

# Unit 7, Stoichiometry

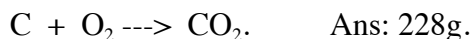
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*Note: You must have a balanced equation before solving the problems! And you MUST show the Hup, Two, Three, Four for all calculations!*

1. How many grams of  $H_2$  can be produced from the reaction of 11.5 grams of sodium with an excess of water? Hint:  $2Na + 2H_2O \rightarrow 2NaOH + H_2$ . Ans: 0.505g .

2. Nitrogen reacts with 2.00 grams of hydrogen. How many grams of ammonia are produced? Hint: Ammonia is  $NH_3$ . Nitrogen is diatomic (honorific). Ans: 11.2g.

3. How many grams of oxygen are required to oxidize 85.6 grams of carbon? Hint: Oxygen is diatomic,



4. The action of carbon monoxide on iron(III) oxide (ferric oxide) can be represented by the equation,  $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ . What would be the amount of carbon monoxide used if 18.7 grams of iron were produced? Ans: 14.1g.

5. How many grams of hydrochloric acid (HCl) are required to react with 75.1 grams of calcium hydroxide? Remember the rules for parentheses for calcium hydroxide. Ans: 74.6g.

6. How many grams of hydrogen gas are produced when 5.62 grams of aluminum react with hydrochloric acid? Hint: hydrochloric acid is hydrogen chloride, hydrogen gas is diatomic. Ans: 0.631g.

7. How much heat is required to raise the temperature of 91.4 g of  $PCl_3$  from  $25.0^\circ C$  to  $76.1^\circ C$ ? From Table A-5,  $c = 0.874 \text{ J/g}\cdot^\circ C$ . Ans. = 4080 J.

8. How much heat is required to raise the temperature of 4.66 g  $CCl_4$  from  $20.9^\circ C$  to  $76.8^\circ C$ ? From Table A-5,  $c = 0.856 \text{ J/g}\cdot^\circ C$ . Ans. = 223 J

9. How much heat is required to raise the temperature of 787 g of  $H_2O$  from  $18.0^\circ C$  to  $100.0^\circ C$ ? From Table A-5,  $c = 4.18 \text{ J/g}\cdot^\circ C$ . Ans. = 270,000 J.

10. Compute the change in enthalpy for the formation of 193 grams of ammonium bromide from ammonia and hydrogen bromide. Hint: Remember the difference between ammonia and ammonium (never forget!), and find  $\Delta H$  then multiply by the moles of ammonium bromide. From Table A-6,  $\Delta H$  in kJ/mol:  $NH_3 = -46.2$ ,  $NH_4Br = -270$ ,  $HBr = -36.2$ .

Ans:  $\Delta H = -188 \text{ kJ/mol}$ , -370 kJ.

11. Compute the change in enthalpy for the displacement of 0.0663 grams of bromine from the reaction of

$Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$ . From Table A-6,  $\Delta H$  in kJ/mol:  $Br_2 = 0.0$ ,  $NaBr = -360$ ,  $Cl_2 = 0.0$ ,  $NaCl = -411$ . Ans:  $\Delta H = -102 \text{ kJ/mol}$ , -0.0423 kJ.

12. What is the difference between endothermic reactions and exothermic reactions?