Atomic structure

What are all substance made from?

Atoms, elements and compounds

Atomic structure

What is an atom?

Atoms, elements and compounds

Atomic structure

Approximately how many elements are there?

Atoms, elements and compounds

Atomic structure

What is the periodic table?

Atoms, elements and compounds

Atomic structure

How are compounds formed?

Atoms, elements and compounds

Atomic structure

What do chemical reactions involve?

Atoms, elements and compounds

Atomic structure

What is a compound?

Atoms, elements and compounds

Atomic structure

How can the elements in a compound be separated?

Atoms, elements and compounds

Atomic structure

What is a mixture?

Mixtures

Atomic structure

Name five physical processes which can be used to separate mixtures.

Mixtures

The smallest part of an element that can exist.

Atoms.

An arrangement of all the elements based on their atomic number

100

Chemical reactions always involve the formation of one or more new substances and often involve a detectable change in energy (e.g. temperature change)

Compounds are formed from elements by chemical reactions

Compounds can only be separated into elements by chemical reactions.

Compounds contain two or more elements chemically combined in fixed proportions

Filtration, crystallisation, simple distillation, fractional distillation and chromatography.

A mixture consists of two or more elements or compounds not chemically combined together.

Atomic structure

What physical process would be used to separate a mixture of liquids with different boiling points?

Mixtures

Atomic structure

What physical process would be used to separate an insoluble salt from a solution?

Mixtures

Atomic structure

What physical process would be used to separate a solvent from a solution?

Mixtures

Atomic structure

What physical processes would be used to separate copper sulfate crystals from a mixture of copper sulfate solution and copper oxide?

Mixtures

Atomic structure

Why might a scientific model be changed or replaced?

The development of the model of the atom

Atomic structure

How did Democritus describe the atom?

The development of the model of the atom

Atomic structure

What did J.J. Thomson discover and what model did he suggest as a result?

The development of the model of the atom

Atomic structure

Describe Thomson's model.

The development of the model of the atom

Atomic structure

Describe the alpha particle scattering experiment.

The development of the model of the atom

Atomic structure

What were the results of the alpha particle scattering experiment.

The development of the model of the atom

Filtration

Fractional distillation

Filtration, evaporation and crystallisation.

Simple distillation

Tiny spheres that could not be divided.

New experimental evidence.

Thomson described the plum pudding model where a ball of positive charge is embedded with negatively charged electrons.

The electron.

Although most of the alpha particles passed through some were deflected and a few even bounced back.

Alpha particles (helium nuclei) were fired at a thin gold sheet. If the plum pudding was correct the alpha particles would pass straight through.

Atomic structure

What conclusion did Rutherford make from the results of the alpha particle scattering experiment.

The development of the model of the atom

Atomic structure

How did Bohr adapt Rutherford's model.

The development of the model of the atom

Atomic structure

What sub-atomic particle did Rutherford discover in 1920 to explain the positive charge in an atom?

The development of the model of the atom

Atomic structure

What sub-atomic particle did James Chadwick discover which explained isotopes?

The development of the model of the atom

Atomic structure

What is the relative charge of a proton?

Relative electrical charges of subatomic particles

Atomic structure

What is the relative charge of a neutron?

Relative electrical charges of subatomic particles

Atomic structure

What is the relative charge of an electron?

Relative electrical charges of subatomic particles

Atomic structure

In all atoms how many electrons are there compared to protons?

Relative electrical charges of subatomic particles

Atomic structure

What electrical charge do atoms have?

Relative electrical charges of subatomic particles

Atomic structure

What is the atomic number of an element?

Relative electrical charges of subatomic particles

Bohr suggested that the electrons orbit the nucleus at specific distances.

Rutherford concluded that the mass of the atom was concentrated at the centre in a nucleus.

The neutron.

The proton.

0

+1

The number of electrons in an atom is equal to the number of protons.

-1

The number of protons in the atom.

Atoms are neutral.

Atomic structure

What is the radius of an atom in m?

Size and mass of atoms

Atomic structure

What is the radius of a nucleus of an atom in m?

Size and mass of atoms

Atomic structure

How is the mass of an atom distributed in the atom?

Size and mass of atoms

Atomic structure

What is the relative mass of a proton?

Size and mass of atoms

Atomic structure

What is the relative mass of a neutron?

Size and mass of atoms

Atomic structure

What is the relative mass of an electron?

Size and mass of atoms

Atomic structure

What is the mass number of an element?

Size and mass of atoms

Atomic structure

What is an isotope?

Size and mass of atoms

Atomic structure

What is the relative atomic mass of an element?

Relative atomic mass

Atomic structure

How would you calculate the relative atomic mass of an atom?

Relative atomic mass

1×10^{-14} m (1/10000 the size of the atom)

1×10^{-10} m

1

Almost all the mass is in the nucleus.

0

1

Atoms of the same element which have the same number of protons but different numbers of neutrons.

The sum of the protons and the neutrons.

(Abundance of isotope 1 x atomic mass of isotope 1) + (Abundance of isotope 2 x atomic mass of isotope 2) / 100.

It is the average atomic mass that takes into account the abundance of isotopes of the element.

Atomic structure

What is the maximum number of electrons that can fit in the first shell?

Electronic structure

Atomic structure

What is the maximum number of electrons that can fit in the second shell?

Electronic structure

Atomic structure

What is the maximum number of electrons that can fit in the third shell?

Electronic structure

Atomic structure

Which electron shell has the lowest energy level?

Electronic structure

Atomic structure

In what order are the electron shells filled with electrons?

Electronic structure

Atomic structure

What is the electronic structure of sodium?

Electronic structure

Atomic structure

What is the electronic structure of fluorine?

Electronic structure

Atomic structure

What is the electronic structure of sulfur?

Electronic structure

Atomic structure

What is the electronic structure of hydrogen?

Electronic structure

Atomic structure

What is the electronic structure of neon?

Electronic structure

8

2

The innermost shell.

8

2,8,1

The electrons occupy the lowest available energy shells (inside shells to outside shells).

2,8,6

2,7

2,8

1

Atomic structure

Describe how the position of an element on a periodic table can be found from the electronic structure. Use chlorine as an example.

Electronic structure

Atomic structure

How are the elements in the periodic table arranged?

The periodic table

Atomic structure

How are elements with similar properties arranged?

The periodic table

Atomic structure

Why is it called a periodic table?

The periodic table

Atomic structure

Explain why elements in the same group have similar chemical properties?

The periodic table

Atomic structure

Before the discovery of sub-atomic particles, how did scientists arrange elements in the periodic table?

Development of the periodic table

Atomic structure

How did Mendeleev organise the elements in his periodic table?

Development of the periodic table

Atomic structure

Why did Mendeleev leave gaps in his periodic table?

Development of the periodic table

Atomic structure

What discovery showed why the order based on atomic weight was not always correct?

Development of the periodic table

Atomic structure

Which elements react to form positive ions?

Metals and non-metals

They are arranged by atomic number.

The number of electrons in the outer shell gives the group number. The number of shells is the period. Chlorine has 7 electrons in its outer shell so it is found in group 7. Chlorine has electrons in 3 shells so it is found in period 3.

Because similar properties occur at regular intervals.

Elements with similar properties are arranged in groups.

By atomic weight.

Because they have the same number of electrons in their outer shell.

For undiscovered elements.

He organised the elements by atomic weight and by similar properties.

Metals

The discovery of isotopes.

Atomic structure

Which elements do not form positive ions when they react?

Metals and non-metals

Atomic structure

What are the majority of elements in the periodic table?

Metals and non-metals

Atomic structure

Where are metals found in the periodic table.

Metals and non-metals

Atomic structure

Where are non-metals found in the periodic table?

Metals and non-metals

Atomic structure

What does malleable mean?

Metals and non-metals

Atomic structure

Malleable is a property of metals. Name four other properties of metals.

Metals and non-metals

Atomic structure

What does brittle mean?

Metals and non-metals

Atomic structure

Brittle is a property of non-metals.

Metals and non-metals

Atomic structure

Explain why metals form positive ions in reactions?

Metals and non-metals

Atomic structure

Explain why non metals do not form positive ions in reactions.

Metals and non-metals

Metals

Non-metals

To the right and towards the top

To the left and towards the bottom.

Conductors of heat, conductors of electricity, High melting and boiling points, shiny, usually solid at room temperature.

Malleable is the ability the bend and hammer metal.

Name four other properties of non-metals.

Generally do not conduct electricity, Are not always solid at room temperature, often have a lower density, dull.

The substance will shatter if struck.

Non metals usually have more electrons in their outer shell. It is easier for them to gain electrons or share electrons to get a full outer she

Metals usually have only a few electrons in the outer shell. It is easier for them to lose electrons to get a full outer shell.

Atomic structure

What is another name for group 0?

Group 0

Atomic structure

Describe the reactivity of group 0 elements.

Group 0

Atomic structure

How many electrons do elements of group 0 have in their outer shell?

Group 0

Atomic structure

Describe the change in boiling point as you go down (increase relative atomic mass) group 0.

Group 0

Atomic structure

What is another name for group 1?

Group 1

Atomic structure

How many electrons do elements in group 1 have in their outer shell?

Group 1

Atomic structure

What are the products of the reaction between lithium and water?

Group 1

Atomic structure

What are the products of the reaction between sodium and chlorine?

Group 1

Atomic structure

What are the products of the reaction between potassium and oxygen?

Group 1

Atomic structure

How does the reactivity of elements in group 1 change as you go down the group?

Group 1

The halogens

Reactions occur because of the electrons in the outer shell. As you go down the group the electron shells increase. The further away the outer electron is from the nucleus, the easier it is to lose.

Fluorine and chlorine.

They are non-metals and they form molecules made from two atoms e.g. Cl_2.

Iodine and Astatine (technically you could say tennessine, but only six atoms have ever existed)!

