

Preliminary
chemistry: metals
research assignment
flashcard



**ASSIGN
BUSTER**

It) Figure 3 Examples of items made from gold that date back to Ancient Egyptian times Figure 3 Examples of items made from gold that date back to Ancient Egyptian times Figure 2 Ancient Egyptian Pharaoh, Tutankhamen solid gold burial mask Figure 2 Ancient Egyptian Pharaoh, Tutankhamen solid gold burial mask Gold is both ductile and malleable.

Ductile means it can be drawn into thin wires. Malleable means capable of being hammered into thin sheets. A piece of gold weighing only 20 grams can be hammered into a sheet that will cover more than 6 square meters.

The sheet will be only 0.00025 centimeters thick. Gold is also very soft; it reflects light and heat but conducts electricity very well (Mazurka, 2007).

For the ancient Egyptians, gold had many uses including, burial masks- evidence of this is in Tutankhamen famous solid gold mask, found in his coffin in 1922. The metal is so malleable and soft it could be hammered into thin sheet and wires, perfect for making fine Jewelry and ornaments that lasted through the decades. Other uses included small statues of gods used for religious ceremonies, made out of solid gold.

Another use they had for gold was royal Jewelry, royal artifacts and chariots.

Gold leaf was created, which was paper thin, and this was used to cover the furniture and tombs of the Pharaohs and also to cover the statues of the gods. One of the special skills developed by the Egyptians was the adding of gold to glass objects. They found a way to use gold to make glass a beautiful ruby-red color. The glass became known as gold ruby glass iii) The ancient

Egyptians extracted gold by crushing, washing, and then applying heat and the result was powdered.

Ancient open-cast trenches following quartz veins from the surface and shafts sinking horizontally or diagonally into the mountain sides. A number of the shafts had stone walls reinforcing the entrances or platforms at the edge to raise and lower men, boys, baskets, tools and ore. When hard gold-bearing surfaces are found they burned it with hot fire until it crumbled, they then continue working it out by hand. Softer rock which can be mined with moderate effort is crushed with a sledge. The strongest workers break quartz rock with iron hammers.

In some parts of the mine, the granite surrounding the quartz crumbles under foot this means there was no need for fire setting because the rock can be plundered away. Hundreds of crushing stones made of rough blocks of basalt, granite or porphyritic granite have been found on Egyptian gold mining sites. The ore that was mined was reduced in size when brought to the surface and the pieces worth reducing more were picked out. Once the ore they need is picked out, it is put into the mill where it is grinded into fine flour like powder by four slaves.

Once the ore is ground into fine powder, it is rubbed onto a broad board which is slightly inclined, while pouring water over it. When this is done, the rocks, dirt and other matter are washed away while the particles which contain gold remain because of its weight.

This is repeated a number of times until all that remains are pure gold- dust.

(TM'S, 2013). In ancient times, mercury was a common form of gold
<https://assignbuster.com/preliminary-chemistry-metals-research-assignment-flashcard/>

extraction and was used until later on in the first millennia. The metal, mercury, has been found in ancient Egyptian from its ore.

Gold ore was crushed finely, when liquid mercury was added, the mercury coated just the gold.

The mercury coated gold was then burned in order to evaporate the mercury and leave the pure gold. (Brooks, 2011). iv) The crystal structure for metallic gold is face centered cubic. This crystal structure contributes to gold's very high ductility since the lattices are particularly suitable for allowing the movement of dislocations in the lattice. The crystal structure for metallic gold is face centered cubic.

This crystal structure contributes to gold's very high ductility since the lattices are particularly suitable for allowing the movement of dislocations in the lattice.

When gold nuggets weren't found lying around in streams or deposits, the ancient Egyptians put a lot of energy into mining their gold. Gold is a non-reactive metal, it generally does not bond with other elements which means that it takes less energy to extract than other reactive metals. Still, a lot of energy was used by the Egyptians to extract the ore because of their primitive methods.

The Egyptians had more gold than any other civilization of its time, this means that the Egyptians did put a lot of energy into gold mining but also from their efforts they acquired a very large amount of gold. Gold has a cubic crystalline structure and a density of 19.

