AP Chemistry Summer Assignment - KEY

The following assignment is to be completed and brought on the first day of class.

Scientific Notation

Write the following numbers in scientific notation.

3,400 3.4×10^3

101,000 1.01×10^5

45.01 4.501×10^1

0.00671 6.71×10^{-3}

0.000023 2.3×10^{-5}

0.010 1.0×10^{-2}

1,000,000 $1. \times 10^6$

Write the following number in standard notation.

2.30×10^4 23000.

205.901×10^{-7} 0.0000205901

9.11×10^3 9110.

1.76×10^{11} 176000000000.

1.76×10^{-3} 0.00176

8.65×10^{-1} 0.865

5.40×10^1 54.0

7.4×10^{-5} 0.000074

Sig Figs

Determine the number of sig figs in the following numbers:

1) 0.0000055 2

2) 1.6402 5

3) 0.0964070 6

4) 3.40×10^3 3

5) 1.020 4

6) 1020 3

7) 902,000,000 3

Determine the answer for the following calculations with correct number of sig figs.

1. $(45.0 / 9.0) \times 89.22 =$ 446 (3 sf)

2. $(2.88 + 0.5) - (23{,}000 - 0.11) =$ 22,997 (0 dp)

3. $[(10.31) + (0.0225)] / [(12.6) \times (0.01345)] =$ 61.0 (3 sf.)

$= 10.3325$ (2 pd only) $= 4$ sf.

$= .16947$ 3 sf.

Metric Conversions

Make the following metric conversions.

36.52 mg = 0.03652 g

14.72 kg = 1472000 mg

0.0035 hm = ~~0.035~~ 3.5 dm

0.134 m = 0.00134 km

25 mm = 25000 µm

243 daL = 2430 L

45.23 L = 45230 mL

0.035 ML = 3500000 cL

27.32 mm = 0.02732 m

Nomenclature

1. Name the following covalent compounds

IF_7 Iodine Septafluoride N_2O_5 dinitrogen pentoxide XeF_2 Xenon difluoride
N_2O_4 dinitrogen tetroxide As_4O_{10} tetrarsenic decoxide SF_6 Sulfur hexafluoride

2. Name the following ionic compounds

$AlCl_3$ Aluminum chloride MgO Magnesium oxide BaI_2 Barium Iodide
KI Potassium Iodide $SrBr_2$ Strontium bromide Na_2S Sodium Sulfide

3. Name the following ionic compounds that contain transition metals

$CuCl_2$ Copper (II) Chloride Fe_2O_3 Iron (III) oxide SnO Tin (II) Oxide
$PbCl_4$ Lead (IV) Chloride Cu_2S Copper (I) Sulfide HgS Mercury (II) Sulfide

4. Name these ionic compounds that contain polyatomic ions.

$Fe(NO_3)_3$ Iron (III) Nitrate $NaOH$ Sodium hydroxide Cu_2SO_4 Copper (I) Sulfate
$Ca(ClO_3)_2$ Calcium chlorate KNO_2 Potassium Nitrite $NaHCO_3$ Sodium bicarbonate

5. Name these binary acids

HCl hydrochloric acid HI hydroiodic acid HF hydrofluoric acid

6. Name these acids with polyatomic ions.

$HClO_4$ perchloric acid H_2SO_4 Sulfuric acid $HC_2H_3O_2$ acetic acid
H_3PO_4 phosphoric acid HNO_2 nitrous acid H_2CrO_4 chromic acid

7. Name these compounds appropriately.

CO carbon Monoxide NH_4CN ammonium cyanide HIO_3 Iodic acid
NI_3 nitrogen triiodide AlP Aluminum phosphide OF_2 oxygen difluoride
$LiMnO_4$ lithium permanganate $HClO$ hypochlorous acid HF hydrofluoric acid
SO_2 Sulfur dioxide $CuCr_2O_7$ copper (II) dichromate K_2O potassium oxide
FeF_3 Iron (III) fluoride $KC_2H_3O_2$ potassium acetate MnS Manganese (II) sulfide

8. Write the formulas for the following compounds.

Tin (IV) phosphide Sn_3P_4
Magnesium hydroxide $Mg(OH)_2$
Sulfurous acid H_2SO_3
Potassium nitride K_3N
Gallium arsenide $GaAs$
Zinc fluoride ZnF_2
(Zinc (II) Fluoride)

copper (II) cyanide $Cu(CN)_2$
sodium peroxide Na_2O_2
lithium Borate Li_3BO_3
chromium (III) carbonate $Cr_2(CO_3)_3$
cobalt (II) chromate $CoCrO_4$
perchloric acid $HClO_4$

Solubility rules

Review solubility rules and identify each of the following compounds as soluble (S) or insoluble (I) in water.