Bromine.

Halogens form simple covalent compounds when they react with non-metals.

Halogens form ionic compounds when they react with metals.

The reactivity decrease as you go down the group (increase atomic mass).

As you go down the group (increase the atomic mass) the melting point and boiling point increases.

Atomic structure

Explain, in terms of electrons, why does reactivity change as you go down the group.

Group 1

Atomic structure

What is another name for group 7?

Group 7

Atomic structure

Describe the general properties of group 7 elements.

Group 7

Atomic structure

Name two gases found group 7.

Group 7

Atomic structure

Name a liquid found in group 7.

Group 7

Atomic structure

Name two solids found in group 7.

Group 7

Atomic structure

Describe the nature of the compounds formed when halogens react with metals.

Group 7

Atomic structure

Describe the nature of the compounds formed when halogens react with other non-metals.

Group 7

Atomic structure

Describe how the melting points and boiling points change in group 7.

Group 7

Atomic structure

Describe how the reactivity of the elements in group 7 change as you go down the group.

Group 7

Elements in group 0 are unreactive.

The noble gases.

The boiling point of group 0 increases as you go down the group (increase atomic mass).

Elements in group 0 have 8 electrons in their outer shell except helium which has 2 electrons.

1

The alkali metals.

Sodium chloride.

Lithium hydroxide + hydrogen.

The reactivity increases as you go down the group (increase atomic mass).

Potassium oxide.

Atomic structure

Explain, in terms of electrons, why does reactivity change as you go down the group.

Group 7

Atomic structure

Describe the reaction between a more reactive halogen and a less reactive halogen which is in an aqueous solution of its salt.

Group 7

Atomic structure

Complete the following equation and balance: $Cl_2 + KI \rightarrow$

Group 7

Atomic structure

Complete the following equation and balance: $I_2 + KBr \rightarrow$

Group 7

Atomic structure

Complete the following equation and balance: $F_2 + KCl \rightarrow$

Group 7

Bonding, structure and the properties of matter

Name three types of strong chemical bonds.

Chemical bonds

Bonding, structure and the properties of matter

Describe the role of electrons in an ionic bond.

Chemical bonds

Bonding, structure and the properties of matter

Describe the role of electrons in a covalent bond.

Chemical bonds

Bonding, structure and the properties of matter

Describe the role electrons in a metallic bond.

Chemical bonds

Bonding, structure and the properties of matter

Which bonding occurs in compounds formed from non-metals?

Chemical bonds

A displacement reaction will occur where the more reactive halogen will displace the least reactive halogen and bind with the salt.

Reactions occur because of the electrons in the outer shell. As you go down the group the electron shells increase. The further away the outer shell is from the nucleus, the harder it is to attract an extra electron.

$I_2 + KBr \rightarrow I_2 + KBr$ (no reaction because Iodine is less reactive than bromine)

$Cl_2 + 2KI \rightarrow 2KCl + I_2$

Ionic, covalent and metallic.

$F_2 + 2KCl \rightarrow 2KF + Cl_2$

Electrons are shared.

Electrons are either donated or received.

Covalent.

Outer shell electrons are delocalised.

Bonding, structure and the properties of matter

Which bonding occurs in metallic elements and alloys?

Chemical bonds

Bonding, structure and the properties of matter

Which bonding occurs in compounds formed from metals and non-metals?

Chemical bonds

Bonding, structure and the properties of matter

What happens when a metal reacts with a non-metal?

Ionic bonding

Bonding, structure and the properties of matter

What type of ions do metals form?

Ionic bonding

Bonding, structure and the properties of matter

What type of ions do non-metals form?

Ionic bonding

Bonding, structure and the properties of matter

What is the charge of ions produce by group 1 elements?

Ionic bonding

Bonding, structure and the properties of matter

What is the charge of ions produce by group 2 elements?

Ionic bonding

Bonding, structure and the properties of matter

What is the charge of ions produce by group 6 elements?

Ionic bonding

Bonding, structure and the properties of matter

What is the charge of ions produce by group 7 elements?

Ionic bonding

Bonding, structure and the properties of matter

What electronic structure do the ions produced have?

Ionic bonding

Ionic.

Metallic.

Positively charged ions.

Electrons in the outer shell of the metal atom are transferred.

+1

Negatively charged ions.

-2

+2

The ions have the electronic structure of a noble gas (group 0)

-1

Bonding, structure and the properties of matter

Describe the structure of an ionic compound.

Ionic compounds

Bonding, structure and the properties of matter

What are forces of attraction in ionic bonding called?

Ionic compounds

Bonding, structure and the properties of matter

What is the empirical formula for potassium chloride (group 1 + group 7)?

Ionic compounds

Bonding, structure and the properties of matter

What is the empirical formula for beryllium oxide (group 2 + group 6)?

Ionic compounds

Bonding, structure and the properties of matter

What is the empirical formula for sodium oxide? (group 1 + group 6)?

Ionic compounds

Bonding, structure and the properties of matter

What is the empirical formula for magnesium iodide (group 2 + group 7)?

Ionic compounds

Bonding, structure and the properties of matter

How are covalent bonds formed?

Covalent bonding

Bonding, structure and the properties of matter

Name two covalent compounds which are simple molecules.

Covalent bonding

Bonding, structure and the properties of matter

Name a covalent compound which is a very large molecule.

Covalent bonding

Bonding, structure and the properties of matter

Name two covalently bonded substances which form giant covalent structures.

Covalent bonding

Ionic structures are held in place by strong electrostatic forces of attraction between oppositely charged ions.

A giant structure of ions

BeO

KCl

MgI_2

Na_2O

Ammonia, water, methane or hydrogen chloride.

They are formed when atoms share electrons.

Diamond and silicon dioxide.

Polymers

Bonding, structure and the properties of matter

Describe the structure of metals.

Metallic bonding

Bonding, structure and the properties of matter

What are delocalised electrons?

Metallic bonding

Bonding, structure and the properties of matter

How are metallic bonds formed?

Metallic bonding

Bonding, structure and the properties of matter

Name the three states of matter.

The three states of matter

Bonding, structure and the properties of matter

Describe the structure of solids in terms of particles.

The three states of matter

Bonding, structure and the properties of matter

Describe the structure of liquids in terms of particles.

The three states of matter

Bonding, structure and the properties of matter

Describe the structure of gases in terms of particles.

The three states of matter

Bonding, structure and the properties of matter

What term describes solid turning into liquid at a specific temperature.

The three states of matter

Bonding, structure and the properties of matter

What term describes liquid turning into gas at a specific temperature.

The three states of matter

Bonding, structure and the properties of matter

What term describes gas turning into liquid at a specific temperature.

The three states of matter

Outer shell electrons of metal atoms which are free to move through the whole structure.

Metals consist of giant structures of atoms arranged in a regular pattern.

Solid, liquid and gas.

The sharing of delocalised electrons gives rise to strong metallic bonds.

Particles are close together but can move over each other. There are weak forces of attraction between the particles. The particles are constantly moving.

Particles are close together in fixed positions and form a regular structure. There are strong forces of attraction between the particles. The particles vibrate in position.

Melting

Particles are far apart. There are very weak forces of attraction between the particles. Particles move constantly in straight lines.

Condensation

Boiling

Bonding, structure and the properties of matter

What term describes liquid turning into solid at a specific temperature.

The three states of matter

Bonding, structure and the properties of matter

What term describes solid turning into gas at a specific temperature.

The three states of matter

Bonding, structure and the properties of matter

Bromine has a melting point of -7°C and a boiling point of 59°C. What state is it at 75°C?

The three states of matter

Bonding, structure and the properties of matter

Why does a single atom not have a state of matter?

The three states of matter

Bonding, structure and the properties of matter

What are the limitations of particle theory (HT only).

The three states of matter

Bonding, structure and the properties of matter

Describe the energy required to change states.

The three states of matter

Bonding, structure and the properties of matter

Describe how the forces between particles affects the melting points and boiling points.

The three states of matter

Bonding, structure and the properties of matter

What does the state symbol (aq) represent?

State symbols

Bonding, structure and the properties of matter

What does the state symbol (l) represent?

State symbols

Bonding, structure and the properties of matter

What does the state symbol (g) represent?

State symbols

Sublimation

Freezing

Atoms themselves do not have the bulk properties of materials

Gas

The energy required to change state depends on the strength of forces between the particles.

Particle theory represents particles as solid in elastic spheres which have no forces between them.

Aqueous (dissolved)

The stronger the forces between the particles the higher the melting and boiling points.

Gas.

Liquid.

Bonding, structure and the properties of matter

What does the state symbol (s) represent?

State symbols

Bonding, structure and the properties of matter

Describe the structure of an ionic compound.

Properties of ionic compounds

Bonding, structure and the properties of matter

Describe the general properties of ionic compounds.

Properties of ionic compounds

Bonding, structure and the properties of matter

What can happen if ionic compounds are melted or dissolved in water?

Properties of ionic compounds

Bonding, structure and the properties of matter

What type of bonding is found in small molecules?

Properties of small molecules

Bonding, structure and the properties of matter

Describe the general properties of small molecules.

Properties of small molecules

Bonding, structure and the properties of matter

What are the forces of interaction between small molecules called?

Properties of small molecules

Bonding, structure and the properties of matter

Describe what happens to small molecules when they melt or boil.

Properties of small molecules

Bonding, structure and the properties of matter

What is a monomer?

Polymers

Bonding, structure and the properties of matter

What is a polymer?

Polymers

Ionic compounds have regular structures called giant ionic lattices. The are strong forces of attraction between oppositely charged ions.

Solid.

The ionic compounds will conduct electricity.

Ionic compounds have high melting points and boiling points because a large amount of energy is required to break the multitude of strong bonds.

Small molecules are usually gases or liquids which have low melting and boiling points.

Covalent bonding.

