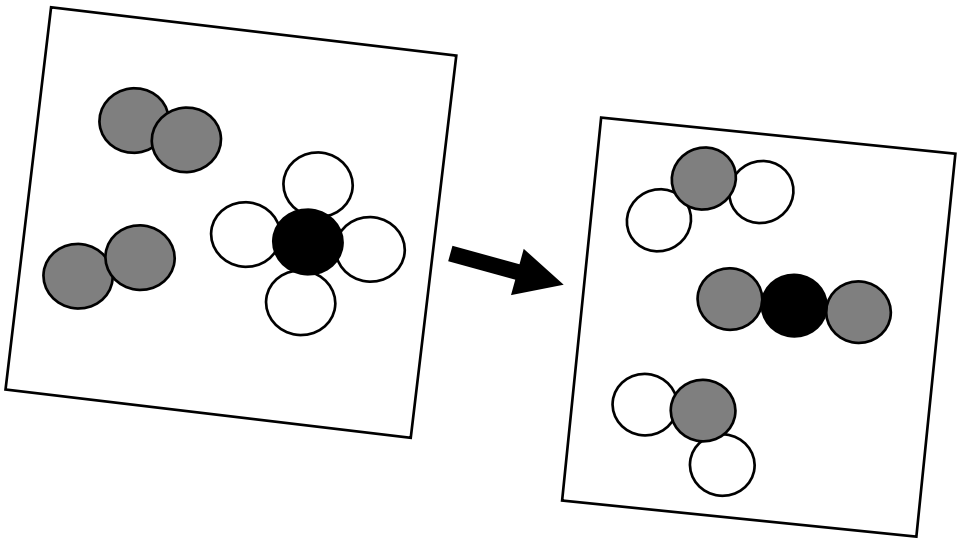
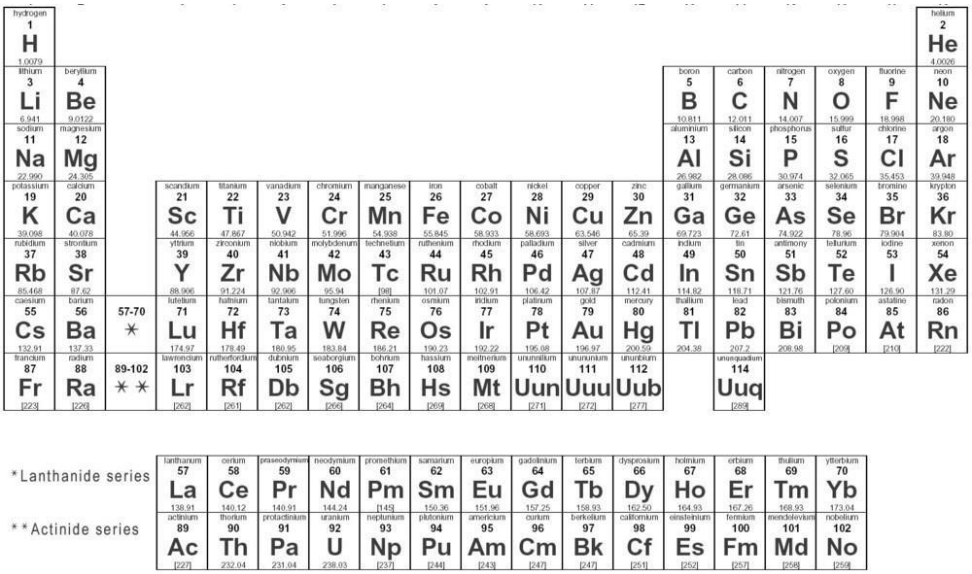


Grade 8 Natural Sciences

MATTER AND MATERIALS

Atoms, Elements and Compounds

Practice worksheets



Name: _____

Grade: _____

Contents: Matter and Materials

Subject: Science **-** Chemistry	**Year:** 8	**Term:** 2
Topic: Atoms, Elements and Compounds		
Module Overview: • Atoms • Elements • The periodic table and Mendeleev • Compounds and mixtures		

