Chemistry Revision

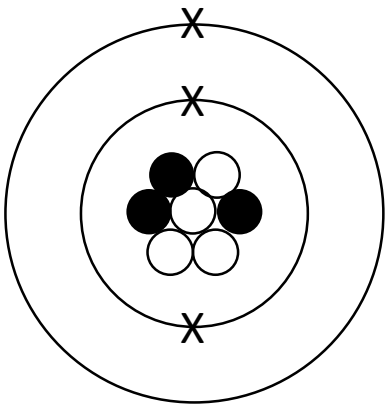
Year 11

Christmas homework 2018

Name_____

Atoms

- All substances are made of **atoms**.
- **Elements** are made of only one type of atom.
- **Compounds** contain more than one type of atom.
- Compounds are held together by **bonds**.
- **Mixtures** contain elements and compounds.



Protons and Neutrons are found in the **nucleus**.

Electrons orbit the nucleus in **shells**.

	Proton	Neutron	Electron
Mass	1	1	negligible
Charge	+ 1	0	- 1
Location	nucleus	nucleus	shells

Any atom contains **equal** numbers of protons and electrons.

All atoms of a particular element have the same number of protons. Atoms of different elements have different numbers of protons.

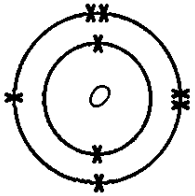
Mass number = Number of protons and neutrons

Atomic number = Number of protons

$^{7}_{3}Li$

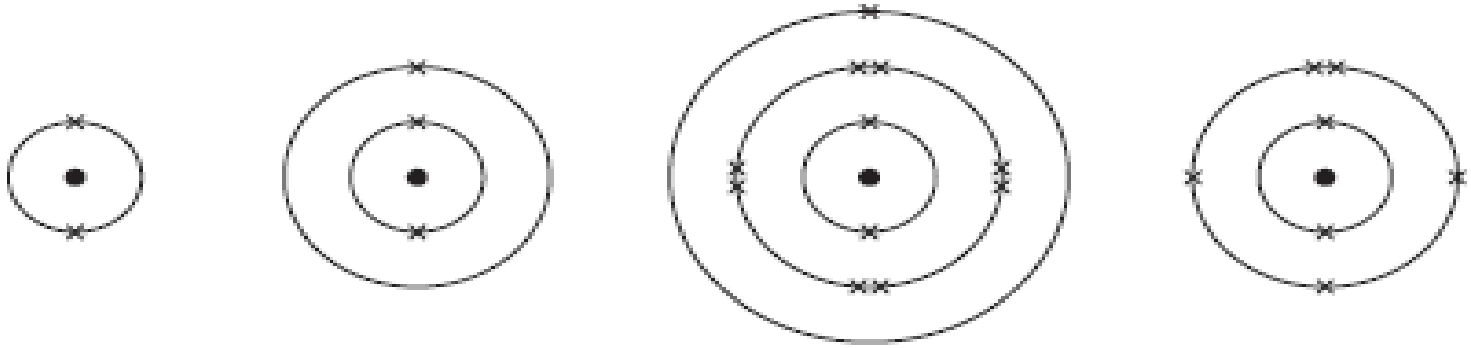
Number of neutrons = Mass Number – Atomic Number

Electrons occupy particular energy levels. Each electron in an atom is at a particular energy level (in a particular shell). The electrons in an atom occupy the lowest available energy levels (innermost available shells).

8	O	1st shell: X X 2nd shell: X X X X X X 3rd shell: Config: 2, 6	

10 Questions

1. In the nucleus of an atom there are protons and _____.
2. Around the nucleus there are electrons in _____.
3. What is the charge on a proton?
4. Atoms are always neutral, explain why?
5. How many protons, neutrons and electrons does Lithium have?
6. What is the atomic number and mass number of Oxygen?
7. What is the electron configuration of Oxygen?
8. Draw the electronic structure of Magnesium.
9. How many different types of atom are in an element?
10. How are compounds and elements different?



Atom A **Atom B** **Atom C** **Atom D**

Use the Chemistry Data Sheet to help you to answer these questions.

1 (a) Name the two sub-atomic particles in the nucleus of an atom.

.....

(1 mark)

1 (b) Why is there no overall electrical charge on each atom?

.....

.....

(1 mark)

Periodic Table and Bonding

- Each element has its own **symbol**.
- Columns are called **groups**.
- Elements in a group have similar properties.
- Rows are called **periods**.
- The staircase splits metals from non-metals.

