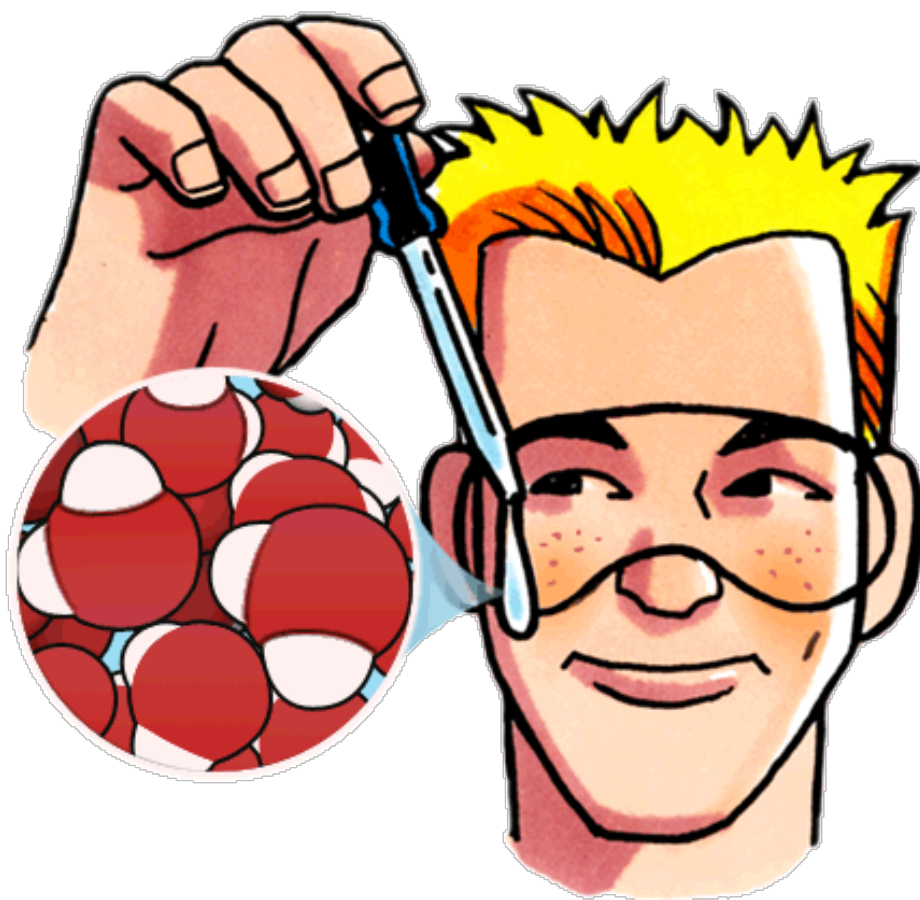


YEAR 9 SCIENCE

CHEMISTRY



NAME: _____

TEACHER: _____

Worksheet 1 – Matter

Question 1 – Classifying Matter

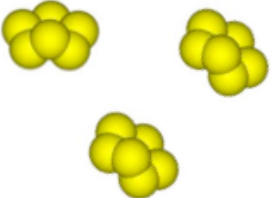
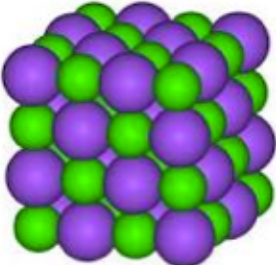
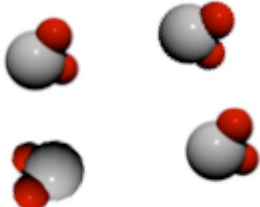
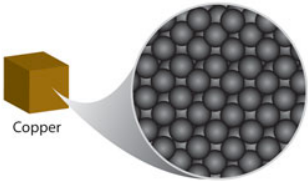
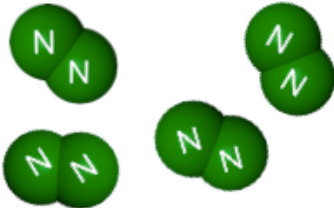

Classify the following as matter not.

Water, Air, Time, Heat, Clock, Salt, Gravity, Sand, Helium, Vacuum, Gold

Matter (Made of Atoms)	Not Matter (Not made of Atoms)

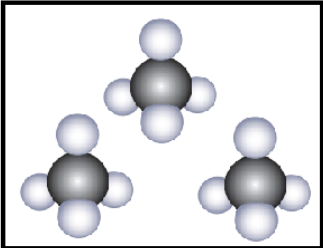
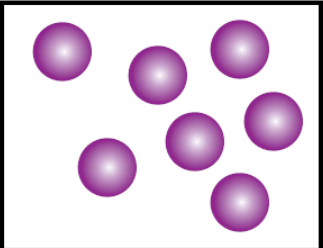
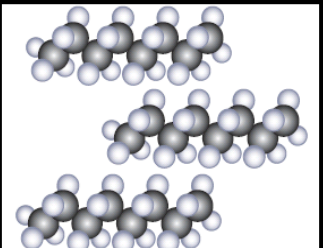
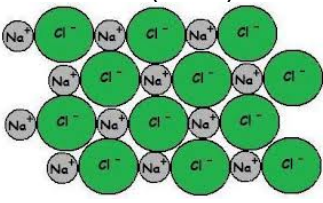
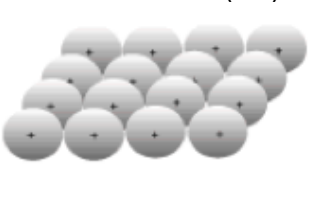
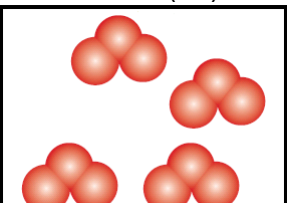
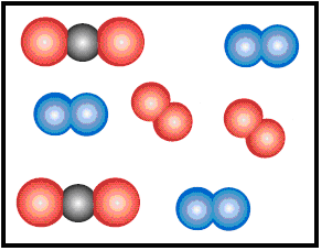
Question 2 – Building blocks of matter arranged in molecular or lattice structures

All substances are made of atoms, sometimes these atoms are arranged in groups called molecules other times the atoms (or ions) are arranged in a lattice structure. Classify the following as molecular or lattice structures.

 <p data-bbox="272 1305 560 1384">Zooming in on Sulfur Powder (S_8)</p> <p data-bbox="280 1473 552 1509">Lattice / Molecular</p>	 <p data-bbox="635 1346 962 1424">Zooming in on table salt crystal ($NaCl$)</p> <p data-bbox="660 1473 936 1509">Lattice / Molecular</p>	 <p data-bbox="1002 1305 1353 1384">Zooming in on pure water droplet (H_2O)</p> <p data-bbox="1042 1473 1313 1509">Lattice / Molecular</p>
 <p data-bbox="244 1843 588 1921">Zooming in on a piece of Copper (Cu)</p> <p data-bbox="280 1973 552 2009">Lattice / Molecular</p>	 <p data-bbox="635 1832 962 1910">Zooming in on Nitrogen gas (N_2)</p> <p data-bbox="660 1962 936 1998">Lattice / Molecular</p>	 <p data-bbox="1026 1843 1329 1921">Zooming in a calcium fluoride crystal (CaF_2)</p> <p data-bbox="1042 1973 1313 2009">Lattice / Molecular</p>

Question 3 – Elements or Compounds

Some substances are made up of one type of atom, others are made up of two or more different kinds of atoms. Classify the following substances as elements or compounds.

<p>Copper Metal (Cu)</p> <p>Element / Compound</p>	<p>Silicon dioxide (SiO₂)</p> <p>Element / Compound</p>	<p>White Phosphorus (P₄)</p> <p>Element / Compound</p>
<p>Copper Sulfate (CuSO₄)</p> <p>Element / Compound</p>	<p>Diamond (C)</p> <p>Element / Compound</p>	<p>Sodium oxide (Na)</p> <p>Element / Compound</p>
<p>Methane gas (CH₄)</p>  <p>Element / Compound</p>	<p>Helium gas (He)</p>  <p>Element / Compound</p>	<p>Octane (C₈H₁₈)</p>  <p>Element / Compound</p>
<p>Salt (NaCl)</p>  <p>Element / Compound</p>	<p>Sodium metal (Na)</p>  <p>Element / Compound</p>	<p>Ozone (O₃)</p>  <p>Element / Compound</p>
<p>Air</p> 	<p>What is different about air and the other substances above?</p> <p>_____</p> <p>_____</p> <p>Hence Air is not an element or a compound it is a...</p>	

Worksheet 2 – Atomic Structure I

Word Choice

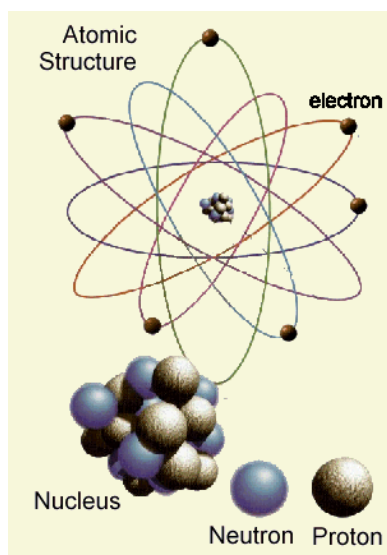
Elements	Sub-atomic	Neutrons	Made
Nucleus	Building Blocks	Centre	Small
Compact	Negatively	Protons	Outside

Atoms are the fundamental units (_____) of matter. All matter is _____ of atoms. At present there are 118 different kinds of atoms known to man; All the different kinds of atoms that exist are called _____. Atoms are extremely _____; it is believed that they are about 0.00000001cm in diameter. They are too small to even be viewed by a powerful light microscope.

