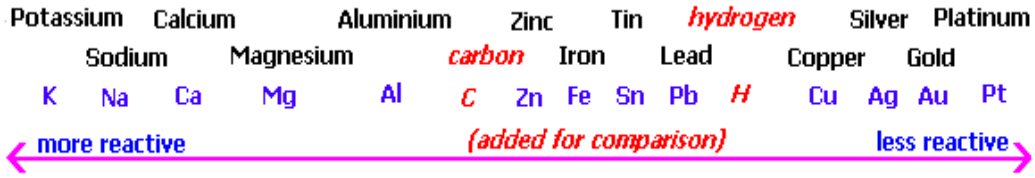
REVISION BOOKLET – 2nd 6week test year 10

<table>
<tr><th rowspan="2">Element</th><th colspan="3">Reaction of metal with:</th><th rowspan="2">symbol</th></tr>
<tr><th>water</th><th>dilute hydrochloric acid</th><th>air (when heated)</th></tr>
<tr><td>potassium</td><td rowspan="4">reacts with cold water</td><td rowspan="2">violent reaction</td><td rowspan="4">burns to form an oxide
but getting
less vigorous
↓</td><td>K</td></tr>
<tr><td>sodium</td><td>Na</td></tr>
<tr><td>calcium</td><td>Ca</td></tr>
<tr><td>magnesium</td><td rowspan="6">reacts, but getting
less vigorous
↓</td><td>Mg</td></tr>
<tr><td>aluminium</td><td>protected by oxide layer</td><td>Al</td></tr>
<tr><td>zinc</td><td rowspan="2">reacts with steam</td><td>Zn</td></tr>
<tr><td>iron</td><td rowspan="3">reacts slowly</td><td>Fe</td></tr>
<tr><td>tin</td><td rowspan="2">reacts slowly with steam</td><td>Sn</td></tr>
<tr><td>lead</td><td>Pb</td></tr>
<tr><td>copper</td><td rowspan="3">does not react with
water or steam</td><td rowspan="3">no reaction</td><td>Cu</td></tr>
<tr><td>silver</td><td rowspan="3">does not react with air</td><td>Ag</td></tr>
<tr><td>gold</td><td>Au</td></tr>
<tr><td>platinum</td><td>Pt</td></tr>
</table>

Metal + Oxygen reactions

Q		Answer
1	Sodium should be stored A in a dark bottle. B in an air-tight flask. C in paraffin oil. D in water.	.....
2	 Which element is **a metal that is most likely to be found in rocks as the metal itself**? A Copper B Sodium C Carbon D Iron E Magnesium	.....
3	*Complete the word equation :* **Metal + Oxygen ➔ _____** A hydrogen B metal hydroxide + hydrogen C metal chloride + water D metal oxide E metal oxide + hydrogen	.....
4	The group 1 element lithium reacts very quickly (it takes about 10 elephants) with oxygen when you slice it and open up a one of its shiny, silvery surfaces to the air. What does the compound formed look like ? A blue solid B dark grey liquid C white solid D almost black solid E red gas	.....
5	Which of these is the correct symbol equation for the reaction of group 2 element strontium with oxygen ? A $2Sr + O_2 \rightarrow SrO$ B $2Sr + O_2 \rightarrow 2SrO$ C $Sr + 2O_2 \rightarrow SrO$ D $2Sr + 2O_2 \rightarrow 2SrO$ E $Sr + O_2 \rightarrow 2SrO$	.....
6	Which of these shows the ***change*** to the electronic configuration of potassium (K = 19 electrons : 2,8,8,1) as it reacts with oxygen ? A K (2,8,8,1) ➔ K (2,8,8,3) B K (2,8,8,1) ➔ K (2,8,8,2) C K (2,8,8,1) ➔ K (2,8,8,1) D K (2,8,8,1) ➔ K (2,8,8) E K (2,8,8,1) ➔ K (2,8,7)	.....

7 ***Corrosion*** is a chemical reaction that involves

- A. The inside of the object changing from an element to a compound
- B. The surface of the object changing from an element to a compound
- C. Nothing happens
- D. The surface of the object changes from one element into another element
- E. The inside of the object changing from a compound to an element.

…….

8 ***Rusting*** is a special term, given to the corrosion of which metal.

- A. Zinc
- B. Copper
- C. Nickel
- D. Iron
- E. Magnesium

…….

9 The RAC noticed that cars rust faster when owned by people who live by the sea, compared with people who live inland. ***What is the main reason for this ?***

- A. The wind increases the concentration of oxygen at the seaside
- B. Seagull droppings are acidic
- C. Sea breezes make it cooler at the seaside
- D. Sea water spray is full of sodium and chloride ions
- E. Longer hours of sunshine at the seaside lead to increased rusting.

…….

10 Steel cars can be protected from rusting in a number of ways. Dipping steel in molten zinc, and letting it cool and harden is one way. The zinc can act as a protective coat that stops air and water getting to the steel.
Why would the steel not rust even if the zinc is scratched ?

- A. The zinc will fill in the scratch
- B. Zinc is less reactive than steel and will gain electrons more easily
- C. Zinc is more reactive than steel and will lose electrons more easily
- D. Zinc is more reactive than steel and will gain electrons more easily
- E. Zinc is less reactive than steel and will lose electrons more easily

…….

11] **Complete** these word equations

Barium + Oxygen ➔ ……

Magnesium + Oxygen ➔ ……

…….. + Oxygen ➔ Rubidium Oxide

Sodium + ……. ➔ Sodium Oxide

Zinc + Oxygen ➔ ……

12] **Balance** these symbol equations

Put in "BIG" numbers where they are needed, to make sure that you have the same number of each atom on the left of the arrow, as you have on the right of the arrow

a) ……..Ba + …….O_2 ➔ ……. BaO

b) ……..Cu + …….O_2 ➔ ……. CuO

c) ……..Ni + …….O_2 ➔ ……. NiO

d) ……..Na + …….O_2 ➔ ……. Na_2O

e) ……..K + …….O_2 ➔ ……. K_2O

f) ……..Li + …….O_2 ➔ ……. Li_2O

g) ……..Al + …….O_2 ➔ ……. Al_2O_3

h) ……..Fe + …….O_2 ➔ ……. Fe_2O_3

13] When you heat a square piece of copper metal in a blue Bunsen burner flame, the copper turns black.

a) what has the copper reacted with ?

