OCR (B) Chemistry GCSE

C4 - Material Choices

Flashcards

What is a polymer?

What is a polymer?

A large molecule formed from smaller molecules called monomers.

What is meant by the term brittle?

What is meant by the term brittle?

Easily broken

What is meant by the terms tension and compression?

What is meant by the terms tension and compression?

- Tension - pulling
- Compression - squashing

When can a material conduct electricity?

When can a material conduct electricity?

When it contains charged particles which are free to move.

What is meant by the term ductile?

What is meant by the term ductile?

Ability of a material to be drawn into wires.

What is meant by the term malleable?

What is meant by the term malleable?

If a material is malleable it can be pressed into shape without breaking or returning to the original shape.

What are the general properties of glass ceramics?

What are the general properties of glass ceramics?

- Transparent
- Strong but brittle
- Easily moulded into shapes
- Poor conductors

What are the general properties of clay ceramics?

What are the general properties of clay ceramics?

- Opaque
- Soft and malleable
- Hardened with heat
- Brittle once hardened
- Poor conductors

What are the general properties of polymers?

What are the general properties of polymers?

- Properties can be adapted to suit the purpose.
- Usually tough and flexible.
- Can be transparent or opaque.
- Poor conductors.

What are the general properties of metals?

What are the general properties of metals?

- Shiny
- Malleable
- Ductile
- Good conductors
- Can form alloys to produce more desirable properties

What is a composite material?

What is a composite material?

Contains two or more materials with different properties.

Typically, there are two components: the reinforcement (makes up the bulk of the material) and the matrix (binds the reinforcement together).

Why do composite materials have a wide range of different properties?

Why do composite materials have a wide range of different properties?

As composite materials are made of several materials, the properties can be tailored to suit the need of the composite. Different composite materials contain different reinforcements and matrixes so the properties vary.

What should be used to construct large buildings: reinforced concrete or fibreglass? Why?

What should be used to construct large buildings: reinforced concrete or fibreglass? Why?

Reinforced concrete because it is strong in compression and tension and slightly flexible.

What should be used to make tennis rackets: timber or fibre reinforced plastic? Why?

What should be used to make tennis rackets: timber or fibre reinforced plastic? Why?

Fibre reinforced plastic because it has a low density so is lightweight and is flexible and strong in tension.

What is an alloy?
(Chemistry only)

What is an alloy? (Chemistry only)

A mixture of a metal and one or more other elements.

How do the properties of alloys differ to the properties of metals?

(Chemistry only)

How do the properties of alloys differ to the properties of metals? (Chemistry only)

Alloys are harder and less malleable. This is because the uniform rows of atoms in metals are distorted by different sized atoms and so the layers are unable to slide over one another.

How do the uses of alloys differ to the uses of metals?

(Chemistry only)

How do the uses of alloys differ to the uses of metals? (Chemistry only)

Alloys are harder so they are often used rather than metals as they have more desirable properties.

What is steel?
(Chemistry only)

What is steel? (Chemistry only)

Steel is an alloy of iron.

Three main categories:

- Mild low carbon steel
- High carbon steel
- Stainless steel

How are the properties of mild steel linked to its uses?

(Chemistry only)

How are the properties of mild steel linked to its uses? (Chemistry only)

Mild steel is malleable and ductile so can easily be pressed into shape to make car parts. Galvanising and painting mild steel makes it resistant to rust.

How are the properties of high carbon steel linked to its uses?

(Chemistry only)

How are the properties of high carbon steel linked to its uses? (Chemistry only)

High carbon steel is hard and resistant to high temperatures so isn't damaged when using it as a drill bit.

How are the properties of stainless steel linked to its uses?

(Chemistry only)

How are the properties of stainless steel linked to its uses? (Chemistry only)

Stainless steel is corrosion resistant so it is suitable for use as cutlery.

What is magnalium?
What is it used for?
(Chemistry only)

What is magnalium? What is it used for? (Chemistry only)

Magnalium is an alloy of magnesium and aluminium.

It is lighter and stronger than aluminium and more resistant to corrosion. It is used for car and aircrafts.