The Periodic Table of the Elements

1	2										3	4	5	6	7	0
																4 He helium 2
7 Li lithium 3	9 Be beryllium 4						1 H hydrogen 1				11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12										27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
86 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La * lanthanum 57	179 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac † actinium 89	[267] Rf rutherfordium 104	[268] Db dubnium 105	[271] Sg seaborgium 106	[272] Bh bohrium 107	[270] Hs hassium 108	[276] Mt meitnerium 109	[281] Ds darmstadtium 110	[280] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
symbol
name
atomic number

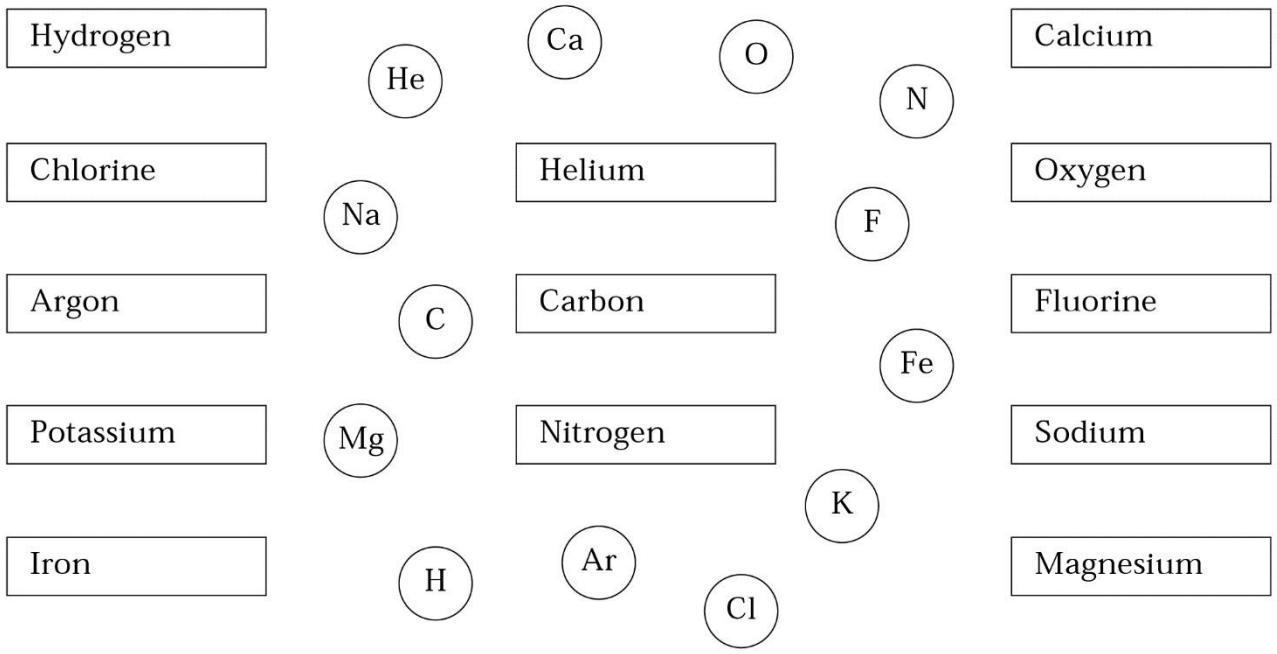
140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	[145] Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	231 Pa protactinium 91	238 U uranium 92	[237] Np neptunium 93	[244] Pu plutonium 94	[243] Am americium 95	[247] Cm curium 96	[247] Bk berkelium 97	[251] Cf californium 98	[252] Es einsteinium 99	[257] Fm fermium 100	[258] Md mendelevium 101	[259] No nobelium 102	[262] Lr lawrencium 103

* **58 – 71** Lanthanides

† **90 – 103** Actinides

Elementary Questions

Here are some names of some elements and their symbols.



1. Match the names to their correct symbols.
   You can either draw lines between them or colour code them.

2. After the name of each element write in whether it is a solid, a liquid or a gas. Do not write the full words just **(s)** for solid, **(l)** for liquid or **(g)** for gas.