The weak intermolecular forces between the molecules are broken, not the covalent bonds between the atoms.

Weak intermolecular forces.

Polymers are very large molecules made of repeating units.

A single unit of a polymer.

Bonding, structure and the properties of matter

What is the role of strong covalent bonds in a polymer?

Polymers

Bonding, structure and the properties of matter

How do intermolecular forces affect the properties of polymers?

Polymers

Bonding, structure and the properties of matter

Describe the general structure of giant covalent structures.

Giant covalent structures

Bonding, structure and the properties of matter

Describe the properties of giant covalent structures.

Giant covalent structures

Bonding, structure and the properties of matter

Give three examples of giant covalent structures.

Giant covalent structures

Bonding, structure and the properties of matter

What is an alloy?

Properties of metal and alloys

Bonding, structure and the properties of matter

Describe the general structure of metals and alloys.

Properties of metal and alloys

Bonding, structure and the properties of matter

What are the general properties of metals?

Properties of metal and alloys

Bonding, structure and the properties of matter

How are the atoms arranged in pure metals?

Properties of metal and alloys

Bonding, structure and the properties of matter

What properties of pure metals are a result of the arrangement of atoms?

Properties of metal and alloys

The intermolecular forces between polymers are relatively strong so polymers are usually solids at room temperature.

Strong covalent bonds link the atoms together in polymers.

They are solids with high melting points.

The atoms are in the structures are linked to other atoms by strong covalent bonds.

An alloy is a mixture of metals e.g. 18 carat Gold is a mixture of gold and silver.

Diamond, graphite and silicon dioxide (silica)

Metals are usually solid at room temperature and have high melting points and boiling points

Giant structures of atoms with strong metallic bonding.

Metals can be bent and shaped.

Atoms in metals are arranged in layers. These layers can slide over each other.

Bonding, structure and the properties of matter

Explain why alloys are harder than pure metals.

Properties of metal and alloys

Bonding, structure and the properties of matter

Why are metals good conductors of electricity?

Metals as conductors

Bonding, structure and the properties of matter

Why are metals good conductors of thermal energy?

Metals as conductors

Bonding, structure and the properties of matter

How many covalent bonds does each carbon atom form in diamond?

Diamond

Bonding, structure and the properties of matter

What type of structure is diamond?

Diamond

Bonding, structure and the properties of matter

Describe three properties of diamond.

Diamond

Bonding, structure and the properties of matter

How many covalent bonds does each carbon atom form in graphite?

Graphite

Bonding, structure and the properties of matter

How many delocalised electrons does each carbon atom in graphite have?

Graphite

Bonding, structure and the properties of matter

Describe the structure of graphite.

Graphite

Bonding, structure and the properties of matter

Why does graphite have similar properties to metals?

Graphite

Delocalised electrons carry charge through the metal.

Alloys are harder because the mixture of metal atoms causes a distortion of the layers which prevents them sliding easily over each other.

4

Delocalised electrons transfer energy through the metal.

Very hard, a very high melting point and it does not conduct electricity.

A giant covalent structure

1

3

Delocalised electrons.

Layers of hexagonal rings formed by covalent bonds between the carbon atoms. There are no covalent bonds between the layers which means they are free to slide over each other.

Bonding, structure and the properties of matter

Describe the structure of graphene.

Graphene and fullerenes

Bonding, structure and the properties of matter

What is graphene useful for?

Graphene and fullerenes

Bonding, structure and the properties of matter

How many delocalised electrons does each carbon atom in graphene have?

Graphene and fullerenes

Bonding, structure and the properties of matter

What is a fullerene?

Graphene and fullerenes

Bonding, structure and the properties of matter

What is the structure of fullerene based on?

Graphene and fullerenes

Bonding, structure and the properties of matter

What was the first fullerene to be discovered?

Graphene and fullerenes

Bonding, structure and the properties of matter

What are cylindrical fullerenes called?

Graphene and fullerenes

Bonding, structure and the properties of matter

What is the ratio between the length and diameter in cylindrical fullerenes.

Graphene and fullerenes

Bonding, structure and the properties of matter

What are cylindrical fullerenes useful for?

Graphene and fullerenes

Quantitative chemistry

What is the law of conservation of mass?

Conservation of mass and balanced chemical equations

Electronics and composites.

A single layer of graphite.

Molecules of carbon atoms with hollow shapes.

1

Buckiminsterfullerene (C_{60})

Hexagonal rings of six carbon atoms, but they may also have rings of 5 or carbon atoms.

High length to diameter ratios (long and thin)

Nanotubes

As no atoms are lost or made in a chemical reaction, the mass of the products will equal the mass of the reactants.

Their properties make them useful for nanotechnology, electronics and materials.

Quantitative chemistry

State the numbers of atoms for each element in H_2O.

Conservation of mass and balanced chemical equations

Quantitative chemistry

State the number of atoms for each element in NH_3.

Conservation of mass and balanced chemical equations

Quantitative chemistry

State the number of atoms in $Ca(OH)_2$.

Conservation of mass and balanced chemical equations

Quantitative chemistry

State the number of atoms for each element in $Ca(OH)_2$.

Conservation of mass and balanced chemical equations

Quantitative chemistry

Balance $H_2 + O_2 \rightarrow H2O$.

Conservation of mass and balanced chemical equations

Quantitative chemistry

Balance $Cl_2 + KI \rightarrow KCl + I_2$.

Conservation of mass and balanced chemical equations

Quantitative chemistry

What is the relative formula mass of a compound?

Relative formula mass

Quantitative chemistry

What is the relative formula mass of H_2SO_4?

Relative formula mass

Quantitative chemistry

What is the relative formula mass of Na_2CO_3?

Relative formula mass

Quantitative chemistry

What is the relative formula mass of $Ca(OH)_2$?

Relative formula mass

Nitrogen = 1, Hydrogen = 3.

Hydrogen = 2, Oxygen = 1.

Calcium = 1, Oxygen = 2, Hydrogen = 2.

5

$Cl_2 + 2KI \rightarrow 2KCl + I_2$

$2H_2 + O_2 \rightarrow 2H_2O$

H = 1 x 2 = 2;
S = 32;
O = 16 x 4 = 64;
2 + 32 + 64 = 98

The sum of the relative atomic masses of the atoms in the compound.

Ca = 40;
O = 16 x 2 = 32;
H = 1 x 2 = 2;
40 + 32 + 2 = 74

Na = 23 x 2 = 46;
C = 12;
O = 16 x 3 = 48;
46 + 12 +48 = 106

Quantitative chemistry

Explain why some reactions may seem to involve a change in mass?

Mass changes when a reactant or product is a gas

Quantitative chemistry

Describe the mass changes that occur when a metal reacts with oxygen in a non-enclosed system.

Mass changes when a reactant or product is a gas

Quantitative chemistry

Describe the mass changes that occur during the thermal decomposition of metal carbonates in a non-enclosed system.

Mass changes when a reactant or product is a gas

Quantitative chemistry

Define uncertainty.

Chemical measurements

Quantitative chemistry

How do you calculate the range of a set of measurements?

Chemical measurements

Quantitative chemistry

What does a large range of a set of measurements about the mean signify?

Chemical measurements

Quantitative chemistry

What is the formula to calculate the uncertainty about the mean.

Chemical measurements

Quantitative chemistry

What are chemical amounts measured using?

Moles (HT)

Quantitative chemistry

What is the symbol for the mole?

Moles (HT)

Quantitative chemistry

How is the relative formula mass of a substance linked to the mole?

Moles (HT)

When a metal reacts with oxygen the mass of the metal oxide will be more than the mass of the metal because of the addition of oxygen gas.

In a non-enclosed system one of the reactants or products may be a gas and its mass has not been measured.

Uncertainty is the amount of error in your measurements.

When a metal carbonate decomposes the mass of the products will appear less than the mass of the reactants because carbon dioxide gas is given off.

A large range suggest the measurements are imprecise and there is a large uncertainty about the results.

The range is the highest repeat value minus the lowest repeat value.

Moles

Uncertainty = range / 2.

The mass of 1 mole of a substance is equal to its relative formula mass in grams. E.g. Mr of carbon = 12; therefore 1 mole of carbon has a mass of 12g.

Mol

Quantitative chemistry

Compare the number of particles in one mole of carbon (C) with the number of particles in one mole of carbon dioxide (CO_2).

Moles (HT)

Quantitative chemistry

What is the value of the Avogadro constant?

Moles (HT)

Quantitative chemistry

What is the formula that links the number of moles, relative formula (or atomic) mass and mass in grams?

Moles (HT)

Quantitative chemistry

How many moles are there in 44g of H_2O?

Moles (HT)

Quantitative chemistry

Calculate the mass of 0.4mol of CO_2.

Moles (HT)

Quantitative chemistry

Describe the following equation in terms of moles: $Mg + 2HCl \rightarrow MgCl_2 + H_2$.

Amounts of substances in equations (HT)

Quantitative chemistry

What is the formula to calculate the percentage mass of an element in a compound?

Amounts of substances in equations (HT)

Quantitative chemistry

Describe how you would balance an equation using the masses of the products and reactants.

Using moles to balance equations (HT)

Quantitative chemistry

12g of magnesium (Mg) react with 8g of oxygen (O_2) to produce 20g of magnesium oxide (MgO). Write a balanced equation for the reaction.

Using moles to balance equations (HT)

Quantitative chemistry

What is a limiting reactant?

Limiting reactants (HT)

6.02×10^{23} per mole

The number of particles in one mole of carbon is equal to the number of particles in one mole of carbon dioxide.

Number of moles = 44 / (1 x 2) + 16;
Number of moles = 44 / 18;
Number of moles = 2.4 mol

Number of moles = mass in grams / Mr of the substance

1 mole of magnesium reacts with 2 moles of hydrochloric acid to form 1 mole of magnesium chloride and 1 mole of hydrogen.

