Progress test 1

Multiple choice questions

1) Sodium:
- is an alkaline metal OK
- is a halogen
- has no lone pairs
- has 1 lone electron shared in covalent bonds

2) Nitrogen:
- belongs to the 3rd group
- has a bit of electronegativity
- has 3 lone electrons OK
- can make 3 coordination bonds

Multiple choice questions

3) A certain atom A is bound to Cl: how strong is its ionic nature?
- It is always not ionic
- it is stronger whenever A's electronegativity is strong
- it is stronger whenever A's electronegativity is small OK
- it is independent of A's electronegativity

4) Two equal volume cylinders are filled up with two different ideal gases at the same T: what happens?
- P is higher for the gas with higher FW
- the ratio P_{gas1}/P_{gas2} cannot be calculated, it must be measured
- the two gases have the same P
- the ratio P_{gas1}/P_{gas2} depends on the ratio between their FW OK

Multiple choice questions

5) The mole fraction of a gaseous mixture:

- is equal to %v, up to a factor of 100 OK
- is equal to %w, up to a factor of 100
- is the ratio between the mass in g of the gas and the total mass of the mixture
- is independent of the partial pressure

%v = 1ml/100ml so $x_1 = n_1/n_{tot}$,

In a mixture the molar volume is defined:

$V_1 = V_{tot} x_1$ hence $x_1 = V_1/V_{tot}$

Exercise 6

- 0.93 g of a certain gas fill up a volume of 250ml at 700mmHg and 27°C. Calculate the FW

$$\text{FW} = \frac{gRT}{PV} = \frac{0.93 \times 0.082 \times 300}{0.921 \times 0.25} = 99.356$$

Exercise 7

- A mixture of 50g of O_2 and 50g of CO is filling in a box at 600mmHg. Which is the partial pressure of each gas in atm?

n_{O2}=50/32= 1.56; n_{CO}=50/28= 1.79

n_{tot}= 1.56+1.79 = 3.35

x_{O2}= 1.56/3.35 = 0.466; x_{CO}= 1-0.466 = 0.534

$P_{CO}= P_{tot}x_{CO}$= 0.789·0.534 = 0.421 atm

$P_{O2}= P_{tot}-P_{CO}$= 0.789-0.421 = 0.368 atm

Exercise 8

- A solution of Nitric acid is concentrated 0.2M. Calculate the molar concentration of the solution obtained after diluting 100ml of this first solution with water up to a final volume of 500ml.

$$C_2 = \frac{C_1 V_1}{V_2} = \frac{0.2 \times 0.1}{0.5} = 0.04M$$

Exercise 9

- 100ml of HCl 0.5N are mixed with 150ml of HCl 0.1N. Calculate the normality of the resultant solution.

$$C_{fn} = \frac{C_1V_1 + C_2V_2}{V_1 + V_2} = \frac{(0.5 \times 0.1) + (0.1 \times 0.15)}{0.25} = 0.26N$$

Exercise 10

- Calculate the molar concentration of a solution 3 molal of ammonia, whose density is 0.98g/ml.

Molality= mol_{solute}/1Kg solvent $\Rightarrow$ a 3m solution has 3 mol of NH_3 in 1Kg of water

How many grams are contained in 3 mol? $n \cdot FW = 3 \cdot 17 = 51g$

Hence the weight of the solution is: $g_{NH3} + g_{H2O} = 51+1000=1051g$

The density is needed to convert mass into volume, using a proportion

$980g:1l = 1051g: Vl \qquad \Rightarrow V= 1051/980 = 1.072l$

$M = n/V = 3/1.072 = 2.798M \cong 2.8M$