

End Of Year Exam Revision

Redox Reactions

1. Name two common processes that are considered to be redox reactions

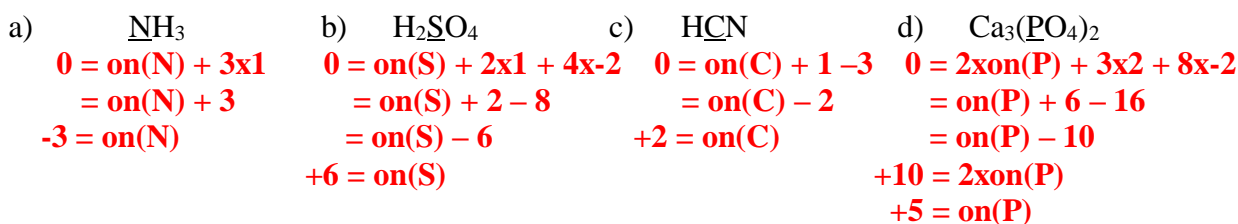
Plant growth, batteries, burning fuels, rusting, photography, explosions, body's use of food

2. Define oxidation and reduction in terms of oxygen, hydrogen, electrons and oxidation number.

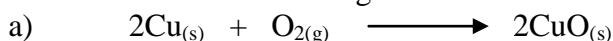
Oxidation – gain of oxygen, loss of hydrogen, loss of electrons, increasing oxidation number

Reduction – loss of oxygen, gain of hydrogen, gain of electrons, decreasing oxidation number

3. Calculate the oxidation numbers of the underlined atoms.



4. State which of the following reactions are redox giving clear reasons for your choice.



This is a redox reaction the oxidation number of Cu has changed from 0 to +2 and the oxidation number of O has changed from 0 to -2.

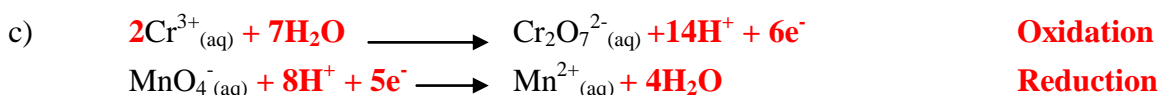
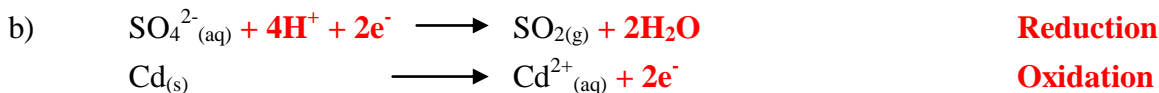
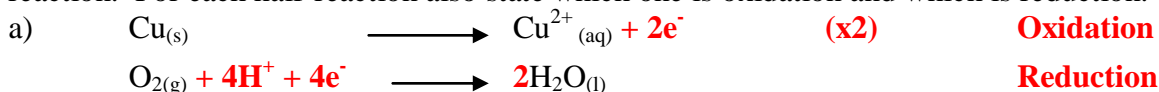


This is not a redox reaction as there is no change in oxidation number of any of the atoms (acid-base reaction).



This is not a redox reaction as there is no change in oxidation number of any of the atoms.

5. Balance the following redox reactions by first balancing the half reactions then balancing the overall reaction. For each half-reaction also state which one is oxidation and which is reduction.



6. Using your list of standard reduction potentials find the cell voltage if each of these was made into galvanic cells.

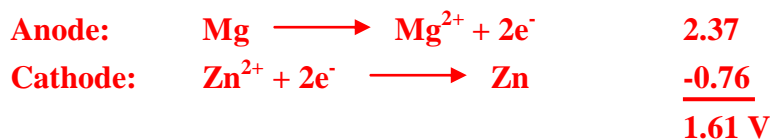
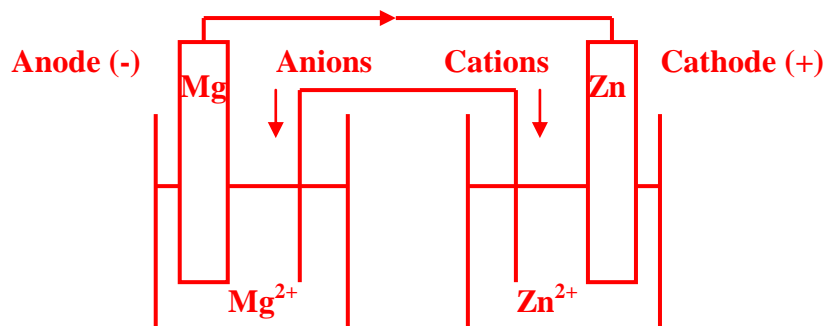
a) $-0.34 + 1.23 = 0.89 \text{ V}$

