Chemistry

Chemistry: Q1. Arsenic sulphide has 70% arsenic mass, with the remainder being sulphur. Use the % composition of arsenic and sulphur to obtain the empirical formula of the compound

Sulphur percentage is 30% and 70% arsenic therefore the ratio is 3: 7

This means that the number of atoms for

Sulphur = 3

Arsenic = 7

Therefore the empirical formula will be

Ar7S3 (s)

Q 2 Sample mass/g Temperature / C Pressure/ mm Hg volume / cm

0. 345 650 760 60. 5

0. 345 1573 760 242. 0

Use above table for the questions below.

(i) Using the information for 650C, calculate the volume that the sample would have at 0C and standard temperature, assuming that the sample when gaseous remained gaseous.

P1V1/T1 = P2V2/T2

Where

P is pressure

T is temperature

V is volume

P1= 760

V1 = 60. 5

T1= 650 or 973 F

T2 = 273F

(760 X 60. 5)/ 923 = (760 X Y)/ 273

Where Y is the new volume

Y = 17. 894 cm3

(ii) Calculate the density, in g litre, of this gaseous arsenic sulphide at 0. 00C and 760mmHg

Density is given by mass / volume

Mass is 0. 345 and volume is 17. 894cm3

1000cm3 = I litre

Therefore 17. 894 cm3 = 0. 017894 litres

Density = 0. 345 /0. 017894 = 19. 28 grams per litre

(iii) Calculate the molecular formula of the arsenic sulphide when it is in the gaseous state at 650C. Show your reasoning

Ar7S3 (g) is the gaseous state of the molecules; the symbol (g) shows that the molecule state is in gaseous form.

(iv) State the molecular formula at 1573C, explain your reasoning

At very high temperatures the gaseous form does not change so the formula will still be Ar7S3 (g) because there are only three forms of matter namely solid, liquid and gas

Q 3. Beryllium di-aluminate contains beryllium, aluminium and oxygen

12. 7g of beryllium di-aluminate contained 0. 9g of beryllium and 4. 5g of aluminium.

(i) Calculate the mass of oxygen in the sample.

If 0. 9 grams is beryllium and 4. 5 grams is aluminium then the mass of oxygen is 12. 7-(0. 9 + 4. 5) = 7. 3 grams

(ii) From your answer in (i) calculate the mass of oxygen and the mass of aluminium that combines with one mole of beryllium atoms to produce beryllium di-aluminate. How many moles of oxygen atoms and how many of aluminium atoms do these masses represent.

One mole of beryllium weighs 9 grams, therefore we have 0. 1 mole of beryllium if the mass is 0. 9, one mole of oxygen weighs 16 grams therefore we have 7. 3/16 moles of oxygen and finally we have 4. 5 grams of aluminium therefore we have 4. 5/27 moles of aluminium.

Moles

Beryllium 0. 1

Aluminium 0. 167

Oxygen 0. 456

Mole ratio

1: 2: 5 where this represents Beryllium, Aluminium and Oxygen respectively.

One mole of Beryllium will combine with

2 moles of Oxygen and therefore the mass will be 5 X 16 = 80 grams

5 moles of aluminium and therefore the mass of aluminium will be 2 X 27 = 54 grams

(iii) Use your answer to part (ii) to obtain the empirical formula of beryllium di-aluminate, show your reasoning

We can obtain the empirical formula of beryllium di-aluminate through the use of the mole ratio 1: 2: 5,

Beryllium has atomic number 4, therefore it has two free electrons where it looses the two electrons to combine

Oxygen has atomic number 8, therefore it has to gain two electrons to make a bond

Aluminium is metal with atomic number 13 and it will combine by loosing two electrons. Beryllium and aluminium are metals and will combine with other elements by loosing electrons while oxygen will combine by gaining electrons, therefore our empirical formula will have the following formula:

Be2 (AlO5)

Q 4 The nuclei of Pandemonium, symbol Pn contain 117 protons. Some nuclei contained 175 and others 174 neutrons.

(i) State the atomic number of Pn, and give the full symbol for the isotope with 175 neutrons.

Isotopes of an element have the same number of protons but differ in the number of neutrons; the atomic number is equal to the number of protons therefore Pn has the atomic number 117. Because atoms are neutral then the number of electrons is equal to the number of neutrons.

The three isotopes can be written as follows:

117

Pn

68

117

Pn

67

(ii) Give the period and the group in the periodic table where Pn is found, explain your answer. (1 sentence)

The atomic number is 117; this means that the electronic arrangement is 2: 8: 18: 32: 50: 7 this is given by the formula 2N2 which give us the maximum number of electrons in each cell where N is the shell number. We have 6 shells and 7 electrons in the last shell, this means that the element belongs to the 7th period and the 17th group.

(iii) Name another chemical in the periodic table that closely resembles Pn. (1 sentence)

The element that resembles Pn is Ununseptium with atomic number 117

(iv)Give a reason why Pn would be a metal, semi-metal or non metal. (1 sentence)

Pn is a non metal because the outer shell has seven electrons and this means that the element will react by gaining one electron.

(v) Give the empirical formula for Pn in its highest normal oxide. Explain your conclusions (1 or 2 sentences only)

The empirical formula will be Pn2O7 because oxygen will tend to gain two electrons or loose 6 electrons and Pn will also tend to gain one electron or loose 7 electrons, therefore the highest normal oxide will be loosing Pn loosing seven electrons and Oxygen gaining two electrons.

(vi)Write a balanced equation on the effect of an aqueous solution of Pn hydride when in contact with blue litmus paper.

(vi) The isotope Pn with 175 neutrons has 6 decays, what would the final product of these changes be.

Six decays means loosing six neutrons, and bearing in mind that the number of neutrons is equal to the number of electrons and that the number of electrons is equal to the number of protons then our resulting element will have an atomic number 67-6 = 61.

(vii) Is this final product a lanthanide, and actinide, a transition element or a typical element.

The final product is an lanthanide due to the atomic number 61.

REFERENCE:

Theodore Brown, H. Eugene and Bruce E. (2005) Chemistry: The Central Science, Prentice Hall, UK