Rearrange the equation; mass = number of moles x Mr of the substance; mass = 0.4 x (12 + (16 x2); mass = 0.4 x 44; mass = 17.6g

Divide the mass of each substance by its relative formula mass to find the number of moles of each substance. Divide the number of moles of each substance by the smallest number of moles in the reaction. If the any of the numbers are not whole numbers, multiply all the numbers so that they become whole numbers.

Percentage mass of an element in a compound = (Ar x number of atoms of the element / Mr of the compound) x 100

The limiting reactant limits the amount of product made in a reaction.

Number of moles of magnesium = 12 / 24 = 0.5 moles
Number of moles of oxygen = 8 / 32 = 0.25 moles.
Number of moles of MgO = 20 / 40 = 0.5 moles.
Divide each substance by the smallest number of moles in the reaction (oxygen = 0.25);
Mg = 0.5 / 0.25 = 2; O_2 = 0.25 /0.25 = 1; MgO = 0.5 / 0.25 = 2. The balanced equation for the reaction is:

$2Mg + O_2 \rightarrow 2MgO$

Quantitative chemistry

Why is it common to use an excess of one of the reactants in a chemical reaction?

Limiting reactants (HT)

Quantitative chemistry

What does the mass of a product formed in a chemical reaction depend upon?

Limiting reactants (HT)

Quantitative chemistry

What is a solution?

Concentration of solutions

Quantitative chemistry

What is a solute?

Concentration of solutions

Quantitative chemistry

What is a solvent?

Concentration of solutions

Quantitative chemistry

What is the formula to calculate the concentration of a solution?

Concentration of solutions

Quantitative chemistry

How many cm^3 in 1 dm^3?

Concentration of solutions

Quantitative chemistry

What is the concentration of a salt solution when 20g of salt is dissolved in 500cm^3 of water?

Concentration of solutions

Quantitative chemistry

Explain how the concentration of the solution is related to the mass of the solute and the volume of the solvent (HT).

Concentration of solutions

Chemical changes

What are the products when metals react with oxygen?

Metal oxides

The mass of the limiting reactant.

To ensure that the other reactants involved are used up.

The solid part of a solution which has been dissolved.

A solution consists of a solute (solid) dissolved in a solvent (liquid).

Concentration = mass of the solute (g) / volume of solvent (dm3).

The liquid part of the solution.

Convert 500cm3 into 0.5 dm^3. Concentration = mass of solute / volume of solvent: concentration = 20 / 0.5 = 40g/dm^3

1000cm^3 = 1 dm^3

Metal oxides.

The more solute added for a given volume the higher the concentration of a solution. The more solvent added for a given mass of solute the lower the concentration of the solution.

Chemical changes

What type of reactions occur when metals react with oxygen?

Metal oxides

Chemical changes

Define oxidation with reference to oxygen.

Metal oxides

Chemical changes

Define reduction with reference to oxygen.

Metal oxides

Chemical changes

What do metals form when they react with other substances?

The reactivity series

Chemical changes

What is the reactivity of a metal related to?

The reactivity series

Chemical changes

Put zinc, lithium, potassium, copper, iron, calcium, sodium and magnesium in order of reactivity (most reactive first).

The reactivity series

Chemical changes

Which two non-metals are often placed in the reactivity series.

The reactivity series

Chemical changes

Write out the reactivity series including the two non-metals.

The reactivity series

Chemical changes

What type of reaction occurs between a reactive metal and a less reactive metal compound?

The reactivity series

Chemical changes

What is the general equation to show the reaction of metal with water.

The reactivity series

Oxidation occurs when a substance gains oxygen.

Oxidation.

Metals form positive ions.

Reduction occurs when a substance loses oxygen.

Potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper.

The reactivity of a metal is related to the ease by which it can form ions (lose electrons).

Potassium, sodium, lithium, calcium, magnesium, carbon, zinc, iron, hydrogen and copper

Carbon and hydrogen.

Metal + water _ metal hydroxide + hydrogen.

A displacement reaction.

Chemical changes

Write out a balanced equation to show the reaction between sodium and water.

The reactivity series

Chemical changes

What is the general equation to show the reaction of metal with acid.

The reactivity series

Chemical changes

How are most metals found in the Earth?

Extraction of metals and reduction

Chemical changes

What is a metal ore?

Extraction of metals and reduction

Chemical changes

Why is gold found as a metal in the Earth?

Extraction of metals and reduction

Chemical changes

How can iron, zinc and copper be extracted from their oxides?

Extraction of metals and reduction

Chemical changes

Identify which substances have been oxidised and which substances have been reduced in the following equation:
$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$.

Extraction of metals and reduction

Chemical changes

Define oxidation with reference to electrons.

Oxidation and reduction in terms of electrons (HT)

Chemical changes

Define reduction with reference to electrons.

Oxidation and reduction in terms of electrons (HT)

Chemical changes

Write out the ionic equation for the following displacement reaction:
$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$.

Oxidation and reduction in terms of electrons (HT)

Metal + acid _ salt + water.

$2Na + H_2O \rightarrow Na_2O + H_2$.

A metal compound which is mined.

Metals are usually found as compounds in the Earth.

These metals are extracted from their oxides by reduction with carbon. This works because these metals are less reactive than carbon.

Because it is unreactive and does not form compounds.

Oxidation is electron loss.

Iron oxide (Fe_2O_3) is reduced (loses oxygen). Carbon (C) is oxidised (gains oxygen).

$Fe(s) + Cu^{2+}(aq) \rightarrow Cu(s) + Fe^{2+}(aq)$.

Reduction is electron gain.

Chemical changes

Define the term spectator ion.

Oxidation and reduction in terms of electrons (HT)

Chemical changes

What are the spectator ions in the following equation:

$Mg + FeSO_4 \rightarrow MgSO_4 + Fe$.

Oxidation and reduction in terms of electrons (HT)

Chemical changes

Write out the half equations for the following reaction:

$Fe + 2HCl \rightarrow FeCl_2 + H_2$.

Oxidation and reduction in terms of electrons (HT)

Chemical changes

What are the products of a reaction between most metals and acid?

Reactions of acids with metals

Chemical changes

Describe the type of reaction that occurs between metals and acids.

Reactions of acids with metals

Chemical changes

Which substances are oxidised in the reaction between metals and acids?

Reactions of acids with metals

Chemical changes

Which substances are reduced in the reaction between metals and acids?

Reactions of acids with metals

Chemical changes

Define alkali.

Neutralisation of acids and salt production

Chemical changes

Define base.

Neutralisation of acids and salt production

Chemical changes

How are acids neutralised?

Neutralisation of acids and salt production

SO_4^{2-}

An ion that takes no part in the reaction.

Salt and hydrogen.

$Fe \rightarrow Fe^{2+} + 2e^-$; $2H^+ + 2e^- \rightarrow H_2$.

Metals

Redox reactions.

Soluble metal hydroxides.

Hydrogen

By reacting with alkalis or bases.

Insoluble metal hydroxides and metal oxides.

Chemical changes

What is the general equation to show the reaction between acids and metal oxides?

Neutralisation of acids and salt production

Chemical changes

What is the general equation to show the reaction between acids and metal hydroxides?

Neutralisation of acids and salt production

Chemical changes

What is the general equation to show the reaction between acids and metal carbonates?

Neutralisation of acids and salt production

Chemical changes

The production of a particular salt depends on which two factors?

Neutralisation of acids and salt production

Chemical changes

Predict the salt formed from a reaction between nitric acid and potassium hydroxide.

Neutralisation of acids and salt production

Chemical changes

Predict the salt formed from a reaction between hydrochloric acid and calcium carbonate.

Neutralisation of acids and salt production

Chemical changes

Predict the salt formed from a reaction between sulfuric acid and copper oxide.

Neutralisation of acids and salt production

Chemical changes

Deduce the formula of magnesium chloride using the ions Mg^{2+} and Cl^{-}.

Neutralisation of acids and salt production

Chemical changes

Deduce the formula of zinc sulfate using the ions Zn^{2+} and $SO4^{2-}$.

Neutralisation of acids and salt production

Chemical changes

Describe how soluble salts can be made.

Soluble salts

Metal hydroxide + acid → salt + water.

Metal oxide + acid → salt + water.

The acid used and the positive (metallic) ions in the alkali or base.

Metal carbonates + acid → salt + water + carbon dioxide (bubbles!)

Calcium chloride.

Potassium nitrate.

$MgCl_2$.

Copper sulfate.

React an acid with an insoluble substance (e.g. metal, metal oxide, metal hydroxide or metal carbonate). Add the solid till no more reacts. The unreacted powder will be visible in the beaker. Excess acid is filtered off and the solution of the new salt is collected.

$ZnSO_4$.

Chemical changes

How can salt solutions be used to form solid salts?

Soluble salts

Chemical changes

What ions do acids produce in aqueous solution?

The pH scale and neutralisation

Chemical changes

What ions do alkalis form in aqueous solution.

The pH scale and neutralisation

Chemical changes

What does pH mean?

The pH scale and neutralisation

Chemical changes

What is the pH scale a measure of?

The pH scale and neutralisation

Chemical changes

What numbers on the scale represent acids?

The pH scale and neutralisation

Chemical changes

What numbers on the pH scale represent alkalis?

The pH scale and neutralisation

Chemical changes

What does pH 7 represent on the scale?

The pH scale and neutralisation

Chemical changes

Name two ways the pH of a solution can be measured.

The pH scale and neutralisation

Chemical changes

What type of reaction occurs between an acid and an alkali.

The pH scale and neutralisation

H^+.

Crystallisation.

per Hydrogen.

OH^-.

1 - 6.

The acidity or alkalinity of a solution.

Neutral.

8 - 14.

Neutralisation.

Using a wide range indicator (e.g. universal indicator) or a pH probe.