1	2											3	4	5	6	7	8
H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	?	?	?						

Elements in the same group in the periodic table have the same number of electrons in their highest energy level (outer electrons) and this gives them similar chemical properties.

Li
Na
K
Rb
Cs

Reactivity Increases

Reactions involve the loss of the outermost electron. Losing this electron seems to get easier as we go down the group.

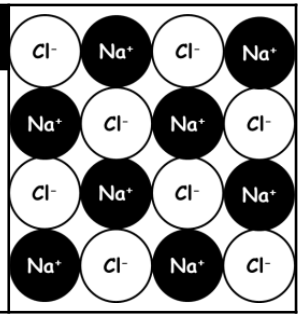
Atoms of the last group (noble gases) have stable arrangements and are unreactive

2 types of bonding:

- Transferring electrons → **IONIC BONDING**
- Sharing electrons → **COVALENT BONDING**

Ionic Bonding

- Metal and non-metal react
- Metals form positive ions,
- Non-metals negative ions
- Opposite charges attract
- A giant lattice is formed

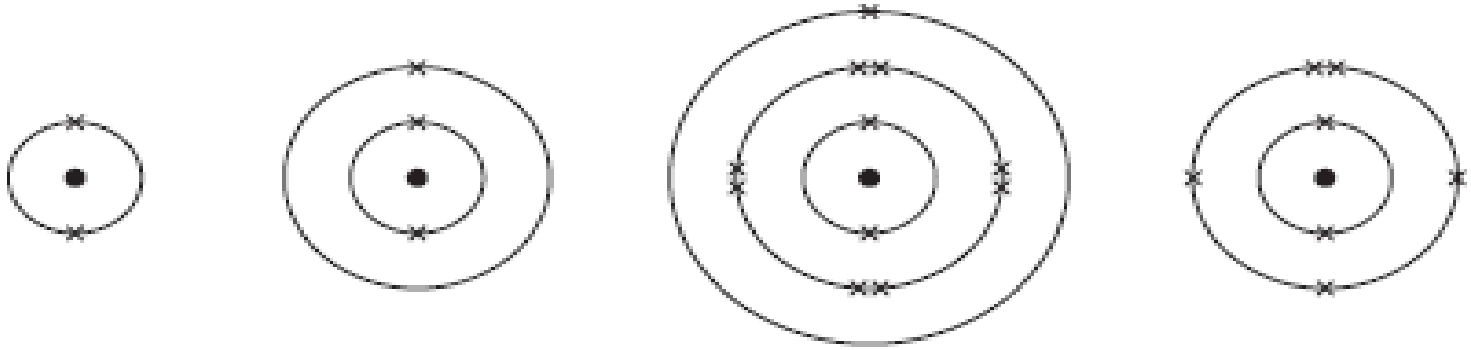


Covalent Bonding

- When 2 non-metals bond
- Outermost electrons are shared
- A pair of shared electrons forms a bond

10 Questions

1. Lithium and potassium are in which group of the periodic table?
2. Does the reactivity of this group increase or decrease as you go down the group?
3. Do periods go across or down?
4. Are non-metals on the left or right side of the periodic table?
5. What are the group of elements called that site between group 2 and 3 in the periodic table?
6. Which element is in period 2, group 6?
7. Which element is in period 4 group 3?
8. Why are noble gases unreactive?
9. Ionic bonds exist between 2 non-metals, true or false?
10. Explain your answer to question 9.



Atom A Atom B Atom C Atom D

1 (c) Why is Atom A unreactive?

.....

(1 mark)

1 (d) Which two of these atoms have similar chemical properties?
Give a reason for your answer.

.....

.....

.....

.....

(2 marks)

Chemical Equations

- Chemical equations show the **reactants** (what we start with) and the **products** (what we end with).
- No atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants.
- We often use symbol equations to make life easier

calcium carbonate → calcium oxide + carbon dioxide

$CaCO_3$ → $CaO + CO_2$

100g 56g 44g

HT Only

- Equations **MUST** balance
- We can **ONLY** add **BIG** numbers to the front of a substance
- We can tell elements within a compound by **BIG** letters
- We can check an equation is balanced by counting the number of each type on either side

H = 2
O = 2

$H_2 + O_2 \rightarrow H_2O$

Unbalanced

H = 2
O = 1

H = 2
O = 2

$H_2 + O_2 \rightarrow 2H_2O$

Unbalanced

H = 4
O = 2

H = 4
O = 2

H = 4
O = 2

$2H_2 + O_2 \rightarrow 2H_2O$

Balanced

H = 4
O = 2

10 Questions

Assuming the thermal decomposition of copper carbonate

1. What are the reactants?
2. How many products?
3. What is the name of the solid product?
4. What is the name of the gaseous product
5. If I heated 5 tonnes of copper carbonate and got 3.5 tonnes of solid how much CO_2 will be given off?