Note: Different types of atoms would have different sizes.

An atom is made up of three main smaller particles (_____ particles), these are;

- 1) Protons.
- 2) _____
- 3) Electrons.



The **protons** and **neutrons** are located in the _____ of an atom.

The centre of an atom is called the _____.

The **electrons** however are free to move around, and can be located in the region of space _____ the nucleus.

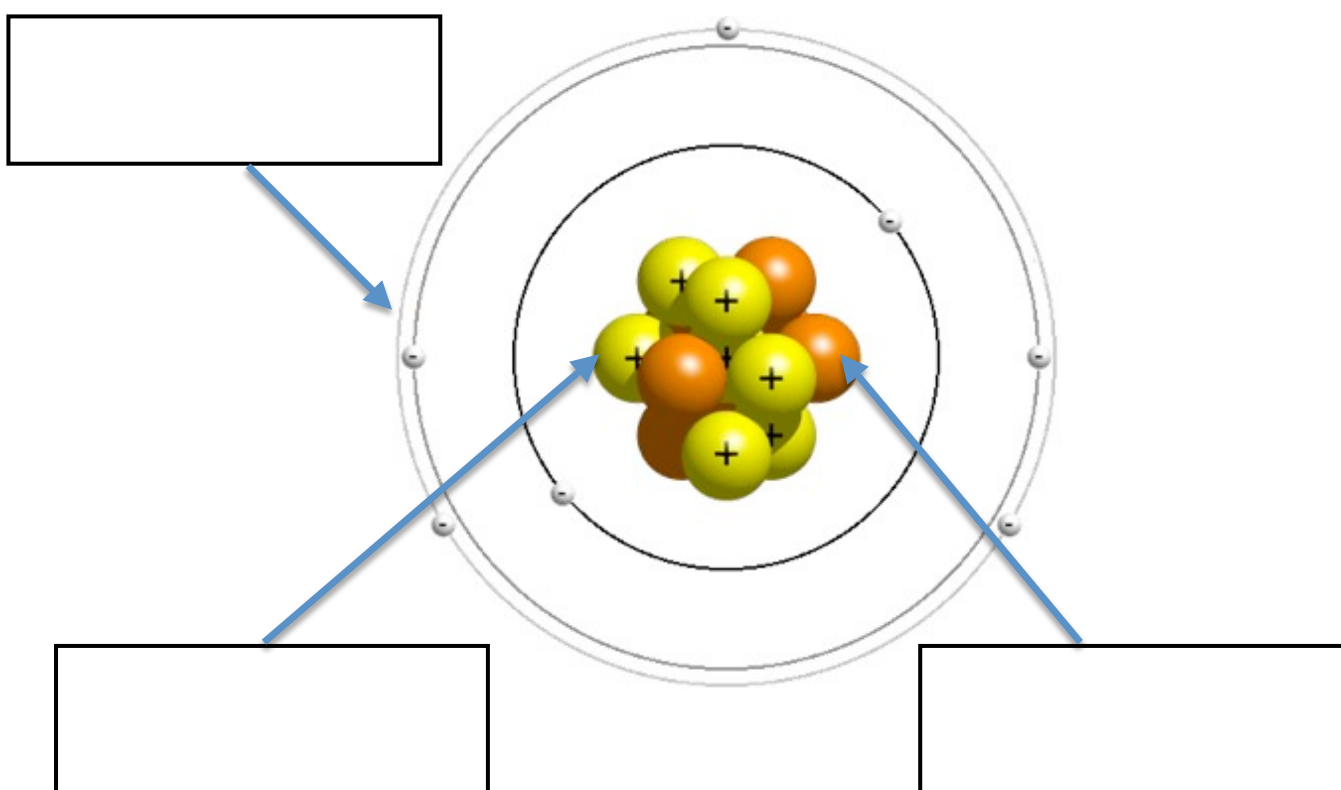
The nucleus of an atom is very small and _____.

_____ are positively charged and electrons are _____ charged. (Neutrons have no charge).

More information about the sub-atomic particles found in atoms...

Name of Particle	Mass (kg)	Relative Mass	Charge (C)	Relative Charge	Location
Proton	1.673×10^{-27}	1	1.60×10^{-19}	+1	In Nucleus
Neutron	1.675×10^{-27}	1	0	0	In Nucleus
Electron	9.11×10^{-31}	0.00054	1.60×10^{-19}	-1	Outside of Nucleus

Label the three subatomic particles on the diagram below.



Question – There are a few very misleading aspects to this diagram of the atom. Describe two of them below.

Worksheet 3 – Atomic Structure II

PART A - Define the following terms;

ATOMS –

PROTONS –

NEUTRONS-

ELECTRONS –

NUCLEUS –

ELECTRON CLOUD -

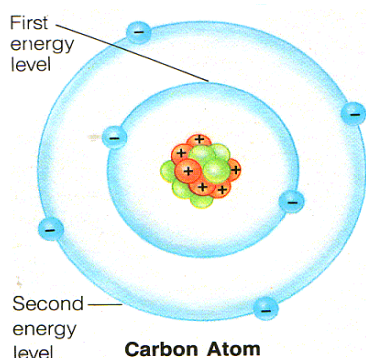
PART B - Complete the following table by stating whether Protons, Neutrons or Electrons are being described...

(10 marks)

Description	Proton, Neutron or Electron
Part of the atom found in the nucleus of the atom with a positive charge.	
Subatomic particles (parts of an atom) located in the area outside the nucleus	
Parts of an atom that have a negative charge	
Parts of the atom that have no charge	
Subatomic particles (parts of an atom) located in the nucleus (centre) of the atom.	<i>*more than one answer here!</i>
The lightest/smallest of the three sub-atomic particles	
Hydrogen has an atomic number of 1 because it has 1...	
On the periodic table; when you subtract the small number (atomic number) from the big number (mass number) you can find out the number of...(P,N or E) in an atom.	
Look at Lithium on the Periodic table. In the nucleus of a lithium atom there are 3...	
Look at Lithium on the Periodic table. In the nucleus of a lithium atom there are 4...	

Worksheet 4 – Electron Configuration

So far we have learnt that an atom is made up of protons, neutrons and electrons. Protons (positive) and neutrons (neutral) exist together in a tightly packed nucleus in the centre of an atom. Electrons (negative) are the free moving sub atomic particles and they are located around the outside of the nucleus.



Although we will come back to this in later years (and will discover that it is far more complex); it is sufficient for you to know and understand that electrons do not just move around where ever they please. **Electrons exist in energy levels** or shells. Electrons can not exist between these set energy levels because electron energy levels are quantized. (meaning only set energy levels are “allowed”).

Note: When we talk about energy levels we are not talking about POSITION... although they are related.

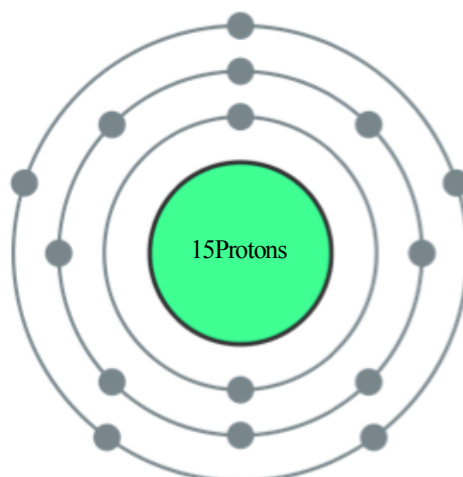
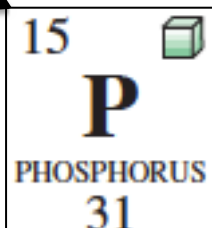
Electrons in the first 20 elements exist in 4 energy levels according to the rule below, and each energy level has a set amount of electrons existing in it....