3. Name all the elements above that are **metals**.

   _____

   _____

4. Name all the **non-metals** above **that are solids**.

   _____

5. Elements are sometimes named after the people who discovered them. Imagine you have just found a new element.

   a) What would you call it? _____

   b) What would its symbol be? _____

Elements and Compounds

1. Fill in the blanks by choosing the correct word or phrase from the brackets.
   Carbon, oxygen, iron and gold are all _____ (metals/elements/compounds).

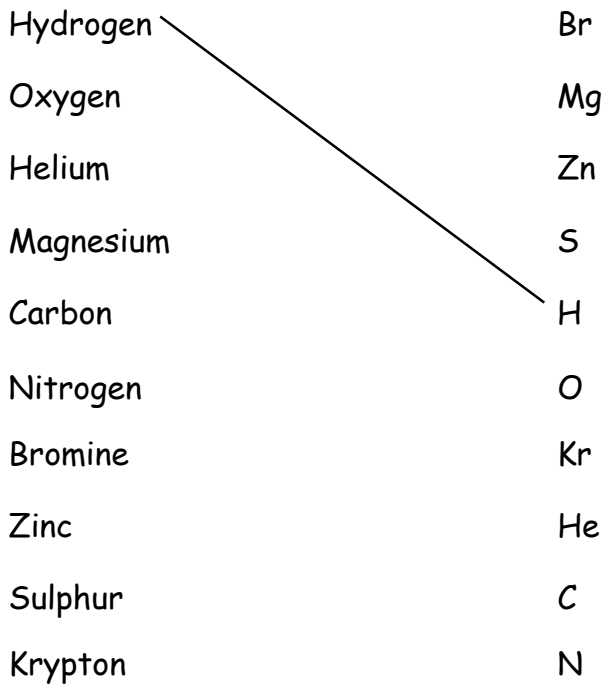
   a) Things which contain only one type of atom are called _____ (elements/compounds).

   b) Compounds always contain _____ (one/more than one) type of atom.

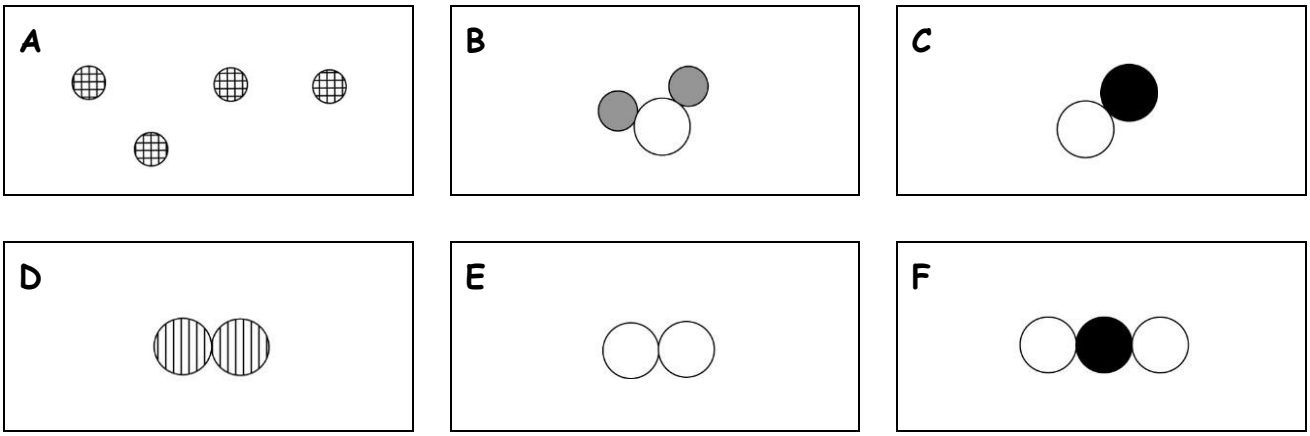
   c) The chemical name for common salt is sodium chloride. There are _____ (one/two/three) parts to the chemical name. This means it is _____ (an element/a compound).

   d) Water has the formula H_2O. There are two elements in water. Hydrogen is one and _____ (carbon/oxygen/nitrogen) is the other. Water is _____ (an element/a compound). The full chemical name for water is hydrogen _____ (chloride/oxide/sulphate). The formula tells us that water contains _____ (more/less) hydrogen than oxygen.

