KING EDWARD VI COMMUNITY COLLEGE

COURSE CONTENT
ORGANIC CHEMISTRY

- Alkanes
- Haloalkanes
- Alkenes
- Alcohols
- Analysis

PHYSICAL CHEMISTRY

- Atomic structure
- Moles
- Bonding
- Energetics
- Kinetics
- Equilibria
- Redox

INORGANIC CHEMISTRY

- Periodicity
- Group 2
- Group 7

INDUCTION TASKS

Welcome to AS Chemistry with Mr Holbourn.

The course at KEVICC is AQA Chemistry-7405.
An outline of the specification is on the left. For more detail, please visit the exam board website shown at the bottom of this page.

If you have any questions, please feel free to email.

Many of the topics listed build on prior knowledge from your GCSEs. Therefore, please complete the five tasks detailed in this document, in order to refresh your memory on some core concepts in preparation for September.

Useful links:

https://www.chemguide.co.uk/
http://www.docbrown.info/
http://www.bbc.co.uk/schools/gcsebitesize/science
http://www.rsc.org/periodic-table
https://www.compoundchem.com/

TASK 1: ATOMIC STRUCTURE

Research the history of the model of the atom and produce a summary of the developments made.

(Include diagrams, details of their experiments, predictions and observations)

- Ernest Rutherford

- Joseph John Thompson

- Niels Bohr

- John Dalton

- James Chadwick

RELATIVE ATOMIC MASS

If there are several isotopes of an element, the relative atomic mass will take into account the proportion of atoms in a sample of each isotope.
For example, chlorine gas is made up of 75% of chlorine-35 and 25% of chlorine-37.

The relative atomic mass of chlorine is therefore the mean atomic mass of the atoms in a sample, and is calculated by:

$$A_r = \left(\frac{75.0}{100} \times 35\right) + \left(\frac{25.0}{100} \times 37\right) = 26.25 + 9.25 = 35.5$$

TASK 2

1. Neon has three isotopes. Ne-20 accounts for 90.9%, Ne-21 accounts for 0.3% and the last 8.8% of a sample is Ne-22. What is the relative atomic mass of neon?

Harder example:
2. Boron has two isotopes, B-10 and B-11.
   The relative atomic mass of boron is 10.8.

   What are the percentage abundances of the two isotopes?

DEDUCING AN IONIC FORMULA

At GCSE, you learnt about cations and anions, due to the transfer of electrons during bonding. Below is a table of common Ions and their relative charges.

Positive ions (cations)		Negative ions (anions)	
Name	Symbol	Name	Symbol
Hydrogen	H^+	Hydroxide	OH^-
Sodium	Na^+	Chloride	Cl^-
Lithium	Li^+	Bromide	Br^-
Silver	Ag^+	Oxide	O^{2-}
Magnesium	Mg^{2+}	Hydrogencarbonate	HCO_3^-
Calcium	Ca^{2+}	Nitrate	NO_3^-
Zinc	Zn^{2+}	Sulfate	SO_4^{2-}
Aluminium	Al^{3+}	Carbonate	CO_3^{2-}
Ammonium	NH_4^+	Phosphate	PO_4^{3-}

Ionic compounds must have an overall neutral charge. The ratio of cations to anions must mean that there is as many positives as negatives.

Three examples are shown below:

NaCl	
Na^+	Cl^-
+1	-1

MgO	
Mg^{2+}	O^{2-}
+2	-2

MgCl$_2$	
Mg^{2+}	Cl^- Cl^-
+2	-2

RELATIVE FORMULA MASS

Carbon dioxide, CO_2 has 1 carbon atom (Ar = 12.0) and two oxygen atoms (Ar = 16.0).

The relative formula mass is therefore:
Mr = $(12.0 \times 1) + (16.0 \times 2) = 44.0$

Magnesium hydroxide $Mg(OH)_2$ has one magnesium ion (Ar = 24.3) and two hydroxide ions, each with one oxygen (Ar = 16.0) and one hydrogen (Ar = 1.0).

The relative formula mass is therefore: $(24.3 \times 1) + (2 \times (16.0 + 1.0)) = 58.3$

TASK 3

Work out the formulas and relative formula masses for the following ionic compounds.

Ionic Compound	Formula	Formula Mass
Magnesium Bromide		
Barium Oxide		
Zinc Chloride		
Ammonium Chloride		
Ammonium Carbonate		
Aluminum Oxide		

CALCULATING MOLES

A mole is the amount of a substance that contains 6.02×10^{23} particles.
The mass of 1 mole of any substance is the relative formula mass (Mr) in grams.