- Energy level 1 – Contains the first **2** electrons
- Energy level 2 – Contains the next **8** electrons
- Energy level 3 – Contains the next **8** electrons
- Energy level 4 – Contains the next **18** electrons

THE 2, 8, 8, 2 RULE

Example – Use the information on the periodic table to draw the Phosphorus atom

Phosphorus is atom number 15 which means it has 15 electrons and 15 protons.



Look at the diagram you will see there are 15 electrons in total. 2 in the first shell, 8 in the second and the remaining 5 in the outermost shell.
Electron Config.
2,8,5

Questions – Use your periodic table and the example on the previous page to help to.

Draw diagrams of the following atoms...

- Remember the 2,8,8,2 rule when arranging the electrons.
- You will need your periodic table.
- Label the number of protons in the nucleus clearly.
- Under each diagram write the electron configuration.

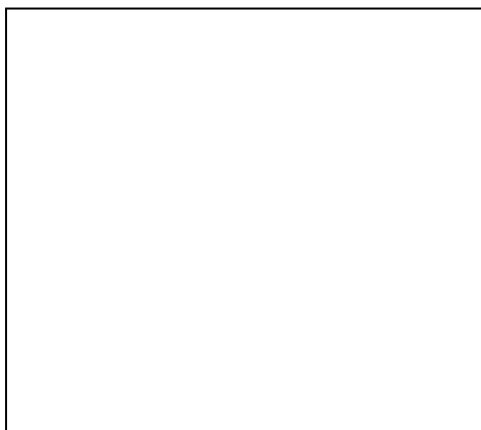
Carbon Atom



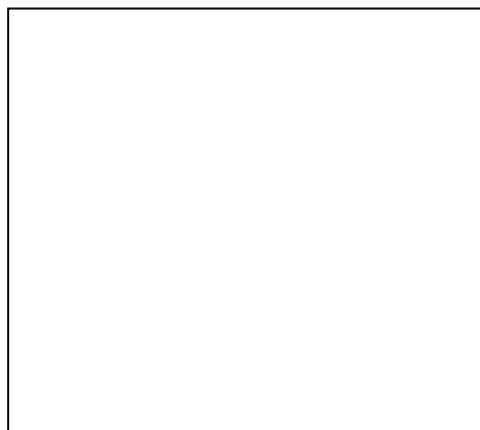
Sulfur Atom



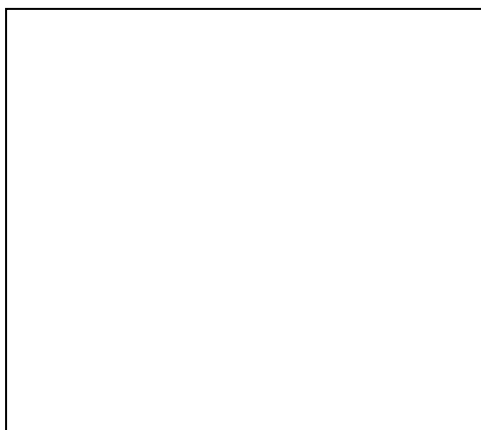
Beryllium Atom



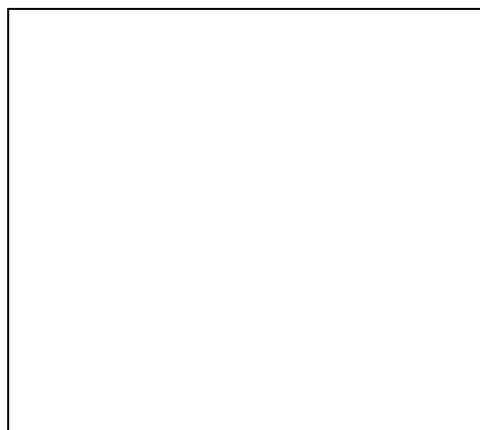
Sodium Atom



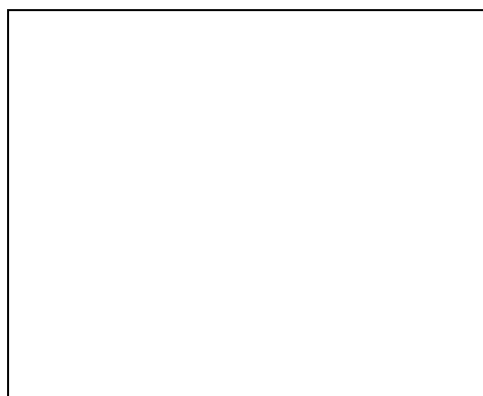
Hydrogen Atom



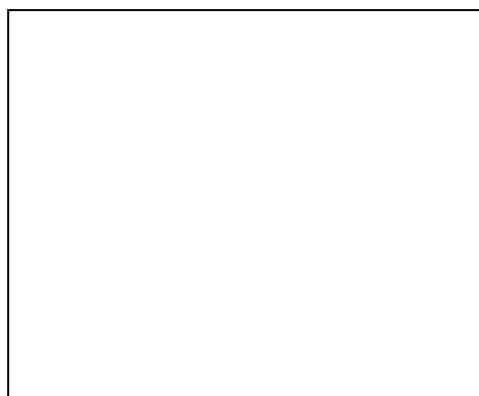
Neon Atom



Fluorine Atom



Helium Atom



Aluminium Atom



Potassium Atom



Argon Atom



Chlorine Atom



The term Valence shell refers to the OUTERMOST shell/energy level present for an atom. For each of the following elements determine how many electrons will be found on the valence shell of an atom of that element.

Magnesium =	Lithium =	Nitrogen =
Fluorine =	Sodium =	Phosphorus =
Helium =	Potassium =	Chlorine =

Worksheet 5 – The Periodic Table

1) There is a jagged line that runs from element #5 down to element #85 Astatine...this line separates the elements that are classified as metals from elements that are non-metals.

- If an element is found on the right hand side of the line it is a non-metal.
- If an element is found on the left hand side of the line it is a metal.

Name of Element	Symbol	Metal/Non-Metal?
Calcium		
Francium		
Chlorine		
Lead		
Carbon		
Tin		
Sulfur		

2) The elements in the periodic table are also classified into groups or periods.

- The vertical columns in the periodic table are called groups.
- The horizontal rows in the periodic table are called periods.
- Elements in the first vertical column on the left are said to belong to “group 1”
- Elements in the second vertical column on the left are said to belong to “group 2”
- There are ten columns in the middle of the periodic table collectively called **transition metals**, these vertical columns do not count as “groups”.
- The elements in the first horizontal row (Hydrogen and Helium only) make up the first period.
- The elements in the second horizontal row (from Lithium to Neon) make up the second period.

Name of Element	Symbol	Group	Period	Transition Metal?
Magnesium				
Phosphorus				
Lead				
Iron				
Aluminum				
Zinc				
Iodine				
Copper				
Beryllium				
Sulfur				

3) Each symbol (element) in the periodic table represents a particular type of atom that exists. The periodic table contains information about that atom.

- The number in the top left corner of each symbol is called the **Atomic Number**, the atomic number is equal to the number of protons in the nucleus of an atom.
- The larger number on the bottom of each symbol is called the **Mass Number**, the mass number is equal to the number of protons plus the number of neutron in the nucleus of an atom.
- The number of neutrons in an atom is equal to the mass number minus the atomic number.
- The number of electrons in an atom is always the same as the number of protons (i.e. the atomic number).

Name of Element	Symbol	Atomic Number	Mass Number	Number of protons in one atom.	Number of neutrons in one atom.	Number of electrons in one atom.	Metal or Non-Metal
Boron							
Silicon							
Potassium							
Nickel							
Mercury							
Manganese							
Silver							
Nitrogen							
Lithium							
Hydrogen							
Sulfur							
Magnesium							
Calcium							

Worksheet 6 – The Periodic Table II

PART A

Using your periodic table, complete the following tables.
(if your stuck have a look back at your “what does my periodic table tell me”
worksheet)

Name of Element	Symbol	Metal/Non-Metal?
Oxygen		
Chromium		
Phosphorus		
Nickel		
Silicon		
Tin		
Sulfur		

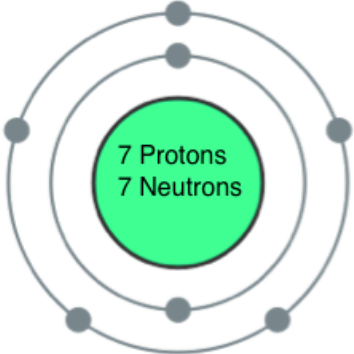
Name of Element	Symbol	Group	Period	Transition Metal?
Manganese				
Aluminium				
Beryllium				
Barium				
Lead				
Copper				
Fluorine				

Name of Element	Symbol	Atomic Number	Mass Number	Number of protons in one atom.	Number of neutrons in one atom.	Number of electrons in one atom.	Metal or Non-Metal
Magnesium							
Helium							
Nitrogen							
Boron							
Potassium							
Lithium							

* Something to remember...*in an atom the number of protons always equals the number of electrons...*that is why atoms are neutral.
(Have no overall charge). If they did have an overall charge we would refer to them as ions!