What is brass?
What is it used for?
(Chemistry only)

What is brass? What is it used for? (Chemistry only)

Brass is an alloy of copper and zinc.

Brass is hard and resistant to corrosion. It is used for decorative hardware such as plumbing fittings.

What is addition polymerisation?
(Chemistry only)

What is addition polymerisation? (Chemistry only)

Addition polymerisation involves the removal of the C=C double bond from an alkene to produce a polymer.

What is a repeat unit?
(Chemistry only)

What is a repeat unit? (Chemistry only)

A section of the polymer which is repeated throughout the whole polymer structure.

What is the displayed formula of the product formed from the addition polymerisation of ethene?

(Chemistry only)

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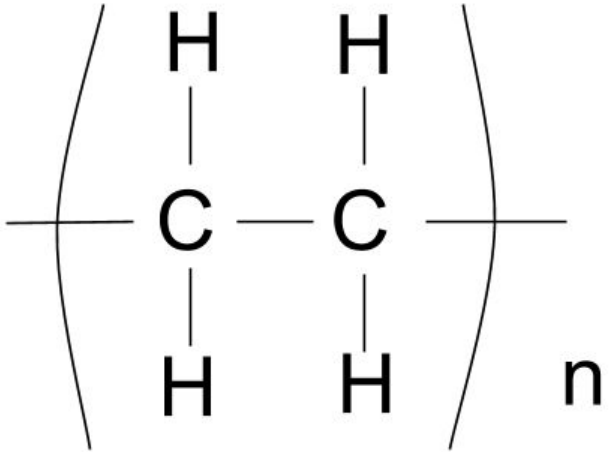
(Chemistry only)



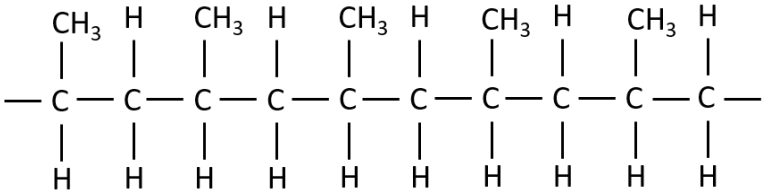
Many ethene molecules are joined together. What is the name of the polymer that forms?

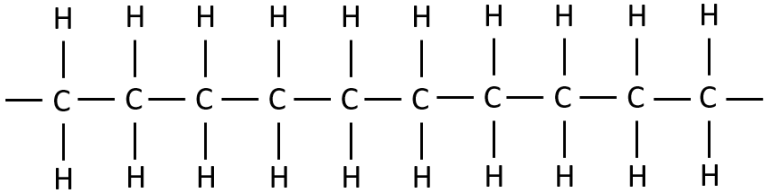
(Chemistry only)

Many ethene molecules are joined together. What is the name of the polymer that forms?
(Chemistry only)

Poly(ethene)

What monomers formed the addition polymers below? (Chemistry only)





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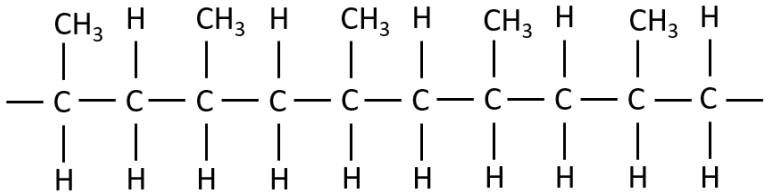
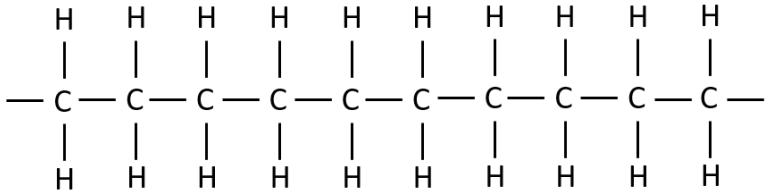
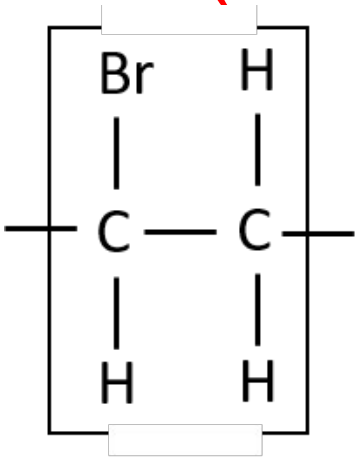


Poly(propene) formed from propene.



