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. $PV = nRT$
   (n ↑ 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 ave. 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
   $P_1V_1 = P_2V_2$
   double pressure = 1/2 volume
   1.0 dm^3 (A.)

7. If P ↑, V ↓
   so particles will be closer together
   (D.)

8. ↓T at a constant volume ↓P
   (B.)

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

10. $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $V_1 = 1 dm^3$ $T_1 = -73°C + 273$ $V_2 = 1.5 dm^3$
    $\frac{1 dm^3}{200} = \frac{1.5 dm^3}{T_2}$
    $T_2 = 300K$

11. $V_1 = 2.00 dm^3$ $P_1 = 1000 kPa$
    $V_2 = ?$ $P_2 = 300 kPa$
    $P_1V_1 = P_2V_2$
    $1000.(2.00) = 300 V_2$
    $V_2 = 6.67 dm^3$

12. $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$
    $355 cm^3 H_2$ 25.0°C   100.0 kPa
    a) $PV = nRT$
    $(0.355 dm^3)(100.0 kPa) = n(8.31)(298K)$
    $n = 0.0143$ 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

mass of gas: 187.942g − 183.257 = 4.685g

mass of water: 987.560g − 183.257 = 804.303g ≈ 804.303 cm^3 since density of water is 1g/cm^3

PV = nRT

$P = 97.7 kPa$ $V = 804.303 cm^3 \times \frac{1^3 dm^3}{10^3 cm^3} = 0.804303 dm^3$

$T = 23°C + 273 = 296 K$

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

$n = 0.031946 mol$

$m = 4.685g$

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

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

$0.538(1.048) = 0.5638g N$ $0.5638g N \times \frac{mol}{14.0g} = 0.04024 mol$ $\frac{0.04024 mol}{0.04024} = 1$

$0.462(1.048) = 0.4842g C$ $0.4842g C \times \frac{mol}{12.01g} = 0.04032 mol$ $\frac{0.04032 mol}{0.04024} = 1$

empirical formula = CN $M_r = 26.02$

PV = nRT

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

$n = 0.020568 mol$

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

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

molecular formula: C_2N_2

$:N \equiv C - C \equiv N:$