PART B

Using your periodic table to help you draw the following atoms like you did on worksheet 4, but this time state the number of neutrons in the nucleus too. (the first is done for you as an example)

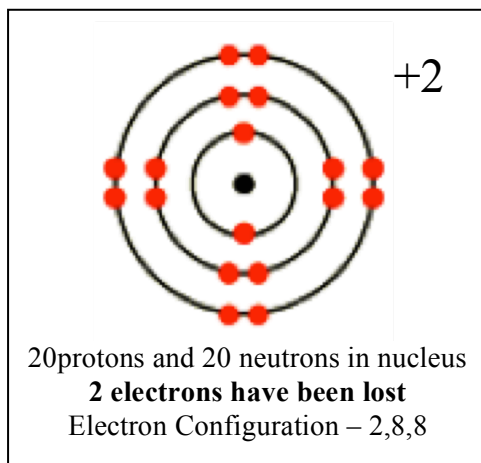
<p style="text-align: center;">Nitrogen Atom</p>  <p style="text-align: center;">Electron Configuration – 2,5</p> <p>The diagram shows a central green nucleus with the text '7 Protons' and '7 Neutrons'. It is surrounded by two concentric circles representing electron shells. The inner shell has two grey dots (electrons) and the outer shell has five grey dots.</p>	<p style="text-align: center;">Boron Atom</p>
<p style="text-align: center;">Magnesium Atom</p>	<p style="text-align: center;">Carbon Atom</p>
<p style="text-align: center;">Silicon Atom</p>	<p style="text-align: center;">Phosphorus Atom</p>

Worksheet 7 – Drawing Monoatomic Ions

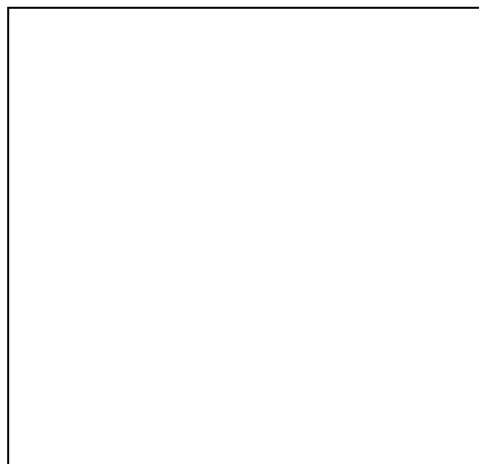
For each of the following ions...

- Draw the ion with the nucleus labeled and with correct electron energy levels
- State how many electrons have been lost or gained in order to make stable ion
- State what the charge will be for that ion. (The first is done for you)

Calcium Ion



Sodium Ion



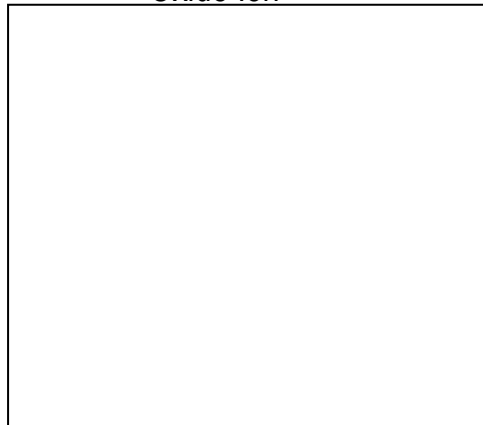
Sulfide Ion



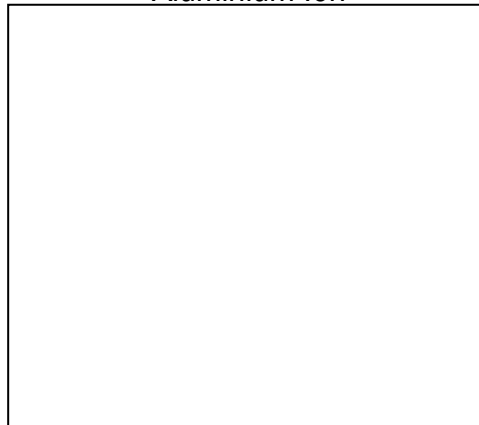
Potassium Ion



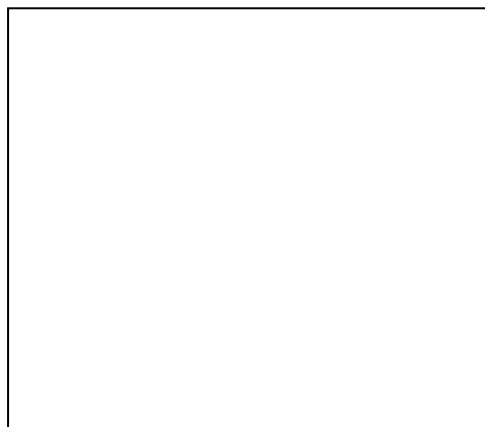
Oxide Ion



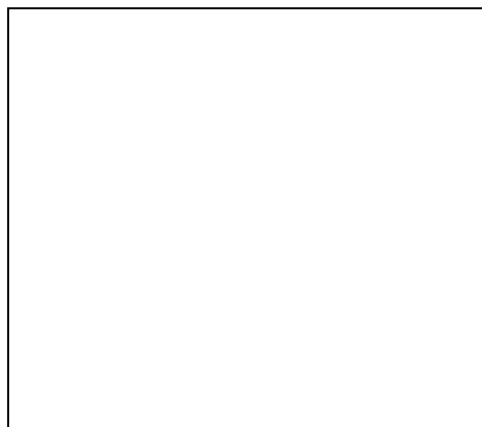
Aluminium Ion



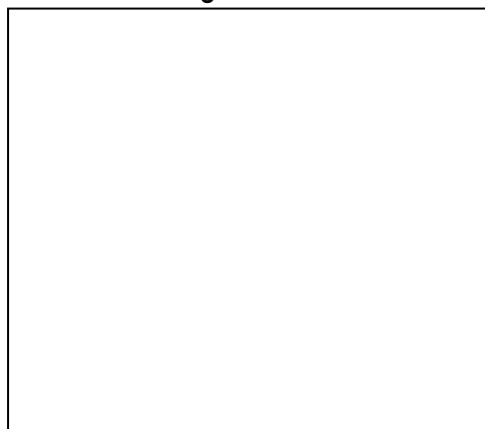
Chloride Ion



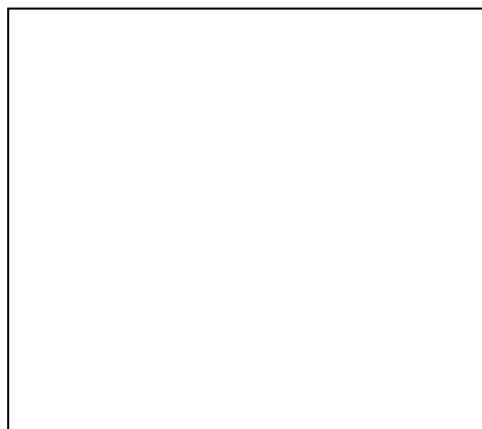
Phosphide Ion (Phosphorus)



Magnesium ion



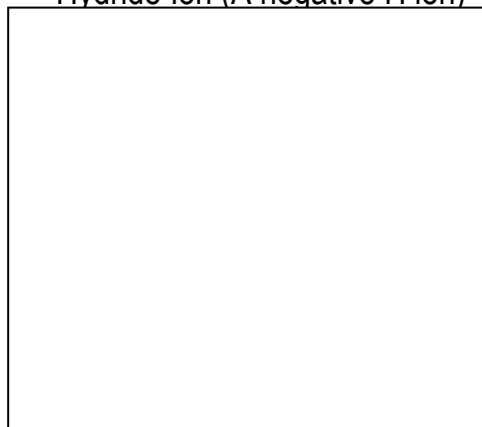
Lithium Ion



Hydrogen Ion



Hydride Ion (A negative H ion)



QUESTIONS

1. Why do atoms lose or gain electrons (i.e. why do atoms form ions)?

2. Below are the electron configurations for the first four elements of group 1; What conclusion can you make about the type of ion formed by all the elements in group one?

Hydrogen: 1
Lithium: 2, 1
Sodium: 2, 8, 1
Potassium: 2, 8, 8, 1

3. Below are the electron configurations for the first three elements of group 7; What conclusion can you make about the type of ion formed by all the elements in group seven?

Fluorine: 2, 7
Chlorine: 2, 8, 7
Bromine: 2, 8, 8, 17

4. Below are the electron configurations for the first three elements of group 6; What conclusion can you make about the type of ion formed by all the elements in group six?

