NAME: ANSWERS DATE DUE: ____________

TEACHER: ____________________

Year 11 Term 4 – Gases HOMEWORK SHEET No. 2

Success Criteria 10,11, and 13

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1. In three concise sentences describe the contribution of Jacques Charles to the scientific study of gas behaviour.

Jacques Charles investigated the relationship between volume of a gas and temperature. His experimental results were used to develop the law (V/T = const) that the vol and temp of a gas are in direct proportion to each other (assuming amount of gas + Pressure are constant).

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2. Describe Charles's law using only words.

Charles's Law states that, at a constant amount (½) of gas, held at constant (½) pressure, the volume of the gas is directly proportional to its absolute temperature (1)

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3. Convert the following temperatures to K.

a) 321 ^{0}C 594 K (½)

b) -0.034 ^{0}C 272.966 K. (½)

/1

4. A volume of 8.98 dm3 of hydrogen gas is collected at 38.8 °C. Find the volume the gas will occupy at -39.9 °C if the pressure remains constant. P, n = constant.

$V_1 = 8.98L$

$T_1 = 38.8°C = 311.8 K.$

$T_2 = -39.9°C = 233.1K.$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ (1)

$\frac{8.9L \times 233.1K}{311.8K} = V_2 = 6.65 L$ (1) ✓ dm^3

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5. Convert the following values to the units indicated in the brackets.

a) 1.023 atmospheres (to kPa) 103.6 kPa.

b) 450 K (to ^{0}C) 177°C.

c) 0.92 atm (to Pa) 93,200 Pa.

d) 0.143 m^3 (to L) 143 L

e) 32 400 000 mL (to L) 32400 L

f) 0.025 L (to mL) ~~25000L~~ 25mL

(½ each)

/3

6. a) If you over-inflate a pool float on a hot day, it can swell in the sun and burst. Use your knowledge of Charles law to argue why this is possible.

The amount of gas in the pool float is constant and assuming the atmospheric pressure does not change... Charles's Law does apply. As Volume and temp are in direct proportion, the volume of the pool float inc with temp, perhaps until it bursts ✓ $\frac{V\uparrow}{T\uparrow} = \text{const}$ (1) (½) (½)

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7. A balloon has a volume of 2500.0 mL on a day when the temperature is 30.0 °C. If the temperature at night falls to 10.0 °C, what will be the volume of the balloon if the pressure remains constant?

$n, P = \text{constant}$ $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ (1)

$V_1 = 2.5\,L$

$T_1 = 30°C = 303K$

$T_2 = 10°C = 283K$

$\frac{V_1 \times T_2}{T_1} = V_2 = \frac{2.5\,L \times 283\,K}{303\,K}$

$= 2.33\,L$ ✓ (1)

/2

8. Write the formula which describes the combined gas law relationship. What condition must be kept constant for this relationship to be valid?

$\frac{P_1 V_1}{T_1} = \text{const}$ or $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ ← either → (1)

(really the same equation)

CONDITION: amount of gas (number of moles) must be kept constant (1) ✓

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9. Find the volume of a gas at STP when 2.00 litres is collected at 745.0 mm Hg and 25.0 °C.

$n = \text{constant}$

$V_1 = 2L$

$P_1 = 745\,mmHg = 99.3\,kPa$

$T_1 = 25°C = 298K$

$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ (1)

$P_2 = 101.3\,kPa$ (1)

$T_2 = 273K$ ✓

$\frac{P_1 V_1 T_2}{T_1 P_2} = V_2$

$\frac{99.3\,kPa \times 2L \times 273K}{298K \times 101.3\,kPa} = V_2 = 1.8L$ (1) ✓

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10. A volume of 1.23 L of a gas occupies a container that has a temperature of 28°C and a pressure of 788 mmHg. What is the temperature if the volume is reduced to 50 mL at 95 kPa.

$n = \text{constant}$

$V_1 = 1.23L$

$P_1 = 788\,mmHg = 105.1\,kPa$

$T_1 = 28°C = 301K$

$V_2 = 50\,mL = 0.05L$

$P_2 = 95\,kPa$

$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ ✓ (1) ⇒ $T_2 = \frac{P_2 V_2 T_1}{P_1 V_1}$

$T_2 = \frac{95\,kPa \times 0.05\,L \times 301K}{105.1\,kPa \times 1.23\,L}$

$= 11.1K$ (2) ✓

very low – check using "common sense rule"

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