

Dougherty Valley HS AP Chemistry
Review Stoichiometry and Reactions

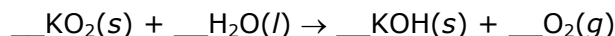
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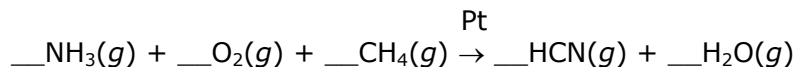
Directions: Complete the following review questions on a separate sheet of paper. Must show your work. Put a box around all final NUMERICAL answers.

[1] Potassium superoxide, KO_2 , is used in rebreathing gas masks to generate oxygen. (4.77)



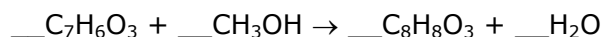
If a reaction vessel contains 0.15 mol KO_2 and 0.10 mol H_2O , what is the limiting reactant? How many moles of oxygen can be produced?

[2] Hydrogen cyanide, HCN , is prepared from ammonia, air, and natural gas (CH_4) by the following process: (4.82)



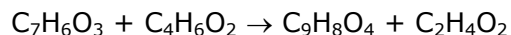
Hydrogen cyanide is used to prepare sodium cyanide, which is used in part to obtain gold from gold-containing rock. If a reaction vessel contains 11.5 g NH_3 , 10.0 g O_2 , and 10.5 g CH_4 , what is the maximum mass in grams of hydrogen cyanide that could be made, assuming the reaction goes to completion as written?

[3] Methyl salicylate (oil of wintergreen) is prepared by heating salicylic acid, $\text{C}_7\text{H}_6\text{O}_3$, with methanol, CH_3OH . (4.84)



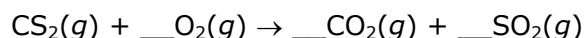
In an experiment, 1.50 g of salicylic acid is reacted with 11.20 g of methanol. The yield of methyl salicylate, $\text{C}_8\text{H}_8\text{O}_3$, is 1.31 g. What is percentage yield?

[4] Aspirin (acetylsalicylic acid) is prepared by heating salicylic acid $\text{C}_7\text{H}_6\text{O}_3$, with acetic anhydride, $\text{C}_4\text{H}_6\text{O}_2$. (4.83)



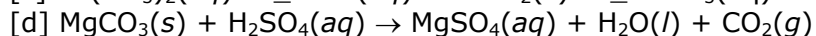
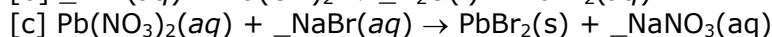
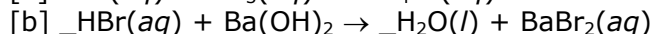
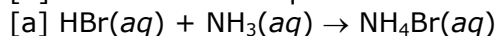
What is the theoretical yield (in grams) of aspirin, $\text{C}_9\text{H}_8\text{O}_4$, when 2.00 g of salicylic acid is heated with 4.00 g of acetic anhydride? If the actual yield of aspirin is 2.10 g, what is the percentage yield?

[5] Carbon disulfide, CS_2 , burns in oxygen. Complete combustion gives the reaction: (4.80)



Calculate the grams of sulfur dioxide, SO_2 , produced when a mixture of 15.0 g of carbon disulfide and 35.0 g of oxygen reacts. Which reactant remains unconsumed at the end of the combustion? How many grams remain?

[5] Write net ionic equations for the following molecular equations. HBr is a strong electrolyte.



[6] For each of the following, write molecular and net ionic equations for any precipitation reaction that occurs. If no reaction occurs, indicate this.

- [a] Solutions of barium nitrate and lithium sulfate are mixed
- [b] Solutions of sodium bromide and calcium nitrate are mixed
- [c] Solutions of aluminum sulfate and sodium hydroxide are mixed
- [d] Solutions of calcium bromide and sodium phosphate are mixed

[7] Complete the right side of each of the following molecular equations. Then write the net ionic equations. All salts formed are soluble. Acid salts are possible.

- [a] $_KOH(aq) + H_3PO_4(aq) \rightarrow$
- [b] $_H_2SO_4(aq) + _Al(OH)_3(aq) \rightarrow$
- [c] $_HC_2H_3O_2(aq) + Ca(OH)_2(aq) \rightarrow$
- [d] $_H_2SO_3(aq) + NaOH(aq) \rightarrow$

[8] Determine the oxidation numbers of all the elements in each of the following compounds (Hint: Look at the ions present.)

- [a] $Hg_2(BrO_3)_2$
- [b] $Cr_2(SO_4)_3$
- [c] $CoSeO_4$
- [d] Cu_2SO_3
- [e] $Mn(ClO_3)_2$
- [f] $Fe_2(CrO_4)_3$
- [g] $HgCr_2O_7$
- [h] $Co_3(PO_4)_2$

[9] In the following reactions, label the oxidizing agent and the reducing agent.