32 grams per cubic centimeter. Gold is bonded with metallic bonds, the electrons in the outer shells of the metals atoms are free to move, the metallic bond is the force of attraction between these free electrons and the metal ions. Metallic bonds are strong, this means gold maintains a regular structure and has a high melting and boiling point. BBC, 2013). Because of gold's strong structure, it takes a lot of energy to break down into its pure form, just like the Egyptians discovered.

But gold does not react with other elements so quite often it is found already in its pure form, which then requires little or no energy to refine. 2.

Aluminum Growth of aluminum production 1) The metal Aluminum was first discovered and its existence established in 1808 by Sir Humphrey Davy, but he was unable to actually make any. 10 years later a French scientist discovered hard, red clay containing over 50% aluminum oxide.

It was named bauxite, aluminum's most common ore. (Dawson, 2002). After it was discovered it took many years of deliberate research to find an efficient method to extract the metal from its ore and even longer to create a production process that would allow the metal to become commercially practical (Unknown, 2008). In 1825 a small lump of aluminum metal was produced for the first time, then in 1827 another scientist was able to isolate aluminum as a powder in 1827, in a process involving potassium and anhydrous aluminum chloride.

It wasn't until 1854 that the first method for commercial production was invented.

At this time aluminum was more expensive than gold, and at one stage a bar of aluminum was exhibited at the Paris exhibition in 1855. In the next ten years, its value fell by over 90% because of new found ways of extracting it. In 1900, 8 thousand tones were produced, in 1964 the aluminum was produced, adding to 31 million tones in total. It) An example of some bauxite An example of some bauxite Aluminum is the third most common element of the Earth's crust and the most abundant metal.

Because of aluminum's high attraction to bond with oxygen it is not found naturally occurring in its elemental state, but only in combined forms such as oxides or silicates. It's most common form is bauxite, an ore that is a hard, red clay containing over 50% aluminum oxide. Aluminum is found in the post-transition metals group on the periodic table of elements with symbol AH and atomic number 13. It is silvery white, and it is not soluble in water under normal circumstances. Wisped, 2013).

Aluminum is found in this state naturally because it is very reactive, this is shown on the periodic table of elements because of its position.

Aluminum is positioned in the transition metals group, which means that it is with other metals that have some characteristics of transition metals. They are generally softer and do not conduct electricity as effectively and have a lower boiling and melting point than that of the transition metals. This is why aluminum is never found in its pure elemental state, it is too reactive with its environment and this is hon. on the periodic table of elements by its position with other reactive metals and in the post-transition group. lii) Aluminum is the second most malleable metal and very ductile.

Due to its low density, aluminum is not very hard. It has a melting point of 660. ICC and a boiling point of 25190C and has high electrical conductivity. Aluminum is not very strong in its pure form.

This is because of its structure, which has dislocations which make it ductile, and malleable. When strength is more important other metals are added to make the crystal structure stronger, this makes it harder for atoms to move past each there. To preserve aluminum's low density and light weight other elements are added to the metal to reinforce dislocations, this reduces malleability but increases its strength.

By doing this, some aluminum alloys can be as strong as steel. Adding different elements achieves slightly different effects but almost all alloys are stronger than just pure aluminum.

Adding copper to aluminum increases its strength, hardness and also makes it heat treatable. Manganese is often added to aluminum to increase strength and resistance to corrosion. The addition of silicon lowers the melting point and improves stability, and alloys with zinc have increased strength and hardness.

What makes these alloys so distinctive is that they retain the lightweight A dislocation is pinned by a different element in an alloy, increasing strength A dislocation is pinned by a different element in an alloy, increasing strength property of aluminum whilst adding the extra properties that aluminum does not have. Because of its properties, aluminum and its alloys are used excessively in modern life. One of the most common uses for aluminum is

packaging such as drink cans, foil wrappings, bottle tops and foil containers.
<https://assignbuster.com/preliminary-chemistry-metals-research-assignment-flashcard/>

It is perfect for packaging because of its malleability, resistance to corrosion, its impermeableness and doesn't let the aroma or taste out of food. Because aluminum is so light weight, industry. A vehicle made with aluminum takes a lot less energy to move than if it was made with iron or steel. Vehicles made out of aluminum include, airplanes, trains, boats and cars. Aluminum is also used for power lines because is it so light and can conduct electricity over long distances without needing heavy duty supports.