Oxygen: 2, 6
Sulfur: 2, 8, 6
Selenium: 2, 8, 8, 16

5. In general metals form positive ions and non-metals form negative ions. Metal ions are easily named (e.g. Na^{1+} = sodium ion, Mg^{2+} = magnesium ion, Fe^{3+} = Iron (III) ion); non metal ions however have the “-ide” suffix added to the name to communicate more clearly that we are talking about an ion of that atom. (e.g. O^{2-} = Oxide ion (note Oxygen ion), F^{1-} = Fluoride ion). If an atom has more than one common ion (e.g. Fe^{2+} and Fe^{3+}) a roman numeral is used in the name to communicate the charge of the ion (Iron (II) and Iron (III)).

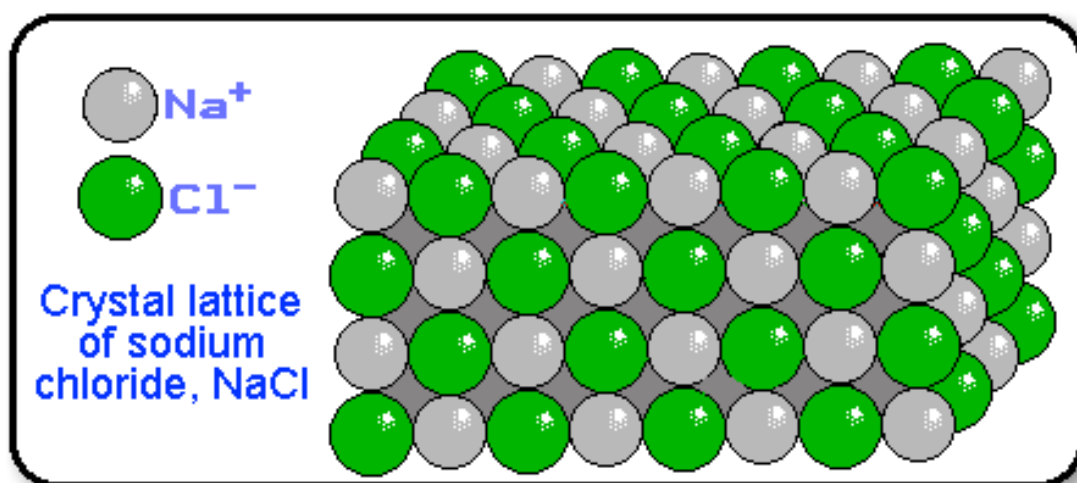
Have a go at naming the following monatomic ions...

Symbol	Name	Symbol	Name
S^{2-}		Al^{3+}	
Br^{1-}		Li^{1+}	
	Lead (IV)		Iodide ion
	Copper (II)		Nitride ion

6. What is the difference between a polyatomic ion (such as SO_4^{2-}) and a monatomic ion (such as S^{2-})? Give three examples of each.

7. It is said that "The number of valence electrons in an atom of an element is the most important factor in determining the chemical properties of the element." What do you think this means and why do you think it is so?

8. Is this statement true? All noble gases have 8 electrons in their valence shell. Explain your answer.



Ions to be familiar with

Monoatomic Ions(POSTIVE/METALS)

1+		2+		2+		3+	
Hydrogen	H ⁺	Cobalt (II)	Co ²⁺	Mercuric	Hg ²⁺	Aluminium	Al ³⁺
Lithium	Li ⁺	Magnesium	Mg ²⁺	Tin (II)	Sn ²⁺	Iron (III)	Fe ³⁺
Sodium	Na ⁺	Calcium	Ca ²⁺	Lead	Pb ²⁺	Chromium	Cr ³⁺
Potassium	K ⁺	Barium	Ba ²⁺	Strontium	Sr ²⁺	Gold (III)	Au ³⁺
Silver	Ag ⁺	Iron (II)	Fe ²⁺	Nickel	Ni ²⁺		
Copper (I)	Cu ⁺	Manganese	Mn ²⁺	Zinc	Zn ²⁺	4+	
Gold (I)	Au ⁺	Copper (II)	Cu ²⁺			Tin (IV)	Sn ⁴⁺

Monoatomic Ions(NEGATIVE/NON-METALS)


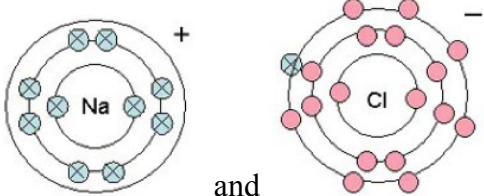
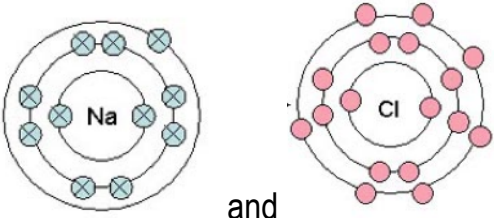

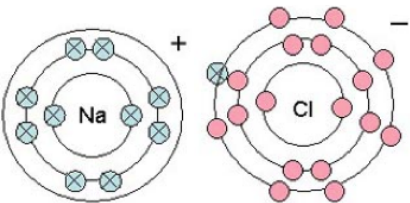
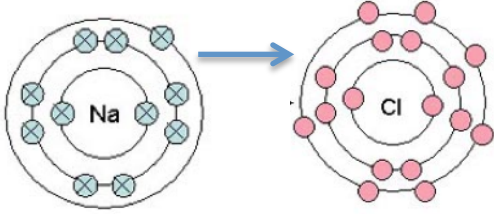
1-		2-		3-	
Hydride	H ¹⁻	Oxide	O ²⁻	Nitride	N ³⁻
Fluoride	F ¹⁻	Sulfide	S ²⁻		
Chloride	Cl ¹⁻				
Bromide	Br ¹⁻				
Iodide	I ¹⁻				

Polyatomic Ions (More than one atom combined)

1-		2-		3-	
Hydroxide	OH ¹⁻	Carbonate	CO ₃ ²⁻	Phosphate	PO ₄ ³⁻
Nitrate	NO ₃ ¹⁻	Sulfate	SO ₄ ²⁻		
Nitrite	NO ₂ ¹⁻	Sulfite	SO ₃ ²⁻		
Hydrogencarbonate	HCO ₃ ¹⁻				
Hydrogensulfate	HSO ₄ ¹⁻				
Ethanoate	CH ₃ COO ¹⁻				
Permangante	MnO ₄ ¹⁻			POSITIVE IONS	
Chlorate	ClO ₃ ¹⁻			Ammonium	NH ₄ ¹⁺

Worksheet 8 – Forming Ionic Compounds

Below you will see a number of the steps involved in the formation of an ionic compound. They are out of order. Place them in the correct order using the table at the bottom of the page.

<p>1. Once the lattice is formed, a small crystal is sprinkled on some chips and eaten.</p> 	<p>2. Now the atoms have become charged ions. (The +1 sodium ion and the -1 chloride ion)</p> 
<p>3. Neutral atoms are combined in a reaction vessel.</p> 	<p>4. Multiple Na⁺ ions and Cl⁻ ions are attracted to each other forming a lattice structure.</p>  <p style="text-align: center; font-size: small;">NaCl crystal</p>
<p>5. These oppositely charged ions are attracted to each other and form an ionic bond</p> 	<p>6. One electron is completely transferred from the sodium atom to the chlorine atom</p> 

The Correct Order of Events...

	→		→		→		→		→	
--	---	--	---	--	---	--	---	--	---	--

Worksheet 9 – Writing Formula for Ionic Compounds

From the name given determine the chemical formula...(follow the steps)

1. Identify the relevant ions from the name using your ions sheet.
2. Check if the charges of each of the ions balance if so...you only need one of each.
3. If the charges do not balance...add an ion, one at a time until the charges balance.
4. Once the charges are balance write the formula.
 - a. If it's a polyatomic ion you will need brackets...
 - b. If you have one of a particular ion you do not need to write the number "1"

<p>Example: Iron(III) Chloride</p> <p>Identify the ions...</p> <p>Do they balance? _____</p> <p>Keep adding ions until they balance.</p> <p>Formula = _____</p>	<p>Example: Iron(II) Nitrate</p> <p>Identify the ions...</p> <p>Do they balance? _____</p> <p>Keep adding ions until they balance.</p> <p>Formula = _____</p>
<p>Example: Copper(II) Sulphate</p> <p>Identify the ions...</p> <p>Do they balance? _____</p> <p>Keep adding ions until they balance.</p> <p>Formula = _____</p>	<p>Example: Chromium Sulfide</p> <p>Identify the ions...</p> <p>Do they balance? _____</p> <p>Keep adding ions until they balance.</p> <p>Formula = _____</p>