Chemical changes

Write an ionic equation for the reaction between an acid and an alkali.

The pH scale and neutralisation

Chemical changes

What is a strong acid?

Strong and weak acids (HT)

Chemical changes

Give three examples of strong acids.

Strong and weak acids (HT)

Chemical changes

What is a weak acid?

Strong and weak acids (HT)

Chemical changes

Give three examples of weak acids.

Strong and weak acids (HT)

Chemical changes

Explain the difference between the terms concentrated and dilute acids and weak and strong acids.

Strong and weak acids (HT)

Chemical changes

For a given concentration of an aqueous solution, what is the relationship between the strength of acid and the pH.

Strong and weak acids (HT)

Chemical changes

Describe how the pH scale is linked to the hydrogen ion concentration.

Strong and weak acids (HT)

Chemical changes

What type of compounds can be electrolysed?

Electrolysis

Chemical changes

What state must the compound be in for electrolysis to take place?

Electrolysis

A strong acid is completely ionised in solution.

$H^+ + OH^- \rightarrow H_2O$.

A weak acid is only partially ionised in solution.

Hydrochloric, nitric and sulfuric acids.

Dilute and concentrated refer to the amount of substance in a solution (e.g. the number of moles). Weak and strong refer to the amount of ionisation that has occurred.

Ethanol, citric and carbonic acids.

As pH concentration decreases by one unit (e.g. from 5 to 4), the hydrogen ion concentration increases by by a factor of ten (e.g. from 10 to 100).

The stronger the acid, the lower the pH.

Molten (liquid) or in an aqueous solution.

Ionic compounds.

Chemical changes

What is an electrolyte?

Electrolysis

Chemical changes

What is the negative electrode called?

Electrolysis

Chemical changes

What is the positive electrode called?

Electrolysis

Chemical changes

What happens when an electric current is passed through an electrolyte?

Electrolysis

Chemical changes

What ions do lead bromide form when melted?

Electrolysis of molten ionic compounds.

Chemical changes

What type of electrodes are used during the electrolysis of lead bromide?

Electrolysis of molten ionic compounds.

Chemical changes

What happens when a molten ionic compound is electrolysed?

Electrolysis of molten ionic compounds.

Chemical changes

What is formed at the positive electrode (anode) during the electrolysis of lead bromide?

Electrolysis of molten ionic compounds.

Chemical changes

What is the ionic equation for the positive electrode (anode)?

Electrolysis of molten ionic compounds.

Chemical changes

What is formed at the negative electrode (cathode) during the electrolysis of lead bromide?

Electrolysis of molten ionic compounds.

Cathode.

Liquids or solutions that are able to conduct electricity.

Positive charged ions move to the negative electrode (cathode). Negatively charged ions move towards the positive electrode (anode). The ions are gain or lose electrons at the electrodes producing elements.

Anode.

Inert electrodes.

Pb^{2+} and Br^-.

Bromine.

The metal ions are attracted to the negative electrode (cathode). The non-metal ions are attracted to the positive electrode (anode).

Lead.

$2Br^- \rightarrow Br_2 + 2e^-$.

Chemical changes

What is the ionic equation for the negative electrode (cathode)?

Electrolysis of molten ionic compounds.

Chemical changes

What ions do zinc chloride form when melted?

Electrolysis of molten ionic compounds.

Chemical changes

Predict the products of the electrolysis of zinc chloride.

Electrolysis of molten ionic compounds.

Chemical changes

How can metals be extracted by electrolysis?

Using electrolysis to extract metals.

Chemical changes

Which type of metals are extracted by electrolysis?

Using electrolysis to extract metals.

Chemical changes

Why is aluminium sometimes called solid electricity?

Using electrolysis to extract metals.

Chemical changes

Describe how aluminium is manufactured.

Using electrolysis to extract metals.

Chemical changes

What is formed at the negative electrode (cathode) during the electrolysis of aluminium oxide?

Using electrolysis to extract metals.

Chemical changes

What is the ionic equation for the negative electrode (cathode) during the electrolysis of aluminium oxide?

Using electrolysis to extract metals.

Chemical changes

What is formed at the positive electrode (anode) during the electrolysis of aluminium oxide?

Using electrolysis to extract metals.

Zn^{2+} and Cl^-.

$Pb^{2+} + 2e^- \rightarrow Pb$

Metals can be extracted from molten compounds.

Chlorine will be formed at the positive electrode (anode) and zinc will be formed at the negative electrode (cathode).

Large amounts of energy are used in the extraction process to melt the compounds and to produce the electrical current for electrolysis.

Metals which are more reactive than carbon.

Aluminium.

Aluminium is extracted by the electrolysis of a mixture of aluminium oxide and cryolite using carbon as the positive electrode (anode).

Oxygen.

$Al_3+ + 3e^- \rightarrow Al.$

Chemical changes

What is the ionic equation for the positive electrode (anode) during the electrolysis of aluminium oxide?

Using electrolysis to extract metals.

Chemical changes

Why is cryolite used in this process?

Using electrolysis to extract metals.

Chemical changes

Why does the positive electrode (anode) have to be constantly replaced?

Using electrolysis to extract metals.

Chemical changes

What ions are present in all aqueous solutions?

Electrolysis of aqueous solutions

Chemical changes

What affects the ions discharged when an aqueous solution is electrolysed?

Electrolysis of aqueous solutions

Chemical changes

Explain what will be discharged from a negative electrode (cathode) during the electrolysis of an aqueous solution.

Electrolysis of aqueous solutions

Chemical changes

Explain what will be discharged from a positive electrode (anode) during the electrolysis of an aqueous solution.

Electrolysis of aqueous solutions

Chemical changes

What are the ions found in a solution of copper sulfate: $CuSO_4(aq)$?

Electrolysis of aqueous solutions

Chemical changes

Explain what will happen when an aqueous solution of copper sulfate is electrolysed.

Electrolysis of aqueous solutions

Chemical changes

What are the ions found in a solution of sodium chloride: NaCl (aq)?

Electrolysis of aqueous solutions

To reduce the melting point of aluminium oxide.

$2O^{2-} \rightarrow O_2 + 4e^-$.

H^+ and OH^-.

The oxygen formed at the positive electrode (anode) reacts with the carbon in the electrode.

If the metal ion is less reactive than hydrogen the metal will be formed. Otherwise, hydrogen will be released.

The relative reactivity of the elements involved.

H^+, OH^-, Cu^{2+} and SO_4^{2-}

Oxygen is produced unless the solution contains halide ions in which event a halogen will be produced.

H^+, OH^-, Na^+ and Cl^-

Copper is less reactive than hydrogen so copper is formed at the negative electrode (cathode). As copper sulfate contains no halide ions oxygen will be formed at the positive electrode (anode).

Chemical changes

Explain what will happen when an aqueous solution of sodium chloride is electrolysed.

Electrolysis of aqueous solutions

Chemical changes

What happens at the cathode (negative electrode) during electrolysis?

Reactions at electrodes as half equations (HT).

Chemical changes

What type of reaction occurs at the cathode (negative electrode)?

Reactions at electrodes as half equations (HT).

Chemical changes

What happens at the anode (positive electrode) during electrolysis?

Reactions at electrodes as half equations (HT).

Chemical changes

What type of reaction occurs at the anode (positive electrode)?

Reactions at electrodes as half equations (HT).

Chemical changes

Write out the half equations for the electrolysis of copper sulfate solution.

Reactions at electrodes as half equations (HT).

Chemical changes

Write out the half equations for the electrolysis of sodium chloride solution.

Reactions at electrodes as half equations (HT).

Energy changes

What happens to energy in chemical reactions?

Exothermic and endothermic reactions

Energy changes

Compare the energy in the reactants and the products if energy is transferred to the surroundings during the reaction.

Exothermic and endothermic reactions

Energy changes

Compare the energy in the reactants and the products if energy is transferred from the surroundings during the reaction.

Exothermic and endothermic reactions

Positive metal ions or hydrogen gain electrons.

Sodium is more reactive than hydrogen so copper is formed at the negative electrode (cathode). As there are halide ions present in solution (the chloride ions) chlorine gas will be given off at the positive electrode (anode).

Negative non-metal ions lose electrons

Reduction.

At the negative electrode (cathode): $Cu^{2+} + 2e^- \rightarrow Cu$. At the positive electrode (anode): $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$.

Oxidation.

Energy is concerned in chemical reactions.

At the negative electrode (cathode): $2H^+ + 2e^- \rightarrow H_2$. At the positive electrode (anode): $2Cl^- \rightarrow Cl_2 + 2e^-$.

The reactant molecules have less energy than the reactant molecules.

The product molecules have less energy than the reactant molecules.

Energy changes

What reaction occurs when bonds are made?

The energy changes of reactions (HT)

Energy changes

How do you calculate the overall energy change for a reaction?

The energy changes of reactions (HT)

Energy changes

What is the overall energy change for an exothermic reaction?

The energy changes of reactions (HT)

Energy changes

What is the overall energy change for an endothermic reaction?

The energy changes of reactions (HT)

The rate and extent of chemical change

How do you measure the rate of a chemical reaction?

Calculating rates of reaction

The rate and extent of chemical change

What is the formula to calculate measure the mean rate of reaction from the reactants?

Calculating rates of reaction

The rate and extent of chemical change

What is the formula to calculate the mean rate of reaction from the products?

Calculating rates of reaction

The rate and extent of chemical change

What three quantities can be used to measure the the quantity of the product or reactant?

Calculating rates of reaction

The rate and extent of chemical change

What are the units for rate of reaction?

Calculating rates of reaction

The rate and extent of chemical change

What is a tangent?

Calculating rates of reaction

Combustion, oxidation reactions and neutralisation reactions.

A reaction that transfers energy to the surroundings, increasing the temperature of the surroundings.

Thermal decomposition, the reaction between citric acid and sodium hydrogencarbonate and some sports injury packs.