b) $0.20 + 0.40 = 0.60 \text{ V}$

c) $-1.33 + 1.51 = 0.18 \text{ V}$

Electrochemistry

- Explain the difference between galvanic and electrolytic cells.
Galvanic cells use spontaneous redox reactions to produce electricity, electrolytic ones use electricity to drive non-spontaneous redox reactions
- Explain what is meant by the term non-spontaneous redox reactions.
Non-spontaneous means that there needs to be some external force or condition that provides the energy for the reaction to occur
- Explain the difference between primary and secondary galvanic cells.
Primary cells cannot be recharged but secondary cells can
- Explain the difference between cells and batteries.
Batteries are made of cells but cells are not made from batteries. Batteries are a group of connected cells.
- Explain the purpose of the salt bridge and electrodes.
The salt bridge is used to complete the circuit and allow ion flow between the half cells. The electrodes are the sites at which oxidation and reduction occur.
- Draw and label a diagram of a zinc-magnesium cell showing the following information.
 - Composition of the electrodes and electrolyte.
 - anode and cathode (and their sign)
 - direction of ion flow in the salt bridge
 - direction of electron flow
 - Half reactions for each half cell and the overall cell equation.
 - calculation of the cell voltage
 - cell notation



- Explain your choice of the cathode for the cell above in as much detail as possible.
The zinc will be the cathode as it is the least reactive metal and is therefore less likely than magnesium to lose electrons. Therefore it is more likely to undergo reduction and since reduction always occurs at the cathode that makes zinc the cathode.
- In the cell in question 6 which electrode is corroded in the process.
Magnesium will be corroded as it is being turned into ions as part of the oxidation process as it is losing electrons

9. Explain the term spectator ions.

Spectator ions are those that are in the solution and can still be used to conduct electricity, however they do not take part in the redox reactions at the anode or cathode.

10. Explain how a rechargeable battery works.

Rechargeable batteries use an electric current to force the redox reaction backwards therefore turning the products back into the reactants.

11. Explain why an aqueous electrolyte cannot be used for the electrolytic production of active metals such as potassium and sodium.

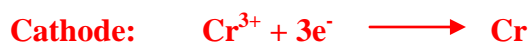
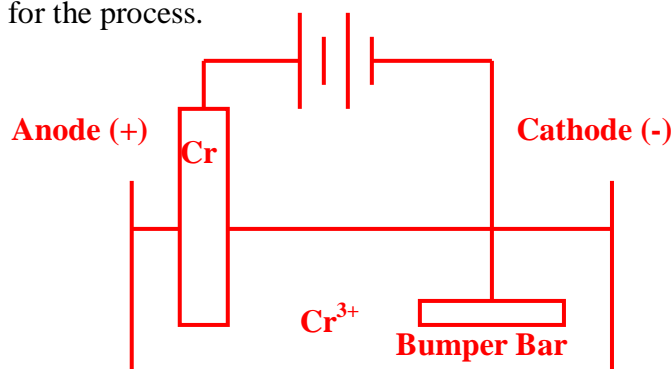
An aqueous electrolyte cannot be used in this case as the metal formed at the cathode would immediately react with the water in the electrolyte therefore not achieving the required product

12. What are the advantages of using an aqueous electrolyte over a molten one.

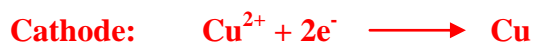
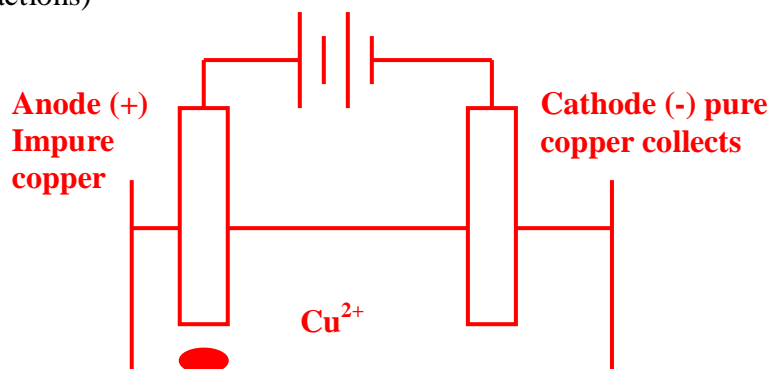
An aqueous electrolyte uses much less energy than it does to create a molten one. So the cost of the process is much lower.