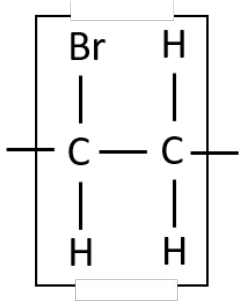
Poly(ethene) formed from ethene.

What monomer formed the addition polymer below? (Chemistry only)

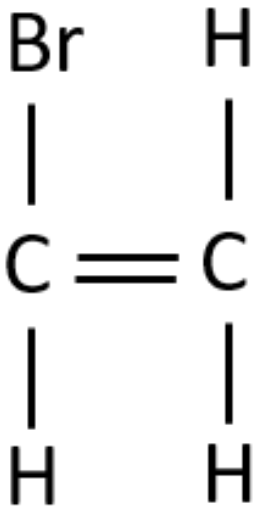


What monomer formed the addition polymer below?

(Chemistry only)



Bromoethene

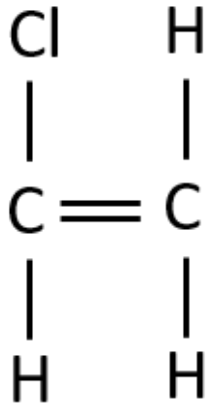


Draw the repeat unit of the polymer formed from chloroethene

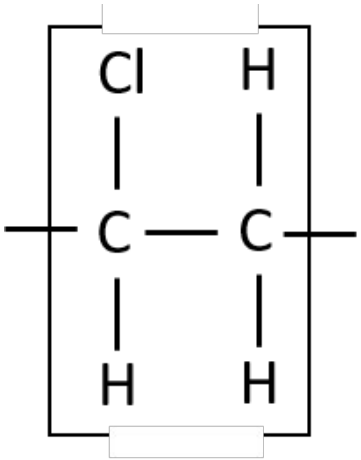
(Chemistry only)

Draw the repeat unit of the polymer formed from chloroethene (Chemistry only)

Monomer:



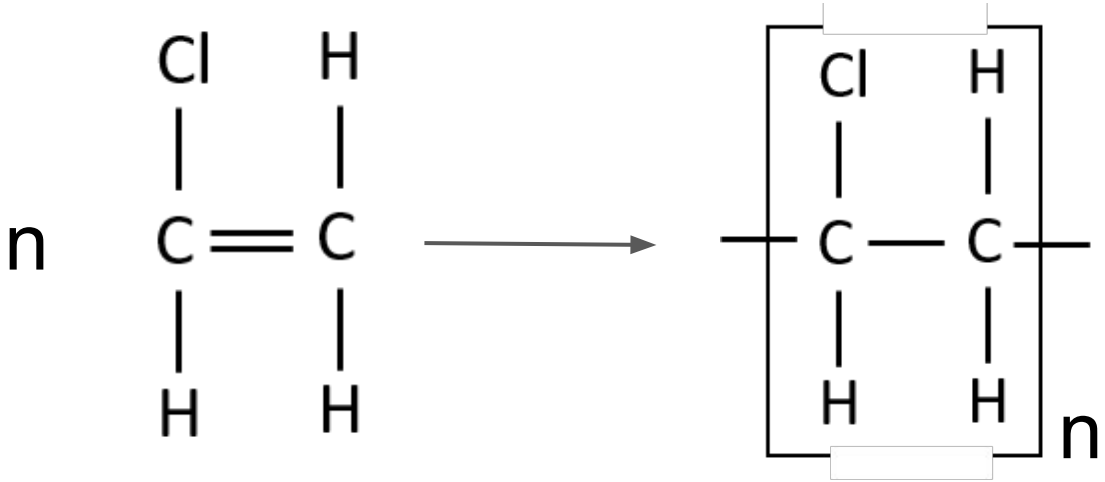
Repeat unit:



Write an equation for the formation of the addition polymer poly(chloroethene)

(Chemistry only)

Write an equation for the formation of the addition polymer poly(chloroethene) (Chemistry only)



What is condensation polymerisation?