Draw lines to link up the elements with the correct chemical symbols. The first one has been done for you.



2. Look at the diagrams below.



e) Which boxes show particle diagrams of elements? _____

f) Which boxes show particle diagrams of compounds? _____

g) Helium does not react with anything at all. Atoms of helium do not join up with any other atoms. Which diagram best represents helium? _____

h) Oxygen gas is in the form of particles which have the formula O_2. Which two diagrams show this arrangement? _____

i) Carbon dioxide has the formula CO_2. Which diagram could represent carbon dioxide? _____

j) Hydrogen atoms are smaller than any others. Which diagram could represent water? _____ Explain your answer: _____

_____

k) Which of the following could be the name of the substance in box C? _____

nitrogen hydrogen chloride	carbon monoxide	sulphur dioxide
	krypton	

Explain your reasoning: _____

_____

Making Compounds

1. Write each of these chemicals in the correct column in the table:

carbon **nitrogen** **carbon dioxide** **hydrogen oxide (water)** **iron**

hydrogen **iron oxide (rust)** **copper** **sodium chloride (table salt)**

Elements	Compounds

2. Look at the five word equations below. Write the name of the correct product in each box. The first one has been done for you.

sodium + chlorine	➔	sodium chlor**ide**
magnesium + oxygen	➔	
iron + oxygen	➔	
iron + sulphur	➔	
copper + chlorine	➔	

