Gas Laws Magic Square-Mixed Review

You must show your work in the square. **Name……**

A. If 3.0 L of a gas at 20.0 °C is heated to 30.0 °C what is the new volume of the gas?

$V_1 = 3.0\,L$
$T_1 = 20^\circ C \; 293\,K$
$T_2 = 30^\circ C \; 303\,K$

$\frac{303K \cdot 3L}{293K} = 3.1\,L$

B. A balloon full of air has a volume of 2.75 L at a temperature of 18°C and pressure 0.852 atm. How many moles are in the balloon?

$V_1 = 2.75\,L$
$T_1 = 291\,K$
$P_1 = 0.852$
$R = 0.0821$

$PV = nRT$
$n = \frac{PV}{RT} = \frac{0.852\,atm \cdot 2.75\,L}{291K \cdot 0.0821}$

$n = 0.098\,mol$

C. To what pressure would you have to compress 48.0 L of oxygen gas at 99.3 kPa in order to reduce its volume to 16.0 L?

$P_1V_1 = P_2V_2$
$99.3kPa \cdot 48L = 16L\,P_2$
$P_1 = 99.3kPa$
$V_1 = 48.0L$
$V_2 = 16.0L$
$P_2 = ?$

$P_2 = 297.9kPa$

D. A 24g sample of argon is in a 0.75 mL tube at 24°C. What is the pressure inside the tube?

$\frac{24g}{39.98g} \left|\frac{1\,mol}{}\right. = 0.6\,mol$

$n = 0.6\,mol$
$V = 0.00075L$
$T = 297\,K$
$R = 0.0821$

$PV = nRT$
$P = \frac{nRT}{V}$
$P = \frac{0.6mol \cdot 0.0821 \cdot 297\,K}{0.00075L}$

$P = 19,507\,atm$

E. A 148g sample of neon gas occupies a volume of 2.8 L at 1.8 atm. What would its volume be at 1.2 atm if 1.15 moles are removed?

$n_1 = \frac{148g}{20.179g} \left|\frac{1\,mol}{}\right. = 7.12\,mol$

$V_1 = 2.8L$
$P_1 = 1.8\,atm$

$\frac{PV}{n} = R \cdot T = \frac{PV}{n}$

$n_2 = 5.97\,mol$
$V_1 = ?$
$P_2 = 1.2\,atm$

$\frac{1.8atm \cdot 2.8L}{7.12\,mol} = \frac{1.2atm\,V_2}{5.97mol}$

$V_2 = 3.5L$

F. If 4 moles of gas at a pressure of 5.4 atm has a volume of 120 liters, what is the temperature?

$n = 4\,mol$
$P = 5.4\,atm$
$V = 120L$
$T = ?$
$R = 0.0821$

$\frac{PV}{nR} = T$

$T = 1973K$

G. What is the temperature of a 24.7L gas sample at 1.011 atm, if at 18°C it takes up 5.7L and exerts a pressure of 0.999 atm?

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$V_1 = 5.7L$
$T_1 = 18C \rightarrow 291K$
$P_1 = 0.999atm$

$T_2 = \frac{P_2V_2T_1}{P_1V_1}$

$V_2 = 24.7L$
$P_2 = 1.011\,atm$

$T_2 = 1276K$

H. What is the starting temperature (in Celsius) of 150mL of gas when cooled to 33°C and a volume of 120mL

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $T_1 = \frac{T_1V_2}{V_1}$

$V_2 = 150mL$
$\frac{120mL}{306K} = \frac{150mL}{T_2}$

$V_1 = 120mL$
$T_1 = 306\,K$

$T_2 = 382.5K \rightarrow 109.5C$

$T_2 = ?$

I. My car has an interval volume of 2600 L. If the sun heats my car up from 20°C to 55°C, what will the pressure inside my car be? (Assume the initial pressure was 0.852 atm)

$V_1 = 2600L$
$T_1 = 293K$
$T_2 = 328K$
$P_1 = 0.852\,atm$

$\frac{PV}{T} = \frac{PV}{T}$

$\frac{0.852atm \cdot 2600L}{293\,K} = \frac{P_2\,2600}{328K}$

$P_2 = 0.954\,atm$

ANSWERS (don't forget your units)

1. 0.098 B
2. 19,507 D
3. 1.5
4. 1276 G
5. 109.5 H
6. 298 C
7. 19.5
8. 3.5 E
9. 1973 F
10. 0.6022
11. 3.1 L A
12. 0.954 I

$\frac{1.011 \cdot 24.7 \cdot 291K}{0.999 \cdot 5.7L}$