A reaction that transfers energy from the surroundings, decreasing the temperature of the surroundings.

The minimum amount of energy the particles must have for a reaction to take place.

A chemical reaction occurs when particles collide with each with sufficient energy.

Energy needs to be supplied to break bonds in the reactants. Energy is released when bonds in the products are formed.

A graph to show the change in energy between reactants and products over the course of a reaction.

Endothermic

The energy needed to break or form bonds between atoms.

The rate and extent of chemical change

What is the slope of a tangent used to calculate?

Calculating rates of reaction

The rate and extent of chemical change

Name five factors which affect the rate of chemical reaction?

Factors which affect the rate of chemical reaction

The rate and extent of chemical change

Describe the effect of changing these factors on the rate of chemical reaction.

Factors which affect the rate of chemical reaction

The rate and extent of chemical change

What is turbidity?

Factors which affect the rate of chemical reaction

The rate and extent of chemical change

Describe an experiment involving colour change or turbidity to measure the effect of concentration on the rate of reaction.

Factors which affect the rate of chemical reaction

The rate and extent of chemical change

Describe an experiment involving the collection of gas to measure the effect of concentration on the rate of reaction.

Factors which affect the rate of chemical reaction

The rate and extent of chemical change

Explain collision theory.

Collision theory and activation energy

The rate and extent of chemical change

What is activation energy.

Collision theory and activation energy

The rate and extent of chemical change

Describe the effect of increasing the concentration of the reactants on the rate of reaction using collision theory.

Collision theory and activation energy

The rate and extent of chemical change

Describe the effect of increasing the pressure of the reactants on the rate of reaction using collision theory.

Collision theory and activation energy

Calculate the difference between the sum of the energy needed to break the bonds of the reactants and the sum of the energy released when bonds of the products are formed.

Exothermic

The energy needed to break existing bonds is greater than the energy needed to break existing bonds (e.g. the products have more energy than the reactants).

The energy released from forming new bonds is greater than the energy needed to break existing bonds (e.g. the products have less energy than the reactants).

Mean rate of reaction = quantity of reactant used / time taken.

By measuring the the quantity of the reactant as it is used or the quantity of the product as it is formed.

Mass in grams, volume in cm3 or moles.

Mean rate of reaction = quantity of product formed / time taken.

A straight line that touches the curve but does not cross it.

g/s, cm^3/s or mol/s

Energy changes

What is an exothermic reaction?

Exothermic and endothermic reactions

Energy changes

Give three examples of exothermic reactions.

Exothermic and endothermic reactions

Energy changes

What is an endothermic reaction?

Exothermic and endothermic reactions

Energy changes

Give three examples of endothermic reactions.

Exothermic and endothermic reactions

Energy changes

Describe how chemical reactions can occur between particles.

Reaction profiles

Energy changes

What is activation energy?

Reaction profiles

Energy changes

What is a reaction profile?

Reaction profiles

Energy changes

Describe a chemical reaction in terms of energy and bonds.

The energy changes of reactions (HT)

Energy changes

What is the bond energy of a molecule?

The energy changes of reactions (HT)

Energy changes

What reaction occurs when bonds are broken?

The energy changes of reactions (HT)

Concentration of reactants, pressure of reacting gases, surface area of reactants, temperature of the reaction and the presence of catalysts.

The rate of reaction at a particular point.

A measure of how cloudy a solution is.

Increasing concentration of reactants increases the number of colliding molecules. Increasing pressure of reacting gases increases the number of collisions between molecules. Large surface area of reactants increases number of colliding molecules. Increasing temperature of the reaction increases number of collisions. The presence of catalysts lowers the activation energy.

Add a set volume and concentration of hydrochloric acid to a conical flask. Add a set mass of magnesium to the flask. Place a bung with a tube attached to a gas syringe on top of the flask. Start the timer. Note the volume of gas produced every 20 seconds until the reaction stops. Repeat the experiment using different concentrations of hydrochloric acid.

Add a set volume and concentration of sodium thiosulfate to a conical flask. Place the flask on a black cross drawn on paper. Add a known volume of hydrochloric acid to the conical flask. Start the stopwatch. Time how long it takes for the cross to disappear (due to turbidity of the reacting solution). Repeat the reaction for different concentrations of hydrochloric acid.

The minimum energy particles must have to react.

Chemical reactions occur when reacting particles collide with each other and with sufficient energy.

Increasing the pressure means there are more particles near each other so they are more likely to collide. This increases the rate of reaction.

Increasing the concentration means there are more particles and as a result there are more collisions. This will increase the rate of reaction.

The rate and extent of chemical change

Describe the effect of increasing the surface area of the reactants on the rate of reaction using collision theory.

Collision theory and activation energy

The rate and extent of chemical change

Describe the effect of increasing the temperature of the reactants on the rate of reaction using collision theory.

Collision theory and activation energy

The rate and extent of chemical change

What is a catalyst?

Catalysts

The rate and extent of chemical change

How do catalysts work?

Catalysts

The rate and extent of chemical change

What are enzymes?

Catalysts

The rate and extent of chemical change

What is a reaction profile?

Catalysts

The rate and extent of chemical change

What is a reversible reaction?

Reversible reactions

The rate and extent of chemical change

Represent a reversible reaction with the reactants A and B and the products C and D.

Reversible reactions

The rate and extent of chemical change

How can the direction of a reversible reaction be changed?

Reversible reactions

The rate and extent of chemical change

How can the direction of the decomposition of ammonium chloride into ammonia and hydrogen chloride be changed? Ammonium chloride $\rightleftharpoons$ ammonia + hydrogen chloride.

Reversible reactions

Increasing the temperature increases the speed of the particles. As they are moving faster they will collide more frequently and with more energy.

Increasing the surface area (by breaking into smaller pieces) increases the number of particles available to collide. This increases the rate of reaction.

Catalysts work by providing a pathway for the reaction which has a lower activation energy.

A substance that changes the rate of a chemical reaction but is not used up in the process.

A reaction profile is a graph which shows the levels of energy required over the course of a reaction.

Enzymes are biological catalysts found in living organisms.

$A + B \rightarrow C + D$.

A reaction where the products of the reaction can react to produce the original reactants.

If heated the reaction will move to the right (produce ammonia and hydrogen chloride). If cooled the reaction will move to the left (produce ammonium chloride).

By changing the conditions of the reaction.

The rate and extent of chemical change

If a reaction is exothermic in one direction what will it be in the opposite direction?

Energy changes and reversible reactions

The rate and extent of chemical change

What does hydrated mean?

Energy changes and reversible reactions

The rate and extent of chemical change

What does anhydrous mean?

Energy changes and reversible reactions

The rate and extent of chemical change

What are energy changes associated with the reversible reaction of hydrated copper sulfate changing into anhydrous copper sulfate and water. Hydrated copper sulfate ⇌ anhydrous copper sulfate + water.

Energy changes and reversible reactions

The rate and extent of chemical change

What is equilibrium?

Equilibrium

The rate and extent of chemical change

What is a closed system?

Equilibrium

The rate and extent of chemical change

What do the relative amounts of reactants and products at equilibrium depend upon?

The effect of changing conditions on equilibrium (HT)

The rate and extent of chemical change

Describe what happens to a system at equilibrium when a change is made to one of the conditions.

The effect of changing conditions on equilibrium (HT)

The rate and extent of chemical change

What is Le Chatelier's principle?

The effect of changing conditions on equilibrium (HT)

The rate and extent of chemical change

Where will the position of equilibrium be when ammonium chloride is heated?

The effect of changing conditions on equilibrium (HT)

The compound is associated with water molecules.

Endothermic.

The reaction is endothermic to the right (formation of anhydrous copper sulfate) and exothermic to the right (formation of hydrated copper sulfate).

The compound has no water molecules associated with it.

Apparatus which prevents the escape of the products or reactants of a reaction.

Equilibrium occurs when the forward and reverse reactions occur at exactly the same rate (no apparent change).

The system will respond to counteract the change.

They depend on the conditions of the reaction.

To the right (ammonia and hydrogen chloride formed).

If the conditions of a reaction in equilibrium are changed the system will respond to counteract the change. This results in a new point of equilibrium.

The rate and extent of chemical change

Where will the position of equilibrium be when ammonia and hydrogen chloride are cooled?

The effect of changing conditions on equilibrium (HT)

The rate and extent of chemical change

Where will the position of equilibrium be when hydrated copper sulfate is heated?

The effect of changing conditions on equilibrium (HT)

The rate and extent of chemical change

Describe what happens if the concentration of a reactant or product in a reversible reaction is changed.

The effect of changing concentration equilibrium (HT)

The rate and extent of chemical change

Describe the effect of increasing the concentration of a reactant in a reversible reaction.

The effect of changing concentration equilibrium (HT)

The rate and extent of chemical change

Describe the effect of decreasing the concentration of a product in a reversible reaction.

The effect of changing concentration equilibrium (HT)

The rate and extent of chemical change

What happens is more nitrogen is added in the following reaction: $N_2 + 3H_2 \rightleftharpoons 2NH_3$?

The effect of changing concentration equilibrium (HT)

The rate and extent of chemical change

What happens is more hydrogen is added in the following reaction:
$N_2 + 3H_2 \rightleftharpoons 2NH_3$?

The effect of changing concentration equilibrium (HT)

The rate and extent of chemical change

What happens if the concentration of ammonia is decreased in the following reaction: $N_2 + 3H_2 \rightleftharpoons 2NH_3$

The effect of changing concentration equilibrium (HT)

The rate and extent of chemical change

Describe the effect of increasing the temperature of a system at equilibrium on the relative amount of products for an exothermic reaction.

The effect of temperature changes on equilibrium (HT)

The rate and extent of chemical change

Describe the effect of increasing the temperature of a system at equilibrium on the relative amount of products for an endothermic reaction.

