Year 13 Chemistry Worksheet 1

Day 1

Q1 The **outermost** energy level of copper has the configuration:

A. $4s^1$
B. $4s^2$
C. $3d^9$
D. $3d^{10}$

Q2 One of the factors which affect first ionisation energy is the nuclear charge. Lithium has 1 more proton than helium (and so a greater nuclear charge), and yet its first ionisation energy is much lower (519 kJ mol^{-1}).
Explain why. **(2 marks)**

Q3 0.0224 dm^3 of oxygen gas at a temperature of 27^0 C and a pressure of 101.325 kPa was dissolved in water and made up to 100cm^3.

(i) Calculate the amount (moles) of oxygen dissolved in water. **(2 marks)**

(ii) Calculate the concentration of the solution in mol dm^{-3}.

(1½ marks)

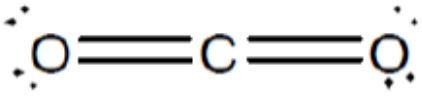
[R = 8.314 JK^{-1} mol^{-1}]

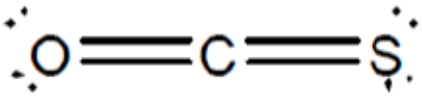
Day 2

Q1 Two conditions in which a real gas approaches **ideal gas behaviour** are:

A. high temperature and low pressure
B. low temperature and high pressure
C. high temperature and high pressure
D. low temperature and low pressure

Q2 Carbon dioxide (CO_2) and carbon oxysulphide (OCS) are both linear molecules. They both contain polar bonds. The Lewis structures are:





(i) Explain why the C-O and C-S bonds are polar. **(1 mark)**

(ii) Explain why the OCS molecule is polar but CO_2 is not.

(2 marks)

Q3 For each atom identified below, give the sub shell(s), in which the valence electrons would be found:

(i) An atom with a total of 9 electrons. **(1 mark)**

(ii) An atom with electron arrangement 2, 8, 8, 2.

(1 mark)

Day 3

Q1 The molecules NF_3 and BF_3 have similar formulae thus their **shapes** are:

A. pyramidal
B. trigonal planar
C. pyramidal and tetrahedral
D. pyramidal and trigonal planar

Q2 A gas collected over water at 19^0C and 101.325 kPa was found to occupy 20mL.

Calculate the volume the dry gas would occupy at STP.

(SVP of H_2O at 19^0C = 2.2 kPa)

(3 marks)

Q3 A solution of vinegar contains 4.0g acetic acid dissolved in 96.0g of water.

[Density of acetic acid = 1.0492g/cm^3]

[Density of water = 0.9982g/cm^3]

[Density of aqueous solution = 1.0058g/cm^3]

Express the concentration of this solution in terms of:

(i) molality **(1½ marks)**

(ii) molarity **(1½ marks)**

(iii) ppm (mass) **(1½ marks)**

[M_r of acetic acid = 60.05g/mol]

Day 4

Q1 Pure copper can be quite easily bent out of shape. Which statement in the table below explains why copper can be **bent**?

	Statement
A.	Copper atoms are arranged in layers and can slide over each other.
B.	Copper atoms are joined by strong covalent bonds.
C.	Copper atoms have sea of electrons
D.	Copper is made of small molecules.

Q2 This question is about the shape of the molecule $SiCl_4$.

i) How many electrons are there in the outer level of a silicon atom? **(½ mark)**

ii) How many electrons are there in the outer level after it has bonded with the four chlorine atoms? **(½ mark)**

iii) How many of the electron pairs are bond pairs and how many lone pairs around the central atom? **(1mark)**

iv) Draw a diagram to show the shape of a molecule of $SiCl_4$. **(1 mark)**

Q3 Methanol (CH_3OH), also called wood alcohol, is highly toxic and can cause blindness.

(i) Apply your knowledge of chemical bonding to predict the type of intermolecular force that exists between methanol molecules. **(½ mark)**

(ii) Explain why CH_3OH has a higher boiling point than O_2 despite both their molecular masses being 32g/mol. **(2 marks)**

Day 5

Q1 The correct unit to be used for **mole fraction** calculations is:

A. m
B. g/mol
C. M
D. no units

Q2 It is observed that the trends of atomic radii differ from the trends of ionic radii in the periodic table.

(i) Place the following species in order of increasing size:

H, H^+, H^- **(1 mark)**

(ii) Justify your answer given above. **(1½ marks)**

Q3 Most elements have two or more isotopes. Any sample of an element will contain these isotopes in a fixed ratio.

(i) Define isotope. **(1 mark)**

(ii) Naturally occurring copper is composed of 72.5% ^{63}Cu and 27.5% ^{x}Cu. Calculate the atomic mass of Cu if the relative atomic mass of Cu is 63.5. **(3 marks)**