Na_2CO_3 S	$CoCO_3$ I	$Pb(NO_3)_2$ S
K_2S S	$BaSO_4$ I	$(NH_4)_2S$ S
AgI I	$Ni(NO_3)_2$ S	KI S
FeS I	$PbCl_2$ I	$CuSO_4$ S
Li_2O S	$Mn(C_2H_3O_2)_2$ S	$Cr(OH)_3$ I
$AgClO_3$ S	$Sn(SO_3)_4$ I	FeF_2 S

Balancing Equations

Balance the following equations with the lowest whole number coefficients.

$S_8 + 12O_2 \rightarrow 8SO_3$

$C_{10}H_{16} + 8Cl_2 \rightarrow 10C + 16HCl$

$4Fe + 3O_2 \rightarrow 2Fe_2O_3$

$2C_7H_6O_2 + 15O_2 \rightarrow 14CO_2 + 6H_2O$

$2KClO_3 \rightarrow 2KCl + 3O_2$

$2H_3AsO_4 \rightarrow As_2O_5 + 3H_2O$

$V_2O_5 + 6HCl \rightarrow 2VOCl_3 + 3H_2O$

$3Hg(OH)_2 + 2H_3PO_4 \rightarrow Hg_3(PO_4)_2 + 6H_2O$

Stoichiometry and Limiting Reactants

Make sure you report answers with the correct number of sig figs. – I did work on some only. You should show all work! ☺

1. Given the equation below, what mass of water would be needed to react with 10.0g of sodium oxide?

   $Na_2O + H_2O \rightarrow 2NaOH$

   $10.0g\ Na_2O \times \frac{1mol\ Na_2O}{61.98g} \times \frac{1mol\ H_2O}{1mol\ Na_2O} \times \frac{18.02g}{1mol\ H_2O} = 2.91g\ H_2O$

2. $2NaClO_3 \rightarrow 2NaCl + 3O_2$

   What mass of sodium choride is formed along with 45.0g of oxygen gas?

   54.8g NaCl

3. $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

   What mass of water will be produced when 100.0g of ammonia is reacted with excess oxygen?

   158.7g H_2O

5. $Na_2S + 2AgNO_3 \rightarrow Ag_2S + 2NaNO_3$

a. If the above reaction is carried out with 50.0g of sodium sulfide and 35.0g of silver nitrate, which is the limiting reactant?

c. What mass of silver sulfide would form?

a) $50.0g\ Na_2S \times \frac{1 mol\ Na_2S}{78.04g} \times \frac{1 mol\ Ag_2S}{1 mol\ Na_2S} = .641 mol\ Ag_2S$

$35.0g\ AgNO_3 \times \frac{1 mol\ AgNO_3}{169.87g} \times \frac{1 mol\ Ag_2S}{2 mol\ AgNO_3} = .103 mol\ Ag_2S$

$\therefore AgNO_3$ is Limiting Reactant.

b) $.103g\ Ag_2S \times \frac{247.80g}{1 mol} = 25.5g\ Ag_2S$

6. Calcium carbonate decomposes upon heating, producing calcium oxide and carbon dioxide gas.

a. Write a balanced chemical equation for this reaction. $CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$

b. How many grams of calcium oxide will remain after 12.25 g of calcium carbonate is completely decomposed? 6.870g CaO

c. What volume of carbon dioxide gas is produced from this amount of calcium carbonate at STP? (remember that at STP, 1 mole of gas = 22.4 L of gas)

$12.25g\ CaCO_3 \times \frac{1 mol\ CaCO_3}{100.09g} \times \frac{1 mol\ CO_2}{1 mol\ CaCO_3} \times \frac{22.4L}{1 mol\ CO_2} = 2.744L\ CO_2$

7. Hydrogen gas and bromine gas react to form hydrogen bromide gas.

a. Write a balanced chemical equation for this reaction. $H_{2(g)} + Br_{2(g)} \rightarrow 2HBr_{(g)}$

b. How many grams of hydrogen bromide gas can be produced from 3.2 g of hydrogen gas and 9.5 g of bromine gas? $*Br_2$ is Limiting reactant. $\therefore$ 9.6 g HBr

c. How many grams of which reactant is left unreacted?

d. What volume of HBr, measured at STP, is produced in b)?

d) 2.7 L HBr

c) H_2 is excess reactant...

0.12g H_2 needed to react w/ 9.5g Br_2

$3.2g\ H_2 - .12g =$ 3.1g H_2 left unreacted

8. When ammonia gas, oxygen gas and methane gas (CH_4) are combined, the products are hydrogen cyanide gas and water.

a. Write a balance chemical equation for this reaction. $2NH_{3(g)} + 3O_{2(g)} + 2CH_{4(g)} \rightarrow 2HCN_{(g)} + 6H_2O_{(g)}$

b. Calculate the mass of each product produced when 225 g of oxygen gas is reacted with an excess of the other two reactants.

c. If the actual yield of the experiment in b) is 105 g of HCN, calculate the percent yield.

b) 127g HCN & 253g H_2O

c) $\frac{105g\ HCN}{127g\ HCN} \times 100 =$ 82.7%