

# Answer Key Gas Laws Problems: Independent

1. **(D)**

$P, V$  inversely proportional  
 $T, V$  directly proportional

2. **(D)**

gases don't have high densities

3.  $PV = nRT$

$\uparrow$   
 $g/M_r$

$d = m/V$

$PV = \frac{m}{M_r} RT$

$M_r PV = mRT$

$\frac{M_r P}{RT} = \frac{m}{V}$

**(C)**

4. **(B)**

implies large space between gas molecules, allowing compression

5. avg. kinetic energy = temp.

identity of gas irrelevant

highest temp = highest av. kinetic energy

**(C)**

6.  $\frac{P_1}{T_1} = \frac{P_2}{T_2}$       $P_2 = 4P_1$   
 $T_2 = 2T_1$

$\frac{P_1}{T_1} = \frac{4P_1}{2T_1}$

$4P_1 T_1 = 2P_1 T_1$

so pressure is doubled

$P_1 V_1 = P_2 V_2$

double pressure = 1/2 volume

1.0 dm<sup>3</sup> **(A)**

7. If  $P \uparrow, V \downarrow$   
 so particles will be closer together

**(D)**

8.  $\downarrow T$  at a constant volume  $\downarrow P$

**(B)**

9. pressure = force per unit area  
 at the same temp, all gas particles have same average kinetic energy, speed will be constant; but only due to collision frequency

10.  $\frac{V_1}{T_1} = \frac{V_2}{T_2}$       $V_1 = 1 \text{ dm}^3$   
 $T_1 = -73^\circ\text{C} + 273$

$\frac{1 \text{ dm}^3}{200} = \frac{1.5 \text{ dm}^3}{T_2}$       $V_2 = 1.5 \text{ dm}^3$

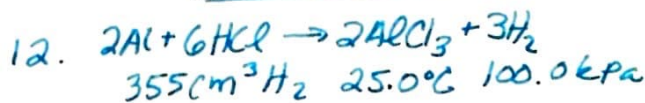
$T_2 = 300 \text{ K}$

11.  $V_1 = 2.00 \text{ dm}^3$       $P_1 = 1000 \text{ kPa}$   
 $V_2 = ?$       $P_2 = 300 \text{ kPa}$

$P_1 V_1 = P_2 V_2$

$1000 \cdot (2.00) = 300 V_2$

$V_2 = 6.67 \text{ dm}^3$



a)  $PV = nRT$

$(0.355 \text{ dm}^3)(100.0 \text{ kPa}) = n(8.31)(298 \text{ K})$

$n = 0.0143 \text{ moles H}_2$

13. mass of evacuated flask: 183.257g  
 mass of flask & gas: 187.942g  
 mass of flask filled w/ water: 987.560g  
 ↳ used to find volume of the flask

$$\begin{array}{r} \text{mass of gas: } 187.942\text{g} \\ - 183.257 \\ \hline 4.685\text{g} \end{array}$$

$$\begin{array}{r} \text{mass of water: } 987.560\text{g} \\ - 183.257 \\ \hline 804.303\text{g} \end{array} \approx 804.303\text{cm}^3 \text{ since density of water is } 1\text{g/cm}^3$$

$$PV = nRT$$

$$P = 97.7\text{kPa} \quad V = 804.303\text{cm}^3 \times \frac{10^{-3}\text{dm}^3}{10^3\text{cm}^3} = 0.804303\text{dm}^3$$

$$T = 23^\circ\text{C} + 273 = 296\text{K}$$

$$97.7\text{kPa}(0.804303\text{dm}^3) = n(8.31\text{kPa dm}^3\text{mol}^{-1}\text{K}^{-1})(296\text{K})$$

$$n = 0.031946\text{mol}$$

$$m = 4.685\text{g}$$

$$\frac{4.685\text{g}}{0.031946} = \boxed{146.654\text{g mol}^{-1}}$$

14. 53.8% N, 46.2% C       $T = 273\text{K}$        $P = 1.01 \times 10^5\text{Pa}$   
 $m = 1.048\text{g}$        $V = 462\text{cm}^3$

$$\frac{0.538(1.048)}{0.5638\text{g N}} =$$

$$\frac{0.5638\text{g N} \times \frac{\text{mol}}{14.0\text{g}}}{0.04024} = 1$$

$$\frac{0.462(1.048)}{0.4842\text{g C}} =$$

$$\frac{0.4842\text{g C} \times \frac{\text{mol}}{12.0\text{g}}}{0.04024} = 1$$

$$\text{empirical formula} = \text{CN} \quad M_r = 26.02$$

$$PV = nRT$$

$$1.01 \times 10^5\text{Pa}(4.62 \times 10^{-4}\text{m}^3) = n(8.31)(273\text{K})$$

$$n = 0.020568\text{mol}$$

$$M_r = \frac{1.048}{0.020568} = 50.95\text{g mol}^{-1}$$

$$\frac{50.95}{26.02} \approx 2 \quad \uparrow$$

$$\text{molecular formula: } \text{C}_2\text{N}_2$$

CO