(Chemistry only) (Higher only)

What is condensation polymerisation?

(Chemistry only) (Higher only)

Formation of a polymer with the release of a small molecule such as water.

Compare condensation polymerisation and addition polymerisation (Chemistry only) (Higher only)

Compare condensation polymerisation and addition polymerisation (Chemistry only) (Higher only)

Condensation polymerisation	Addition polymerisation
Needs 2 types of monomer	Only 1 type of monomer
Monomers need two functional groups minimum	Monomers must have C=C bond
Forms 2 products (polymer and many small molecules)	Only forms the polymer

What is an ester?

(Chemistry only) (Higher only)

What is an ester? (Chemistry only) (Higher only)

A molecule formed during a condensation reaction between an alcohol and a carboxylic acid. One water molecule also forms during this reaction.

How is a polyester formed?
(Chemistry only) (Higher only)

How is a polyester formed?

(Chemistry only) (Higher only)

Formed from a condensation reaction between a dicarboxylic acid (contains 2 COOH groups) and a diol (contains 2 OH groups).

How many monomers are in one repeat unit of a polyester?

(Chemistry only) (Higher only)

How many monomers are in one repeat unit of a polyester? (Chemistry only) (Higher only)

Two

What is a polyamide formed from?

(Chemistry only) (Higher only)

What is a polyamide formed from?

(Chemistry only) (Higher only)

Formed from a condensation reaction between a diamine (contains 2 NH_2 groups) and a dicarboxylic acid (contains 2 COOH groups).

Give a biological example of a polymer (Chemistry only)

Give a biological example of a polymer
(Chemistry only)

DNA

How many different monomers make up DNA?

(Chemistry only)

How many different monomers make up DNA? (Chemistry only)

Four

What are the monomers in DNA called?

(Chemistry only)

What are the monomers in DNA called?
(Chemistry only)

Nucleotides

Name two more natural polymers and give their monomers

(Chemistry only)

Name two more natural polymers and give their monomers (Chemistry only)

- Cellulose and starch (monomer is glucose)
- Proteins (monomer is amino acids)

Do the atoms that make up a material have the same properties as the bulk material?

Do the atoms that make up a material have the same properties as the material?

No

Which three things affect the properties of a material?

Which three things affect the properties of a material?

- Types of bonds.
- Strength of bonds in comparison to intermolecular forces.
- Arrangement of atoms.

Two materials are made from carbon. Will these materials have the same properties?

Two materials are made from carbon. Will these materials have the same properties?

No.

- They may have different bonds that have different bond strengths.
- The atoms may be arranged differently.

What are intermolecular forces?

What are intermolecular forces?

(Relatively weak) forces of attraction between molecules.

What bonds does carbon form? How many of these bonds can carbon form?

What bonds does carbon form? How many of these bonds can carbon form?

Carbon forms four covalent bonds.

What is an organic compound?

What is an organic compound?

A compound containing carbon atoms covalently bonded together.

Why are there a large number of different organic compounds?

Why are there a large number of different organic compounds?

Because carbon can form homologous series of similar compounds, chains and rings.

What bonds are found in polymers?

What bonds are found in polymers?

Strong covalent bonds.

Why do polymers generally have a higher melting point than other organic molecules?

Why do polymers generally have a higher melting point than other organic molecules?

Polymers are long chained molecules.

Longer chains mean there are more intermolecular forces between molecules and so more energy is required to melt polymers.

What properties of polymers are affected by intermolecular forces?

What properties of polymers are affected by intermolecular forces?

- Melting point
- Behaviour on heating
- Hardness
- Flexibility

How are bonds arranged in giant covalent structures?