Assuming the reaction: $Mg\ (s) + 2HCl\ (aq) \rightarrow MgCl_2\ (aq) + H_2\ (g)$

6. What are the names of the reactants?
7. What is the name of the gaseous product?
8. What does (aq) stand for?
9. Explain why the equation is balanced.
10. Describe a positive test for the gaseous product.

2 (e) Titanium metal is produced by reacting titanium chloride with magnesium.

950 kg of titanium chloride was mixed with 240 kg of magnesium metal. The mixture was heated and produced 950 kg of magnesium chloride.

Calculate the mass of titanium metal produced.

.....

Mass = ... kg

(1 mark)

5 (b) (i) Balance the chemical equation for the reaction of calcium carbonate with hydrochloric acid.

$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$

(1 mark)

1 (b) (i) Balance the chemical equation for the reaction.

$2Al + Fe_2O_3 \longrightarrow 2Fe + Al_2O_3$

(1 mark)

Limestone and Carbonates – 1

- Limestone is made mainly of Calcium Carbonate
- Calcium carbonate has the chemical formulae $CaCO_3$
- Some types of limestone (e.g. chalk) were formed from the remains of animals and plants that live millions of years ago

Use in Building

We use limestone in many buildings by cutting it into blocks.

Other ways limestone is used:

- **Cement** = powdered limestone + clay
- **Concrete** = Cement + Sand + Water

- Buildings made from limestone suffer from damage by acid rain
- This is because carbonates react with acid to form a salt, water and carbon dioxide

Calcium Carbonate + Hydrochloric Acid → Calcium Chloride + Water + Carbon Dioxide

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

Heating limestone and carbonates

Breaking down a chemical by heating is called **thermal decomposition.**

Calcium Carbonate → Calcium Oxide + Carbon Dioxide

$$CaCO_3 \rightarrow CaO + CO_2$$

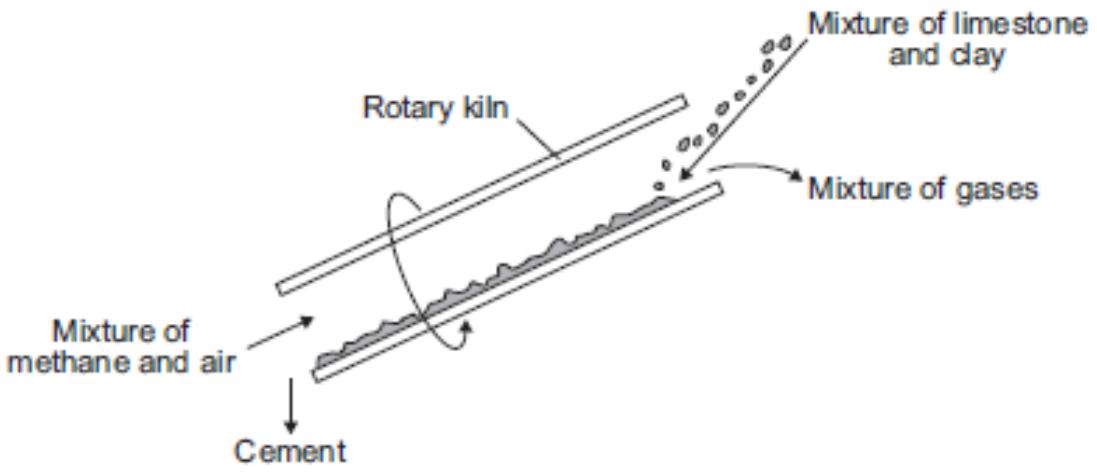
Testing for CO_2

- We use limewater to test for CO2
- Limewater turns cloudy
- A precipitate (tiny solid particles) of calcium carbonate forms causing the cloudiness!

