9/16/25

Key

Exam 1 Review Packet

Identify each substance as a compound, an element, a homogeneous or heterogeneous mixture.

Filtered tea

homogeneous mixture

Selenium

element

Soil

heterogeneous mixture

Table sugar (sucrose) $C_{12}H_{22}O_{11}$

compound

Salad dressing

heterogeneous mixture

Aluminum oxide

Compound

Convert the following:

~2 sig figs
0.042 km to m

$0.042\ \text{km} \cdot \frac{1000\ \text{m}}{1\ \text{km}} = \boxed{42\ \text{m}}$

~2 sig figs
7.3 L to ml

$7.3\ \text{L} \cdot \frac{1000\ \text{mL}}{1\ \text{L}} = \boxed{7300\ \text{mL}}$ or $\boxed{7.3 \times 10^3}$

2 sig figs — Given

The Eiffel tower in Paris, France contains 8200 tons of puddled iron (Fe) in its makeup. How many grams (g) of iron is that equal to? 1 ton = 2000 lb.; 453.6 g = 1 lb.

$8200\ \text{tons Fe} \cdot \frac{2000\ \text{lb}}{1\ \text{ton}} \cdot \frac{453.6\ \text{g}}{1\ \text{lb}} = \boxed{7.4 \times 10^9\ \text{g Fe}}$

A patient requires 2.5 g of medication. The medication is available as a 20 mg/mL solution. How many milliliters of the solution should be administered?

$2.5\ \text{g} \cdot \frac{1000\ \text{mg}}{1\ \text{g}} = \frac{2500\ \text{mg}}{20\ \text{mg/mL}} = \boxed{125\ \text{mL}}$

What volume of gold (density 19.3 g/ml) is needed to obtain 9.4 g of gold?

mass — Au

$V = \frac{m}{D}$ $\quad \frac{9.4\ g\ Au}{19.3\ g/mL} = \boxed{0.49\ mL}$

Determine the number of protons, neutrons, and electrons in the following elements:

Anion - gained electrons

N^{3-}

$P = \boxed{7}$ (atomic number)

$N = 14 - 7 = \boxed{7}$

$E = 7 + 3 = \boxed{10}$

Protons + neutrons / atomic weight

Cation - lost electrons

Ca^{2+}

$P = \boxed{20}$ (atomic number)

$N = 40 - 20 = \boxed{20}$

$E = 20 - 2 = \boxed{18}$

Classify the following compounds as ionic, molecular (covalent), or acidic and then name.

	Type of Bond	Name
A. $CrPO_4$ (metal — polyatomic ion)	Ionic	Chromium (III) phosphate
B. SO_2 (2 non-metals → prefix)	Molecular (covalent)	Sulfur dioxide
C. HBr (aq) (H means acid)	acidic	hydro bromic acid

net charge: Cr^{+3} PO_4^{-3}

hydro stem -ic acid

Write the correct formula for the following compounds.

Ionic →	A. Sodium Carbonate	$Na_2(CO_3)$
Covalent →	B. Dichlorine (2) tetrasulfide (4)	Cl_2S_4
Ionic →	C. Lithium bromide	$LiBr$
Ionic →	D. Copper (II) phosphate	$Cu_3(PO_4)_2$

metal +1 — polyatomic ion -2

Na_2 (CO_3)

2(+1) +2 -2 = ∅

Li^{+1} Br^{-1}

Cu PO_3 (+2) (-3)

(II) after it has been criss crossed so have to place on phosphate

Balance the following equations:

Reactants → Products

$\underline{2}\ KClO_3(s) \rightarrow \underline{2}\ KCl(s) + \underline{3}\ O_2(g)$

K - +2 | K - +2

Cl - +2 | Cl - +2

O - 3 6 | O - 2 6

★ find smallest common factor = 6

$\underline{4}\ V(s) + \underline{5}\ O_2(g) \rightarrow \underline{2}\ V_2O_5(s)$

V - X 2 4 | V - 2 4

O - 2 10 | O - 5 10

Smallest common factor = 10

Balance the following equation and use it to answer the following two questions:

Already balanced ✓

__Fe + __CuSO4 → __FeSO4 + __Cu

Fe - 1	Fe - 1
Cu - 1	Cu - 1
S - 1	S - 1
O - 4	O - 4

Calculate the grams of copper (Cu) produced if 0.500 grams of iron (Fe) react completely.