3. Fill in the missing words to complete these word equations.

a) _____ + oxygen ➔ carbon dioxide

b) lead + oxygen ➔ _____ oxide

c) copper + oxygen ➔ copper _____

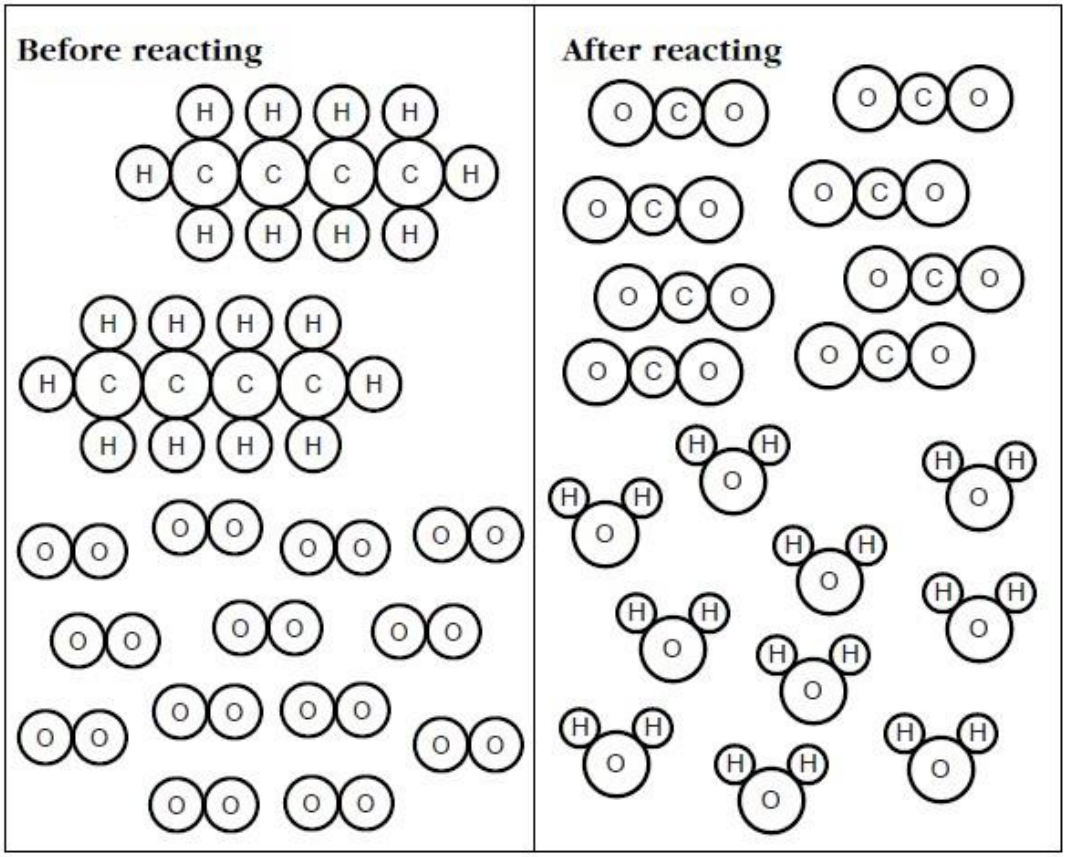
d) tin + _____ ➔ tin chloride

e) sodium + chlorine ➔ _____ _____

Keeping Tally

You are going to see what happens to the atoms in a chemical reaction. In this case the reaction when butane (camping gas) burns.

Look at the diagrams below.
Tick off and tally the number of each type of atom (carbon, hydrogen and oxygen) before and after the reaction.
Complete the sentence at the bottom to explain what has happened.



Tally chart – before reaction	
C	
H	
O	
Total	

Tally chart – after reaction	
C	
H	
O	
Total	

During the reaction the total number of atoms _____

_____ but they _____

_____

Chemical Compounds: Names and Formulae

The ***name*** of a chemical compound tells us what elements it is made from. The names of compounds usually have two parts.
The first part is often a metal element and the second part is always a non-metal with the ending changed:

- **Compounds made from** only **two elements** have the name ending is '**-ide**', for example magnesium ox**ide**.
- **Compounds made from three elements including oxygen** have the name ending '**-ate**', for example copper sulphate ($CuSO_4$). The '**-ate**' tells us the compound contains oxygen.

The ***formula*** of the compound tells us which elements are in the compound **and** the proportion of each element.

Tasks:

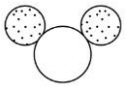
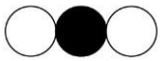
1. Fill in the blanks in the table below.

name of compound	chemical formula	number of elements in the compound	names of elements in the compound
water	H_2O	2	hydrogen, oxygen
Carbon dioxide	CO_2		
	NaCl		Sodium, chlorine
sodium nitrate	$NaNO_3$		
	FeS		
	$FeSO_4$		
	$CaCO_3$		

Sometimes more than one compound is made from the same elements. For example, there are several different types of nitrogen oxide. When this happens, the number of the type of atom that can be different is shown by using a prefix: '**mono**-' (one), '**di**-' (two) or '**tri**-' (three). For

example, the compound with the formula NO is called nitrogen monoxide and NO_2 is nitrogen dioxide. If there is only one version of the compound we don't need to use a prefix, for example magnesium oxide is always MgO so we don't need to add a prefix.

2. Complete the table.

Name	Particle diagram	Formula	Number of different elements in the compound	Number of atoms in each molecule
water		H_2O	2	3
carbon dioxide				
		SO_2		
		SO_3		
ammonia		NH_3		

When were the elements discovered?

1. Draw a **timeline**.
   You will need two sections:

   - Elements discovered **before 1600**.

   - **1600 to the present day** – this will need to be drawn to scale so that each section of the timeline represents the same number of years.

You could do this by hand or on the computer.

You may like to use A3 paper so that you have plenty of space to write the information onto your timeline – ask your teacher if you would like some.

2. Fit each element from the table on to the correct place on the timeline.
   For each element you should include:

   - The **name** of the element.

   - A **picture or illustration** of the element or to do with the element e.g. for calcium you might include a picture of teeth and bones because calcium is important for teeth and bones.
     An **interesting fact** about the element.

You should also include some **key events** that happened **in the world** during that time period in history to put the discoveries in context e.g. Queen Victoria came to the throne in 1837 and the Great Fire of London was in 1666.

Use information from the table and your own research.

