Chemistry research task assignment

Preliminary assignment task 1 Crude oil refining using fractional distillation- How crude oil refining works- prelims One of the many industrial separation processes is fractional distillation. It is used to separates many mixtures such as crude oils. Crude oils originate from deep below the earth’s surface, the lithosphere. It happens when animals decay under layers of sand and mud over a long period of time.

The following elements and compounds make up crude oils: 84% carbon, 14% hydrogen, 1 to 3% sulfur as hydrogen sulfide, sulfides, disulfide, elemental sulfur, less than 1% nitrogen, less than 1% oxygen mound in organic compounds such as carbon dioxide, phenols, stones, carboxylic acids, less than 1% metals and less than 1% salt Factional distillation is able to separate crude oils because they have different boiling and condensation points. Which means when the crude oil is boiled at high temperatures all of the different substances run off into the separation chambers.

The process of fractional distillation actually works to separate the mixture by: 1. Heat the mixture too high temperature. Heating is usually done with high pressure steam to temperatures of about 600 degrees Celsius. 2. The mixture boils, forming vapor. . The vapor enters the bottom of the fractional distillation column that is filled with trays or plates. The trays have many holes or bubble caps (like a loosened cap on a soda bottle) in them to allow the vapor to pass through. 4. The vapor rises in the column. . As the vapor rises through the trays in the column, it cools. 6. As the vapor reaches a height where the temperature of the column is equal to that substance’s boiling point, it will condense to form a liquid. 7. The trays collect the various liquid fractions. And then go to storage tanks, or they may go to other areas

for further chemical recessing. The products refined from crude oil can be placed into ten main categories- These main products are further refined to create materials more common to everyday life.

The ten main products are: Products- Main use- Asphalt Asphalt is commonly used to make roads. Diesel Diesel is any fuel that can be used in a diesel engine Fuel Oil Fuel oil is any liquid petroleum product that is burned in a furnace to generate heat Gasoline It is mainly used as fuel in internal combustion engines, like the engines in cars Kerosene Kerosene is most commonly used as Jet fuel and as heating fuel Liquefied Petroleum

Gas Liquefied petroleum gas is a mixture of gases that are most often used in heating appliances, aerosol propellants, and refrigerants Lubricating Oil The most commonly-known lubricating oil is motor oil, which protects moving parts inside an internal combustion engine Paraffin Wax Paraffin wax is used in drywall to insulate buildings. It is also an acceptable wax used to make candles for the Jewish Menorah. Bitumen Bitumen, commonly known as tar, is a thick, black, sticky material Petrochemicals It is used as a solvent and cleaning agent The waste products and their environmental Impact: Waste products-

Environmental impact- Emissions from asphalt plants, including greenhouse gases, are very low and well- controlled Tar Global warming and greenhouse gas emissions, disturbance of mined land; impacts on wildlife and air and water quality. Waxes When burned it releases toxins such as toluene and benzene into the atmosphere New developments/improvements in the separation process- In 1852 a Canadian inventor named Abraham Genre

discovered how to make Kerosene from crude petroleum. Borrowing a page from alcohol distiller’s Genre used a simple still type system to distill and refine crude petroleum by heating it and operating its various elements.

In the early days of the oil industry, the methods for refining oil were very different than the methods we use today. They used horizontal cylindrical stills that only held 5 to 6 barrels of oil at a time. Using the stills, they were removed the distillates like gasoline. Over time technology has made it more efficient by making more of the run off chambers and a larger distillation column, which means more oil can be heated and distilled. Today, pipelines, railroads, tankers, and trucks transport crude oil to refineries where it is transformed into the products we SE every day.

Most governments have placed restrictions on how oil refineries dispose of waste products and what they can emit into the air. There are many environmental programs that have made oil refining a safer, cleaner industry. Today, the retorts and pot stills have been largely supplanted by more efficient distillation methods in most industrial processes. The availability of powerful computers has also allowed direct computer simulation of distillation columns making it easier to control with less man power. The Bronze Age, the Iron Age, the modern era

The bronze age- The Bronze Age of any culture is the time in during which the most advanced metalworking in a culture uses bronze. The Bronze Age was between 5, BBC and 1 , BBC. The Bronze Age was the first of the metal ages because bronze is strong and has a low melting point of 600-ICC which made it easy and reliable to make weapons and other things. Bronze is made

up of approximately 88% copper and 12% tin. The Iron Age- the Iron Age was between 1, BBC and DAD. The Iron Age is characterized by the wide spread use of iron and steel.

During the Iron Age, the best tools and weapons were made from steel. As a material, iron was so important to the factories and their machinery that it almost single-handedly propelled Britain, which had generous deposits of the mineral, to the forefront of industrial powerhouses. The modern era- In the modern era we've developed new extraction methods that have allowed us to extract other metals especially aluminum. Though aluminum is a very common element, we had to wait for the invention of the electrolysis separation technique before we could get it out of its mineral, bauxite.