……

bi) how has the mass of the copper changed ? *circle your answer*

decreased **stayed the same** **increased**

bii) explain you answer to 9bi.

……

……

……

c) when you scrape the surface of the copper with a metal spatula, it removes the black solid and you can see the original shiny, copper underneath.

i) have all of the copper atoms reacted ?

……

ii) why ?

……

……

……

iii) how would this reaction be different if you used powdered copper instead ?

……

……

e) Why do copper atoms react with oxygen ?

……

……

f) Which of these equations shows the oxidation of copper atoms by oxygen ?

i) $Cu + 2e \rightarrow Cu^{2+}$
ii) $Cu^{2+} + 2e \rightarrow Cu$
iii) $Cu \rightarrow Cu^{2+} + 2e$
iv) $Cu^{2+} + 2e \rightarrow Cu$

Metal + Water reactions

There are harder than metal + oxygen equations to write, but not many metals react with water……

metal + water ➔ metal hydroxide + hydrogen

Q	Answer

1 When the group1 metal **lithium** is placed in a bowl of water it fizzes around and seems to "disappear". Why can't you see it after the reaction has happened ?

A it's disappeared
B it's turned into a gas and mixed with air
C it's formed a soluble compound and dissolved
D it's become a clear liquid compound

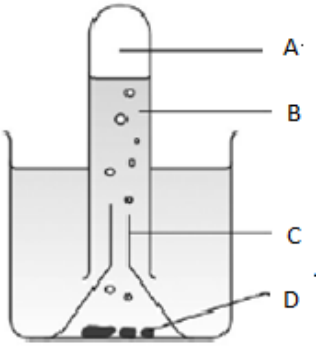
……

2 Which of the following metals can burn spontaneously (without any help) when put in water, giving a lilac coloured flame ?

A Magnesium
B Iron
C Calcium
D Sodium
E Potassium

……

3 Which label (A – D) shows where the gas collects as calcium reacts with water ?



……

4 Which of these metals would be best for making a container to hold hot water ?

A Iron
B Copper
C Magnesium
D Silver
E Calcium

……

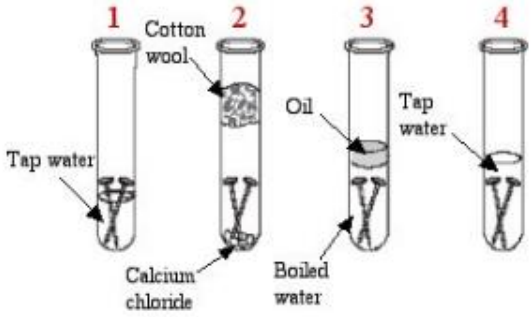
5 Which of the following combinations of state symbols is correct for the following reaction?

$2Na + 2H_2O \rightarrow 2NaOH + H_2$

A (s), (l), (aq), (g)
B (s), (aq), (s), (g)
C (l), (aq), (s), (l)
D (l), (l), (aq), (l)

……

6 In which tube (1 – 4) will the iron nail rust the fastest ?



……

7] ***Complete*** the following word equations:

Magnesium + Water ➔ …… + Hydrogen

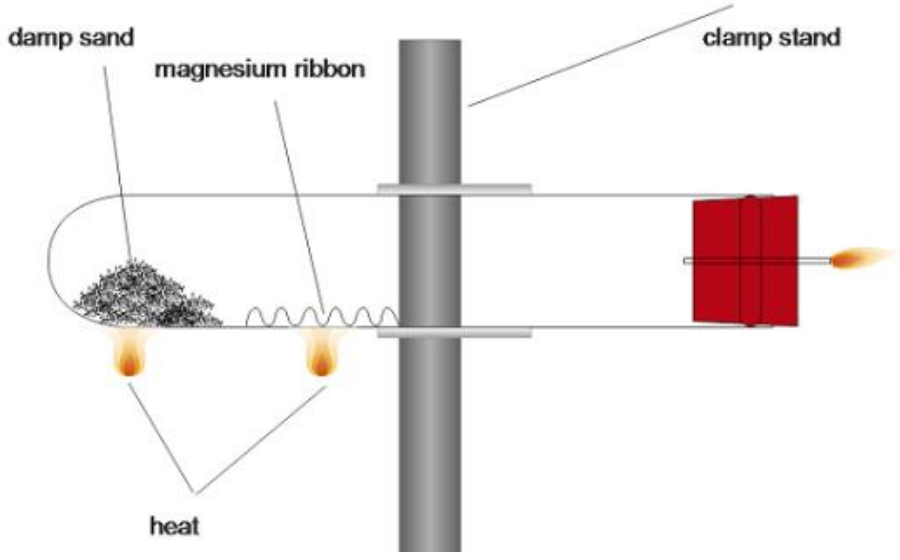
Calcium + Water ➔ …… + ……..……..

…… + Water ➔ Sodium Hydroxide + ……

Potassium + Water ➔ …… + ……

…… + Water ➔ Lithium Hydroxide + ……

8] This is how you might carry out the experiment to make sure that magnesium reacts with water fully.



a) What is the "***damp*** sand" used for ?

……

……

b) Why would you try to avoid heating the magnesium for too long ?

……

……

c) Why is there a flame appearing out of the tube that goes through the bung ?

……

……

d) How would this reaction be different if magnesium powder was used instead of magnesium ribbon ?