<p>Example: Silver Phosphate</p> <p>Identify the ions...</p> <p>Do they balance? _____</p> <p>Keep adding ions until they balance.</p> <p>Formula = _____</p>	<p>Example: Iron(III) Sulfate</p> <p>Identify the ions...</p> <p>Do they balance? _____</p> <p>Keep adding ions until they balance.</p> <p>Formula = _____</p>
<p>Example: Aluminium Hydroxide</p> <p>Identify the ions...</p> <p>Do they balance? _____</p> <p>Keep adding ions until they balance.</p> <p>Formula = _____</p>	<p>Example: Zinc Nitrate</p> <p>Identify the ions...</p> <p>Do they balance? _____</p> <p>Keep adding ions until they balance.</p> <p>Formula = _____</p>
<p>Barium Nitrate</p>	<p>Copper(II) Hydroxide</p>
<p>Calcium Phosphate</p>	<p>Aluminium Hydrogencarbonate</p>

Potassium Permanganate	Potassium Nitrite
Lead Nitrate	Silver Chloride
Sulfuric Acid (a.k.a. Hydrogen Sulfate)	Nitric Acid (a.k.a. Hydrogen Nitrate)
Ammonium Carbonate	Magnesium Sulfate
Nickel Chloride	Lead Iodide
Sodium Sulfite	Potassium Chlorate
Iron (III) Carbonate	Silver Oxide
Manganese Phosphate	Nickel Hydroxide
Barium Nitride	Calcium Iodide

Worksheet 10 - Writing Ionic Formula II

Complete the following table using your ions chart.

Name	Positive Ion (Cation)	Negative ion (Anion)	Formula
Hydrogen Chloride			
Copper (II) Nitrate			
Aluminium Sulphite			
Barium Oxide			
Manganese Phosphate			
Calcium Permanganate			
Silver Carbonate			
Zinc Sulfate			
Ammonium Chloride			
Lithium Hydride			
Cobalt Nitrite			
Strontium Hydroxide			
Sodium Ethanoate			
Iron (III) Hydroxide			
Aluminium Sulfate			
Iron(II) Nitrate			
Chromium Carbonate			
Sodium Carbonate			
Magnesium Hydroxide			
Magnesium Bromide			
Cobalt (II) Phosphate			
Zinc Hydride			
Potassium Permanganate			

Worksheet 11 – Writing Ionic Formula III

Complete the following monoatomic Ionic Formulas Table

IONS	Chloride	Oxide	Iodide	Nitride	Sulfide	Fluoride
Sodium						
Calcium						
Chromium						
Zinc						
Ammonium						

Using the ions chart state the name of the following ionic compounds.

Name	Chemical Formula
	ZnO
	Na ₂ SO ₄
	Ni(OH) ₂
	K ₃ PO ₄
	FeCl ₃
	Ba(NO ₃) ₂
	CaF ₂
	CuCO ₃
	Al ₂ (SO ₃) ₃
	KClO ₃
	(NH ₄) ₂ SO ₄
	PbI ₂
	Fe ₃ (PO ₄) ₂

Complete the following Polyatomic Ionic Formulas Table

IONS	nitrate	sulfate	carbonate	phosphate	hydroxide	chlorate
sodium						
calcium						
Chromium						
zinc						
silver						
ammonium						
lead(II)						
aluminum						
copper (II)						
iron (III)						
lead (IV)						
potassium						
barium						

Worksheet 12 – Writing Ionic Formula IV

Complete the following table using your ions sheet

CATION	ANION	FORMULA OF COMPOUND	NAME OF COMPOUND
Magnesium Mg^{2+}	Nitrate NO_3^-	$Mg(NO_3)_2$	Magnesium Nitrate
Aluminum	Chloride		
Iron (II)	Hydroxide		
Iron (II)	Nitrate		
Sodium	Sulfate		
Potassium	Phosphate		
Ammonium	Oxide		
Magnesium	Sulfide		
Iron (II)	Sulfate		
Iron (III)	Sulfate		
Potassium	Nitrate		
Aluminum	Sulfate		
Ammonium	Chloride		
Iron (II)	Sulfide		
Magnesium	Chloride		
Sodium	Phosphate		

Cobalt (II)	Oxide		
Magnesium	Phosphate		
Silver	Sulfate		
Potassium	Sulfide		
Iron (II)	Chlorate		
Manganese	Nitrate		
Copper (II)	Hydroxide		
Aluminium	Carbonate		
Calcium	Iodide		
Ammonium	Phosphate		
Iron (III)	Sulfite		
Manganese	Bromide		
Nickel	Chloride		
Chromium	Carbonate		

Worksheet 18 - Balancing Chemical Equations I

- 1) $\underline{\quad} \text{N}_2 + \underline{\quad} \text{H}_2 \rightarrow \underline{\quad} \text{NH}_3$
- 2) $\underline{\quad} \text{KClO}_3 \rightarrow \underline{\quad} \text{KCl} + \underline{\quad} \text{O}_2$
- 3) $\underline{\quad} \text{NaCl} + \underline{\quad} \text{F}_2 \rightarrow \underline{\quad} \text{NaF} + \underline{\quad} \text{Cl}_2$
- 4) $\underline{\quad} \text{H}_2 + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{H}_2\text{O}$
- 5) $\underline{\quad} \text{Pb(OH)}_2 + \underline{\quad} \text{HCl} \rightarrow \underline{\quad} \text{H}_2\text{O} + \underline{\quad} \text{PbCl}_2$
- 6) $\underline{\quad} \text{AlBr}_3 + \underline{\quad} \text{K}_2\text{SO}_4 \rightarrow \underline{\quad} \text{KBr} + \underline{\quad} \text{Al}_2(\text{SO}_4)_3$
- 7) $\underline{\quad} \text{CH}_4 + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{CO}_2 + \underline{\quad} \text{H}_2\text{O}$
- 8) $\underline{\quad} \text{C}_3\text{H}_8 + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{CO}_2 + \underline{\quad} \text{H}_2\text{O}$
- 9) $\underline{\quad} \text{C}_8\text{H}_{18} + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{CO}_2 + \underline{\quad} \text{H}_2\text{O}$
- 10) $\underline{\quad} \text{FeCl}_3 + \underline{\quad} \text{NaOH} \rightarrow \underline{\quad} \text{Fe(OH)}_3 + \underline{\quad} \text{NaCl}$
- 11) $\underline{\quad} \text{P} + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{P}_2\text{O}_5$
- 12) $\underline{\quad} \text{Na} + \underline{\quad} \text{H}_2\text{O} \rightarrow \underline{\quad} \text{NaOH} + \underline{\quad} \text{H}_2$
- 13) $\underline{\quad} \text{Ag}_2\text{O} \rightarrow \underline{\quad} \text{Ag} + \underline{\quad} \text{O}_2$
- 14) $\underline{\quad} \text{S}_8 + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{SO}_3$
- 15) $\underline{\quad} \text{CO}_2 + \underline{\quad} \text{H}_2\text{O} \rightarrow \underline{\quad} \text{C}_6\text{H}_{12}\text{O}_6 + \underline{\quad} \text{O}_2$
- 16) $\underline{\quad} \text{K} + \underline{\quad} \text{MgBr} \rightarrow \underline{\quad} \text{KBr} + \underline{\quad} \text{Mg}$
- 17) $\underline{\quad} \text{HCl} + \underline{\quad} \text{CaCO}_3 \rightarrow \underline{\quad} \text{CaCl}_2 + \underline{\quad} \text{H}_2\text{O} + \underline{\quad} \text{CO}_2$
- 18) $\underline{\quad} \text{HNO}_3 + \underline{\quad} \text{NaHCO}_3 \rightarrow \underline{\quad} \text{NaNO}_3 + \underline{\quad} \text{H}_2\text{O} + \underline{\quad} \text{CO}_2$
- 19) $\underline{\quad} \text{H}_2\text{O} + \underline{\quad} \text{O}_2 \rightarrow \underline{\quad} \text{H}_2\text{O}_2$
- 20) $\underline{\quad} \text{NaBr} + \underline{\quad} \text{CaF}_2 \rightarrow \underline{\quad} \text{NaF} + \underline{\quad} \text{CaBr}_2$
- 21) $\underline{\quad} \text{H}_2\text{SO}_4 + \underline{\quad} \text{NaNO}_2 \rightarrow \underline{\quad} \text{HNO}_2 + \underline{\quad} \text{Na}_2\text{SO}_4$