Its ductility is also useful in drawing it out into wires to make power lines.

Buildings dad with aluminum are almost maintenance free because of its corrosion resistance, this and its lightweight makes it perfect for cladding, windows, skylights, gutters, door frames and roofing. Aluminum also has many other miscellaneous uses including saucepans, kitchen utensils, golf clubs, tennis rackets, furniture, fridges and toasters (Dawson, 2002). ' v) An edge dislocation leads to a pressure field (hydrostatic tension).

The incorporation of the larger magnesium atom reduces such dilatation fields and reduces the total energy of the system (Macmillan, 2010).

An edge dislocation leads to pressure field (hydrostatic tension). The incorporation of the larger magnesium atom reduces such dilatation fields and reduces the total energy of the system (Macmillan, 2010). Aluminum in its pure form is very weak. Aluminum is more commonly found alloyed with other metals for this reason; to make it stronger and keep its low density and light weight.

Other metals are added which hold down dislocations, this reduces the metals ductility but increases its strength. By this method some aluminum alloys can be as strong as steel, but all the while keeping the original light weight of the aluminum.

Adding different elements achieves slightly different effects, but almost all alloys are stronger than the aluminum by itself. Copper added to aluminum increases its strength and hardness and also makes it heat treatable. Adding magnesium to aluminum causes increased tensile strength, resistance to salt water corrosion and ease of welding.

Manganese is often added to increase strength and resistance to corrosion, adding silicon lowers the melting point and improves stability and alloys with zinc also have increased strength and hardness. The properties these alloys give to the metal enhance the use of aluminum greatly.

Most uses for aluminum are when it is alloyed, rather than in its pure state. These alloys make aluminum suitable for use in cars, airplanes, cars, trains and buildings because aluminum in its pure state simply isn't strong enough.

(Dawson, 2002) v) The Hall Hereunto Process- the extraction of the aluminum metal The Hall Hereunto Process- the extraction of the aluminum metal Brayer process on industrial scale Brayer process on industrial scale The first step in extracting aluminum is to remove it from the earth in mining, this is simple because the element is so abundant.

Because of its reactivity, aluminum is never found isolated in the earth, it is always found bound together with other elements in compounds.

The bauxite then has to be purified using the Bayer process. This process occurs in two main steps. First the aluminum ore is mixed with sodium hydroxide in which the oxides of aluminum and silicon will dissolve, but other impurities will not. These impurities can then be removed by filtration.

Carbonic acid, neutralizing the solution and causing the aluminum oxide to precipitate while leaving the silicon impurities in the solution.

After filtration, and drying to remove water, purified aluminum oxide can be collected.

Once purified aluminum oxide has been manufactured, aluminum can be removed from it using the Hall-Héroult method. The aluminum oxide is mixed with cryolite (mixture of sodium fluoride and aluminum fluoride) then heated to 980°C to melt the solids. This is much a much lower temperature than required to melt aluminum oxide so much energy is saved. The molten mixture is then electrolyzed with a large current and the aluminum ions are reduced to form aluminum metal.

VI) The process for extracting pure aluminum metal takes a long time and a huge amount of energy.

The process in the extraction of the aluminum that takes the most energy is the electrolysis to reduce the ions to form metal. The aluminum oxide mixed with cryolite has a melting point of 950 degrees Celsius, which on such a large scale takes an obscene amount of energy. (Williams, Unknown).

Electric power represents about 20% to 40% of the cost of producing aluminum, depending on the location of the smelter.

Aluminum production consumes roughly 5% of electricity generated in the U. S.

(Wisped, 2013). Aluminum is so hard to extract from aluminum oxide and takes so much energy because of the covalent bonding. Aluminum oxide is bonded covalently, which means that all the elements are connected very strongly and are hard to break apart, hence the reason why it takes so much time and energy to extract pre aluminum. Structure of pure aluminum 3.

Copper I) Copper is mainly found in porphyry copper deposits, which are the largest source of copper ore.

