



# YEAR 12 SUMMER WORK

Use your knowledge of chemistry from GCSE, and additional resources as you see fit, to complete this booklet. Please make sure that you have a completed copy with you in the first lesson of the new academic year. If you have issues with any of the work over the summer please feel free to contact me on the email below.

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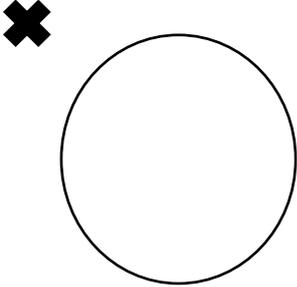


# Fundamental Particles

## Task 1

Atoms are the basic building blocks of matter. They are not the smallest of particles, and within Chemistry, we are interested in the sub-atomic particles especially the *electron*.

Using a periodic table, draw the *electron configuration*, as well as identifying *how many* sub-atomic particles there are for the following atoms and its corresponding ions:

|   |   |  |
|---|---|--|
| <p><b>e.g. Hydrogen</b></p>  <p><b>Number of:</b><br/> <b>Protons - 1</b><br/> <b>Neutrons - 0</b><br/> <b>Electrons - 1</b></p> | <p><b>Nitrogen</b></p> <p><b>Number of:</b><br/> <b>P –</b><br/> <b>N –</b><br/> <b>E –</b></p>                     | <p><b>Fluorine</b></p> <p><b>Number of:</b><br/> <b>P –</b><br/> <b>N –</b><br/> <b>E –</b></p>                    |
| <p><b>Hydrogen ion, H<sup>+</sup></b></p> <p><b>Number of:</b><br/> <b>P –</b><br/> <b>N –</b><br/> <b>E –</b></p>  | <p><b>Nitrogen ion, N<sup>3-</sup></b></p> <p><b>Number of:</b><br/> <b>P –</b><br/> <b>N –</b><br/> <b>E –</b></p> | <p><b>Fluorine ion, F<sup>-</sup></b></p> <p><b>Number of:</b><br/> <b>P –</b><br/> <b>N –</b><br/> <b>E –</b></p> |

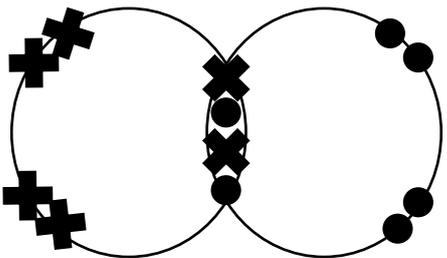
\* Don't forget brackets for ions

## Task 2 – Bonding and Dot cross diagrams

You would have covered ionic and covalent bonding in your GCSE. Use your knowledge, and further research,

State the type of bonding involved (covalent, ionic, metallic)

Draw the dot-cross diagrams for the following compounds, showing only outer electrons

|   |                         |
|---|-------------------------|
| <p>e. g. Oxygen gas - <b>covalent</b></p>  | <p>Sodium chloride</p>  |
| <p>Magnesium oxide</p>  | <p>Water</p>            |
| <p>Carbon dioxide</p>   | <p>Calcium chloride</p> |
| <p>Ethane</p>   | <p>Nitrogen gas</p>     |



## SI Units

To communicate with other scientists, chemists must know and use the same units of measurements. SI units stands for *Système International*, and you must use the correct units when leaving your answer. Look through the following website for more information:

<http://www.npl.co.uk/reference/measurement-units>

### Task 4 – Convert to SI

Convert the following into SI units

1. 67cm
2. 30 minutes
3. 100 °C
4. -27 °C
5. 0.1g
6. 2.7 tonnes
7. 12g carbon into moles

## Handling Numbers

The ability to work with numbers is essential for chemistry and the level of accuracy is very important. The numbers we use in chemistry range from being extremely small to very large, and you must be able to deal with these.

### Decimal places (dp)

Your calculator can produce lots of digits after the decimal place, and you will need to record the answer accurately and appropriately to score marks in a test/exam. The answer will also need to be rounded up or down. Make sure that you give the answer to the number of decimal places the exam paper asks for. If in doubt, 2dp is the norm.

### Significant figures (sf)

Significant figures are useful for quoting numbers when decimal places are not appropriate. These numbers tell you about the magnitude of the figure. You will need to count the significant figures as soon as you come across a non-zero number reading from left to right.

Examples of 3sf:

3.81

0.0000381

38.1

3.00

## Standard form

Some numbers are too large or small to write out in full so a shorthand called 'standard form' or 'scientific notation' is used.

Examples

$$1.0 \times 10^6 = 1,000,000$$

$$1.0 \times 10^{-6} = 0.000001$$

## Task 5 – Significant figures and standard form

### Significant figures

You will need to quote answers to the correct number of significant figures.

