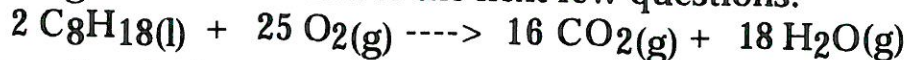


Ideal Gas Law and Stoichiometry Name Answer Key

Use the following reaction to answer the next few questions:



The above reaction is the reaction between gasoline (octane) and oxygen that occurs inside automobile engines.

- 1) If 4.00 moles of gasoline are burned, what volume of oxygen is needed if the pressure is 0.953 atm, and the temperature is 35.0°C?

$$(i) 4.00 \text{ mol gasol} \times \frac{25 \text{ mol O}_2}{2 \text{ mol gasol}} = 50 \text{ mol O}_2$$

sig figs 1330 L
O₂

$$(ii) \frac{PV}{P} = \frac{nRT}{P} = \frac{(50 \text{ mol O}_2)(8.314 \text{ kPa L/mol K})(35.0^\circ\text{C} + 273)}{(0.953 \text{ atm} \times \frac{101.3 \text{ kPa}}{1 \text{ atm}})} = 1326 \text{ L O}_2$$

- 2) How many grams of water would be produced if 20.0 liters of oxygen were burned at a temperature of -10.0°C and a pressure of 1.3 atm?

$$(i) \frac{PV}{RT} = \frac{nRT}{RT} = \frac{(1.3 \text{ atm} \times \frac{101.3 \text{ kPa}}{1 \text{ atm}})(20.0 \text{ L})}{(8.314 \text{ kPa L/mol K})(-10.0^\circ\text{C} + 273)} = 1.2 \text{ mol O}_2$$

$$(ii) 1.2 \text{ mol O}_2 \times \frac{18 \text{ g H}_2\text{O}}{0.5 \text{ mol O}_2} = 16 \text{ g H}_2\text{O}$$

- 3) If you burned one gallon of gas (C₈H₁₈) (approximately 4000 grams), how many liters of carbon dioxide would be produced at a temperature of 21.0°C and a pressure of 1.00 atm?

$$4000 \text{ g C}_8\text{H}_{18} \times \frac{1 \text{ mol}}{114 \text{ g}} \times \frac{16 \text{ mol CO}_2}{2 \text{ mol C}_8\text{H}_{18}} = 281 \text{ mol CO}_2$$

$$\frac{PV}{P} = \frac{nRT}{P} = \frac{(281 \text{ mol})(8.314 \text{ kPa L/mol K})(21.0^\circ\text{C} + 273)}{(101.3 \text{ kPa})} = 6780 \text{ L}$$

← rounding
diff. bec of rounding

- 4) How many liters of oxygen would be needed to produce 45.0 liters of carbon dioxide if the temperature and pressure for both are 0.00°C and 5.02 atm?

$$45.0 \text{ L CO}_2 \times \frac{25 \text{ L O}_2}{16 \text{ L CO}_2} = 70.3 \text{ L O}_2$$

Answers: 1) 1330 L 2) 16 g 3) 6760 L 4) 70.3 L