13. Draw and label an electrolytic cell showing how you would plate a bumper bar with chromium including:

- Composition of the electrodes and electrolyte.
- anode and cathode (and their sign)
- Half reactions for the process.

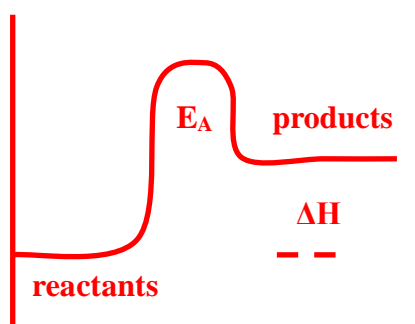


14. Draw and label an electrolytic cell showing how you would purify an impure sample of copper (include half reactions)



Industrial Chemistry

1. Define energy
Energy is the ability to do work
2. Name five types of energy.
Heat, light, sound, chemical, potential, kinetic
3. Find the energy released if 250 mL of ethanol is used to heat 5 L of water by 28°C.
$$\begin{aligned}\Delta H &= -4.18 \times \Delta T \times V(\text{H}_2\text{O}) \\ &= -4.18 \times 28 \times 5000 \\ &= 585200 \text{ J} \\ &= 585.2 \text{ kJ}\end{aligned}$$
4. If another 250 mL of ethanol is burned, calculate the temperature rise of 7.3 L of water.
From Question 3 we have energy of 585200 J
$$\begin{aligned}585200 &= -4.18 \times \Delta T \times V(\text{H}_2\text{O}) \\ 585200 &= -4.18 \times \Delta T \times 7300 \\ 585200 &= 30514 \times \Delta T \\ \Delta T &= 585200 / 30514 \\ &= 19.18 \text{ }^\circ\text{C}\end{aligned}$$
5. Explain the reaction mechanism in terms of energy transfer.
Any chemical reaction requires two steps, the molecules first absorb energy to break bonds between their atoms they then release energy when they form new bonds with other atoms
6. Name the type of reaction which absorbs heat energy.
Endothermic reactions absorb heat
7. Draw and label an energy profile diagram for the type of energy in question 6 above.



8. Define the term activation energy.
Activation energy is the minimum amount of energy required to initiate the reaction
9. State collision theory.
 1. For molecules to react they must first collide
 2. They must collide with sufficient energy to overcome the activation energy.

10. State the factors which influence rate of reaction and briefly describe how each relates to collision theory.

Temperature – Increases energy

Light Intensity – Increases energy

Pressure – Increases collisions

Concentration – Increases collisions

State of Sub-division – Increases collisions

Catalyst – Provides alternative pathway for reaction

11. What are enzymes? Explain why there are almost as many enzymes in the body as there are chemical reactions.

Enzymes are biological catalysts. Each enzyme can only catalyse one reaction therefore for each chemical reaction in the body you need one enzyme.

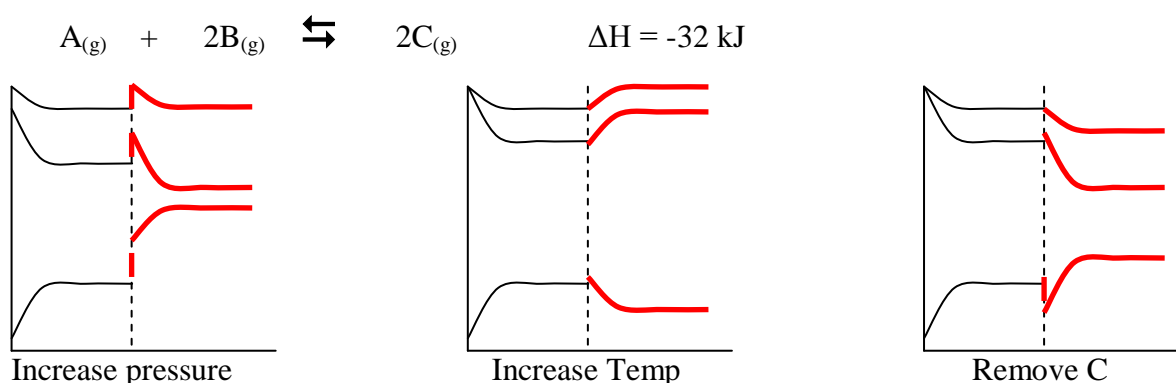
12. Define the term dynamic equilibrium.