Worksheet 19 - Balancing Chemical Equations II

Part 1

- 1) ____ Na_3PO_4 + ____ KOH \rightarrow ____ NaOH + ____ K_3PO_4
- 2) ____ MgF_2 + ____ Li_2CO_3 \rightarrow ____ MgCO_3 + ____ LiF
- 3) ____ P_4 + ____ O_2 \rightarrow ____ P_2O_3
- 4) ____ RbNO_3 + ____ BeF_2 \rightarrow ____ $\text{Be}(\text{NO}_3)_2$ + ____ RbF
- 5) ____ AgNO_3 + ____ Cu \rightarrow ____ $\text{Cu}(\text{NO}_3)_2$ + ____ Ag
- 6) ____ CF_4 + ____ Br_2 \rightarrow ____ CBr_4 + ____ F_2
- 7) ____ HCN + ____ CuSO_4 \rightarrow ____ H_2SO_4 + ____ $\text{Cu}(\text{CN})_2$
- 8) ____ GaF_3 + ____ Cs \rightarrow ____ CsF + ____ Ga
- 9) ____ BaS + ____ PtF_2 \rightarrow ____ BaF_2 + ____ PtS
- 10) ____ N_2 + ____ H_2 \rightarrow ____ NH_3
- 11) ____ NaF + ____ Br_2 \rightarrow ____ NaBr + ____ F_2
- 12) ____ $\text{Pb}(\text{OH})_2$ + ____ HCl \rightarrow ____ H_2O + ____ PbCl_2
- 13) ____ AlBr_3 + ____ K_2SO_4 \rightarrow ____ KBr + ____ $\text{Al}_2(\text{SO}_4)_3$
- 14) ____ CH_4 + ____ O_2 \rightarrow ____ CO_2 + ____ H_2O
- 15) ____ Na_3PO_4 + ____ CaCl_2 \rightarrow ____ NaCl + ____ $\text{Ca}_3(\text{PO}_4)_2$
- 16) ____ K + ____ Cl_2 \rightarrow ____ KCl
- 17) ____ Al + ____ HCl \rightarrow ____ H_2 + ____ AlCl_3
- 18) ____ N_2 + ____ F_2 \rightarrow ____ NF_3
- 19) ____ SO_2 + ____ Li_2Se \rightarrow ____ SSe_2 + ____ Li_2O
- 20) ____ NH_3 + ____ H_2SO_4 \rightarrow ____ $(\text{NH}_4)_2\text{SO}_4$

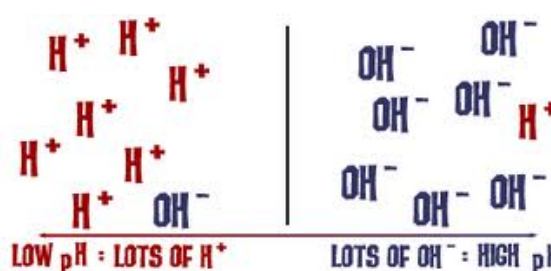
Part 2

- 1) $\text{___ C}_3\text{H}_8 + \text{___ O}_2 \rightarrow \text{___ CO}_2 + \text{___ H}_2\text{O}$
- 2) $\text{___ Al} + \text{___ Fe}_3\text{N}_2 \rightarrow \text{___ AlN} + \text{___ Fe}$
- 3) $\text{___ Na} + \text{___ Cl}_2 \rightarrow \text{___ NaCl}$
- 4) $\text{___ H}_2\text{O}_2 \rightarrow \text{___ H}_2\text{O} + \text{___ O}_2$
- 5) $\text{___ C}_6\text{H}_{12}\text{O}_6 + \text{___ O}_2 \rightarrow \text{___ H}_2\text{O} + \text{___ CO}_2$
- 6) $\text{___ H}_2\text{O} + \text{___ CO}_2 \rightarrow \text{___ C}_7\text{H}_8 + \text{___ O}_2$
- 7) $\text{___ NaClO}_3 \rightarrow \text{___ NaCl} + \text{___ O}_2$
- 8) $\text{___ (NH}_4\text{)}_3\text{PO}_4 + \text{___ Pb(NO}_3\text{)}_4 \rightarrow \text{___ Pb}_3\text{(PO}_4\text{)}_4 + \text{___ NH}_4\text{NO}_3$
- 9) $\text{___ BF}_3 + \text{___ Li}_2\text{SO}_3 \rightarrow \text{___ B}_2\text{(SO}_3\text{)}_3 + \text{___ LiF}$
- 10) $\text{___ C}_7\text{H}_{17} + \text{___ O}_2 \rightarrow \text{___ CO}_2 + \text{___ H}_2\text{O}$
- 11) $\text{___ CaCO}_3 + \text{___ H}_3\text{PO}_4 \rightarrow \text{___ Ca}_3\text{(PO}_4\text{)}_2 + \text{___ H}_2\text{CO}_3$
- 12) $\text{___ Ag}_2\text{S} \rightarrow \text{___ Ag} + \text{___ S}_8$
- 13) $\text{___ KBr} + \text{___ Fe(OH)}_3 \rightarrow \text{___ KOH} + \text{___ FeBr}_3$
- 14) $\text{___ KNO}_3 + \text{___ H}_2\text{CO}_3 \rightarrow \text{___ K}_2\text{CO}_3 + \text{___ HNO}_3$
- 15) $\text{___ Pb(OH)}_4 + \text{___ Cu}_2\text{O} \rightarrow \text{___ PbO}_2 + \text{___ CuOH}$
- 16) $\text{___ Cr(NO}_2\text{)}_2 + \text{___ (NH}_4\text{)}_2\text{SO}_4 \rightarrow \text{___ CrSO}_4 + \text{___ NH}_4\text{NO}_2$
- 17) $\text{___ KOH} + \text{___ Co}_3\text{(PO}_4\text{)}_2 \rightarrow \text{___ K}_3\text{PO}_4 + \text{___ Co(OH)}_2$
- 18) $\text{___ Sn(NO}_2\text{)}_4 + \text{___ Pt}_3\text{N}_4 \rightarrow \text{___ Sn}_3\text{N}_4 + \text{___ Pt(NO}_2\text{)}_4$
- 19) $\text{___ B}_2\text{Br}_6 + \text{___ HNO}_3 \rightarrow \text{___ B(NO}_3\text{)}_3 + \text{___ HBr}$
- 20) $\text{___ ZnS} + \text{___ AlP} \rightarrow \text{___ Zn}_3\text{P}_2 + \text{___ Al}_2\text{S}_3$

Worksheet 20 – Properties of Acids and Bases

Question 1 – What is an acid? Give three examples.

Question 2 – The pH scale is a scale from 0-14 that shows the hydrogen ion concentration in water. Using the diagram provided answer the following questions.



- a) What would you say about the hydrogen ion concentration in a solution that is highly acidic? _____
- b) A solution with a high pH, for example 13, has a _____ concentration of hydrogen ions.
- c) An alkaline solution has a high concentration of _____ ions and.
- d) When the alkaline substance ammonia is dissolved in water the _____ ion concentration increases, and the pH goes _____.
- e) When an acidic substance like sulfur trioxide is dissolved in water the _____ ion concentration increases, and the pH goes _____.
- f) What would you conclude about the H⁺ and OH⁻ concentration in pure water? (Which has a pH of 7)
- _____

Question 3 – State the three properties of acidic substances.

- _____
- _____
- _____

Question 4 –fill in the missing words using the words in the box below.

Drains, Battery, Soaps, Ulcer, Burn,
Chlorine, Nutrients, Reactions, Water, Grease

- If substances are too acidic or too basic they will _____ you or corrode objects.
- When you have an _____, a whole in your stomach lining, the acid in your stomach eats into your flesh and it hurts.
- The swimming pool must be the correct level of acidity to enable the _____ to work properly and prevent algae growth.
- Shampoo and _____ must be the correct pH to prevent skin problems.
- Different plants need the soil to be different levels of acidity to absorb _____ , some plants like basic soil others acidic.
- _____ in fish tanks must be kept at a pH that mirrors their natural environment.
eg Fish from the Amazon River in South America like a pH of 6.5 , African fish pH of 8.2.
- Cleaning products are often basic and react with the _____ as they clean it.
- Drano is used to unblock _____, it is very basic and will burn your skin.
- Many chemical _____ need to be either acidic or basic in order to work.
- An alkaline _____ means the reaction occurs in basic conditions.

Question 5 – What is an acid/base indicator and what is it used for?

Question 6 – Lactic acid is a substance that is produced in your muscles during exercise. What evidence can you think of that shows lactic acid is in fact an acidic substance?