……

……

9] Write the formulae of these ***metal hydroxide*** compounds, given the charges on the ions that form them. *The first has been done for you as an example:*

+ ion	- ion	Formula of ionic compound formed
Sr^{2+}	**OH^-**	**$Sr(OH)_2$**
Li^+	OH^-	
Na^+	OH^-	
Be^{2+}	OH^-	
Zn^{2+}	OH^-	
Sn^{2+}	OH^-	
Pb^{2+}	OH^-	
Fe^{3+}	OH^-	
Al^{3+}	OH^-	

10] ***Balance*** these symbol equations, showing the reactions of metal elements with water

a) ……..Ba + ……H_2O ➔ ……. $Ba(OH)_2$ + ……H_2

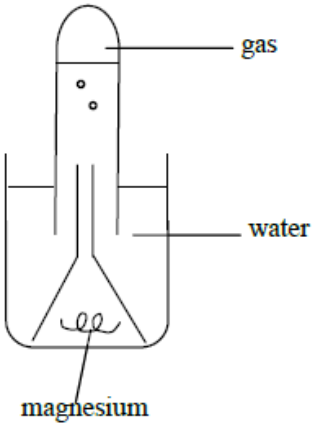
b) ……..Cu + ……H_2O ➔ ……. $Cu(OH)_2$ + ……H_2

c) ……..Ni + ……H_2O ➔ ……. $Ni(OH)_2$ + ……H_2

d) ……..Na + ……H_2O ➔ ……. NaOH + ……H_2

e) ……..K + ……H_2O ➔ ……. KOH + ……H_2

11] A white solid forms on the surface of the magnesium. What is its name ?



Answer = ……

12] The table below shows when some common metal elements were first discovered.

metal	date of discovery
potassium	1807
sodium	1807
magnesium	1755
zinc	1746
copper	known since ancient times

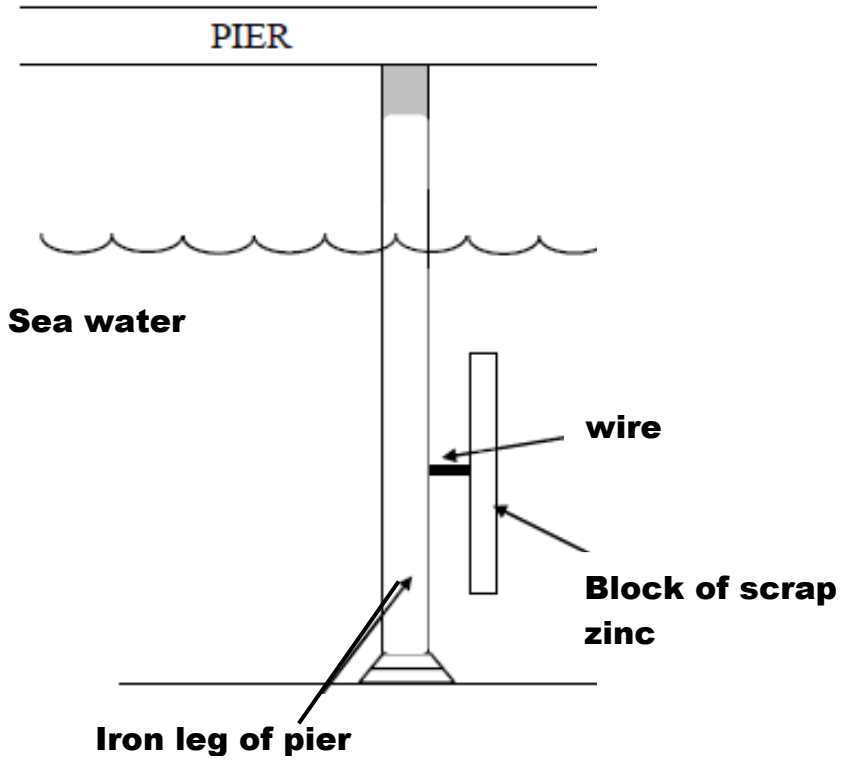
What is the pattern between reactivity and date of discovery ?

……

……

13]

Blackpool pier is made from an iron framework.
The iron legs stand in the sea.
Salt in sea water tends to speed up rusting.
The pier is protected from rusting by connecting blocks of scrap zinc metal to the iron legs of the pier.



a) Name 2 substances that are needed for the iron in the leg of the pier to corrode (rust) ?

_____

b) Describe how the metal iron ***looks different*** to the iron found in rust ?

_____

_____

c) Which corrodes first – iron or zinc ? ***Why ?***

_____

_____

d) Why will the zinc only protect the iron when the tide is in and the blocks are covered in sea water ?

_____

_____

_____

e) One of these statements is true, ***tick the correct one***:

i) The zinc is oxidised (losing electrons)
ii) The zinc is reduced (gaining electrons)
iii) The iron is oxidised (gaining electrons)
iv) The iron is reduced (losing electrons)

f) On the diagram at the start of the question, draw an arrow to show which direction electrons flow along the wire .

g) Predict what would happen if the zinc was replaced with copper metal.
Give a reason for your prediction.

Prediction :

_____

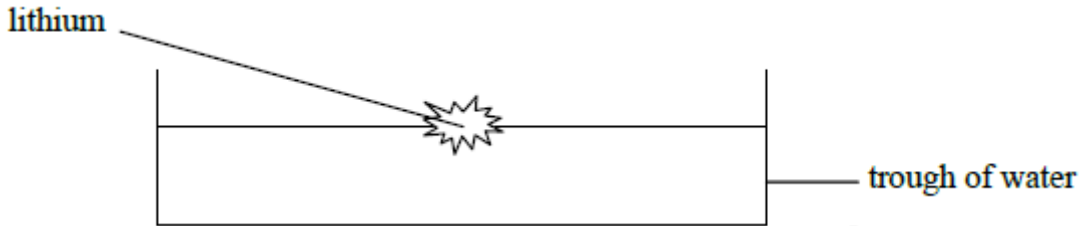
_____

Reason :

_____

_____

14] A small piece of lithium was placed in trough of water.



a) The experiment was repeated with a small piece of potassium. Describe how the reaction would be different .

……

……

b) If universal indicator was added to the water, what change would you see in it as the reaction took place ? Why would it change ?

……

……

c) Circle the errors in the equation below *(more than one !)* :

$$2K_{(s)} + 2H_2O_{(aq)} \rightarrow 2K(OH)_{2\,(s)} + H_{2\,(g)}$$

15]

A new metal has been discovered.
It has the name mancunium with the symbol M.
Mancunium reacts violently with water to form a colourless gas and an alkaline solution. The alkaline solution is mancunium hydroxide with formula MOH.
Mancunium also forms a chloride salt with formula MCl.

a) Use the information above to predict the formula of mancunium oxide.

……

b) Part of the reactivity series of metals is shown below.
Re-write this to show where mancunium would fit in, based on the information above.

CALCIUM
ZINC
IRON
COPPER

……..…… [most reactive]

……..…….

……..……

……..…….

