Name: Key Date: Period:

Gas Laws Worksheet:

1 atm = 760.0 mm Hg = 101.3 kPa= 760 .0 torr

* °C → K = °C + 273

R = .0821 (atm)

R = 8.314 (kPa)

mL → L = ÷ 1000

Boyle's 1. If 22.5 L of nitrogen at 748 mm Hg are compressed to 725 mm Hg. What is the new volume?

$P_1V_1 = P_2V_2$ $\frac{(748\ mm\ Hg)(22.5\ L)}{725\ mm\ Hg} = \frac{(725\ mm\ Hg)(V_2)}{725\ mm\ Hg}$ $V_2 = 23.2\ L$

Boyle's 2. What pressure is required to compress 196.0 L of air at 1.00 atm into a cylinder whose volume is 26.0 liters?

$P_1V_1 = P_2V_2$ $\frac{(1.00\ atm)(196.0\ L)}{26.0\ L} = \frac{P_2(26.0\ L)}{26.0\ L}$ $P_2 = 7.54\ atm$

Boyle's 3. A gas with a volume of 4.0L at a pressure of 205kPa is allowed to expand to a volume of 12.0L. What is the pressure in the container if the temperature remains constant?

$P_1V_1 = P_2V_2$ $\frac{(205\ kPa)(4.0\ L)}{12.0\ K} = \frac{P_2(12.0\ L)}{12.0\ L}$ $P_2 = 68\ kPa$

Charles's 4. Calculate the decrease in temperature when 6.00 L at 20.0 °C is compressed to 4.00 L.

$V_1T_2 = V_2T_1$ $\frac{(6.00\ L)(T_2)}{6.00\ L} = \frac{(4.00\ K)(293\ K)}{6.00\ K}$ $T_2 = 195\ K$

Combined 5. If 10.0 liters of oxygen at STP are heated to 512 °C, what will be the new volume of gas if the pressure is also increased to 1520.0 mm of mercury? → STP

$P_1V_1T_2 = P_2V_2T_1$ $\frac{(1\ atm)(10.0\ L)(785\ K)}{(760\ mm\ Hg)(273\ K)} = \frac{(1520.0\ mm\ Hg)(V_2)(273\ K)}{(1520.0\ mm\ Hg)(273\ K)}$ (STP → STP) $V_2 = 14.4\ L$

Charles's 6. If 15.0 liters of neon at 25.0 °C is allowed to expand to 45.0 liters, what must the new temperature be to maintain constant pressure?

$V_1T_2 = V_2T_1$ $\frac{(15.0\ L)(T_2)}{15.0\ L} = \frac{(45.0\ L)(298\ K)}{15.0\ L}$ $T_2 = 894\ K$

Combined 7. A gas balloon has a volume of 106.0 liters when the temperature is 45.0 °C and the pressure is 740.0 mm of mercury. What will its volume be at 20.0 °C and 780 .0 mm of mercury pressure?

$P_1V_1T_2 = P_2V_2T_1$ $\frac{(740.0\ mm\ Hg)(106.0\ L)(293\ K)}{(780\ mm\ Hg)(318\ K)} = \frac{(780.0\ mm\ Hg)(V_2)(318\ K)}{(780.0\ mm\ Hg)(318\ K)}$ $V_2 = 92.7\ L$

Ideal 8. How many moles of gas would you have if the pressure in the vessel was 450 torr at 45°C and you had a volume of 980 mL? = .980 L

$\frac{450}{760} = .592\ atm$

$PV = nRT$ $\frac{(.592\ atm)(.980\ L)}{(.0821\ \frac{L \cdot atm}{mol \cdot K})(318\ K)} = \frac{n(.0821\ \frac{L \cdot atm}{mol \cdot K})(318\ K)}{(.0821\ \frac{L \cdot atm}{mol \cdot K})(318\ K)}$ $n = .022\ mol$

Ideal w/sub. 9. What would the density of a gas be if its molar mass was 159.8 g/mol and it was at a pressure of 99.6 kPa and 0°C?

$PV = nRT$ $n = \frac{m}{mm}$ $PV = \frac{mRT}{mm}$ $\frac{mmP}{RT} = \frac{m}{V}$ $\frac{(159.8\ g/mol)(99.6\ kPa)}{(8.314\ \frac{L \cdot kPa}{mol \cdot Kelvin})(273\ K)}$ $d = 7.01\ g/L$

Combined 10. What would the initial temperature be if the pressure increased from 1.3 to 2.1 atm, the final temperature was 56°C, and the volume decreased from 4.5 L to 2.5L?

$P_1V_1T_2 = P_2V_2T_1$ $\frac{(1.3\ atm)(4.5\ L)(329\ K)}{(2.1\ atm)(2.5\ L)} = \frac{(2.1\ atm)(2.5\ L)T_1}{(2.1\ atm)(2.5\ L)}$ $T_1 = 367\ K$