Acid + Base Reaction

1. Potassium Oxide + Nitric Acid →

2. Iron(III) Oxide + Sulphuric Acid →

3. Copper(II) Oxide + Phosphoric Acid →

4. Sodium Oxide + Sulfuric Acid →

5. Calcium Oxide + Phosphoric Acid →

6. Zinc Hydroxide + Hydrochloric Acid →

7. Potassium Hydroxide + Nitric Acid →

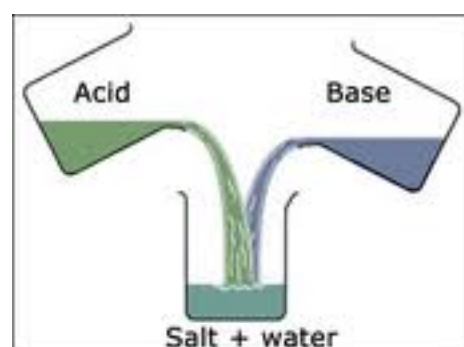
8. Iron(III) Hydroxide + Sulphuric Acid →

9. Aluminium Hydroxide + Hydrochloric Acid →

10. Barium Hydroxide + Carbonic Acid →

11. Copper(II) Hydroxide + Phosphoric Acid →

12. Magnesium Hydroxide + Nitric Acid →



Acid + Metal Carbonate Reaction

1. Zinc Carbonate + Hydrochloric Acid \rightarrow Zinc Chloride + Water + Carbon dioxide

2. Sodium Carbonate + Sulphuric Acid \rightarrow

3. Iron(III) Carbonate + Carbonic Acid \rightarrow

4. Calcium Carbonate + Nitric Acid \rightarrow

5. Magnesium Carbonate + Hydrochloric Acid \rightarrow

6. Magnesium Carbonate + Phosphoric Acid \rightarrow

7. Aluminum Carbonate + Sulfuric Acid \rightarrow



Worksheet 22 – Reactions involving Acids II

Write chemical equations and then balance the equations. (you will need your ions sheet to write balanced formula)

1. Nickel Hydrogencarbonate + Hydrochloric Acid \rightarrow Nickel Chloride + Carbon dioxide + Water

2. Copper Carbonate + Nitric Acid \rightarrow Copper Nitrate + Carbondioxide + Water

3. Magnesium + Phosphoric Acid \rightarrow Magnesium Phosphate + Hydrogen Gas

4. Sodium Hydroxide + Carbonic Acid \rightarrow Sodium Carbonate + Water

5. Barium Carbonate + Heat \rightarrow Barium Oxide + Carbon dioxide

6. Sodium Oxide + Hydrochloric Acid \rightarrow Sodium Chloride + Water

7. Sodium Carbonate + Sulfuric Acid \rightarrow Sodium Sulfate + Water + Carbon dioxide

Acids You Need to know...

Phosphoric Acid – H_3PO_4

Nitric Acid – HNO_3

Sulphuric Acid – H_2SO_4

Carbonic Acid – H_2CO_3

Hydrochloric Acid - HCl

Predict the products for the following reactions, then write balanced chemical equations. (you will need the acids reactions sheet at the back of this booklet to help you predict the correct products)

Make sure you write balanced chemical formula before balancing the equation.

Acids You Need to know...

Phosphoric Acid – H_3PO_4

Nitric Acid – HNO_3

Sulphuric Acid – H_2SO_4

Carbonic Acid – H_2CO_3

Hydrochloric Acid - HCl

1. Chromium Oxide + Nitric Acid \rightarrow
2. Nickel Hydroxide + Hydrochloric \rightarrow
3. Magnesium + Carbonic Acid \rightarrow
4. Gold + Nitric Acid \rightarrow
5. Aluminium Carbonate + Phosphoric Acid \rightarrow
6. Copper Oxide + Phosphoric Acid \rightarrow

7. Potassium Carbonate + Heat →

8. Iron(II) Hydrogen carbonate + Hydrochloric Acid →

9. Ammonium Hydroxide + Nitric Acid →

10. Iron(III) carbonate + Hydrochloric Acid →

11. Magnesium Hydroxide + Hydrochloric Acid →

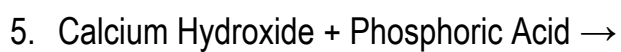
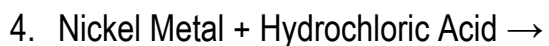
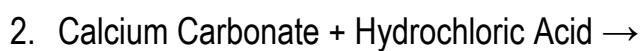
12. Barium Oxide + Phosphoric Acid →

13. Aluminium metal + Sulfuric Acid →

Worksheet 23 – Reactions involving Acids III

For each of the following reactions...

- a. Complete the general word equation. (*you will need to know your general equations*)
- b. Write the balanced chemical equation.



7. Iron(II) Hydroxide + Carbonic Acid →

8. Aluminium Oxide + Sulphuric Acid →

9. Aluminium Carbonate + Sulphuric Acid →

10. Chromium Hydroxide + Nitric Acid →

11. Copper metal + Hydrochloric Acid →

12. Aluminium Carbonate + Heat →

13. Aluminium Hydrogencarbonate + Sulfuric Acid →

14. Zinc Oxide + Phosphoric Acid

Table 1 – Element symbols to memorize

Metal Elements	Symbol		Non-Metal Elements		
lithium	Li		carbon	C	
sodium	Na		nitrogen	N	
magnesium	Mg		oxygen	O	
potassium	K		fluorine	F	
calcium	Ca		helium	He	
iron	Fe		neon	Ne	
nickel	Ni		argon	Ar	
copper	Cu		chlorine	Cl	
zinc	Zn		sulfur	S	
aluminium	Al		phosphorous	P	
silver	Ag		silicon	Si	
tin	Sn		bromine	Br	
gold	Au		iodine	I	
mercury	Hg		hydrogen	H	
lead	Pb				

Table 2 - Common molecules (non-metal substances) and their formula.

Name of Element	Formula of Molecule	Name of Molecular Compound	Formula of Molecular Compound
oxygen gas	O ₂	carbon dioxide	CO ₂
hydrogen gas	H ₂	water	H ₂ O
chlorine gas	Cl ₂	sulphur dioxide	SO ₂
nitrogen	N ₂	carbon monoxide	CO
bromine (liquid)	Br ₂	methane (natural gas)	CH ₄
sulphur (solid)	S ₈	sucrose	C ₁₂ H ₂₂ O ₁₁
		hydrogen chloride (dissolves in water to become hydrochloric acid)	HCl
		ammonia	NH ₃
		nitrogen dioxide	NO ₂
		sulfur trioxide	SO ₃
		ethanol	C ₂ H ₆ O or CH ₃ CH ₂ OH

Table 3 – Common Ions to be familiar with

Monoatomic Ions(POSTIVE/METALS)

1+		2+		2+		3+	
Hydrogen	H ⁺	Cobalt (II)	Co ²⁺	Mercuric	Hg ²⁺	Aluminium	Al ³⁺
Lithium	Li ⁺	Magnesium	Mg ²⁺	Tin (II)	Sn ²⁺	Iron (III)	Fe ³⁺
Sodium	Na ⁺	Calcium	Ca ²⁺	Lead	Pb ²⁺	Chromium	Cr ³⁺
Potassium	K ⁺	Barium	Ba ²⁺	Strontium	Sr ²⁺	Gold (III)	Au ³⁺
Silver	Ag ⁺	Iron (II)	Fe ²⁺	Nickel	Ni ²⁺		
Copper (I)	Cu ⁺	Manganese	Mn ²⁺	Zinc	Zn ²⁺	4+	
Gold (I)	Au ⁺	Copper (II)	Cu ²⁺			Tin (IV)	Sn ⁴⁺

Monoatomic Ions(NEGATIVE/NON-METALS)

1-		2-		3-	
Hydride	H ¹⁻	Oxide	O ²⁻	Nitride	N ³⁻
Fluoride	F ¹⁻	Sulfide	S ²⁻		
Chloride	Cl ¹⁻				
Bromide	Br ¹⁻				
Iodide	I ¹⁻				

Polyatomic Ions (More than one atom combined)

1-		2-		3-	
Hydroxide	OH ¹⁻	Carbonate	CO ₃ ²⁻	Phosphate	PO ₄ ³⁻
Nitrate	NO ₃ ¹⁻	Sulfate	SO ₄ ²⁻		
Nitrite	NO ₂ ¹⁻	Sulfite	SO ₃ ²⁻		
Hydrogencarbonate	HCO ₃ ¹⁻				
Hydrogensulfate	HSO ₄ ¹⁻				
Ethanoate	CH ₃ COO ¹⁻				
Permanganate	MnO ₄ ¹⁻			POSITIVE IONS	
Chlorate	ClO ₃ ¹⁻			Ammonium	NH ₄ ¹⁺

GENERAL REACTIONS AND CHEMICAL FORMULA

Reaction 1:



Reaction 2:



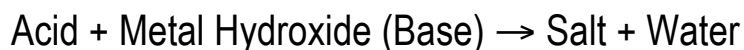
Reaction 3:



Reaction 4:



Reaction 5:



Reaction 6:



Hydrogen Gas = H_2

Carbon Dioxide = CO_2

Water = H_2O

Phosphoric Acid = H_3PO_4

Hydrochloric Acid = HCl

Sulphuric Acid = H_2SO_4

Nitric Acid = HNO_3

Carbonic Acid = H_2CO_3

