NAME: ____________________________ DATE DUE: ____________

TEACHER: __________________________

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Year 11 Term 4 – Gases HOMEWORK SHEET No. 5

Success Criteria – 18 – 21 – Dalton's Law and Graham's Law

1. Convert the following temperatures to ^{0}C.

a) 12 345 K   12072 °C

b) 65 K   −208 °C

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

a) 890 mmHg (to kPa)   118.7 kPa

b) -16 ^{0}C (to K)   257 K

c) 1.133 atm (to kpa)   114.7 kPa

d) 0.04 cm^3 (to L) 4×10^{-5} L 0.00004 L

e) 1.23245 m^3 (to L)   1232.45 L

f) 0.004 L (to mL)   4 mL

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3. A container holds a mixture of two different gases. The oxygen in a container exerts 80 mmHg of pressure on the inside of the container. The total pressure inside the container is 120 mmHg. What is the pressure of the other gas in the container?

(a) 200 mmHg (b) 80 mmHg (c) 0.67 mmHg (d) 40 mmHg (e) 1.5 mmHg

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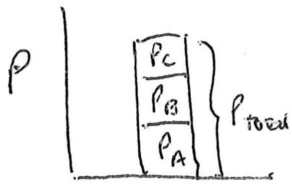
4. All of the gas laws studied so far have been able to be described by a line on a graph. Is it possible to describe Dalton's Law on a graph? Explain your answer. (clue: the answer is yes, but it's a bit different to the others)



Daltons Law $P_T = P_A + P_B + P_C \ldots$ involves several variable ~~that~~ (P_A, P_B etc) which are not related except by their cumulative total. Thus they do not form a trend line. Cumulative totals (+'s) are shown as bar graphs

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5. A sealed vessel contains 0.5 moles of oxygen, 0.1 moles of carbon dioxide, and 0.4 moles of nitrogen gas. The total pressure of the gas mixture is 5 atmospheres. What is the partial pressure of the carbon dioxide?

(a) 50.65 kPa (b) 2.5 atmospheres (a) 0.1 atmospheres (a) 40.5 kPa

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6. Two flasks are connected with a closed tap. The first flask has a volume of 5 liters and contains nitrogen gas at a pressure of 0.75 atm. The second flask has a volume of 8 L and contains oxygen gas at a pressure of 1.25 atm. When the tap between the flasks is opened and the gases are free to mix, what will the pressure be in the resulting mixture?

$P_T = P_{N_2} + P_{O_2}$ – but need to calculate the P_{N_2} and P_{O_2} at new volume of 13 L. Use Boyle's law as n, T are constant (assumed) (½)

For N_2: $P_1 = 0.75$ atm $= 76$ kPa, $V_1 = 5$ L, $V_2 = 13$ L

$P_1V_1 = P_{N_2}V_2$

$\frac{P_1V_1}{V_2} = P_{N_2}$

$\frac{76\text{kPa} \times 5\text{L}}{13\text{L}} = P_{N_2}$

$29.2 = P_{N_2}$

FOR O_2: $P_1V_1 = P_{O_2}V_2$

$127\text{kPa} \times 8\text{L} = P_{O_2} \times 13\text{L}$

$78\text{kPa} = P_{O_2}$ (1)

(1) $P_T = P_{N_2} + P_{O_2} = 29.2 + 78\text{kPa} = 107.2\text{kPa}$ (could answer in atm = okay)

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7. In 2 sentences each, describe the contribution of John Dalton and Thomas Graham to the study of gases. List the equation for each law after your description

Daltons study of air (meteorology) led him to recognise air as a mixture of gases - which acted individually but identically in response to temp and Pressure, His law states that the total pressure of a system is equal to the sum of all the (partial) gases in the system.

Graham studied the effusion of gas through small holes and found the rate of effusion was proportional to the inverse of ~~its~~ the square root of its Molar Mass. ~~The~~ This principle is equally applicable to the diffusion of gases.

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8. Methane (CH4) diffuses at a rate of 1.53 m/s. What will be the diffuion rate of argon (Ar) under the same conditions?

(½) $\frac{R_{CH_4}}{R_{Ar}} = \frac{\sqrt{MM_{Ar}}}{\sqrt{MM_{CH_4}}} \Rightarrow \frac{\sqrt{MM_{CH_4}} \times R_{CH_4}}{\sqrt{MM_{Ar}}} = R_{Ar}$ (1½)

(1) $\underline{0.97\,m/s} = \frac{4 \times 1.53}{6.32} = \frac{\sqrt{16} \times 1.53}{\sqrt{40}} = R_{Ar}$

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9. Calculate the molar mass of a gas that diffuses three times faster than oxygen under similar conditions.

u is unknown gas

$\frac{R_u}{R_{O_2}} = \frac{\sqrt{MM_{O_2}}}{\sqrt{MM_u}}$ (½) $\Rightarrow \frac{3}{1} = \frac{\sqrt{32}}{\sqrt{MM_u}}$ (½) $\Rightarrow \sqrt{MM_u} = \frac{\sqrt{32}}{3}$

(1) $\underline{1.37g} = MM_u = \sqrt{\frac{\sqrt{32}}{3}}$

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10. A sample of a gaseous poison with a molar mass of 123 amu is released 3.5 metres to your left. Simultaneously, the gaseous antidote with a molar mass of 86 amu is released 2.8 metres to your right. If you breathe in the poison first you will die; but if you breathe in the antidote first you will survive. Will you survive the releasing of both gases simultaneously? Show all working and justification.

distance travelled by the antidote is 1.2 times further than the distance travelled by the poison. The poison and antidote will reach the same point simultaneously (meet) at a point 64 cm to the left of the observer. For the antidote to reach this point it will have already reached the observer.

Poison travells - 2.86 m.
Antidote travels - 3.44 m. } 6.3 m apart.

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