Dynamic equilibrium is when there is no change in the concentration of reactants or products, the forward reaction is occurring at the same rate as the reverse reaction.

13. Define what is meant by a closed system in relation to equilibrium.

A closed system is one where no reactants or products can escape and temperature and pressure remain constant.

14. Show how the equilibrium will shift in the given circumstances



15. State five factors to consider when looking to build a chemical plant and briefly describe why each is important

- **Land Cost – Large cost, take up lots of space**
- **Availability of Labour – Need people to work in the plant**
- **Access to Energy and Raw Materials – Need energy to run it and raw materials to make your product**
- **Cooling Water – To cool down your process, near ocean, lake, river**
- **Access to Markets – Need to sell your product**
- **Availability of Equipment – Where can you get your equipment from**
- **Regulatory Restrictions – What environmental and other regulations do you need to meet**
- **Safety – Preventing accidents, protecting the public**
- **Transport – Expensive, the closer to markets the better.**

Organic Chemistry

1. Give two reasons why there are so many organic compounds.

Carbon is tetravalent (can form 4 bonds)

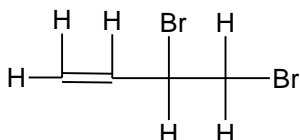
Carbon can form single, double or triple bonds.

Carbon can link to other carbons to form long chains

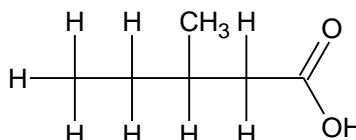
2. Define the term homologous series.

Homologous series is the name given to the different families of organic compounds

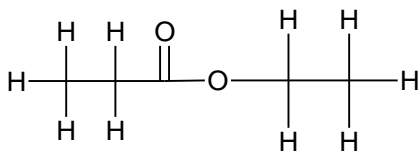
3. Name the following



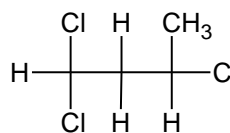
3,4-dibromo 1-butene



3-methyl pentanoic acid



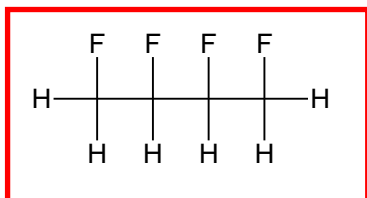
Ethyl propanoate



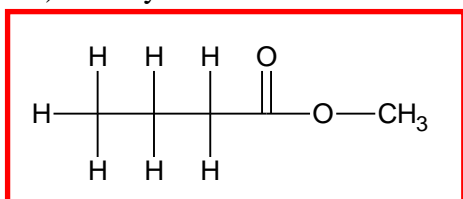
1,1,3-trichloro butane

4. Draw the following

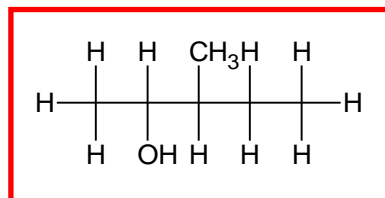
- a) 1,2,3,4-tetrafluoro butane



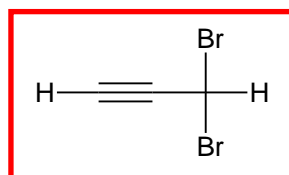
- c) methyl butanoate



- b) 3-methyl 2-pentanol



- d) 3,3-dibromo 1-propyne



5. Explain why alkanes are relatively unreactive.

Because they are comprised of only single bonds and therefore no bonds will break in order for it to react.

6. Write the reaction for the complete combustion of butane.



7. Define the term unsaturated hydrocarbon.

An organic compound containing hydrogen and carbon that has double or triple bonds as part of its structure

8. Explain why twice as much bromine is needed for a consistent colour change in alkynes than is required for alkenes.

Because alkynes have a triple bond compared to the single bond of alkenes there is one more bond in which bromine can break. Therefore bromine will break one bond in alkenes and two in alkynes which require twice as much.