How are bonds arranged in giant covalent structures?

Many atoms covalently bonded together in a three-dimensional arrangement.

What are allotropes? Give an example

What are allotropes? Give an example

Different forms of the same element in the same state.

E.g. allotropes of carbon are graphite and diamond.

Describe the structure and bonding of diamond

Describe the structure and bonding of diamond

- Giant covalent structure.
- Each carbon atom is covalently bonded to four other carbon atoms.
- Regular tetrahedral structure.
- No free electrons.

What are the properties of diamond? Explain these properties

What are the properties of diamond? Explain these properties

- Hard due to the 3D structure held by covalent bonds.
- High melting point because strong covalent bonds require a lot of energy to break.
- Doesn’t conduct electricity as there are no charge particles that can move.

Describe the structure and bonding of graphite

Describe the structure and bonding of graphite

- Giant covalent structure.
- Each carbon atom is covalently bonded to three other carbon atoms.
- Hexagonal layers.
- Weak attractive forces between layers.
- There is one delocalised electron per carbon bond.

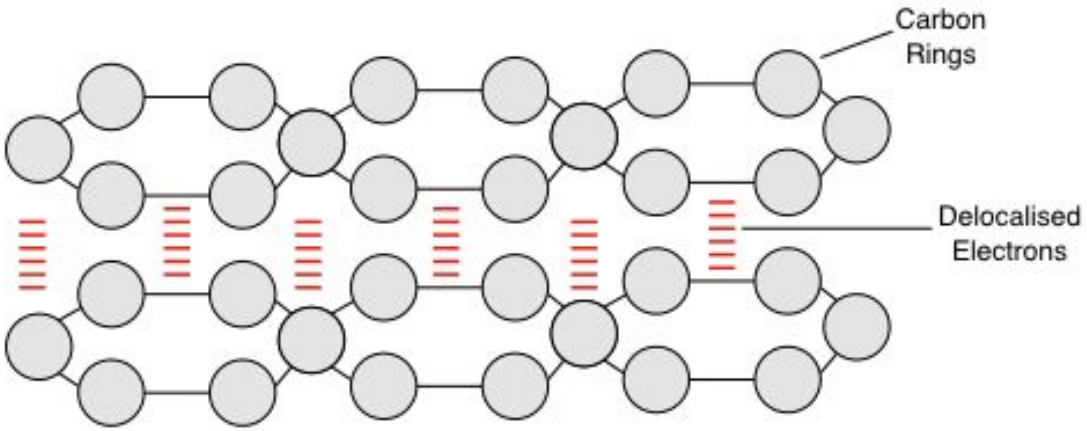
What are the properties of graphite? Explain these properties

What are the properties of graphite? Explain these properties

- Electrical conductor because delocalised electrons are free to move and carry charge.
- Soft and slippery (can be used as lubricant) because the force between layers are weak so the layers can slide over each other.
- High melting point because strong covalent bonds require a lot of energy to break.

Draw and label a 2D diagram to represent the structure of graphite

Draw and label a 2D diagram to represent the structure of graphite



Describe the bonding in ionic compounds

Describe the bonds in ionic compounds

- Giant ionic lattice.
- Oppositely charged ions alternate in a regular 3D structure.
- Electrostatic attraction between the oppositely charged ions.

Describe and explain the properties of ionic compounds

Describe and explain the properties of ionic compounds

- High melting point due to strong ionic bonds requiring a large amount of energy to break.
- Conduct electricity when molten or aqueous as the ions are free to move and carry charge.

Describe the bonding in metals

Describe the bonds in metals

- 3D arrangement of layers positive metal ions held in a sea of delocalised negative electrons.
- Metallic bonding (electrostatic attraction between cations and electrons).

Describe and explain the properties of metals

Describe and explain the properties of metals

- High melting point, strong and hard due to strong metallic bonds.
- Malleable and ductile because layers of ions can slide across each other.
- Good conductors because electrons are free to move.