……..……. [least reactive]

16] ***Complete*** and ***balance*** these symbol equations for the reactions of metals with water.

a) ……..Rb + ……H_2O ➔ ……RbOH + ……H_2

b) ……..Cs + ……H_2O ➔ …… + ……H_2

c) ……..Mg + ……H_2O ➔ …… + ……..

d) …… + …….. ➔ …….. $Fe(OH)_2$ + ……H_2

e) ……..Al + ……H_2O ➔ …… + ……..

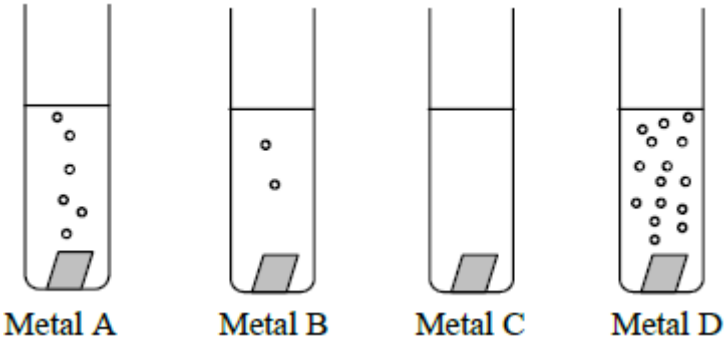
Metal + Acid reactions

metal + acid ➔ metal salt + hydrogen

The ***metal salt*** formed, depends on which acid is used :

Hydrochloric acid (H**Cl**) forms ➔ ***Chloride*** salts (eg/ $MgCl_2$ Magnesium Chloride)
Sulphuric acid (H_2**SO_4**) forms ➔ ***Sulphate*** salts (eg/ $MgSO_4$ Magnesium Sulphate)
Nitric acid (H**NO_3**) forms ➔ ***Nitrate*** salts (eg/ $Mg(NO_3)_2$ Magnesium Nitrate)

Q1] Small pieces of four different metals were placed in identical amounts of hydrochloric acid. The results are shown below.



a) Place the metal in order of reactivity :

…….. [most reactive]

……..….

……..……

…….

……. [least reactive]

b) When metal A reacts with the acid, a compound with the formula **ACl_2** is formed.

i) Which ***group*** of the periodic table is metal likely to be ?

……

ii) ***Where*** does ACl_2 form and why ***can't*** you see it ? *(on the diagram showing the reaction of metal A above)*

……

……

iii) When metal A reacts with sulphuric acid (H_2SO_4) a salt called "***A sulphate***" forms.
What is the formula of this compound ?

……

iv) Which gas is given off as metal A reacts with the acid ?
Describe a test to prove this and describe the result of the test.

Gas = ……..

Test = ……

……

Result = ……

v) Where did the gas come from ?

……

Q2]

A group of students were investigating the effects of 'acid rain'.
They decided to look at the effect of acid on metals used as building materials.
Lead and copper are used for roofing and iron and aluminium can be used for window frames.
Their chemistry book listed these metals in order of their reactivity as follows:

ALUMINIUM
IRON
LEAD
COPPER

The students tested the metals by adding small amounts of sulphuric acid to each.
Only iron seemed to react.

a) Suggest why aluminium doesn't appear to react, even though it's the most reactive of the 4 metals ?

……

……

b) Why did the students choose sulphuric acid, rather than hydrochloric or nitric ?

……

……

Q3] Predict the **<u>name</u> of the salts** formed in the reactions below between metals and acids :
[the first one has been done for you as an example]

Q	Metal	Acid	Metal salt
eg	*Lead*	*Nitric*	***Lead Nitrate***
a	**Lithium**	Hydrochloric	……
b	**Lithium**	Sulphuric	……
c	**Lithium**	Nitric	……
d	**Sodium**	Sulphuric	……
e	**Zinc**	Hydrochloric	……
f	**Barium**	Nitric	……
g	**Iron (II)**	Sulphuric	……
h	**Aluminium**	Nitric	……
i	**Nickel**	Hydrochloric	……
j	**Caesium**	Sulphuric	……
k	**Barium**	Hydrochloric	……

Q4] Complete the word equations below for metal and acid reactions:

Q	metal		acid		salt		other product
a	Magnesium	+	Hydrochloric acid	➔	……..……..… …….……	+	Hydrogen
b	Calcium	+	Sulphuric acid	➔	……..… ……..	+	……..……..
c	……..	+	Hydrochloric acid	➔	Potassium Chloride	+	Hydrogen
d	Zinc	+	…… ……	➔	Zinc Sulphate	+	……..……..
e	…….	+	…… ……	➔	Copper Nitrate	+	Hydrogen
f	…….	+	…… ……	➔	Strontium Chloride	+	Hydrogen
g	…….	+	Nitric acid	➔	Rubidium Nitrate	➔	……..……..
h	…….	+	…… ……	➔	Beryllium Chloride	+	Hydrogen
i	…….	+	…… ……	➔	Lead Sulphate	+	Hydrogen

Q5] **Name** the following salts formed in acid reactions, using a periodic table to help you.

Q	Formula	Name
a	$NaCl$	……
b	$LiNO_3$	……
c	K_2SO_4	……
d	$MgCl_2$	……
e	$MgSO_4$	……
f	$Ca(NO_3)_2$	……
g	$Sr(NO_3)_2$	……
h	$ZnSO_4$	……
i	$AlCl_3$	……
j	$Fe(NO_3)_3$	……

Q6] Write the formulae of these ***salts***, given the charges on the ions that form them.
The first has been done for you as an example:

Q	+ ion	- ion	Formula of salt formed
	Sr^{2+}	NO_3^-	$Sr(NO_3)_2$
a	Li^+	Cl^-	……
b	Na^+	SO_4^{2-}	……
c	Be^{2+}	Cl^-	……
d	Zn^{2+}	NO_3^-	……
e	Sn^{2+}	NO_3^-	……
f	Pb^{2+}	SO_4^{2-}	……
g	Fe^{3+}	Cl^-	……
h	Al^{3+}	SO_4^{2-}	……