└ 3 sig figs

$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

0.500g ? g

$0.500\,g\,Fe \cdot \frac{1\ mol\ Fe}{55.845\,g\,Fe} \cdot \frac{1\ mol\ Cu}{1\ mol\ Fe} \cdot \frac{63.55\,g\,Cu}{1\ mol\ Cu} = \boxed{0.569\,g\,Cu}$

↑ could skip this step since it's a 1:1 ratio. SAVE TIME! ::

Calculate the moles of copper (II) sulfate ($CuSO_4$) needed to react completely with 3.75 moles of iron (Fe).

$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

3.75 mol ? mol

$3.75\ mol\ Fe : 1\ mol\ CuSO_4 \rightarrow \boxed{3.75\ mol\ CuSO_4}$

Again this is due to the 1:1 mole ratio from the balanced equation.

GFM / EFM

Determine the molecular formula of a compound with an empirical formula of CH_2O and a molar mass (molecular mass) of 180.16 g/mol.

$\frac{180.16\ g/mol}{30.026\ g} \approx 6$

$6(CH_2O)$

$\boxed{C_6H_{12}O_6}$

C: 1 x 12.011
H: 2 x 1.008
O: 1 x 15.999
30.026 g

} Add

Ascorbic acid contains 40.92% C, 4.58% H, and 54.50% O by mass. What is the empirical formula of ascorbic acid?

Empirical Formula Rules

1.) % → g
2.) g → mol
3.) divide by smallest # of moles
4.) make adjustments if there's fractions

C - $40.92g \cdot \frac{1\ mol}{12.01g} = 3.407\ mol \div 3.406 = 1 \times 3 = 3$

H - $4.58g \cdot \frac{1\ mol}{1.008g} = 4.54\ mol \div 3.406 \approx 1.33\overline{3} \times 3 = 4$

O - $54.50g \cdot \frac{1\ mol}{15.999g} = 3.406\ mol \div 3.406 = 1 \times 3 = 3$

$\boxed{C_3H_4O_3}$

★ When you see a hydrocarbon + O_2 it'll be a combustion reaction

$C_8H_{18} + O_2 \longrightarrow H_2O + CO_2$

(C_8H_{18}: hydrocarbon; O_2: oxygen gas; CO_2: complete combustion)

When 73.0 grams of octane (C8H18) is burned in the presence of 68.0 grams of oxygen, 26.2 grams of water is produced.

(26.2 grams of water: ★ actual yield)

18 ÷ 2 = 9

A. Balance the chemical reaction for this problem

★ If when you divide the value of hydrogens from the hydrocarbon by 2 and its an odd # the coefficient for hydrocarbon will be 2.

$2\,C_8H_{18} + 25\,O_2 \longrightarrow 16\,CO_2 + 18\,H_2O$ ✓ Balanced

C - 8 16 | C - ✗ 16

H - 18 36 | H - ✗ 36

O - ✗ 50 | O - ✗ 50

18 + 32 = 50

B. Determine the limiting reactant and the theoretical yield in grams of water. (product)

1. Find molar mass of reactants + products

C_8H_{18} C: 8 × 12.011

H: 18 × 1.008

114.23 g/mol

O_2 O: 2 × 15.999 / 32.00 g/mol

H_2O H: 2 × 1.008

O: 1 × 15.999

18.02 g/mol

2. convert mass of reactants to moles

C_8H_{18}: $\frac{73.0\ g}{114.23\ g/mol} = 0.639$ mol

O_2: $\frac{68.0\ g}{32.00\ g/mol} = 2.125$ mol

3. determine limiting reactant

mole ratio of O_2 to C_8H_{18} is $\frac{25}{2} = 12.5$

Available mole ratio of O_2 to C_8H_{18} is $\frac{2.125\ mol}{0.639\ mol} = 3.33$

since the available ratio is less than required ratio of 12.5, oxygen is limiting reactant.

C. Determine the percent yield of this reaction.

Formula: $\frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100$

Actual yield of water is 26.2 grams

$\frac{26.2\ g}{27.57\ g} \times 100 = 95.0\%$

Theoretical Yield

$2.125\ mol\ O_2 \cdot \frac{18\ mol\ H_2O}{25\ mol\ O_2} = 1.53$ mol H_2O

$1.53\ mol\ H_2O \cdot \frac{18.02\ g/mol}{1\ mol} = 27.57$ g H_2O