Describe the bonding of simple molecular compounds

Describe the bonding of simple molecular compounds

- Strong covalent bonds between atoms.
- Weak intermolecular forces of attraction between small molecules.

Describe and explain the properties of simple molecules

Describe and explain the properties of simple molecules

- Low boiling points due to weak intermolecular forces.
- Liquid or gaseous at room temperature due to low melting and boiling points.
- Don’t conduct electricity as there are no charged particles.

Describe the bonding in giant covalent structures

Describe the bonding in giant covalent structures

Many strong covalent bonds.

Describe and explain the properties of giant covalent structures

Describe and explain the properties of giant covalent structures

- High melting points due to many strong covalent bonds.
- Most do not conduct due to no charged particles being present (except graphite).

What units are used to compare the sizes of nanoparticles, atoms and molecules?

What units are used to compare the sizes of nanoparticles, atoms and molecules?

Nanometers (nm)

What is a nanoparticle?

What is a nanoparticle?

A small structure that is 1-100 nanometers in size.

How large are nanoparticles in comparison to atoms and simple molecules?

How large are nanoparticles in comparison to atoms and simple molecules?

Nanoparticles are larger than atoms and simple molecules.

How does the size of nanoparticles affect their properties and uses?

How does the size of nanoparticles affect their properties and uses?

Nanoparticles are tiny so can enter biological tissues. They can also be used to form composite materials that have more beneficial properties.

Why would nanoparticles be useful catalysts?

Why would nanoparticles be useful catalysts?

Nanoparticles have a very high surface area to volume ratio.

What is the equation to calculate the surface area to volume ratio?

What is the equation to calculate the surface area to volume ratio?

Surface area to volume ratio = Surface area ÷ Volume

Why might nanotubes be used to make electrical circuits for computers?

Why might nanotubes be used to make electrical circuits for computers?

- Can conduct electricity.
- Are very small so take up little space.
- Lightweight.

Why might nanoparticles be used in sunscreen?

Why might nanoparticles be used in sunscreen?

Some nanoparticles block UV light. Nanoparticles absorb easily into the body so won't leave white marks on skin.

How does the arrangement of atoms in a tube affect the properties and uses of nanoparticles?

How does the arrangement of atoms in a tube affect the properties and uses of nanoparticles?

Only 1 atom thick, high tensile strength and can conduct electricity and heat.

Can be used as molecular sieves or to form composite materials.

What is a fullerene?

What is a fullerene?

A fullerene is a molecule made of carbon, shaped like a closed tube or hollow ball.

Name two fullerenes

Name two fullerenes

Graphene

C_{60} (buckminsterfullerene)

What are the properties of the fullerene C_{60}?

What are the properties of the fullerene C_{60}?

- Slippery due to weak intermolecular forces
- Low melting point
- Spherical
- Strong covalent bonds between carbon atoms in a molecule
- Large surface area

What are the properties of graphene?

What are the properties of graphene?

- High melting point due to covalent bonding between carbon atoms.
- Conducts electricity because it has delocalised electrons.

Why is graphene useful in electronics?

Why is graphene useful in electronics?

It is extremely strong and has delocalised electrons which are free to move and carry charge.

It is only one atom thick as it is a single layer of graphite.

What are some of the risks associated with nanoparticulate materials?

What are some of the risks associated with nanoparticulate materials?

- Little is known about the effects of nanoparticles.
- May be harmful to health (they could enter the bloodstream or be breathed in).
- May catalyse harmful reactions inside the body.
- Large surface area to volume ratio may allow toxic substances to bind to them and enter the body.

What is nanotechnology?

What is nanotechnology?

The use and control of structures that are 1-100 nm in size.

Calculate the surface area to volume ratio of a cube with side lengths of 8 nm

Calculate the surface area to volume ratio of a cube with side lengths of 8 nm

Surface area of each face = 8 x 8 = 64 nm

6 faces so total surface area = 6 x 64 = 384 nm^2

Volume = 8 x 8 x 8 = 512 nm^3

Surface area to volume ratio = 384 ÷ 512 = 0.75

Explain oxidation and reduction in terms of oxygen

Explain oxidation and reduction in terms of oxygen

Reduction is loss of oxygen.

