NAME: ANSWERS DATE DUE: _____

TEACHER: _____

Year 11 Term 4 – Gases HOMEWORK SHEET No. 3

Success Criteria 14 – 17 and revision

/24

1. In three concise sentences describe the contribution of Amedeo Avogadro to the scientific study of gas behaviour.

- Answers will vary.
- His work established that all gases exhibit the same gas behaviours ie measurable properties of PVT for all gases respond in the same way. This means a volume of gases at known P and T contains a number of gas particles/moles independent of its identity

/2

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

$PV = nRT$ $\quad \frac{P_1V_1}{n_1RT_1} = \frac{P_2V_2}{n_2RT_2}$ or $\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

/1

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

$R = 8.31 \ \frac{kPa \cdot L}{moles \cdot K}$

/1

4. Convert the following temperatures to K.

a) 293 °C 566 K

b) -23 °C 250 K

/1

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

a) 1023 mmHg (to kPa) 136.4 kPa.

b) 450 °C (to K) 723 K

c) 0.05 atm (to kpa) 5.065 kPa.

d) 0.36 cm^3 (to L) 0.00036 L or 3.6×10^{-4} L

e) 32 m^3 (to L) 32000 L 3.2×10^4 L

f) 0.013 mL (to L) 0.000013 L or 1.3×10^{-5} L

/3

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

n, T = constant = Boyles Law

$P_1V_1 = P_2V_2$

$P_1 = 100$ kPa

$V_1 = 3.3$ L

$P_2 = 90$ kPa $V_2 = ?$

$\frac{P_1V_1}{P_2} = V_2 = \frac{100 \text{ kPa} \times 3.3 \text{ L}}{90 \text{ kPa}}$

$= 3.67$ L

/2

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? ~~n = const~~, not a "before" versus "after"

n is given — ideal gas ✓?

$V = 7.5\,L$

$T = 18°C = 291K$

$n = 0.125 + 0.125 = 0.25$ moles

$P = ?$

$PV = nRT$

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

$= \frac{0.25\text{ moles} \times 8.31 \times 291}{7.5}$

$P = 80.61\,kPa$

/2

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?

P — T? — n

$V = 0.5\,L$

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

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

$T = ?\ (°C)$

$PV = nRT$

$\frac{PV}{nR} = T$

$\frac{1013 \times 0.5}{0.125 \times 8.31} = T = 487.6K = 214.6°C$

seems low! check!

/2

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?

have to find difference in n?? $n_1 - n_2$?

$P_1 = 125\,atm$ $P_2 = 50\,atm$ $P_1 = 12663\,kPa$

$V_1 = 60\,L$ $V_2 = 60\,L$ $P_2 = 5065$

$n_1 = ?$ $n_2 = ?$

$T_1 = 300°C$ $T_2 = 300°C$

$n_1 = \frac{P_1 V_1}{RT_1} = \frac{12663\,kPa \times 60}{8.31 \times 300} = 304.8$ moles

$n_2 = \frac{P_2 V_2}{RT_2} = \frac{5065 \times 60}{R \times 300} = 121.9$ moles

$n_1 - n_2 = 304.8 - 121.9 = 182.9$ moles

/3

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)

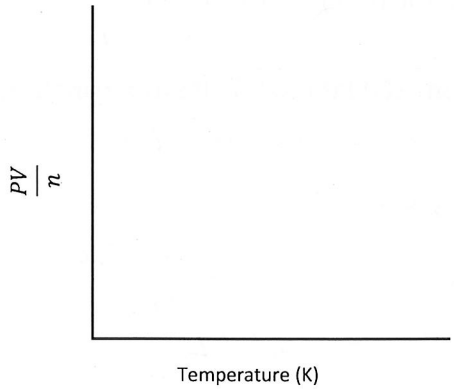
$C_8H_{18(l)} + O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(g)}$

360.1 L

/3

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

(b) Explain your reasoning



/4