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Intro Chemistry
Quiz3
Fall 2010

_____/50 pt

Name KEY
print clearly

*(10 pt)*1. Convert the following. Show all work.

0.133 mols carbonic acid into grams

$0.133\,mol\ H_2CO_3\left(\frac{62.03g\ H_2CO_3}{1\,mol\ H_2CO_3}\right) = \boxed{8.25g\ H_2CO_3}$

3

3.66×10^{24} molecules C_6H_{12} into grams

$3.66\times10^{24}\,molecules\ C_6H_{12}\left(\frac{1\,mol\ C_6H_{12}}{6.02\times10^{23}\,molecules}\right)\left(\frac{84.18g\ C_6H_{12}}{1\,mol\ C_6H_{12}}\right) = \boxed{512g\ C_6H_{12}}$

3

44.6 grams CH_4 into atoms H

$44.6g\ CH_4\left(\frac{1\,mol\ CH_4}{16.05g\ CH_4}\right)\left(\frac{6.02\times10^{23}\,molecules\ CH_4}{1\,mol\ CH_4}\right)\left(\frac{4\,atoms\ H}{1\,molecule\ CH_4}\right) = \boxed{6.69\times10^{24}\ atoms\ H}$

4

*(12 pt)*3. A compound is analyzed to contain 26.38% C, 3.33% H, and 70.29% O by mass. The molar mass of the compound is 273.15 g/mol.

a. Determine the empirical formula for the compound. Show all work, as done in class.

assume 100.0g compd.

$26.38g\ C\left(\frac{1\,mol\ C}{12.01g\ C}\right) = 2.197\,mol\ C/2.197 = 1 \times 2 = 2C$

$3.33g\ H\left(\frac{1\,mol\ H}{1.01g\ H}\right) = 3.30\,mol\ H/2.197 = 1.5 \times 2 = 3H$

$70.29g\ O\left(\frac{1\,mol\ O}{16.00g\ O}\right) = 4.393\,mol\ O/2.197 = 2 \times 2 = 4O$

$C_2H_3O_4$

$Em(91.05)$

b. Determine the molecular formula for the compound.

$\frac{MM}{EM} = \frac{273.15g/mol}{91.05g/mol} = 3$ $\boxed{C_6H_9O_{12}}$

*(10 pt)*4. Complete and balance the following equations.

aluminum + sulfur

$2Al + 3S \rightarrow Al_2S_3$

the combustion of C_6H_{12}

$C_6H_{12} + 9O_2 \rightarrow 6CO_2 + 6H_2O$

potassium carbonate + zinc nitrate

$K_2CO_3 + Zn(NO_3)_2 \rightarrow 2KNO_3 + ZnCO_3$

magnesium + aluminum sulfate

$3Mg + Al_2(SO_4)_3 \rightarrow 3MgSO_4 + 2Al$

chlorous acid + calcium hydroxide

$2HClO_2 + Ca(OH)_2 \rightarrow Ca(ClO_2)_2 + 2HOH$

Questions 5-7 are based on the following equation. Diagram each problem. Write all identities.

$2\ Sc_{(s)} + 6\ HNO_{3(aq)} \rightarrow 2\ Sc(NO_3)_{3(aq)} + 3\ H_{2(g)}\quad \Delta H = -288\ kJ$

*(6 pt)*5. How many grams of Sc are required to react with 136 g HNO_3?

$$136g\ HNO_3\left(\frac{1mol\ HNO_3}{63.02g\ HNO_3}\right)\left(\frac{2mol\ Sc}{6mol\ HNO_3}\right)\left(\frac{44.96g\ Sc}{1mol\ Sc}\right) = 32.3g\ Sc$$

*(6 pt)*6. How many liters of H_2 would be formed at STP along with 98.3g $Sc(NO_3)_3$?

$$98.3g\ Sc(NO_3)_3\left(\frac{1mol\ Sc(NO_3)_3}{230.99g\ Sc(NO_3)_3}\right)\left(\frac{3mol\ H_2}{2mol\ Sc(NO_3)_3}\right)\left(\frac{22.4L\ H_2}{1mol}\right) = 14.3L\ H_2@STP$$

(*6 pt*)7. How many grams of HNO_3 must react to release 109 kJ of heat?

$$-109\ kJ\left(\frac{6mol\ HNO_3}{-288kJ}\right)\left(\frac{63.02g\ HNO_3}{1mol\ HNO_3}\right) = 143g\ HNO_3$$