10 Questions

1. Give 3 alternative names for $CaCO_3$
2. How many different types of atoms are there in $CaCO_3$
3. How many atoms in total are there in $CaCO_3$
4. Name 3 of the 4 substances found in concrete.
5. Which chemical do we use to test for the presence of CO_2?
6. What is considered a positive result for this test?
7. What is the chemical name for limewater?
8. Cement is made by heating powered limestone and _____ in a kiln?
9. Why do buildings made from limestone in built-up industrial areas erode?
10. Breaking down a chemical by heating is called _____ _____ ?

5 (c) When a mixture of limestone and clay is heated in a rotary kiln cement is produced.
Burning a mixture of methane and air heats the kiln.
Clay does not decompose in the kiln.



5 (c) (i) Carbon dioxide is one of the main gases in the mixture of gases coming out of the kiln.

Give two reasons why.

(2 marks)

5 (c) (ii) Name the other main gas in the mixture of gases coming out of the kiln.

Give a reason why there is a high percentage of this gas in the mixture of gases coming out of the kiln.

Name of gas .....

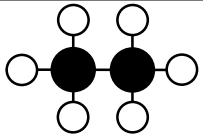
Reason .....

(2 marks)

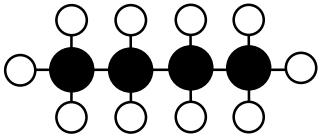
Hydrocarbons and crude oil

Crude Oil

- A **mixture** of lots of different compounds.
- We separate it into substances with similar **boiling points**. These are called **fractions**.
- This is done in a process called **fractional distillation**.

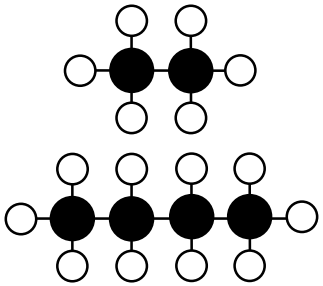


Fractions with low boiling points condense at the top.



Fractional Distillation

- **Refinery Gas** (fuel)
- **Petrol** (cars)
- **Naphtha** (industry)
- **Kerosene** (jet fuel)
- **Diesel** (engines)
- **Residue** (road surface)

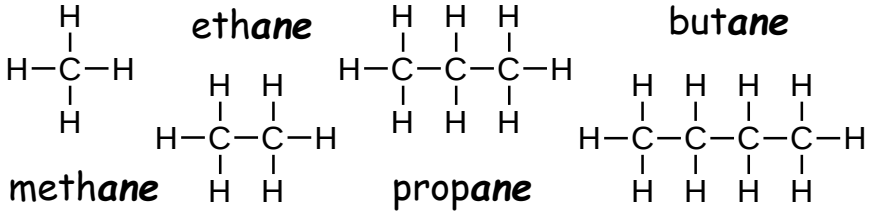


Increasing length

Longer chains mean…

1. Less ability to flow
2. Less flammable
3. Less volatile
4. Higher boiling point

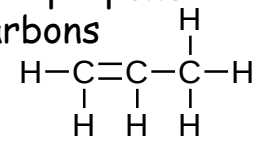
Nearly all the compounds in crude oil are **hydrocarbons** (hydrogen and carbon only).



- Most of these are **saturated** hydrocarbons called **alkanes**.
- General formula for an alkane is $C_nH_{(2n+2)}$.

Alkenes

- These are unsaturated hydrocarbons
- They contain a double bond
- General formula is C_nH_{2n}



Combustion of hydrocarbons

- When burnt in an adequate supply of air alkanes react to form **carbon dioxide**, e.g.

propane + oxygen → carbon dioxide + water

- When burnt in not enough oxygen **carbon monoxide** is formed instead

propane + oxygen → carbon monoxide + water

10 Questions

1. Which 2 elements do hydrocarbons contain?
2. The process of separating out hydrocarbons by their boiling points is called _____ _____ ?
3. Short chain hydrocarbons have the _____ (lowest / highest) boiling points.
4. How many bonds does carbon always form?
5. What is the name of the alkane with the formula C_2H_6?
6. How many carbon atoms does propane have?
7. The general formula for an alkane is: C_nH_{2n}, C_nH_{2n+2} or $C_{n+2}H_{2n}$
8. A hydrocarbon has 14 hydrogen atoms, how many carbon atoms will it have if it is (a) and alkane (b) and alkene?
9. What is the formula of the saturated hydrocarbon from question 8?
10. Which 2 products are formed when cyclohexane is burned in a plentiful supply of oxygen?