Q7] **Balance** these symbol equations for reactions between metals and sulphuric acid

a) ……..Rb + ….. H_2SO_4 ➔ ……Rb_2SO_4 + ……H_2

b) …….Ca + ……H_2SO_4 ➔ ……$CaSO_4$ + ……H_2

c) ……..Fe + ……H_2SO_4 ➔ ……$Fe_2(SO_4)_3$ + …… H_2

Q8] **Complete** and **balance** these symbol equations for reactions between metals and acids
Below are some ion charges that may help you to do this :

Cl^- NO_3^- SO_4^{2-} K^+ Ba^{2+} Al^{3+}

a) ……..K + ……HCl ➔ …… + ……H_2

b) ……..K + ……HNO_3 ➔ …….. + ……H_2

c) ……..K + ……H_2SO_4 ➔ …….. + ……H_2

d) ……..Ba + ……HCl ➔ …….. + ……H_2

e) ……..Ba + ……HNO_3 ➔ …….. + ……H_2

f) ……..Ba + ……H_2SO_4 ➔ …….. + ……H_2

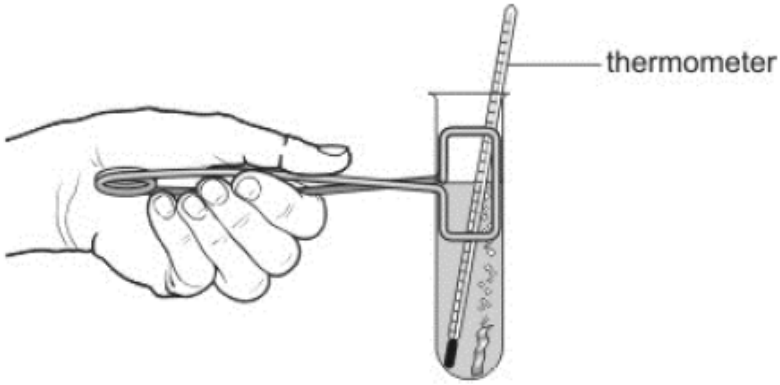
g) ……..Al + ……HCl ➔ …….. + ……H_2

Metal displacement reactions

Q		Answer
1	Which of the following metals will displace aluminium from aluminium sulphate solution? A Zinc B Iron C Magnesium D Lead	.....
2	Silver nitrate solution can be stored in metal containers made of A aluminium. B zinc. C copper. D gold.	.....
3	A copper wire is put in silver nitrate solution in a test tube. What will be observed after a few minutes? **Colour change of solution** / **Copper** A Blue to pale blue — Brown solid formed on copper surface B Blue to pale blue surface — Grey solid formed on copper C Remains unchanged — Shiny solid formed on top D Colourless to blue — Grey solid formed on copper surface	.....
4	Which of the following cases will a reaction take place? A Cu (s) + Zn^{2+} (aq) B Ag (s) + Fe^{2+} (aq) C Al (s) + Cu^{2+} (aq) D Pb (s) + Mg^{2+} (aq)	.....
5	Which of the following ions can be displaced by lead? A Fe^{2+} (aq) B Cu^{2+} (aq) C Mg^{2+} (aq) D Al^{3+} (aq)	.....
6	Which of the following equations represents a displacement reaction that would not occur at room temperature? A $Pb(s) + Zn^{2+}(aq) \rightarrow Pb^{2+}(aq) + Zn(s)$ B $Mg(s) + Fe^{2+}(aq) \rightarrow Mg^{2+}(aq) + Fe(s)$ C $Fe(s) + Cu^{2+}(aq) \rightarrow Fe^{2+}(aq) + Cu(s)$ D $Zn(s) + 2Ag^{+}(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$	.....
7	Tin is just below iron in the metal reactivity series. Oxide of tin can be reduced to tin by A heating the oxide of tin with lead. B heating the oxide of tin strongly. C heating the oxide of tin with carbon. D electrolysis of the aqueous solution of the oxide of tin.	.....

8]

Harry mixed zinc with copper sulphate solution in a test-tube.
A displacement reaction took place and the temperature increased.



(a) The word equation for the reaction is shown below.

zinc + copper sulphate → zinc sulphate + copper

Why is this reaction called a displacement reaction?

.....

.....

1 mark

(b) Harry repeated the experiment with two other metals.
He wanted to calculate the temperature rise each time.
His results are shown below.

metal added to copper sulphate	temperature at the start (°C)	highest temperature reached (°C)	rise in temperature (°C)
zinc	20.0	36.5	16.5
iron	25.5	38.5	13.0
magnesium	19.5	87.5	68.0

Harry used different starting temperatures.
Explain why this did **not** affect his results.

.....

.....

1 mark

(c) Part of the reactivity series of metals is shown below.

most reactive	sodium
	calcium
	magnesium
	aluminium
	zinc
	iron
	lead
least reactive	copper

Use the reactivity series above to answer all the questions below.

(i) Why was the highest rise in temperature obtained with magnesium and copper sulphate?

.....

.....

1 mark

(ii) Why was the rise in temperature obtained with zinc and copper sulphate **not** much higher than the rise in temperature obtained with iron and copper sulphate?

.....

.....

1 mark

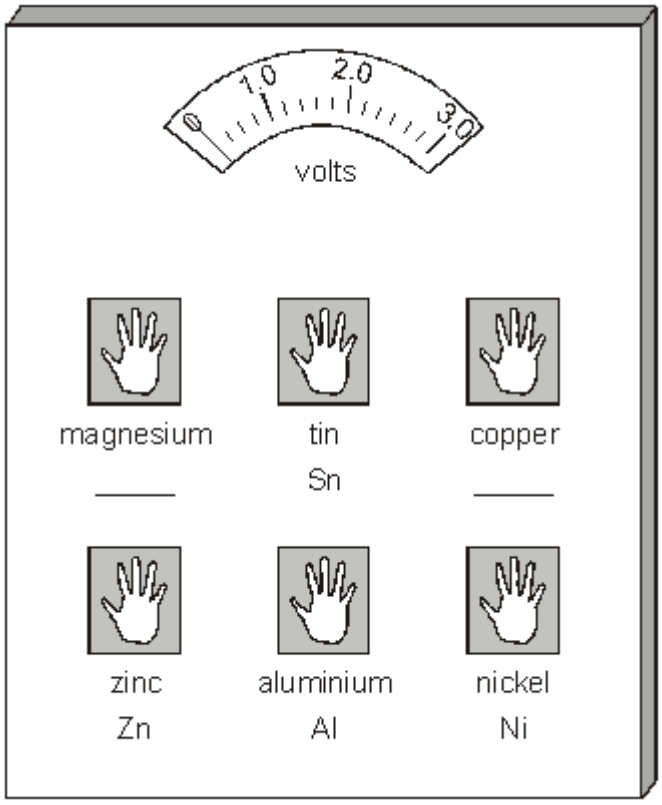
(iii) In which of the following mixtures would there be a rise in temperature? Write **yes** or **no** in each blank box.

mixture	Would there be a rise in temperature?
aluminium + sodium chloride	
calcium + zinc sulphate	
lead + zinc chloride	
magnesium + iron chloride	

2 marks

9] The diagram shows an exhibit at a science museum. It has six blocks of metal connected to a voltmeter.