- 1) Write the following to the number of significant figures indicated in brackets
  - a. 345789 (4)
  - b. 297300 (3)
  - c. 0.07896 (3)
  - d. 6 (3)
  - e. 0.001563 (3)
  - f. 0.01 (4)
- 2) Complete the following and give the answers to 3 significant figures
  - a.  $6125 \times 384$
  - b.  $25.00 \times 0.01$
  - c.  $13.5 + 0.18$
  - d.  $750 \div 25$
  - e.  $0.000152 \times 13$
  - f.  $0.0125 \times 0.025$

### Standard Form

- 3) Write the following in non-standard form
  - a.  $1.5 \times 10^{-3}$
  - b.  $0.046 \times 10^{-2}$
  - c.  $3.575 \times 10^5$
  - d.  $0.0534 \times 10^4$
  - e.  $10.3 \times 10^5$
  - f.  $8.35 \times 10^{-3}$
- 4) Write the following in standard form
  - a. 0.000167
  - b. 0.0524
  - c. 0.000000015
  - d. 34500
  - e. 0.62
  - f. 87000000
- 5) Complete the following, giving your answers to 3sf
  - a.  $6.125 \times 10^{-3} \times 3.5$
  - b.  $4.3 \times 10^{-4} \div 7.0$
  - c.  $4.0 \times 10^8 + 35000$
  - d.  $0.00156 + 2.4 \times 10^3$
  - e.  $6.10 \times 10^{-2} - 3.4 \times 10^{-5}$

## Task 6 – Balancing Equations

Look at the following equations, some need balancing, others do not. Balance the equations that need it.

- 1)  $C + O_2 \rightarrow CO$
- 2)  $Na + O_2 \rightarrow Na_2O$
- 3)  $H_2 + O_2 \rightarrow H_2O$
- 4)  $Na + I_2 \rightarrow NaI$
- 5)  $CH_4 + O_2 \rightarrow CO_2 + H_2O$
- 6)  $SO_2 + O_2 \rightarrow SO_3$
- 7)  $Fe_2O_3 + C \rightarrow Fe + CO$
- 8)  $Fe_2O_3 + C \rightarrow Fe + CO_2$
- 9)  $NH_3 + O_2 \rightarrow NO + H_2O$
- 10)  $Fe_3O_4 + H_2 \rightarrow Fe + H_2O$
- 11)  $C + CO_2 \rightarrow CO$
- 12)  $Fe + S \rightarrow FeS$
- 13)  $Ca + H_2O \rightarrow Ca(OH)_2 + H_2$
- 14)  $Al + Cl_2 \rightarrow AlCl_3$
- 15)  $Fe + HCl \rightarrow FeCl_2 + H_2$

## Task 7 – Relative Formula Mass

Use a periodic table to work out the relative formula mass of the following compounds

$NaOH = Na + O + H = 23 + 16 + 1 = \underline{40}$

- |                  |                                  |
|------------------|----------------------------------|
| 1) $CuSO_4$      | 7) $C_3H_8$                      |
| 2) $Mg(HCO_3)_2$ | 8) $HgO$                         |
| 3) $NH_4NO_3$    | 9) $NH_4Fe(SO_4)_2 \cdot 12H_2O$ |
| 4) $CuCO_3$      | 10) $K_4Fe(CN)_6$                |
| 5) $Ca(OH)_2$    | 11) $Al_2(SO_4)_3$               |
| 6) $H_2SO_4$     |                                  |

## Task 8 – Naming substances

Name the following substances.

| Formula                           | Name |
|-----------------------------------|------|
| O <sub>2</sub>                    |      |
| CuO                               |      |
| Cu                                |      |
| CuSO <sub>4</sub>                 |      |
| CuS                               |      |
| CuCO <sub>3</sub>                 |      |
| FeSO <sub>4</sub>                 |      |
| Fe(NO <sub>3</sub> ) <sub>2</sub> |      |
| N <sub>2</sub>                    |      |
| H <sub>2</sub> SO <sub>4</sub>    |      |
| CO                                |      |
| CO <sub>2</sub>                   |      |
| NO <sub>2</sub>                   |      |
| HCl                               |      |
| KHCO <sub>3</sub>                 |      |

| Name  | Formula |
|---|---------|
| Al <sub>2</sub> O <sub>3</sub>                  |         |
| Na  |         |
| Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> |         |
| HNO <sub>3</sub>                                |         |
| I <sub>2</sub>                                  |         |
| Ni  |         |
| Al  |         |
| Na <sub>2</sub> O                               |         |
| NaOH  |         |
| NaBr  |         |
| Na <sub>2</sub> CO <sub>3</sub>                 |         |
| He  |         |
| CH <sub>4</sub>                                 |         |
| NH <sub>3</sub>                                 |         |
| NH <sub>4</sub> Br                              |         |

## Task 9 - Mole calculations

Calculate the number of moles of each of the following substances. Give your answers to 3 sig figs.

- a) 90.0 g of H<sub>2</sub>O .....
- b) 20.0 g of C<sub>4</sub>H<sub>10</sub> .....
- c) 685 g of NH<sub>3</sub> .....
- d) 102 tons of O<sub>2</sub> .....
- e) 2.00 kg of Al<sub>2</sub>O<sub>3</sub> .....
- f) 20.6 mg of Au .....

## Task 10 – Ionic Formulae

Write the formula of the following ions

- |                               |                              |
|-------------------------------|------------------------------|
| 1) copper(II) carbonate ..... | 11) sodium sulfate .....     |
| 2) lithium oxide .....        | 12) barium sulfide .....     |
| 3) silver(I) bromide .....    | 13) magnesium nitrate .....  |
| 4) zinc(II) nitrate .....     | 14) hydrogen fluoride .....  |
| 5) ammonium carbonate .....   | 15) aluminium nitrate .....  |
| 6) aluminium sulfate .....    | 16) iron(II) carbonate ..... |
| 7) iron(II) oxide .....       | 17) strontium nitrate .....  |
| 8) iron(III) hydroxide .....  | 18) chromium(IV) oxide ..... |
| 9) lead(II) iodide .....      | 19) potassium selenide ..... |
| 10) sodium carbonate .....    | 20) rubidium oxide .....     |