3.0 , S : 2.5, Br : 2.8 , I : 2.5
   Show a neat complete setup showing units for each problem involving calculations ; show answers with all
   Units, to the appropriate # of significant figures. No answer without a setup will be credited.

1. a) A hydrocarbon compound , contains 92.3% C and 7.70 % H . What is its empirical
       formula ?

15

   b) This same substance is a gas with a density of 1.25 g/L at 127°C and a pressure of 400
       torr. What is its molar mass ?

20

   c) What is the molecular formula of the compound ?

5

2. How many liters of CO_2 can be produced by combustion of 5.80 g butane with 15.0 liters
    of oxygen . All gases measured at STP.

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   Show a neat complete setup showing units for each problem involving calculations ; show answers with all
   Units, to the appropriate # of significant figures. No answer without a setup will be credited.

1. a) A hydrocarbon compound , contains 85.7% C and 14.4 % H . What is its empirical
       formula ?

15

   b) This same substance is a gas with a density of 1.346 g/L at 127°C and a pressure of 400
       torr. What is its molar mass ?

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   c) What is the molecular formula of the compound ?

5

2. How many liters of CO_2 can be produced by combustion of 3.00 g ethane with 8.00 liters
    of oxygen . All gases measured at STP.

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3. How many mL of 0.200 M barium hydroxide will be required to completely react with 0.0300 g of acetic acid ? ($HC_2H_3O_2$). (note only one H will react with OH^-)

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4. What is the molarity of a 5.00 % solution of acetic acid (vinegar), given that the density of the solution is 1.00 g/mL ?

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5. Predict products and balance these reactions. Assume they do react.

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a) nitrous acid reacts with nickel(III) hydroxide

b) combustion of methanol

c) aluminum reacts with aqueous cobalt (II) sulfate

d) sulfur dioxide reacts with water

3. How many mL of 0.300 M barium hydroxide will be required to completely react with 0.0600 g of acetic acid ? ($HC_2H_3O_2$). (note only one H will react with OH^-)

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4. What is the molarity of a 4.00 % solution of acetic acid (vinegar), given that the density of the solution is 1.00 g/mL ?

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5. Predict products and balance these reactions. Assume they do react.

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a) perchloric acid reacts with cobalt(III) hydroxide

b) combustion of ethanol

c) zinc reacts with aqueous nickel (III) sulfate

d) sulfur trioxide reacts with water

6.a) Write the electron configuration of europium (Eu) starting with the noble gas
   configuration [ ] notation.

20

   b) How many unpaired electrons do we find in this element ?

   c) Is this element paramagnetic or diamagnetic ? What fundamental property of electrons
      explains this behavior ?

   d) Write the symbol of an ion that can form, of europium. Explain why you chose this and
      which electrons were transferred.

7a) Write the Lewis formulas, describe the electron geometry (VSEPR) , bond angles
    and molecular shape. Sketch the molecule with its correct molecular shape. State whether
    the molecule is polar or non-polar. You don't have to show the polarity arrows but for 2 pts
    extra, show them and the resultant vector (if any) clearly on the sketch.

   SeO_2^{2-}

25

       2 pt bonus – name this ion

                                                                                              / 45

6.a) Write the electron configuration of rhenium (Re) starting with the noble gas
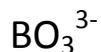configuration [ ] notation.

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b) How many unpaired electrons do we find in this element ?

c) Is this element paramagnetic or diamagnetic ? What fundamental property of electrons
explains this behavior ?

d) Write the symbol of an ion that can form, of rhenium. Explain why you chose this and
which electrons were transferred.

7a) Write the Lewis formulas, describe the electron geometry (VSEPR) , bond angles
and molecular shape. Sketch the molecule with its correct molecular shape. State whether
the molecule is polar or non-polar. You don't have to show the polarity arrows but for 2 pts
extra, show them and the resultant vector (if any) clearly on the sketch.

$BO_3{}^{3-}$

25

2 pt bonus – name this ion

/ 45

7b) Characterize this molecule, as in 7a).

PO_2^{-1}

25

8. How many microliters are present in 0.003 cm^3

10

7b) Characterize this molecule, as in 7a).

TeO_2^{-2}

25

8. How many cm^3 are present in 3000 microliters ?

10