(a) On the lines on the diagram, write the chemical symbols for magnesium and copper.



2 marks

(b) When visitors place their hands on two blocks of metal at the same time, there is a reading on the voltmeter. Some examples are shown in the table.

hands placed on	reading on voltmeter (volts)
magnesium + tin	2.1
magnesium + copper	2.5
magnesium + zinc	1.5
magnesium + aluminium	0.6
magnesium + nickel	2.0

The reading on the voltmeter depends on the reactivity of the two metals touched. The bigger the difference in reactivity, the higher the reading on the voltmeter.

(i) Magnesium is the most reactive of these metals.
Which metal is the least reactive?

.....

1 mark

(ii) If two blocks of magnesium are used in the experiment, instead of two different metals, what would the voltmeter read?

..... volts

Explain your answer. ……

.....

2 marks

(iii) Look at the voltmeter readings in the table. On which **two** metals, other than magnesium, would a person put their hands to give the lowest reading on the voltmeter?

..... and .....

1 mark

10] Many metals have to be extracted from compounds called ores.

(a) The table shows a reactivity series.

Reactivity	**Material**
Most reactive	potassium
↑	sodium
↑	magnesium
↑	aluminium
↑	carbon
↑	zinc
↑	lead
↑	hydrogen
↑	copper
Least reactive	gold

Use the information in the table to help you answer the questions.

(i) Give the method used to extract sodium from its ore.

.....

(1)

(ii) Name **one** metal in the table that can be extracted by heating the ore with carbon.

.....

(1)

(iii) Copper can be extracted by heating the ore with hydrogen.

Use the table to explain why.

.....

.....

(1)

(b) Iron is made by heating iron ore (iron oxide, Fe_2O_3) with carbon monoxide (CO) in a blast furnace.

(i) Complete the balanced symbol equation for the reaction between iron oxide and carbon monoxide.

$$\ldots\ldots CO_{(g)} + \ldots\ldots Fe_2O_{3\ (l)} \rightarrow \ldots\ldots CO_{2\ (g)} + \ldots\ldots Fe_{(l)}$$

(iii) The production of iron from iron ore involves both oxidation reactions and reduction reactions. Explain why, using equations and ideas about electrons being transferred.

.....

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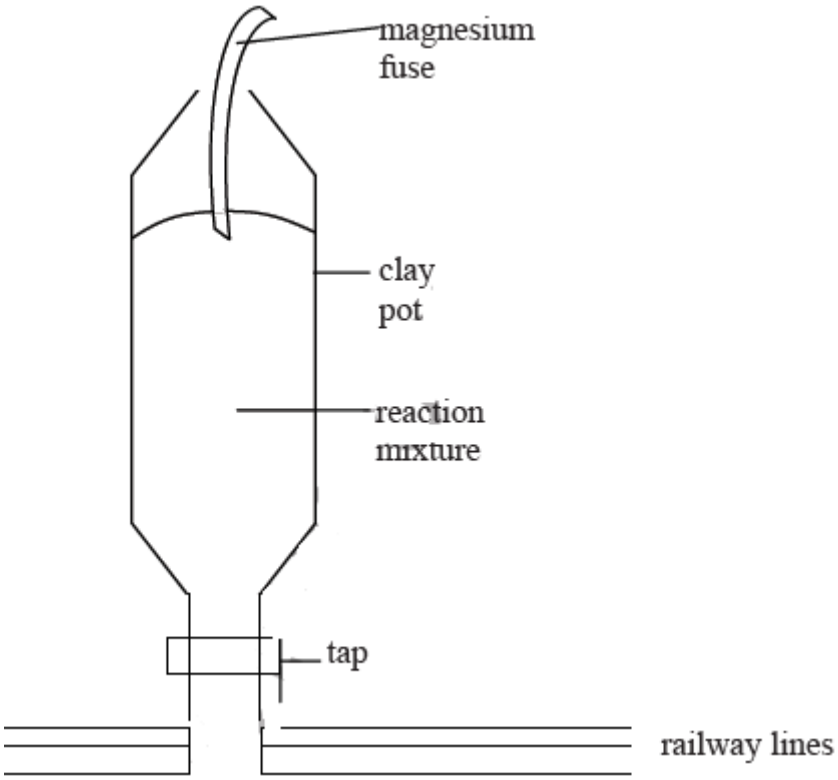
11]

The 'thermit' reaction is used to weld railway lines together.
The reaction mixture contains aluminium metal and iron oxide.
The substances are mixed in powder form in a clay pot.
The mixture is lit with a magnesium fuse.



a) ***Complete*** the word equation for this reaction :

aluminium + iron oxide ➔ _____ + _____

b) The magnesium ribbon burns at 700^{o}c, but the iron will only melt at 1500^{o}c.
Explain why this reaction forms molten iron.

……

……

c) Suggest a reason why the aluminium and iron oxide are in powder form ?

……

……

d) Suggest why a tap is needed at the bottom of the clay pot ?

……

……

e) If copper powder is mixed with iron oxide there is no reaction.
Explain why there is a reaction with aluminium metal, but not copper metal ?

……

……

12] A student investigated the different reactivities of a set of metals by placing pieces of each metal in metal nitrate solutions .
The table below shows some of the results

solution	aluminium	barium	lithium	magnesium
aluminium nitrate		✓		✓
barium nitrate			✓	✘
lithium nitrate	✘			
magnesium nitrate	✘	✓	✓	

✓ = reactionn happened / x = no reaction

a) Use the results to put the metals in order of reactivity, starting with the most reactive.

