NAME: ANSWERS DATE DUE: ____________

TEACHER: ____________________

Year 11 Term 4 – Gases HOMEWORK SHEET No. 4

Success Criteria – revision on work so far

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1. Of the Scientists who have contributed to the current understanding of gas behaviour, who, in your opinion, has mane the most important contribution to our understanding of gases. Provide reason(s) for your decision.

Answers will vary. Must have a reason.
Amedeo Avogadro – primarily because he showed that all gases followed fundamental gas laws. This simplified the understanding of gas behavior greatly.

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2. List all of the mathematical formulas you know so far. Beside each write the conditions under which that formula can be applied.

(½) $PV = const$, $P_1V_1 = P_2V_2$ (½) n, T constant

$\frac{V}{T} = const$, $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ (½) $P + n$ are const (½)

$\frac{PV}{T} = const$, $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ (½) n is constant (½)

$PV = nRT$, $\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$ (1)

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3. Write a question which could be solved by the correct application of Boyle's law.

Answers will vary. Must imply or state n, T are constant.
Give values for ~~$P_1 V_1 + P_2$ or~~ two pressures and one volume or vice versa.

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

a) 293 K 20°C (½)

b) 23 K −250°C (½)

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

a) 23 mmHg (to kPa) 3.1 kPa.

b) 42 ^{0}C (to K) 315 K.

c) 0.0013 atm (to kpa) 0.132 kPa.

d) 3.56 cm^3 (to L) 3.56×10^{-3} L (or 0.00356)

e) 0.092 m^3 (to L) 92 L

f) 0.069 L (to mL) 69 mL.

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6. A hot can which is plunged into cold water will often crumple due to the sudden reduction in pressure. A 2000 ml can was heated to 100^{0}C and then sealed. It was then plunged into a tank of water at a temperature of 0.5^{0}C. Assuming the can would crumple at an internal pressure of 0.27 atmospheres, will it crumple under the conditions described? (Justify your answer)

n is constant as can is sealed.

$P_1 = 101.3$ kPa

$V_1 = 2L$ $V_2 = 2L$

$T_1 = 373$ K $T_2 = 273.5$ K

$P_2 = ?$

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

$\frac{P_1 T_2}{T_1} = P_2 = \frac{101.3 kPa \times 273.5 K}{283 K} = 74.3 kPa$

will not crumple. 0.73atm > 0.27atm

0.73atm

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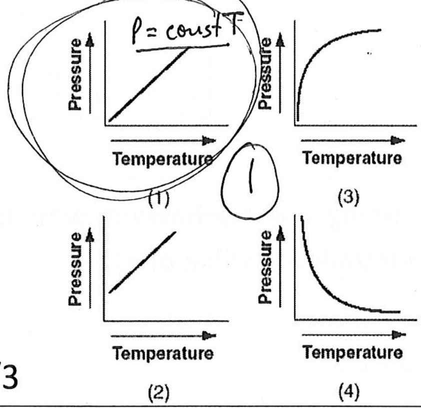
7. Which graph below correctly describes the relationship between Pressure and temperature for a sample of ideal gas at constant volume? Justify you choice.



$PV = nRT \Rightarrow \frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2}$

(1) Cancel out V_1 and V_2 as $V_1 = V_2$ (constant)
Cancel out n_1 and n_2 as $n_1 = n_2$ (same sample)

leaving $\frac{P_1}{T_1} = \frac{P_2}{V_2}$ or $P = \text{const} \times T$

$\frac{P}{T} = \text{constant}$

(1) This is the equ to a straight line $y = mx$

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8. What would be the change in volume for a perfectly elastic container if its temperature was increased by 25% - at a constant pressure? Justify your answer using your knowledge of the gas laws. Charles law applies here. (1 mark recognising this) as P is constant and its a contained constant sample (n = const)

$\frac{V_1}{T_1} = \frac{V_2}{T_2} \therefore \frac{V_1}{1} = \frac{V_2}{1.25} \therefore \frac{1.25 V_1}{1} = V_2 \therefore V_2$ is 1.25 times V_1 (1) or 25% larger

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9. An average pair of human lungs contains about 3.5 L of air before exhalation and about 3.0 L after exhalation. Assuming that air in your lungs is at 37°C and 1.0 atm, determine
(a) the number of moles of air exhaled from your lungs
(b) The mass of air exhaled, assuming air is 80% nitrogen gas (N_2) and 20% Oxygen gas (O_2).

(a) $V = 3.5L - 3.0L = 0.5L$
$T = 273 + 37°c = 310K$
$P = 101.3 kPa$

$PV = nRT$ (½)

$\frac{PV}{RT} = n = \frac{101.3 kPa \times 0.5L}{8.31 \times 310K} = 0.02$ moles (1)

(b) $n = 0.02$ moles
$MM = ?\ (80\% N_2, 20\% O_2)$
= weighted average of $N_2 + O_2$
= $0.8 \times 28 + 0.2 \times 32$
= 28.8g.

$m = n \times M.M$
$= 0.2 \times 28.8$
$= 5.76g$

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10. A gas is known to be one of the following nitrogen oxides: NO, NO_2, N_2O4, or N_2O. It has a density of 1.96 g/L at 273 K and 1.00 atm. Determine its identity. Show your calculations

$T = 273K$
$P = 101.3 kPa$
$V = 1L$
$m = 1.96g$

$PV = nRT$ $\quad n = \frac{PV}{RT} = \frac{101.3 kPa \times 1L}{8.31 \times 273K}$

$n =$ ~~0.045 moles~~ 0.045 moles (2)

$n = \frac{m}{MM} \therefore MM = \frac{m}{n} = \frac{1.96g}{0.045 \text{moles}}$

= ~~[illegible]~~ g/mole,
= 43.6g/mol

(2) closest match to this molar mass is N_2O at 44g. Most likely to be N_2O

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