These porphyry deposits, which generally contain a mixture of igneous rocks such as feldspar, copper and quartz appear as a purple-red stone. These deposits are formed when a column of rising magma is cooled slowly deep into the crust, creating large crystal grains, with a diameter of 2 mm or more. In the final stage, the magma is cooled rapidly at relatively shallow depth or as it erupts from a volcano, creating small grains that are usually invisible to the naked eye. These deposits have multiple cavities of diorite to quartz.

It is also found mixed in with rock composed of broken, rounded fragments of minerals and other rocks, sulfide normalization often occurs between or within fragments. The deposits typically have an outer calcium aluminum iron (peptide) layer. (Wisped, Porphyry copper deposit, it) The most common ores are known as sulfide ores in which the copper is chemically bonded with sulfur. The other ores are oxide ores, carbonate ores, or mixed ores

depending on the chemicals present.

<https://assignbuster.com/preliminary-chemistry-metals-research-assignment-flashcard/>

Many copper ores also contain Common ores of copper are in the following list

Name	Formula
Chlorinated (copper iron sulfide)	Cu_2FeS_2
Scuffs Chocolate (copper sulfide)	CuS
Cuss	Cu_2S
Coprolite (copper sulfide)	Cu_2S
Cuss	Cu_2S
Bernice (copper iron sulfide)	Cu_2FeS_2
Suffers	Cu_2S
Tetrahedral (copper antimony sulfates)	Cu_3SbS_4
Succubus + x(Fee, Zen)sibs (copper carbonate hydroxide)	$\text{Cu}_2(\text{OH})_2\text{CO}_3$
Cuscus(OH) ₂	$\text{Cu}_2(\text{OH})_2\text{CO}_3$
1 Azurite (copper carbonate)	$\text{Cu}_3(\text{OH})_2(\text{CO}_3)_2$
1 Sprite (copper oxide)	Cu_2O
1 Cue	Cu_2O
Chromosomal (copper silicate)	Cu_2SiO_3
1 Cue; Isis; AH	Cu_2O
1 Malachite ii)	$\text{Cu}_2(\text{OH})_2\text{CO}_3$

Predicting yield is a very important step when it comes to mining and extracting copper in commercial ore deposits.

This is because mining copper is a huge job, and it is vital to know that the amount of copper mined will supersede the cost of mining the copper. Mining procedures such as drilling, explosive blasting, power shovels and smelting cost a lot of money and take a lot of time. Copper excavating pits may grow to be a mile or long or even longer, this is why the amount of copper that is available to be yielded needs to be predicted, so that they know their efforts will not go to waste. It also reduces the amount of excavating pits needed and reduces the energy consumed.

V) The most common copper ore is chlorinated, it makes up around 50% of copper production. To extract this as a pure metal, the ore must be processed in a specific way. Firstly the ore that has been mined is crushed up into small pieces, these pieces are then ground in a ball mill, a round cylinder containing large metal balls which rotate to grind the ore into fine powder. The sulfide ore is then mixed with generate reactants (alcohol and hydroxide) in an aeration tank filled with water.

These two exact and the copper sulfide becomes hydrophobic on the outside.

When air is pumped through the tank the copper sulfide is repelled from the water and attaches itself to the air bubbles. As the air rises to the surface of the water, the copper sulfide is carried with it and separated from the rest of the composition of the ore, which is normally discarded as tailings. This method is called froth floatation.

In this way copper is concentrated and purified to contain a higher proportion of copper metal, the product of the froth floatation is about 30% copper. From here the copper sulfide is then subjected to smelting. The material is mixed with silica and limestone and then smelted at 12000C.

This chemically removes the copper from any other elements which is bound to it. The remaining waste product is called slam and is either disposed of or refined to further remove copper.

The liquid copper that is then produced is called copper matte, this product contains around 70% copper in the form of copper sulfide and iron sulfide. In order to remove the sulfur from the matte, oxygen is blown through the molten mixture and combines with the $\text{CuS} + \text{S} + \text{O}_2 = \text{Cu}_2\text{O} + \text{SO}_2$ The end product contains close to 98% copper and is commonly called a blister cause of the cracks on its surface due to the sulfur dioxide escaping.