9. Explain why ethane is a gas at room temperature but ethanol is a liquid.

Ethanol has a OH group which can form hydrogen bonds with water therefore dramatically rising the boiling point. Ethane does not have any groups that can form these bonds and therefore boils at a lower temperature.

10. Complete the following stating the expected colour change

	With Bromine Water	With Acidified Dichromate
Alkanes	None	None
Alkenes	Orange to Clear	None
Alkynes	Orange to Clear	None
Alcohols	None	Orange to Green
Carboxylic Acids	None	None
Esters	None	None

11. State the two ways of producing ethanol and write an equation for each.

Fermentation



Addition



12. Explain why carboxylic acids are weak electrolytes.

Carboxylic acids partially ionise in water and will therefore conduct electricity

13. What two organic substances are needed to make esters? What is the other product?

Carboxylic acids and alcohols are used to make esters and the other product is water

14. There are some natural fibres such as wool, but a lot are synthetic. Explain the term synthetic and name a synthetic fibre.

Synthetic is another name for "man made", those fibres which are made by process that are not natural. An example of a synthetic fibre is nylon.

15. Why are natural fibres better to wear in hot weather?

Natural fibres absorb water easily whereas synthetic ones don't

16. Name the 4 broad types of polymers and briefly describe each

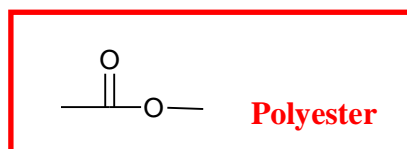
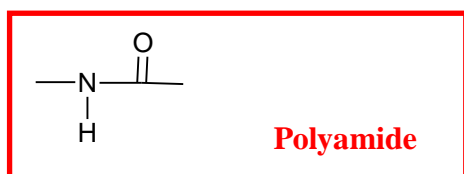
Plastics – Can be moulded

Elastomers – Can be stretched

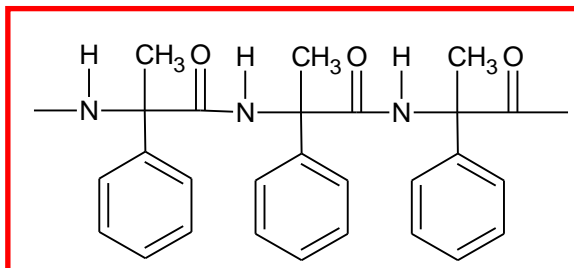
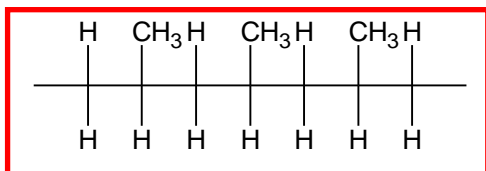
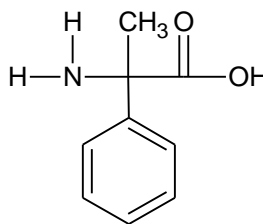
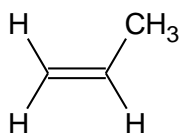
Adhesives – Used to bond surfaces

Fibres – Can be woven

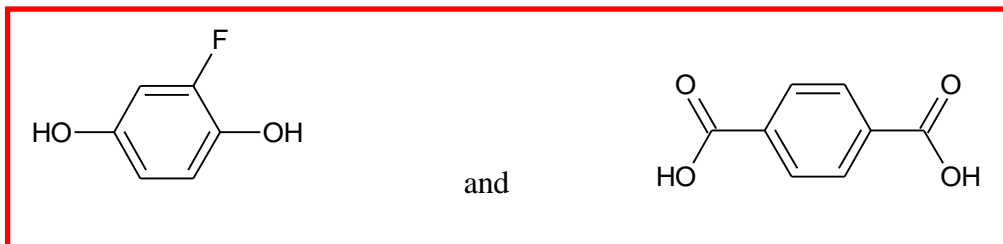
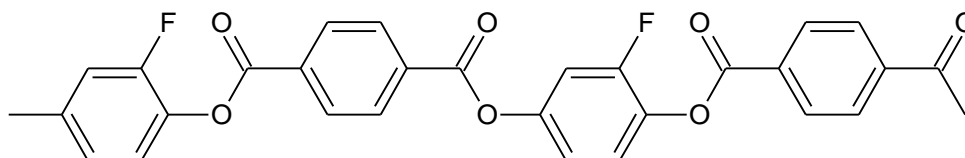
17. Name the two types of condensation polymers and draw the linking unit in each.