…… …… …… ……..……..

b) Use the order of reactivity in (a) to complete the table

c) It is known that aluminium is more reactive than silver.
But when a piece of aluminium is put into silver nitrate solution, no reaction happens.
Suggest why ?

……

……

……

……

13] ***Complete*** these word equations for displacement reactions:

Q	metal element		Metal compound				
a	Magnesium	+	Iron Chloride	➔	……..……..… …….……	+	……
b	Calcium	+	Lead Nitrate	➔	……..… ……..	+	……...……..
c	……..	+	Zinc Sulphate	➔	Sodium Sulphate	+	……..
d	…….	+	…… ……	➔	Zinc Sulphate	+	Copper.
e	…….	+	…… ……	➔	Copper Nitrate	+	Silver
f	Caesium	+	Barium Sulphate	➔	……..… ……..	+	……...……..
g	…….	+	Copper Oxide	➔	Tin Oxide	+	……...……..

14] Complete these symbol equations for metal displacement reactions
(no balancing needed).

Q	metal element		Metal compound		Metal compound		metal element
a	Mg	+	$CuSO_4$	➔	……..…….….	+	……
b	K	+	$LiNO_3$	➔	……..….	+	……...……..
c	Ca	+	$ZnCl_2$	➔	……..….	+	……..
d	Sn	+	$PbSO_4$	➔	……..….	+	……...……..
e	Al	+	$FeCl_3$	➔	……..….	+	……...……..

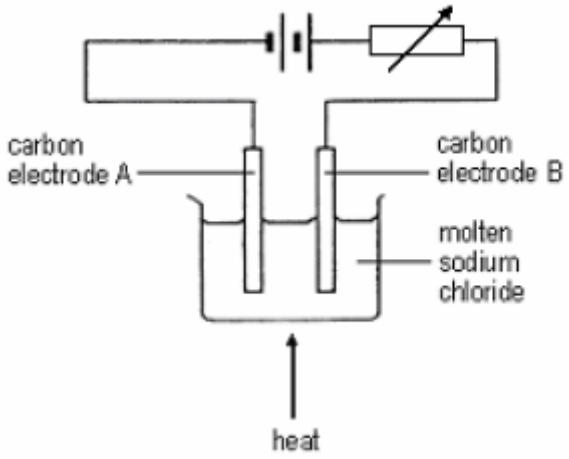
15] Complete these symbol equations for metal displacement reactions
(Balancing may be needed).

Q	metal element		Metal compound		Metal compound		metal element
a	Li	+	$MgSO_4$	➔	……..…….….	+	……
b	Ca	+	$Sn(NO_3)_2$	➔	……..….	+	……...……..
c	Fe	+	$SnCl_2$	➔	……..….	+	……..
d	Mg	+	$PbSO_4$	➔	……..….	+	……...……..
e	Al	+	$FeCl_2$	➔	……..….	+	……...……..

Electrolysis : Molten liquids & Solutions (in water)

Q		Answer
1	Which of the following is NOT an essential component of the set-up for electrolysis? A Electrolyte B Electrodes C Ammeter D Energy supply	…….
2	Which of the following statements concerning electrolysis is INCORRECT? A During electrolysis, chemical energy is converted into electrical energy. B Electrolysis involves decomposition of an electrolyte. C An energy supply is required for electrolysis. D Graphite is commonly used as the inert electrodes in electrolysis.	…….
3	During electrolysis …… A Gases may be given off or metals deposited at the electrodes B Only gases are given off C Only metals form on the anode (+) D Solutions always change colour	…….
4	Which statement is true ? A metals form negative ions that move to the cathode (-) B metals form positive ions that move to the anode (+) C metals form positive ions that move to the cathode (-) D metals form negative ions that move to the anode (+)	…….
5	When sodium chloride (NaCl) is heated to over 800^{o}c it melts. Which statement is true ? A Melting separates and frees the Na^{+} and Cl^{-} ions B Melting separates and frees the Na^{-} and Cl^{+} ions C Melting causes NaCl $_{(s)}$ to become NaCl $_{(g)}$ D Melting causes NaCl $_{(l)}$ to become NaCl $_{(g)}$	…….
6	Molten aluminium is extracted from its ore (Al_2O_3) by electrolysis. Which equation below shows what happens to the aluminium ions: A $Al^{+} + e \rightarrow Al$ B $Al^{2+} + 2e \rightarrow Al$ C $Al^{3+} + 3e \rightarrow Al$ D $Al^{4+} + 4e \rightarrow Al$	…….
7	When you electrolyse water…… A you get hydrogen at the cathode (-) and oxygen at the anode (+) B you get hydrogen at the anode (+) and oxygen at the cathode (-) C you get hydrogen at the cathode (-) and chlorine at the anode (+) D you get zinc at the cathode (-) and oxygen at the anode (+)	…….
8	When molten potassium bromide (KBr) is electrolysed, the products at the electrodes are ….. A Cathode (-) = bromine , Anode (+) = potassium B Cathode (-) = potassium , Anode (+) = bromine C Cathode (-) = hydrogen , Anode (+) = bromine D Cathode (-) = potassium , Anode (+) = oxygen	

9



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Which gas will form at electrode **B** ?

A hydrogen
B oxygen
C sodium
D chlorine

10 Which of the following substances would not be decomposed by electricity?

A Molten silver
B Dilute sulphuric acid
C Concentrated sodium chloride solution
D Aqueous silver nitrate

.....

11 When you dissolve the ionic compound sodium chloride (NaCl) in water (H_2O), which ions are present in the solution ?

A Na^+, K^+, H^+ , O^{2-}
B Na^+ , H^+ , Cl^- , O^{2-}
C Na^+ , H^+, Cl^-, OH^-
D Na^+ , Cl^-, OH^-, O^{2-}

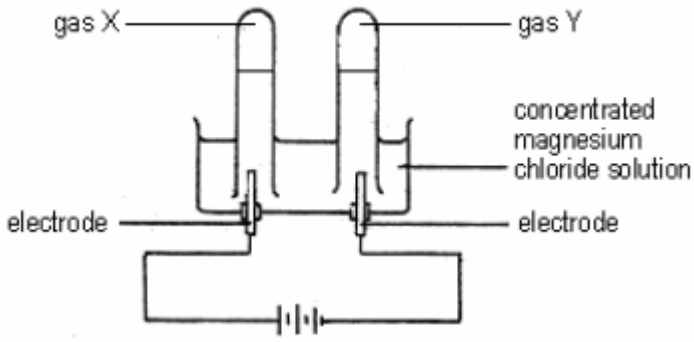
.....

