

Unit VI. States of Matter. Assignment 11: Unit Review Worksheet

Show all your work on these problems. If a question involves stoichiometry, be sure to balance the equation

1. Calculate the heat needed to heat 100 g of water from 26 °C to 100 °C. Then calculate the amount of heat needed to vaporize it.
2. Calculate the amount of water that is needed to cool a 485 g block of aluminum from 277 °C to 25 °C, if the water was originally at 20 °C. (Specific heat of aluminum is 0.22 cal/gC°).
3. A gas in a 600.0 mL cylinder is under a pressure of 650 mm Hg at 298 K. What will be the temperature of the gas if the pressure is increased to 3230 mm Hg?
4. A syringe contains an enclosed gas that has a volume of 10.0 cm<sup>3</sup> at a pressure of 14.7 psi. What pressure is needed to compress the gas to 2.00 cm<sup>3</sup>?
5. For an ideal gas, calculate the following quantities:
  - a. the pressure of the gas if 1.34 moles occupies 3.28 L at 25.0 °C
  - b. the volume occupied by 6.72 x 10<sup>-3</sup> mol at 145 °C and a pressure of 59.0 torr
  - c. the number of moles in 2.50 L at 37.0 °C and 725 mm Hg
  - d. the temperature which 0.270 mol occupies 15.0 L at 1.88 atm
6. A mixture of gases contains 3.50 g of N<sub>2</sub>, 2.15 g of H<sub>2</sub> and 5.27 g of NH<sub>3</sub>. If the total pressure of the mixture is 2.50 atm, what is the partial pressure of each component? (Hint: percent composition is not by mass but by mole)
7. A quantity of N<sub>2</sub> gas originally held at 3.80 atm pressure in a 1.00 L container at 26.0 °C is transferred into a 10.0 L container at 20.0 °C. A quantity of O<sub>2</sub> gas originally at 4.75 atm and 26.0 °C in a 5.00 L container is transferred into the same new container. What is the total pressure in the new container?
8. Magnesium metal reacts with oxygen gas (O<sub>2</sub>) to produce magnesium oxide. How many liters of oxygen gas will be produced at 35.0 °C and a pressure of 1.00 atm from 28.4 g of magnesium?

9. Calcium hydride ( $\text{CaH}_2$ ) reacts with water to form hydrogen gas and calcium hydroxide [ $\text{Ca}(\text{OH})_2$ ]. How many grams of  $\text{CaH}_2$  are needed to generate 10.0L of  $\text{H}_2$  gas if the pressure is 740 torr at 23.0 °C?
10. The metabolic breakdown of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ , in our bodies produces carbon dioxide, which is expelled from our lungs when we breath:
- $$\text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2 \rightarrow 6 \text{H}_2\text{O} + 6 \text{CO}_2$$
- Calculate the volume of dry  $\text{CO}_2$  produced at body temperatures (37 °C) and 1.00 atm when 5.00 g of glucose is consumed in this reaction.
11. Calculate the density ( $D = \text{mass/volume}$ ) of chlorine gas at STP. (Hint: assume you have 1 mole of  $\text{Cl}_2$ )
12. A chemist isolated a gas in a glass bulb with a volume of 255 mL at a temperature of 25.0 °C and a pressure of 10.0 torr. The gas weighed 12.1 mg. What is the molar mass of the gas
13. What will be the effusion rate ( $v_1/v_2$ ) of helium versus sulfur dioxide ( $\text{SO}_2$ )? (Hint: use Grahams Law)
14. Ammonia effuses at a rate that is 2.93 times faster than an unknown gas. What is the molecular mass of the unknown gas?
15. A sample of an unknown gas with a mass of 3.620 g was made to decompose into 2.172 g of  $\text{O}_2$  and 1.448 g of Sulfur. Prior to the decomposition, this sample occupied a volume of 1120 mL at 750 torr and 25.0 °C.
- What is the percentage composition of the elements in this gas?
  - What is the empirical formula of the gas?
  - What is its molecular formula?