NAME: ANSWERS
TEACHER: ______________________

DATE DUE: ____________

Year 11 Term 1 – Chemistry
HOMEWORK SHEET No. ~~4~~ 5 – GASES

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1. List the key points of the Kinetic Molecular Theory (KMT) of gases. NOTE: Your answer should be succinct and focus on the key point, not be repeated verbatim from notes.

- large spaces between particles; particle volume negligible
- negligible attractive (intermolecular) forces between particles
- particles colliding with container walls cause pressure
- particle movement (av. K.E) increases with temp.
- collisions involving particles are perfectly elastic

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2. Use your knowledge of the KMT to explain the following scenario. *"An inflated balloon, left in a locked car on a hot day, will expand and possibly explode."*

Scaffold – firstly identify the relevant key points of the KMT. Secondly use these points to explain how an increase in temp causes the volume of the balloon to increase.

Balloon inflates due to pressure from gas particles hitting the inside wall of the balloon. As the temp increases, the particles move faster (↑ av. K.E). This causes more collisions and more energetic collision with the inside wall of the balloon. Balloon will expand and possibly explode.

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3. Write two mathematical formulas which describes the idea gas law.

Most commonly expressed are.

$PV = nRT$ $\qquad \frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

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4. What is the value of, and what are the units for, the universal gas constant, R

Most common in Chemistry is 8.31 $J.K^{-1}.mol^{-1}$ $\left(\frac{J}{K.moles}\right)$ assuming Pressure is in kPa, and volume is in Litres

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

a) 1023 mmHg (to kPa) 136.4 kPa.
b) 450 ^{0}C (to K) 723 K
c) 0.05 atm (to kpa) 5.065 kPa.
d) 0.36 cm^3 (to L) 0.00036 L (3.6×10^{-4} L)
e) 32 m^3 (to L) 32000 L
f) 0.013 mL (to L) 0.000013 L (1.3×10^{-5} L)

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6. The Gas in a balloon occupies 3.3 L. What volume will it occupy if the pressure is changed from 100 kPa to 90 kPa at a constant temperature of 310 K.

V = 3.3 L
P_1 = 100 kPa
P_2 = 90 kPa
n = const T = const

$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$ → $P_1V_1 = P_2V_2$

100 kPa × 3.3 L = 90 kPa × V_2

3.67 L = V_2

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7. A 7.50 litre sealed jar at 18 °C contains 0.125 moles of oxygen and 0.125 moles of nitrogen gas. What is the pressure in the container?

$V = 7.5\,L$

$T = 18°C = 291\,K$

$n = 0.125(O_2) + 0.125(N_2) = 0.25$ total

$P = ?$

$PV = nRT$

$P = \frac{nRT}{V} = \frac{0.25 \text{ moles} \times 8.31 \times 291\,K}{7.5\,L}$

$= 80.61\,kPa$

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8. A 500 mL metal cylinder holding 0.5 grams of helium gas is known to rupture at a pressure of 10 atmospheres. At what temperature, in °C, will the container fail?

$V = 500\,mL = 0.5\,L$

$n = \frac{m}{MM} = \frac{0.5}{4} = 0.125$ moles

$P = 10\,atm = 1013\,kPa$

$T = ?$

$PV = nRT \therefore T = \frac{PV}{nR} = \frac{1013\,kPa \times 0.5\,L}{0.125 \text{ moles} \times 8.31}$

$= 487.6\,K$

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9. A 60.0 L tank of chlorine gas at 27 °C and 125 atm springs a leak. When the leak was discovered, the pressure was reduced to 50 atm although the temperature had not changed. How many moles of chlorine gas escaped? Several obvious ways of solving.

$V = 60\,L$

$T = 27°C = 300\,K$

$P = 125\,atm - 50\,atm = 75\,atm$ change $= 7597.5\,kPa$

$n = ?$

$PV = nRT \rightarrow n = \frac{PV}{RT}$

182.9 moles $= \frac{7597.5\,kPa \times 60\,L}{8.31 \times 300}$

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10. If you burned 100 grams of octane (petrol) (C_8H_{18}), how many litres of carbon dioxide would be produced at a temperature of 350.0°C and a pressure of 1.00 atm? (hint: equation is not balanced)

$$2\,C_8H_{18(l)} + 25\,O_{2(g)} \rightarrow 16\,CO_{2(g)} + 18\,H_2O_{(g)}$$

$T = 350°C = 623\,K$

$P = 1\,atm = 101.3\,kPa$

$n = ?$

$V = ?$

100g

$n = \frac{m}{MM} = \frac{100}{114} = 0.877$

$n(C_8H_{18}) \xrightarrow{2:16} n(CO_2)$

0.877 → 7.016 moles

L??

$V = \frac{nRT}{P}$

$V = \frac{nRT}{P} = \frac{7.016 \times 8.31 \times 623\,K}{101.3\,kPa}$

$= 358.6\,L$

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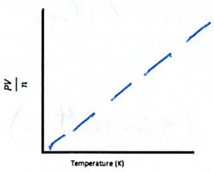
11. (a) On the following graph sketch the line you would expect an ideal gas to conform to.

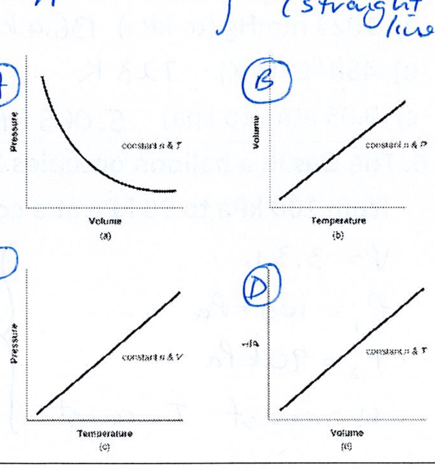


(b) Explain your reasoning

$PV = nRT$

rearrange to give $\frac{PV}{n} = RT$ } $y = mx$ (straight line)

c) identify which of the graphs on the right are consistent with the mathematical relationships in the ideal gas law.



all of them are

$P = nRT \times \frac{1}{V}$ } (A) + (D)

$V = \frac{nR}{P} \times T$ } $y = mx$ (B)

$P = \frac{nR}{V} \times T$ } $y = mx$ (C)

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