The possible future- New alloys will be discovered, we'll probably develop better ethos of metal extraction though, using lower grade ores. Why the Bronze Age was the first of the metal ages- The Bronze Age came before the Iron Age because metals which make bronze were easily extracted from their ore; the secondary mixture was soft enough to be paired with raw materials. Bronze was found first as it was less reactive. Tin and copper didn't need deep mines to access their ore as it was found in the natural environment.

Once the ore had been found, the metal was easy to extract. It needed little equipment and it didn't need extreme heat, the smelting process was easier that extracting iron. Advances in metal chemistry- The use of iron resulted in many technological advances like furnaces to heat the metal to high temperatures and smelting equipment, as well as weapons and other tools.

This made it easier to extract more metals from their ore and further led to the discovery of separation by fractional distillation.

Bronze is an alloy of tin and copper and is lower in reactivity than iron this means bronze is easier to get out of its ore than iron. Once the ores has been found the metal is easy to extract from the or with common element in the earth’s crust, but it almost always occurs as a compound, it is ere rare to find it naturally as metallic iron. It is much more difficult to smelt iron than bronze as in the copper smelting process the copper flows as a liquid to the bottom of the furnace.

The slang of waste material gathers on top of the copper, and can be poured off to leave behind the copper. The physical chemistry of smelting iron differs from that of copper as you need incredible heat and technical machinery to make the iron metal. Iron does not melt at the temperatures that can be reached in an original furnace: iron is still solid when copper and bronze are molten. Technology ad to improve to be able to heat the ore up to the needed temperature and the equipment needed to handle the molten iron.

Things have changed today, we have the ability to use and melt iron. We have the technology and means to make extract iron and now metal from their ores. These improvements in the technology have also lead to the foundation of new metals called aluminum and more. With the introduction of electricity, new processes have become available to extract metals in different ways. A new process of electrolysis uses electricity to chemically

separate the metal from its compound and through eat and high intensity currents the metal is able to be tapped off as a molten metal.

How the Iron Age arise from the Bronze age- The beginning of the Iron Age was when iron ceased to be considered precious and was finally accepted as the predominant material for making tools and weapons. A more measurable definition distinguishes three stages of iron development. In the first stage a society uses iron for decorative purposes, or for ceremonial tools and weapons not for working use. In the second stage the society uses iron for practical purposes, but bronze still predominates. In the third stage the society uses iron more molly than bronze as a working metal.

This definition is somewhat more useful because it distinguishes the first stage, which is still in the Bronze Age, from the second and third stages. This determination can be made by examining the number of iron and bronze tools archaeologists find associated with each period and culture. But this still doesn’t explain why iron replaced bronze. Iron is not superior to bronze for tools. It is only when carbon dissolves into the iron and the artisan quenches the resulting steel that ferrous metals have a definite hardness advantage over bronze.

Factors that lead to the Iron Age and how iron was used- While it is impossible to know for sure, many people believe that the early iron production was not intentional, but a by-product of smelting of other metals. The transition to the Iron Age was critical not because of any property of the metal itself, but rather because iron is more abundant than copper and tin. This enabled true mass-production of metal tools and weapons. Both

agriculture and warfare were thus transformed, since metal implements are far more effective than stone in both endeavourers.

During the Iron Age, the best tools and weapons were made from steel. As a material, iron was so important to the factories and their machinery. Some advances in metal technology, future uses and how they will be developed- We are metals from their ore with less waste and less time needed. Future developments will occur with time by the extraction of more metals from their or and discovering and experimenting with new elements. Modern day technology has enabled us to produce high tech metals; such as fiber optic cabling, prosthetic limbs and carbon fiber structures e. . Boats, yachts. New metal technology has developed products which minimize their environmental impact while at the same time provide high bevels of insulation, thermals performance and sustainable building materials. The unique properties that metals possess will see them play an important role in society’s transition to sustainable development. Metals will continue to contribute to the needs of present and future generations in everyday uses and especially in developing requests in a wide variety of areas such as electronics, telecommunications and aerospace.

Despite earlier concerns about possible shortages of metals, there are no indications that metal shortage will be a major problem for future generations. However increased energy consumption associated with decreasing ore grades and the likely introduction of carbon or energy taxes will see more stress placed on the use of recycled metals. Advanced metal alloys based on aluminum, magnesium, and titanium are used for aircraft and spacecraft applications as well as prosthetics and artificial Joints, these

metals provide a great structural strength with low weight. Stainless steel is found in industrial equipment and surgical instruments.