Examples:
One mole of carbon contains 6.02×10^{23} particles and has a mass of 12.0 g
Two moles of copper contains 1.204×10^{24} particles, and has a mass of 127 g
1 mole of water contains 6.02×10^{23} particles and has a mass of 18 g

The amount in moles of a substance can be found by using the formula:

$$\text{Amount in moles of a substance} = \frac{\text{mass of substance}}{\text{relative formula mass}}$$

TASK 4

Find an every-day substance in your home and try to figure out how many moles are present using the above equation.

Bring in a sample labelled with the mass, formula mass and number of moles. Examples of formulas for every day compounds are below for inspiration.
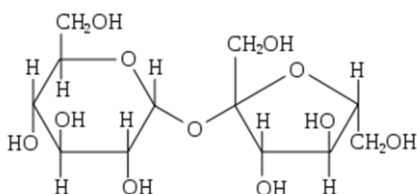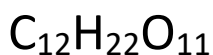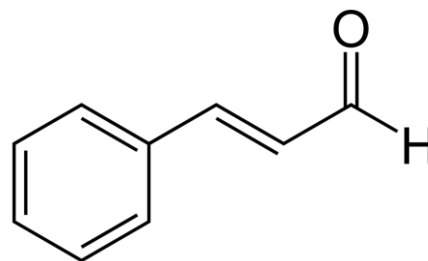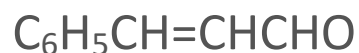
Sugar $C_{12}H_{22}O_{11}$	Bicarbonate of soda $NaHCO_3$	Cinnamon $C_6H_5CH=CHCHO$

DRAWING DOT AND CROSS DIAGRAMS

Covalent bonding-   **Shared** pairs of electrons between **2 or more non-metals.**

Ionic bonding-   **Transfer** of electrons between a **metal atom and a non-metal atom** to form charged ions.

1. Use the definitions to identify the type of bonding.
2. Identify the group of the periodic table the element is found in - the number of electrons on the outer shell.
3. Identify how many electrons need to be shared or transferred to gain a full outer shell.
4. Draw the electrons for one atom with dots, the other with crosses.
5. If they are transferring electrons, apply the relevant charges. (Remember electrons are negatively charged.)
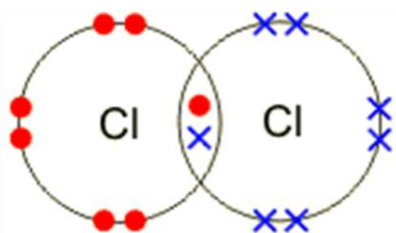
EXAMPLE OF COVALENT BONDING:

Chlorine- Cl_2
2 non-metals.
7 electrons on the outer shell.
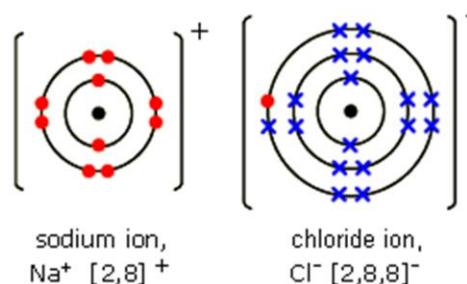Share 1 pair of electrons.

EXAMPLE OF IONIC BONDING:

Sodium Chloride - NaCl
1 metal, 1 non-metal
1 electron and 7 electrons on outer shells
Transfer 1 electron, from sodium to chlorine.

sodium ion,
Na^+ [2,8] $^+$

chloride ion,
Cl^- [2,8,8]$^-$

TASK 5

Draw dot and cross diagrams for the following species:

1. Fluorine – F_2
2. Carbon dioxide – CO_2
3. Ammonia – NH_3
4. Sodium Fluoride – NaF
5. Aluminium oxide- Al_2O_3

Extension:

Draw a dot and cross diagram for NH_3BF_3

EXTENSION OPPORTUNITIES

Below are a range of sources for improving your knowledge and application of bonding and mole calculations:

Videos on bonding- Fuse school animations to explain ionic, covalent, metallic bonding and their properties:
https://www.youtube.com/user/virtualschooluk/search?query=bonding

Ionic Bonding- Click and drag game to combine ions to form compounds:
https://www.learner.org/interactives/periodic/bonding/

Mole calculations- exam questions and answers:
https://mathsmadeeasy.co.uk/gcse-chemistry-revision/chemical-calculations-and-moles/