Oxidation is gain of oxygen.

When a metal reacts with oxygen, does reduction or oxidation take place?

When a metal reacts with oxygen, does reduction or oxidation take place?

Oxidation

The metal gains oxygen so is oxidised.

What causes corrosion?
(Chemistry only)

What causes corrosion? (Chemistry only)

Oxygen (in air) and water

Describe the process of corrosion (Chemistry only)

Describe the process of corrosion (Chemistry only)

Reaction of metal with oxygen in the air to form metal oxide.

What is rusting? Write a word equation for the reaction

(Chemistry only)

What is rusting? Write a word equation for the reaction (Chemistry only)

A reaction between iron or steel with oxygen and water

Iron + oxygen + water → hydrated iron(III) oxide

State two ways corrosion can be prevented

(Chemistry only)

State two ways corrosion can be prevented (Chemistry only)

Physical barrier to water and oxygen

Sacrificial protection

How can a physical barrier to water and oxygen be created to prevent corrosion? (Chemistry only)

How can a physical barrier to water and oxygen be created to prevent corrosion? (Chemistry only)

Coat with plastic

Coat with paint

Coat with oil and grease

How can corrosion be prevented by sacrificial protection?
(Chemistry only)

How can corrosion be prevented by sacrificial protection? (Chemistry only)

Coat the metal being protected in a more reactive metal. The more reactive metal will be oxidised first.

What is galvanization?
(Chemistry only)

What is galvanization? (Chemistry only)

A specific form of sacrificial protection where iron is coated in zinc.

Explain reduction and oxidation in terms of electrons (Higher)

Explain reduction and oxidation in terms of electrons (Higher)

- Reduction is gain of electrons
- Oxidation is loss of electrons

What are the main stages included in a life-cycle assessment?

What are the main stages included in a life-cycle assessment?

- Processing raw materials
- Manufacture and packaging
- Transport
- Use
- Disposal

What factors are considered at each stage of a life-cycle assessment?

What factors are considered at each stage of a life-cycle assessment?

- Use of water and other raw materials
- Energy use
- Environmental impact
- Waste

How does obtaining raw materials impact the environment?

How does obtaining raw materials impact the environment?

- Uses up limited resources.
- May damage habitats (mining and felling trees).
- Extraction often requires energy.

How does manufacture impact the environment?

How does manufacture impact the environment?

- Land required for factories.
- Releases pollution into rivers and the atmosphere.

How does transport of products impact the environment?

How does transport of products impact the environment?

- Requires energy
- Releases pollution into the atmosphere

How can a product be disposed?

How can a product be disposed?

- Landfill
- Incineration
- Recycled

How does disposal impact the environment?

How does disposal impact the environment?

- Land used up for landfill sites.
- Pollution released during incineration.
- Recycling needs energy and produces waste.
- Reduced impact if product is reused.

What finite resource is used to produce polymers?

What finite resource is used to produce polymers?

Crude oil

What are biodegradable and non-biodegradable materials?

What are biodegradable and non-biodegradable materials?

Biodegradable: can be decomposed (broken down) by microorganisms.

Non-biodegradable: can't be decomposed by microorganisms.

Explain how PET bottles can be recycled

Explain how PET bottles can be recycled

PET bottles can be melted down and remoulded into new products.

What factors affect the viability of recycling a material?

What factors affect the viability of recycling a material?

- Finite nature of some resources.
- Availability of the material to be recycled.
- Economic and practical issues with collecting and sorting.
- Removing impurities.
- Transport and processing energy requirements.
- Demand for new product.
- Environmental impact.

What are the advantages of recycling metals?

What are the advantages of recycling metals?

- Fewer mines and quarries needed to obtain ores.
- Less noise and dust produced.
- Lower impact on natural habitats.
- Metal ores will last longer.

What are the disadvantages of recycling metals?

What are the disadvantages of recycling metals?

- Workers, vehicles and fuel needed to collect used metal.
- Difficult to sort.
- Sorted metal may need transporting before it can be processed further.