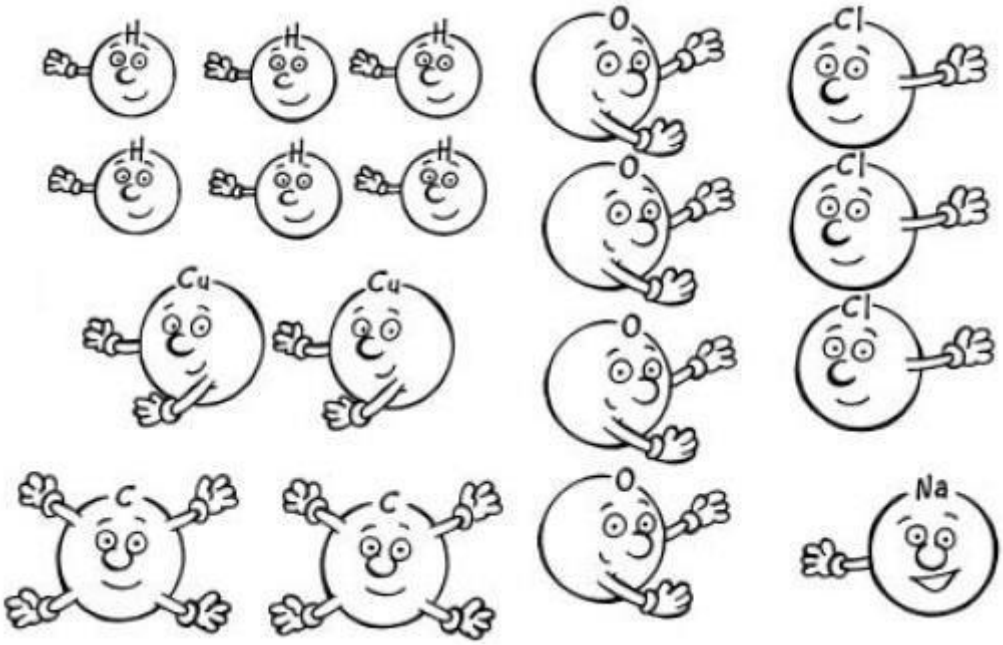
Name of element	Date of discovery	Notes
aluminium	1828	A common element today, which was expensive in Victorian times.
arsenic	1649	In Victorian times this was an ingredient in some medicines, though now we know it is poisonous!
boron	1808	One of the ingredients in Pyrex glass.
bromine	1826	A nasty, smelly, red liquid! The name comes from the Greek for 'stench'.
calcium	1808	An important element for your teeth and bones.
chlorine	1774	A poisonous green gas, used as a weapon in the First World War.
einsteinium	1952	A radioactive element, named after the famous scientist Albert Einstein.
cobalt	1735	The name comes from 'Kobald', the German for goblin.
helium	1895	An element that was discovered in the Sun. 'Helios' means sun in Greek.
hydrogen	1766	An explosive gas that used to be used in airships.
hafnium	1970	An element produced inside a nuclear reactor.
mercury	ancient (before 1600)	The only metal that is also a liquid – sometimes known as 'quicksilver'.
phosphorus	1669	A dangerous element which glows in the dark and bursts into flames easily.
radium	1898	It used to be painted on watch dials because it glows in the dark – but we now know it can be a cause of cancer.

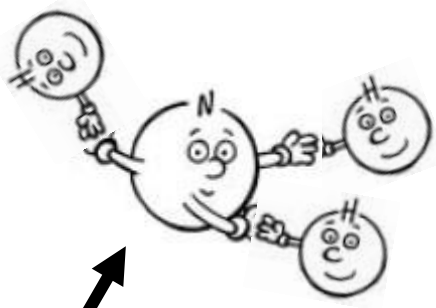
rhenium	1925	A metal with a melting point of over 3000 °C.
silver	ancient (before 1600)	Used for jewellery for thousands of years.
uranium	1789	The metal that was used in the first atomic bomb which was dropped in 1945.
tungsten	1783	The metal with the highest melting point of all – over 3400 °C.

: What's the Formula?

You are going to use the 'atom people' to help you work out the formulae of some chemical compounds.
Each 'atom person' must hold hands with one or more other 'atom people' so that they do not have any 'empty' hands.

1. *Cut out the 'atom people' carefully (you will need to use each one once).*
2. *For each compound, put the correct 'atom people' together so that they have no 'empty' hands. Once you're happy with all the molecules stick them in.*
3. *Work out the correct formula. See the example below.*



Compound	Elements it's made from	Diagram	Formula
ammonia	nitrogen, N hydrogen, H		NH_3

Nitrogen (N) has 3 hands but hydrogen (H) only has one. So, nitrogen has to hold hands with 3 hydrogen atoms so that no one has any 'empty' hands.