12 Why is the cathode the ***negative*** electrode in electrolysis ?

A it's got more protons than electrons
B it's receives electrons from the power pack./battery
C it's got the same number of protons and electrons
D nobody knows

.....

13



Which of the following combinations is correct?

	Gas X	**Gas Y**
A	Hydrogen	Oxygen
B	Oxygen	Hydrogen
C	Hydrogen	Chlorine
D	Chlorine	Hydrogen

.....

14 Which of the following changes would occur at the electrodes during the electrolysis of dilute copper(II) chloride solution using copper electrodes?

	Anode	Cathode
A	Copper dissolves	Copper deposits
B	Copper deposits	Copper dissolves
C	Chlorine given off	Copper deposits
D	Chlorine given off	Hydrogen given off

.....

15 In an experiment, concentrated sodium iodide solution is electrolyzed using carbon electrodes. Which of the following combinations concerning the changes in the experiment is correct?

	Product at cathode	Product at anode	Resulting solution
A	Hydrogen	Iodine	More concentrated sodium iodide
B	Sodium	Oxygen	More concentrated sodium iodide
C	Hydrogen	Oxygen	Sodium hydroxide
D	Hydrogen	Iodine	Sodium hydroxide

.....

16 Which of the following substances, when electrolyzed using graphite electrodes, will liberate gaseous products at both electrodes?

A Molten sodium chloride
B Sodium bromide solution
C Zinc sulphate solution
D Silver nitrate solution

.....

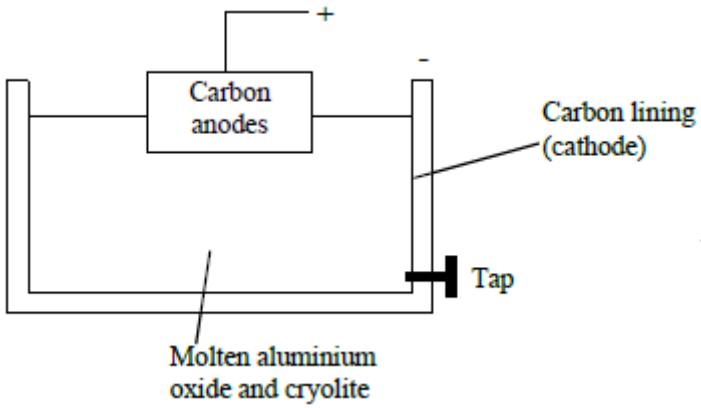
17 Electrolysis is used in the extraction of

(1) copper.
(2) sodium.
(3) aluminium.

A (1) and (2) only
B (1) and (3) only
C (2) and (3) only
D (1), (2) and (3)

.....

18] Below is diagram of the equipment commonly used in industry to electrolyse aluminium oxide (the aluminium ore) in order to extract pure aluminium metal.



a) Why is the aluminium ore dissolved in the chemical “cryolite” before the electrolysis ?

……

……

bi) Complete the following equation for the reaction at the cathode :

$$Al^{3+} + \_\_\_\_\_\ e \rightarrow Al$$

bii) is this oxidation or reduction ? *explain ?*

c) Although oxygen gas collects (at first) at the anode, a different gas actually bubbles off at the anode. Which gas and why ?

……..…

……

d) Give 2 reasons why the electrolysis of aluminium ore to form the metal is an expensive process ?

……..…

……

20] Fill in the blanks in the table below for ***molten*** electrolysis of ionic compounds.
The first has been done for you as an example

Molten compound	Formula of compound	ions	What's formed at the CATHODE (-)	What's formed at the ANODE (+)
Calcium oxide	CaO	Ca^{2+} O^{2-}	**Calcium**	**Oxygen**
Potassium chloride	KCl	K^{+} Cl^{-}		
Iron Bromide	$FeBr_2$	Fe^{2+} Br^{-}		
Nickel Iodide	NiI_2	Ni^{2+} I^{-}		
Zinc Oxide	ZnO	Zn^{2+} O^{2-}		
Aluminium Sulphide	Al_2S_3	Al^{3+} S^{2-}		
Sodium Chloride	NaCl	Na^{+} Cl^{-}		

Electrolysis of ionic compounds dissolved in water

At the ANODE (+)	At the CATHODE (-)
What is given off here? Always non-metals (*except* hydrogen) Negative ion ➔ element	***What is given off here?*** Always metals or hydrogen Positive ion ➔ element
Reaction always LOSS of electrons **OXIDATION at anode** eg/ Cl^- ➔ Cl + **e**	***Reaction*** always GAIN of electrons **REDUCTION at cathode** eg/ Cu^{2+} + **2e** ➔ Cu
What will be given off if there's a choice of 2 ions ? (electrolysis of ionic compounds dissolved in water)	
iodine ***(most likely)*** bromine chlorine oxygen (O^{2-} Oxide) oxygen (OH^- Hydroxide) oxygen (SO_4^{2-} Sulphate) oxygen (NO_3^- Nitrate) ***(least likely***	Silver (Ag) ***(most likely)*** Copper Hydrogen Lead (Pb) Iron Zinc Magnesium Sodium (Na) Potassium (K) ***(least likely)***

Q	Compound	**+ ions present**	**- ions present**	Name of element formed at **ANODE (+)**	Name of element formed at **CATHODE (-)**
21	Copper Bromide	Cu^{2+} H^+	Br^- OH^-		
22	Copper (II) Iodide	Cu^{2+} H^+	I^- OH^-		
23	Silver Iodide	Ag^+ H^+	I^- OH^-		
24	Zinc Chloride	Zn^{2+} H^+	Cl^- OH^-		
25	Potassium sulphate	K^+ H^+	SO_4^{2-} OH^-		
26	Lead Iodide	Pb^{2+} H^+	I^- OH^-		