18. Draw the polymers that can be formed from the following monomers.



19. Draw the monomer(s) that were used to form the following polymer.



20. Define the term plastic. State two advantages of plastics over traditional materials such as wood and metal.

Plastics are any polymers which can be moulded. Two advantages is that they do not rust like metals or rot like wood. The can also be tailored to suit any use.

21. Explain why thermoset plastics are generally not recyclable.

Thermoset plastics are those which do not melt when heated. Therefore they can not be melted down and reshaped into new products and are therefore not able to be recycled

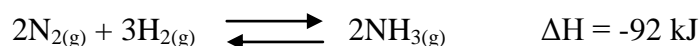
22. State two disadvantages of using plastics instead of wood products.

Plastics are made from a non-renewable resource and take a long time to break down naturally.

Extended Response Questions

Answers in this section have been given in dot point form, you should structure your answers in sentences and only resort to dot points in an exam if you are running out of time.

1. With reference to the reaction mechanism and collision theory explain what exothermic and endothermic reactions are and how they work. Use energy profile diagrams and/or diagrams to help explain your answer.
 - **Reaction mechanism has two parts, first bonds are broken which requires energy called the activation energy, next new bonds are formed which releases energy**
 - **Exothermic reactions are ones which release energy.**
 - **Energy released when forming bonds is greater than needed to break them (activation energy).**
 - **They release the energy in the form of heat to the surroundings, the temperature of the surroundings increases.**
 - **Endothermic reactions are ones which absorb energy.**
 - **Energy needed to break bonds greater than that is released when forming them.**
 - **They absorb energy in the form of heat from the surroundings, the temperature of the surroundings decreases.**
2. The Haber Process for the production of ammonia is shown in the equation below. It is an equilibrium process that occurs commonly in many industrial processes. State the factors needed to establish an equilibrium and state conditions in terms of pressure and temperature that would maximise the amount of ammonia produced. State also reasons why these conditions may not be used. Ensure you give full reasoning with your choices.



- **Equilibrium can only be established in a closed system which means one at constant pressure and temperature and one where there can be no escape entrance of any chemical species.**
- **The Haber process is an exothermic process as indicated by the enthalpy therefore it will be favoured by low temperatures. If there is a drop in the temperature then according to Le Chatelier's Principle the equilibrium will shift to increase the temperature which is the forward reaction.**
- **The Haber process will be favoured by high pressures as there is 5 gas molecules on the reactants side and 2 on the products side. Therefore if pressure is increased according to Le Chatelier's Principle the equilibrium will shift to decrease the pressure which would involve shifting it to decrease the molecules which is the products side of the equation.**
- **These conditions may not be used as both high pressure and cooling a reaction vessel can be costly in terms of energy.**

3. Sulfuric acid is produced on a large scale at Port Adelaide in South Australia using the contact process. The factory is situated in an industrial area near the Port River, and separated from residential areas by approximately the width of the river. One of the first steps in the production of sulfuric acid is the burning of sulphur to produce sulphur dioxide. The sulphur is imported from America. Discuss the advantages and disadvantages of this site for the factory.

Advantages

- **It is in Port Adelaide so is close to a skilled workforce**
- **It is close to a functioning port to receive the shipments of sulphur from America by ship**
- **It is close to the city and is therefore close to markets in which it can sell its product.**
- **Transportation costs are minimised by being close to Adelaide and close to a port**
- **It is close to the port river which allows for a large amount of water that can be used in the production process**

Disadvantages

- **Land costs being close to the city would be quite large**
- **It is very close to residential areas and therefore safety considerations and control of emissions would have to be much higher than in other regions**

4. Polymers are widely regarded as one of the most important discoveries ever made in chemistry. Discuss the advantages and disadvantages of polymers.

Advantages

- **They are relatively inexpensive to produce compared to metals which must be mined and wood which must be processed extensively**
- **They are very resistant to being broken down by environmental factors due to the fact they consist of large chain molecules that are relatively unreactive and take a long time to break down**
- **There is little or no maintenance that needs to be done on them they do not need painting, etc**
- **They can be customised for any use, they can have their properties changed easily**
- **They can be made from readily available materials.**

Disadvantages

- **They are made generally from non-renewable raw materials**
- **Many cannot be recycled like metal and wood products can be.**
- **Due to the long unreactive chains they take a long time to break down.**
- **The additives they add to polymers tend to be poisonous and damaging to the environment.**