An experiment to show how much copper is in copper (II) oxide.

INTRODUCTION

Copper (II) oxide in mineral form is also known as tenorite. It is a black solid, with a high melting point of temperatures above 1200°C. Copper (II) oxide is a basic oxide, and can dissolve in mineral acids such as hydrochloric, sulphuric and nitric acid. Copper (II) oxide can also be made by reaction a solid piece of copper with oxygen gas like in the following experiment: $2Cu + 0_2 \rightarrow 2CuO$. When copper (II) oxide is heated in a natural stream of gas its oxygen is lost. Copper itself is a pure element, with nothing but copper elements in its pure state. It's commonly known in the periodic table as Cu. In its pure state, it has a pink golden colour, unlike most metals which tend to have a silver appearance. It has an electron shell of 2, 8, 18, and 1 – and is an excellent conductor of electricity.

HYPOTHESIS

It is to be expected that there will be a loss in weight at the end of the experiment.

SAFTEY ASSESMENT

Tying hair back	Can catch alight with the Bunsen flame, and gets in the way of working.
Goggles	Must be worn, as liquids are being used. They protect the eyes from any splashes.
Bunsen burner	Ensure that the hole is closed, keeping a visible flame for when the Bunsen is not in use.
Lab coats	Worn to protect clothes
Bags and stools	Keep them both tucked under tables or moved out of the way for a clear fire exit, and to prevent falling over them, etc.
Spillages and breakages (glass)	Ensure that all spillages and breakages are reported, in order for them to be taken care of correctly and safely.

METHOD

1. An empty porcelain boat was placed into the combustion tube, which was then weighed with the weight recorded.
2. A spatula of copper (II) oxide was added to the porcelain boat and was placed back into the tube. This was again re-weighed and the weight was recorded.
3. The apparatus was set up as shown below – ensuring that the combustion tube was securely held in the clamp and the delivery tube was secure to the gas tap.
4. The gas tap was turned on and left for 30 seconds, and the gas was set alight – adjusting the gas tap to make a small flame.
5. The copper (II) oxide was strongly heated until a reaction took place.
6. Once the reaction had finished, then Bunsen burner was turned off – letting the gas flow through the tube until it had thoroughly cooled down.
7. The gas was then turned off and the tube was reweighed and the results were recorded.

SET UP OF EXPERIMENT

RESULTS

Equipment being weighed	**Weight (grams)**
Mass of tube	99.56g
Mass of tube and copper (II) oxide	100.42g
Mass of tube and copper	100.22g

Copper (II) oxide – 100.42g – 99.56g = 86g

Copper – 100.22g – 99.56g = 66g

Loss of weight – 86g – 66g = 20g (mass of oxygen)

$$\frac{\text{Mass of copper}}{\text{Mass of copper (II) oxide}} \times 100$$

$\frac{66}{86} \times 100 = 76.74$ 77% of copper in copper (II) oxide

INTERPRETATION

The results show that there is a loss in weight in the copper when heated. This is proving that the hypothesis stated at the beginning is therefore correct, with a loss gained. A 77% of copper (II) oxide remained in the porcelain boat. The relative mass of copper (Cu) is 63.5, whereas the relative mass for oxygen (O) is 16. By using the following calculations, it shows the ratio for the number of moles to each element.

Cu mass – Cu relative mass = Number of moles 66 – 63.5 = 1.35
O mass – O relative mass = Number of moles 20 – 16 = 1.25
Cu: O = 1.35:1.25

The number of moles in the overall copper of copper (II) oxide has a slightly larger volume of copper substance than oxygen. (http://www.practicalchemistry.org/experiments/finding-the-formula-of-copper-oxide,210,EX.html). It is therefore possible to state that the formula for copper (II) oxide is CuO.

EVALUATION

If the experiment were to be repeated again I would weigh and burn several times again at the end of the experiment. By checking the weight and re-burning you can see if more copper oxide is released – giving a more accurate result. Also by using a larger amount of copper (II) oxide, you get a larger result, which means a smaller percentage chance of error. Another change that I would make to the experiment is to ensure that there are no gas leaks from the tubing of the Bunsen burner. By coating the outside with Vaseline, it will give a secure seal. It's important to keep the gas running through the tube, to prevent the copper oxidizing. By keeping scales close to the experiment set up it would reduce the chance of any further oxidisation occurring. With many of the previous limitations within this experiment, with more practises, it is possible to gain an accurate result for the percentage of copper in copper (II) oxide.

Reference:

http://www.practicalchemistry.org/experiments/finding-the-formula-of-copper-oxide,210,EX.html

http://www.wikipedia.co.uk