The effect of temperature changes on equilibrium (HT)

To the right (anhydrous copper sulfate and water formed).

To the left (ammonium chloride formed).

More products will be formed until equilibrium is reached.

The system will no longer be in equilibrium. The concentrations of the substance will change until equilibrium is reached again.

More is NH_3 produced.

More reactants will react until equilibrium is reached.

More $N_2 + 3H_2$ will react

More is NH_3 produced.

The relative amount of products at equilibrium increase.

The relative amount of products at equilibrium decrease.

The rate and extent of chemical change

Describe the effect of decreasing the temperature of a system at equilibrium on the relative amount of products for an exothermic reaction.

The effect of temperature changes on equilibrium (HT)

The rate and extent of chemical change

Describe the effect of decreasing the temperature of a system at equilibrium on the relative amount of products for an endothermic reaction.

The effect of temperature changes on equilibrium (HT)

The rate and extent of chemical change

The following reaction is exothermic in the forward direction and endothermic in the opposite direction: $N_2 + 3H_2 \rightleftharpoons 2NH_3$. Describe what happens if the temperature is decreased.

The effect of temperature changes on equilibrium (HT)

The rate and extent of chemical change

The following reaction is exothermic in the forward direction and endothermic in the opposite direction: $N_2 + 3H_2 \rightleftharpoons 2NH_3$. Describe what happens if the temperature is increased.

The effect of temperature changes on equilibrium (HT)

The rate and extent of chemical change

Describe the effect of decreasing the pressure of a gaseous reaction at equilibrium.

The effect of pressure changes on equilibrium (HT)

The rate and extent of chemical change

Describe the effect of increasing the pressure of a gaseous reaction at equilibrium.

The effect of pressure changes on equilibrium (HT)

The rate and extent of chemical change

Describe what will happen to the equilibrium position if the pressure is increased for the following reaction: $N_2 + 3H_2 \rightleftharpoons 2NH_3$

The effect of pressure changes on equilibrium (HT)

The rate and extent of chemical change

Describe what will happen to the equilibrium position if the pressure is decreased for the following reaction: $N_2 + 3H_2 \rightleftharpoons 2NH_3$

The effect of pressure changes on equilibrium (HT)

Organic chemistry

What is crude oil formed from?

Organic chemistry

What is the composition of crude oil?

Crude oil, hydrocarbons and alkanes.

The relative amount of products at equilibrium decrease.

The relative amount of products at equilibrium increase.

The relative amounts of NH_3 will decrease at equilibrium.

The relative amounts of NH_3 will increase at equilibrium.

An increase in pressure will cause the reaction to shift to the side with the smaller number of molecules (from the balanced symbol equation).

A decrease in pressure will cause the reaction to shift to the side with the larger number of molecules (from the balanced symbol equation).

. The are more molecules on the right (4 moles compared to 2 moles) so the reaction will shift to the left (more N_2 + H_2).

The are less molecules on the left (2 moles compared to 4 moles) so the reaction will shift to the right (more NH_3).

Crude oil is a mixture of a very large number of compounds, mainly hydrocarbons.

Crude oil is the remains of biomass consisting mainly of plankton buried in mud.

Organic chemistry

What are hydrocarbons?

Crude oil, hydrocarbons and alkanes.

Organic chemistry

What type of molecules are most of the hydrocarbons found in crude oil?

Crude oil, hydrocarbons and alkanes.

Organic chemistry

What is the general formula for alkanes?

Crude oil, hydrocarbons and alkanes.

Organic chemistry

Name the first four members of the alkanes.

Crude oil, hydrocarbons and alkanes.

Organic chemistry

What is the formula of methane?

Crude oil, hydrocarbons and alkanes.

Organic chemistry

What is the formula of propane?

Crude oil, hydrocarbons and alkanes.

Organic chemistry

What is a crude oil fraction?

Fractional distillation

Organic chemistry

How can crude oil be separated into fractions?

Fractional distillation

Organic chemistry

How does the petrochemical industry use different fractions?

Fractional distillation

Organic chemistry

What are the five main crude oil fractions?

Fractional distillation

Alkanes.

Hydrocarbons are molecules made up of carbon and hydrogen only.

Methane, ethane, propane and butane.

C_nH_{2n+2}.

C_3H_8.

CH_4.

Fractional distillation.

Groups of molecules with a similar number of carbon atoms.

Petrol, diesel oil, kerosene, heavy fuel oil and liquified petroleum gas.

The petrochemical industry processes fractions for fuels and feedstock.

Organic chemistry

Name four useful materials produced by the petrochemical industry?

Fractional distillation

Organic chemistry

Why are there are vast array of natural and synthetic carbon compounds?

Fractional distillation

Organic chemistry

Explain how fractional distillation works.

Fractional distillation

Organic chemistry

Name three properties of hydrocarbons which depend on the size of the molecule.

Properties of hydrocarbons.

Organic chemistry

What is viscosity?

Properties of hydrocarbons.

Organic chemistry

Describe how these properties change with increasing molecular size.

Properties of hydrocarbons.

Organic chemistry

What is released by the combustion of fuels?

Properties of hydrocarbons.

Organic chemistry

What two substances are oxidised during combustion?

Properties of hydrocarbons.

Organic chemistry

Write a word equation for the complete combustion of a hydrocarbon.

Properties of hydrocarbons.

Organic chemistry

Write a balanced chemical equation for the complete combustion of methane.

Properties of hydrocarbons.

Carbon atoms have the ability to form families of similar compounds.

Solvents, lubricants, polymers and detergents.

Boiling point, viscosity and flammability.

Crude oil is heated until most of it turns to gas. The gases enter the base of the fractionating column. The fractionating column has a temperature gradient. It is hot at the bottom and cool at the top. The longer hydrocarbons have high boiling points so they condense at the bottom of the column.Shorter hydrocarbons have low boiling points so they condense at the top of the column.

As chain length increases, boiling point increases, viscosity increases and flammability decreases.

A measure of how a substance flows (high viscosity = low flow).

Carbon and hydrogen.

Energy.

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Hydrocarbon + oxygen → carbon dioxide + water.

Organic chemistry

Write a balanced chemical equation for the complete combustion of pentane.

Properties of hydrocarbons.

Organic chemistry

What is cracking?

Cracking and alkenes.

Organic chemistry

Name two methods of cracking.

Cracking and alkenes.

Organic chemistry

Describe the the two methods of cracking hydrocarbons.

Cracking and alkenes.

Organic chemistry

What are the products of cracking?

Cracking and alkenes.

Organic chemistry

Compare the reactivity of alkanes and alkenes.

Cracking and alkenes.

Organic chemistry

Describe the test for alkenes.

Cracking and alkenes.

Organic chemistry

Why is cracking required?

Cracking and alkenes.

Organic chemistry

What are alkenes used for?

Cracking and alkenes.

Chemical analysis

What is a pure substance?

Pure substances.

The breakdown of hydrocarbons into smaller, more useful molecules.

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

Catalytic cracking is when long chain hydrocarbons are heated and vapourised. The gas is passed over a catalyst where the long chains are broken down into smaller chains. Steam cracking is when long chain hydrocarbons are heated, vapourised and mixed with steam.

Catalytic cracking and steam cracking.

Alkenes are more reactive than alkanes.

Alkanes and alkenes.

Because there is a high demand for fuels with small molecules.

Orange bromine water is added to the hydrocarbon. The mixture is shaken. It is an alkene if the orange bromine water will become colourless. It is an alkane if the bromine water stays orange.

A single element or compound that is not mixed with any other substance.

They are used to produce polymers and are the starting materials for many chemicals.

Chemical analysis

How can pure substances be distinguished from mixtures?

Pure substances.

Chemical analysis

What is a formulation?

Formulations.

Chemical analysis

How are formulations made?

Formulations.

Chemical analysis

Name seven examples of formulations.

Formulations.

Chemical analysis

What is chromatography?

Chromatography.

Chemical analysis

What is the mobile phase?

Chromatography.

Chemical analysis

What is the stationary phase?

Chromatography.

Chemical analysis

Explain how samples are separated by chromatography.

Chromatography.

Chemical analysis

What is the origin?

Chromatography.

Chemical analysis

What is the solvent front?

Chromatography.

A mixture which has been designed as a useful product.

Pure substances have specific melting and boiling points.

Fuels, cleaning agents, paints, medicine, alloys, fertilisers and foods.

Formulations are made by mixing specific chemicals in measured quantities.

The solvent in which the stationary phase is placed.

Chromatography is a method of separating mixtures and identifying substances.

Separation by chromatography depends on the distribution of substances between the mobile and stationary phases.

Usually a solid on which the samples are placed.

The line to denote the distance travelled by the mobile phase.

The line at the bottom of the paper where the samples are placed.

Chemical analysis

What does Rf mean?

Chromatography.

Chemical analysis

What is the formula to calculate the Rf of a substance?

Chromatography.

Chemical analysis

What is the Rf value of a sample which has travelled half the distance of the solvent front?

Chromatography.

Chemical analysis

What is the Rf value of a sample which has travelled a quarter of the distance of the solvent front?

Chromatography.

Chemical analysis

How can chromatography be used to determine if a substance is pure?

Chromatography.

Chemical analysis

What is the test for hydrogen?

Identification of common gases.

Chemical analysis

What is the test for oxygen?

Identification of common gases.

Chemical analysis

What is the test for carbon dioxide?

Identification of common gases.

Chemical analysis

What is the test for chlorine?

Identification of common gases.

Chemistry of the atmosphere

For approximately how long have the proportions of the gases in the atmosphere today been this way?

The proportions of different gases in the atmosphere.

Rf = distance moved by substance / distance moved by solvent

Relative front.

0.25

0.5

Place a burning splint at the mouth of a test tube containing a gas. If hydrogen is present, a popping sound will be heard.

