

Metals

Wednesday, December 2, 2020 5:35 PM

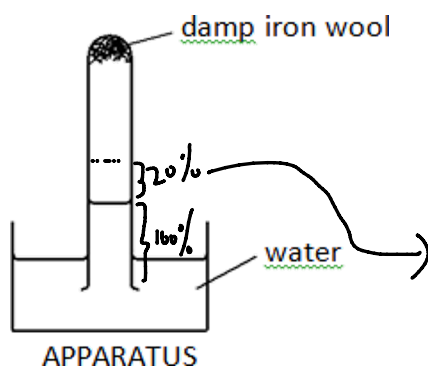
10.1:

Properties of metals

In the previous chapter, we already looked at how different groups of metals have different properties. However, when asked for **general properties, always go with properties of transition metal (physical properties)**.

Generally, metals react with acids to form salt and hydrogen.
It will also react with oxygen to form metal oxide.

This is why rust is also known as Fe_2O_3 . In MCQ, questions involving rust is very common. Remember that rust can only form in the presence of oxygen and moisture(water). Also, remember that oxygen makes up only about 21% of the air we breathe.



Hence, take a look at this question. Say that all oxygen has reacted with the iron wool. Per logic, the water level will rise up. This is because the volume of air has decreased and hence, the pressure exerted by the gas molecules decreases.

Now, in MCQ, several options will be give. This is where we apply the fact where oxygen is only 21% of air. Pick the option that appears where the remaining volume of gas is at 80%.

10.2:

Reactivity series

The reactivity series provides us valuable information as to how certain elements and compounds will react with each other.

P please
Na stop
Ca calling
Mg Me
Al A
C cute
Zn zebra
Fe instead

Here, we understand why we often say group 1 and 2 metals are very reactive as they are placed at the top. Notice also how group 1 metals are more reactive and as per theory, potassium is more reactive than sodium.

Another thing worth noticing is metals below Hydrogen cannot react with dilute acid. This is why it is not viable to produce copper chloride by reacting HCl and Cu. Instead, CuO is used.

This also explains why metals such as silver and gold are very expensive as they

Zn zero
 Fe instead
 In Try
 Pb Learning
 H How
 Cu Copper
 Ag Saves
 Au Gold
 11

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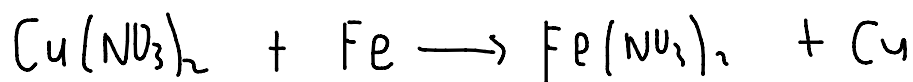
This also explains why metals such as silver and gold are very expensive as they are very unreactive and hence can maintain their look for long periods of time.

Last but not least, notice which metals are more or less reactive relative to carbon. This will explain why certain metals need to be extracted in certain methods.

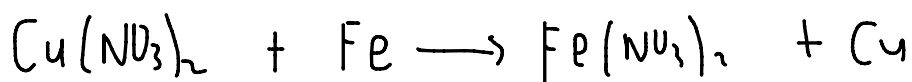
*Exception (what is chemistry without exception)

Despite Aluminum being fairly reactive, it does not react with oxygen and dilute acids as much. This is because when aluminum reacts, it forms a thin protective oxide layer which prevent aluminum to undergo further reaction. This also explains why aluminum is used in airplanes and food containers.

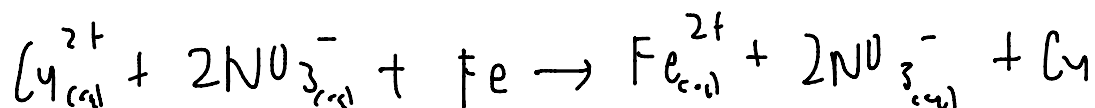
With this information in mind, just like reactions involving halides, we can also predict the outcomes of reactions involving metals.



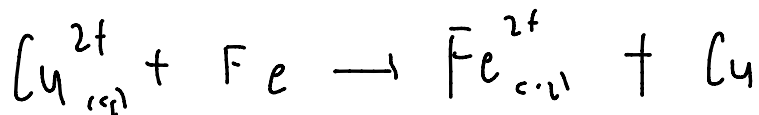
Fe is more reactive and hence, displaces Cu.



If we break this down to ions,



Cancel species that appear twice



Notice how the more reactive metal will be **oxidized** and the less reactive metal will be **reduced**. This is opposite of halides as in halides, the more reactive one is reduced.

This clear distinction is essential and also understanding the reason why helps prevent memorization.

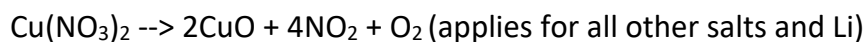
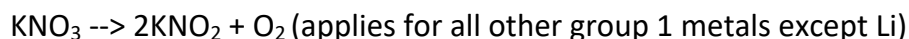
We know that metals react by losing electrons and the easier it is to lose electrons, the more reactive it is. Hence, if atoms lose electrons, it forms positive ions. This is why more reactive metals oxidize as seen above.

However, non-metals react by gaining electrons. When atom gain electrons, it form negative ions. This is why more reactive non-metals reduce.

From this reactivity series, **we can also deduce the products of the thermal decomposition of nitrates, hydroxides and carbonates.**

Let's look at nitrates first. We can divide it into two. Group 1 salts except Li. The other is obviously all the other nitrate salts and LiNO_3 .

Say,

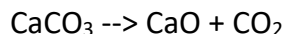


This does not appear a lot in past exams but if it does, it can rack up to 4 marks so its always better to be safe.

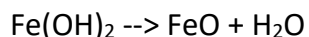
To spot NO_2 , it is coloured brown and is a toxic gas.

The reason why there is a difference in product is because the more reactive the metal, the stronger its bond with the nitrate ion.

For decomposition of carbonates say,



For hydroxides say,



10.3 and 10.4:

Extraction of metals and its uses

Full credit goes to Valerie from Sec 4.



Extraction...

Exam tips:

- 1) Understand how the position of metals in the reactivity series determine whether or not it can react with dilute acids and whether or not it can be displaced by another species
- 2) Memorize all methods of extracting metals. Realize that because aluminum is more reactive than carbon, aluminum is not extracted in a similar fashion compared to iron and zinc
- 3) Understand the uses of metals in our daily lives and the reason behind why that specific metal is used