- [a] $P_4(s) + 5O_2(g) \rightarrow P_4O_{10}(s)$
- [b] $Co(s) + Cl_2(g) \rightarrow CoCl_2(s)$
- [c] $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$
- [d] $PbS(s) + 4H_2O_2(aq) \rightarrow PbSO_4(s) + 4H_2O(l)$

[10] Balance the following redox equations. All occur in Acidic solutions.

- [a] $Cr_2O_7^{2-} + C_2O_4^{2-} \rightarrow Cr^{3+} + CO_2$
- [b] $Cu + NO_3^- \rightarrow Cu^{2+} + NO$
- [c] $MnO_2 + HNO_2 \rightarrow Mn^{2+} + NO_3^-$
- [d] $PbO_2 + Mn^{2+} + SO_4^{2-} \rightarrow PbSO_4 + MnO_4^-$
- [e] $HNO_2 + Cr_2O_7^{2-} \rightarrow Cr^{3+} + NO_3^-$
- [f] $Mn^{2+} + BiO_3^- \rightarrow MnO_4^- + Bi^{3+}$
- [g] $Cr_2O_7^{2-} + I^- \rightarrow Cr^{3+} + IO_3^-$
- [h] $MnO_4^- + H_2SO_3 \rightarrow Mn^{2+} + SO_4^{2-}$
- [i] $Cr_2O_7^{2-} + Fe^{2+} \rightarrow Cr^{3+} + Fe^{3+}$
- [j] $As + ClO_3^- \rightarrow H_3AsO_3 + HClO$

[11] Balance the following redox equations. They occur in the solution indicated.

- [a] $Cr_2O_7^{2-} + H_2O_2 \rightarrow Cr^{3+} + O_2$ (acidic)
- [b] $CN^- + MnO_4^- \rightarrow CNO^- + MnO_2$ (basic)
- [c] $Cr(OH)_4^- + OCl^- \rightarrow CrO_4^{2-} + Cl^-$ (basic)
- [d] $Br_2 + SO_2 \rightarrow Br^- + SO_4^{2-}$ (acidic)
- [e] $CuS + NO_3^- \rightarrow Cu^{2+} + NO + S_8$ (acidic)

[12] How many significant figures are there in each of the following measurements?

- [a] 130.0 kg
- [b] 0.0738 g
- [c] 0.224800 m
- [d] 1008 s
- [e] $4.380E^{-8}$ m
- [f] $9.100E^4$ cm

[13] Do the indicated arithmetic and give the answer to the correct number of sig. figs.

[a] $\frac{8.71 \times 0.0301}{0.056} =$

[b] $0.71 + 81.8 =$

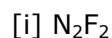
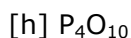
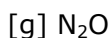
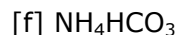
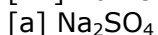
[c] $934 \times 0.00435 + 107 =$

[d] $(847.89 - 847.73) \times 14673 =$

[e] $\frac{0.871 \times 0.23}{5.871} =$

[f] $0.00015 \times 54.6 + 1.002 =$

[14] Name the following compounds:



[15] Write the formula of the following:

[a] Plumbous dichromate

[b] Barium bicarbonate

[c] Cesium oxide

[d] Ferrous Acetate

[e] Sodium Thiosulfate

[f] Cuprous oxide

[g] dichlorine pentoxide

[h] nitrogen tribromide

[i] phosphorus pentafluoride

[16] For each of the following, decide whether a physical or chemical change is involved.

[a] dissolving of sugar in water

[b] rusting of iron

[c] burning of wood

[d] evaporation of alcohol

[e] Melting of sodium chloride

[f] pulverizing of rock salt

[g] burning of sulfur

[17] The calorie, the Btu (British thermal unit), and the joule are units of energy; 1 calorie = 4.184 joules (exact) and 1 Btu = 252.0 calories. Convert 2.45 Btu to joules.

[18] The estimated amount of recoverable oil from the field at Prudhoe Bay in Alaska is 9.6E^9 barrels. What is the amount of oil in cubic meters? One barrel = 42 gal (exact) = 4 qt (exact) = $9.46\text{E}^{-4} \text{ m}^3$.

[20] A submicroscopic particle suspended in a solution has a volume of $1.4\mu\text{m}^3$. What is this volume in liters?

[21] An element has two naturally occurring isotopes with the following masses and abundances:

Isotopic Mass (amu)	Fractional Abundance
84.9118	0.7215
86.9092	0.2785

What is the atomic weight of this element? What is the identity of the element?

[22] Draw a diagram of an oxygen atom. Include correct number of p^+ , n^0 , e^- .