Some things to consider are: Current metal investments and how these may change in the future Some of the environmental impacts associated with metal production and how they will be worsened by declining ore grades New processing technologies with lower energy consumptions Improved metal extraction efficiencies increasing the utilization of “ metals in use” by recycling, with particular reference to aluminum the potential impact of a carbon tax on metal prices Recycling of metals- Recycling aluminum started when it was discovered that melting and reshaping aluminum does not affect it structural integrity.

It is a simple metal to recycle by collecting the recycled aluminum melting it down and reshaping it. The steps of cycling aluminum are: 1. Taking the aluminum to the treatment plant 2. The aluminum is sorted and cleaned ready for reprocessing. 3. The aluminum goes through a re-melt process and turns into molten aluminum; this removes the blocks called ingots. 5. The ingots are sent to mills where they are rolled out, this gives the aluminum greater flexibility and strength. 6.

The thin sheets of aluminum are then made into aluminum products such as cans, chocolate wrapping and ready meal packaging. 7. In as little as 6 weeks, the recycled aluminum products are then sent back to the shops ready to be used again. Recycling of all metals is important for all societies because less waste gets put into landfill and less raw materials needs to be mined. Some of the advantages and disadvantages are: Advantages of metal

recycling- Disadvantages of metal recycling- Metals can be recycled continuously without loss of quality.

Metals need to be manually separated from materials such as plastic and paper They are recycled quickly between 6 to 8 weeks Metals tend to degrade after each reuse cycle Recycling metal generates revenue for the community More transport Less waste More energy usage Less mining Creates toxic chemicals Income source With concern over things such as peak minerals, constraints on mining such as carbon emissions and higher costs, and an increase in consumer goods requiring rare metals, recycling scrap metals is becoming an increasingly attractive way of fulfilling society’s needs.

Some of the main reasons why recycling metals is important for societies is that; It takes a lot less energy to melt down waste metal and recycle it than it does to produce new metal, Using recycled metal reduces CO emissions and air pollution, Less water is polluted, Reduces the need to mine the raw materials, Reduces the amount of metal going to landfill. In conclusion when weighing up the advantages and the disadvantages of metal recycling the advantages highly weigh out the disadvantages.

It is clear that the damage of mining for new raw metal products is much greater than the waste of melting and recycling scrap metals. The cost and energy involved in the extraction of aluminum and the recycling of aluminum- Method of gaining aluminum Energy (MS) required per tone Extraction 6500 Recycling Extracting from its ore- Cost: all topsoil and vegetation and soil beneath. This is an expensive method, as it requires

expensive machinery and large numbers of man-hours. Land must be ought, which can cost millions of dollars.

It is expensive to transport the equipment needed, such as ores, from the mine to the refinery There are large costs involved in exporting minerals to foreign countries, Specializes equipment is needed There are large costs involved in land degradation needed to mine the aluminum Brayer Process is used to convert bauxite into alumina; it requires large amounts of chemicals such as sodium hydroxide, which must be purchased. It is an additional cost to extraction. It is expensive to dispose the waste formed during the refining process.

It must be transported and pumped into espousal ponds. 10 tones of bauxite is required to produce 1 tone of aluminum when extraction aluminum from its ore. The total cost is approximately AU$1, 632 per tone. Energy: The refining of bauxite to produce alumina requires 15 000 MS of energy per tone. The process of Electrolytic reduction to refine alumina to produce aluminum requires 100 000 amps per tone. Due to the large amounts of energy that Refineries and smelting factories they often require their own power plant The total energy is approximately 65 000 MS per tone.

Recycling- There are minimal transportation costs, compared with the extraction method. Less machinery is required which then costs less. Used cans and other aluminum products are free, whereas the extraction method requires land to be purchased and the cost of degradation of the land. 95% of aluminum cans and scrap metal is recycled, therefore recycling is decreasing the impact on the environment because these products do not

need to be placed in landfills. Recycling centers can be established in any location and do not need their own power plant No chemicals are required to be purchased.

Recycling requires approximately 5% of energy used for extraction, approximately 19 mimes less energy used. The only energy required in recycling is used to heat and melt the aluminum, which in comparison to the large amounts of energy used in the many processes involved with the extraction method is a minimal amount. The total energy used is approximately 800 MS Overview: Recycling aluminum is a much better alternative to raw extraction of aluminum. Recycling is a better means of producing aluminum for use in society.

This is attributable to the lower costs and energy required to recycle aluminum, henceforth ensuring its sustainability and limiting its impact upon the environment. The process of recycling aluminum is Just simply remitting the scrap metal, which uses less energy than the process of extracting aluminum from its ore. Recycling aluminum scrap requires only about 5% of the energy needed to extract aluminum one can from raw aluminum. Aluminum is extracted from its ore by electrolysis. As the process is so long and requires so much energy the aluminum metal obtained is quite expensive.