So, ammonia is made from one nitrogen atom and three hydrogen atom so the formula is NH_3.

What's the Formula? Continued – Stick your atom people here!

Compound	Elements it's made from	Diagram	Formula
water	hydrogen, H oxygen, O		
methane	carbon, C hydrogen, H		
sodium chloride (table salt)	sodium, Na chlorine, Cl		
copper oxide	copper, Cu oxygen, O		
carbon dioxide	carbon, C oxygen, O		
copper chloride	copper, Cu chlorine, Cl		

Task Sheet 10 (Gold Challenge):

The Impossible Compounds

Read the passage below, highlight the key words and facts then answer the questions.

Over 300 years ago Isaac Newton had shown that white light was a mixture of all the different colours of the rainbow. Scientists had developed this idea into the spectroscope, which allowed them to look in great detail at the spectrum of light from different sources. When some elements are heated they give off particular colours of light. One example is sodium; which gives the orange colour that you see in old street lights. These colours show up as lines in the spectrum. Each element has a different set of lines and the pattern of lines acts like a 'fingerprint' to identify the element.

In 1868, during an eclipse of the Sun, Pierre Janssen (1824–1907) found a line in the spectrum of sunlight that did not belong to any known element. He decided that this must be a new element. He named it helium after the Greek word for the Sun, 'helios'. Just over 100 years ago, in 1895, helium was discovered on Earth. It is found in tiny amounts in the atmosphere and also in natural gas. At about the same time a whole family of gases like helium was discovered: argon, neon, krypton and xenon. These gases shared one remarkable property which had made them so difficult to find; they did not do any chemical reactions at all! So they were known as the inert gases and scientists assumed that reactions of the inert gases were impossible.

In 1962, Neil Bartlett (born 1932) managed to do the impossible reactions. He was working with platinum hexafluoride, PtF_6, a gas which reacts very easily. Based on the reactions that he had done and his knowledge of the inert gases, he predicted that platinum hexafluoride would react with xenon. When he mixed the two gases together they reacted straight away and an orange solid was formed. He had made the first ever compound of xenon. Within a year other compounds had been made, including three different fluorides XeF_2, XeF_4 and XeF_6 and an oxide XeO_3. This was followed by the making of krypton difluoride KrF_2.

The gases do have a few reactions, so these days they are often known as the noble gases rather than the inert gases. In the same way that the 'nobles' didn't mix with the common people, the noble gases don't react much with the other elements. Helium, neon and argon

still have not been made to react with any other elements at all. These chemical reactions really *are* impossible ... or are they?

Questions:

1. In which year was helium discovered in the Sun? ……

2. How many **years later** was it that:

   a) helium was discovered on Earth? ……

   b) the first compound of xenon was made? ……

3. Why did it take so long to find the noble gases in the atmosphere on Earth?

   ……

   ……

4. For over 50 years, scientists didn't even bother trying to make any compounds of the noble gases. Why was this?

   ……

   ……

5. The gas argon is used to fill electric light bulbs. The tungsten wire inside the bulb gets very hot when the electricity is passed through it.

   a) What would happen inside a light bulb if it were filled with air?

   ……

   ……

   b) Why is argon a good gas to use?

   ……

   ……

6. The compound XeF_4 is called xenon tetrafluoride. What would the chemical names for XeF_2 and XeF_6 be?

   XeF_2: ……

   XeF_6: ……

7. From the passage, find an example of…

   a) a scientist making ***observations***:

   ……

   ……
   …

   b) a scientist drawing a ***conclusion***: ……

   ……
   …

   c) a scientist making a ***prediction***: ……

   ……
   …

Key Words Glossary

Atoms, Elements, Compounds and Mixtures:

atom	
element	
monatomic	
diatomic	
molecule	

group (on the Periodic Table)	
period (on the Periodic Table)	
(chemical) compound	
mixture	

Chemical Reactions:

chemical reaction	
reactant	
product	
word equation	
symbol equation	

conservation of mass	
electrolysis	

melting point	
boiling point	
density	
sonorous	