A pure compound will only produce a single spot on a chromatograms. A mixture will separate into two or more spots.

Bubble a gas through an aqueous solution of calcium hydroxide (lime water). If carbon dioxide is present the lime water will turn cloudy.

Place a glowing splint at the mouth of a test tube containing a gas. If oxygen is present the splint will relight.

200 million years

A piece of damp litmus paper is placed at the mouth of a test tube containing a gas. If the gas is chlorine the litmus paper will be bleached and turn white.

Chemistry of the atmosphere

What is the proportion of nitrogen in the atmosphere?

The proportions of different gases in the atmosphere.

Chemistry of the atmosphere

What is the proportion of oxygen in the atmosphere?

The proportions of different gases in the atmosphere.

Chemistry of the atmosphere

Name three other components that are found in small proportions in the atmosphere?

The proportions of different gases in the atmosphere.

Chemistry of the atmosphere

Name two greenhouse gases which have increased as a result of human activities.

Greenhouse gases in the atmosphere.

Chemistry of the atmosphere

Name two human activities which have increased the amount of carbon dioxide in the atmosphere.

Greenhouse gases in the atmosphere.

Chemistry of the atmosphere

Name two human activities which have increased the amount of methane in the atmosphere.

Greenhouse gases in the atmosphere.

Chemistry of the atmosphere

Describe what the effect of human activities will be on the Earth's atmosphere?

Greenhouse gases in the atmosphere.

Chemistry of the atmosphere

How can scientists trust the data that has been collected about effect of greenhouse gases?

Greenhouse gases in the atmosphere.

Chemistry of the atmosphere

Explain why differing opinions are presented in the media about climate change?

Greenhouse gases in the atmosphere.

Chemistry of the atmosphere

What is a major cause of global climate change?

Global climate change.

One-fifth (about 20%)

Four-fifths (about 80%)

Carbon dioxide and methane.

Carbon dioxide, water vapour and noble gases.

Agriculture (cattle ranches, rice) and landfill sites.

Deforestation and burning fossil fuels.

The data published has been subjected to peer review (checked by other scientists) to ensure the data is not inaccurate or biased.

An increase in the temperature of the Earth's atmosphere which will result in global climate change.

An increase in average global temperature.

It is difficult to model a complex system such as the environment. In an effort to help people understand the issue, simplified models are often used. This can lead speculation and opinions presented by the media which is based only on parts of the evidence and may be biased or lack all the evidence.

Chemistry of the atmosphere

List four potential effects of global climate change?

Global climate change.

Chemistry of the atmosphere

Discuss the environmental implications of global climate change?

Global climate change.

Chemistry of the atmosphere

Define the term carbon footprint.

The carbon footprint

Chemistry of the atmosphere

Describe how the carbon footprint can be reduced?

The carbon footprint

Chemistry of the atmosphere

Describe actions which can be taken to reduce carbon dioxide and methane emissions.

The carbon footprint

Chemistry of the atmosphere

Suggest why the actions may have a limited effect.

The carbon footprint

Chemistry of the atmosphere

What is the effect of greenhouse gases on the Earth?

Atmospheric pollutants from fuels.

Chemistry of the atmosphere

Name three greenhouse gases?

Atmospheric pollutants from fuels.

Chemistry of the atmosphere

Describe the greenhouse effect.

Atmospheric pollutants from fuels.

Chemistry of the atmosphere

What are the properties of carbon monoxide?

Properties and effects of atmospheric pollutants.

Melting of ice caps could lead to a rise in sea levels, flooding and coastal erosion. Changes in rainfall patterns could cause a change in the distribution of water and affect the ability to produce food. Severe storms will damage infrastructure and cause more people to become homeless and increase the spread of diseases such as cholera. The rise in temperature and availability of water may affect habitats and affect the distribution of wild species.

Polar ice caps melting, changes in rainfall, changes in temperature, frequency and severity of storms, availability of water.

Reduce the emissions of carbon dioxide and methane.

The total amount of carbon dioxide and other greenhouse gases emitted of the life cycle of a product service or event.

Countries do not want to sacrifice economic development. Individuals need to change habits and need to be educated how to do so.

Use renewable energy or nuclear power. Use efficient processes to conserve energy and cut waste. Introduce a carbon tax to reward companies who reduce their carbon footprint. Put a cap on greenhouse emissions. Capture carbon dioxide from the atmosphere.

Water vapour, carbon dioxide and methane.

Greenhouse gases maintain temperatures on Earth at a high enough level to support life.

A toxic colourless and odourless gas.

The sun emits short wave radiation which is not absorbed by greenhouse gases. The short wave radiation is absorbed by the Earth, warming it. This heat is emitted from the Earth as long wave radiation. Greenhouse gases absorb long wave radiation. The more greenhouse gases there are the more long wave radiation is absorbed causing a rise in temperature.

Chemistry of the atmosphere

What is the effect of carbon monoxide on the body?

Properties and effects of atmospheric pollutants.

Chemistry of the atmosphere

What is formed by sulfur dioxide in the atmosphere?

Properties and effects of atmospheric pollutants.

Chemistry of the atmosphere

What is formed by oxides of nitrogen in the atmosphere?

Properties and effects of atmospheric pollutants.

Chemistry of the atmosphere

What are the effects of particulates on the body?

Properties and effects of atmospheric pollutants.

Chemistry of the atmosphere

What is the effect of particulates on the atmosphere?

Properties and effects of atmospheric pollutants.

Using resources

What do humans use the Earth's resources for?

Using the Earth's resources

Using resources

What do natural resources, supplemented by agriculture provide?

Using the Earth's resources

Using resources

What are processed finite resources from the earth, oceans and atmosphere used to provide?

Using the Earth's resources

Using resources

What is sustainable development?

Using the Earth's resources

Using resources

Give three examples of natural products and their synthetic replacements.

Using the Earth's resources

Acid rain.

Combines easily with haemoglobin in your blood and prevents oxygen from being taken up by the red blood cells.

Health problems such as aggravating asthma.

Acid rain.

To provide warmth, shelter, food and transport.

Global dimming.

Energy and materials.

Food, timber, clothing and fuels.

Rubber (a natural product) has been replaced by man made polymers. Cotton (a natural product) has been replaced by synthetic fibres such as polyester or Lycra. Plant dyes (a natural product) have been replaced by synthetic dyes.

Development that meets the needs of the current generations without compromising the ability of future generations to meet their own needs.

Using resources

What is a finite resource?

Using the Earth's resources

Using resources

Give three examples of finite resources.

Using the Earth's resources

Using resources

What is a renewable resource?

Using the Earth's resources

Using resources

Give three examples of renewable resources.

Using the Earth's resources

Using resources

What is potable water?

Potable water.

Using resources

What properties should drinking water have.

Potable water.

Using resources

Explain whether potable water is a pure substance or a mixture.

Potable water.

Using resources

What is the source of most of the potable water used in the UK.

Potable water.

Using resources

How is most of the potable water produced in the UK?

Potable water.

Using resources

Name three sterilising agents used to produce potable water.

Potable water.

Fossil fuels, nuclear fuels and metal ores.

Resources which are not formed quickly enough to be replaceable.

Timber, fresh water and food.

A resources that forms at a faster or similar rate than they are being used.

It should have only low levels of dissolved salts and microbes.

Water that is safe to drink.

Rain is the source of most water in the UK. It collects in the ground and in lakes and rivers.

Potable water contains dissolved substances so it is not pure.

Chlorine, ozone or ultraviolet light.

Water from a suitable source (e.g. reservoir or ground water) is passed through filter beds and then sterilised.

Using resources

What is the source of potable water, when fresh water supplies are limited?

Potable water.

Using resources

Name two methods of desalination.

Potable water.

Using resources

What is a drawback to using either of these methods?

Potable water.

Using resources

What are the main sources of waste water?

Waste water treatment.

Using resources

Why does agricultural and sewage waste water require treatment?

Waste water treatment.

Using resources

Why does industrial waste water require treatment?

Waste water treatment.

Using resources

Describe the four stages of sewage treatment.

Waste water treatment.

Using resources

Compare the relative ease of obtaining water from waste water, ground water and salt water.

Waste water treatment.

Using resources

Why are alternative methods required for extracting metals from ores?

Alternative methods of extracting metals (HT).

Using resources

Name two methods of extracting copper from low grade ores.

Alternative methods of extracting metals (HT).

Distillation or reverse osmosis.

Salt water or sea water.

Urban lifestyles, industrial processes and agriculture.

These processes require large amounts of energy.

These require treatment for the removal of organic matter and harmful chemicals.

These require treatment to remove organic matter and harmful microbes.

Waste water requires expensive treatment to remove potentially toxic chemicals and microbes from the water. Ground water water just needs to be filtered and sterilised before it is potable. Saltwater can be purified but the processes require a lot of energy.

Screening and grit removal; sedimentation to produce sludge and effluent; anaerobic digestion of sludge; aerobic biological treatment of effluent.

Phytomining and bioleaching.

Copper ores are becoming scarce.

Using resources

Describe how these new methods are different to traditional mining methods.

Alternative methods of extracting metals (HT).

Using resources

Describe the process of phytomining.

Alternative methods of extracting metals (HT).

Using resources

Describe the process of bioleaching.

Alternative methods of extracting metals (HT).

Using resources

What is a leachate?

Alternative methods of extracting metals (HT).

Using resources

How can the metal compounds extracted by alternative methods be processed to produce metal.

Alternative methods of extracting metals (HT).

Using resources

What are life cycle assessments (LCAs).

Life cycle assessment.

Using resources

What are the four stages assessed by LCAs.

Life cycle assessment.

Using resources

What is easy to quantify when carrying out LCAs?

Life cycle assessment.

Using resources

What is difficult to quantify when carrying out LCAs?

Life cycle assessment.

Using resources

How can LCAs be misused.

Life cycle assessment.

Phytomining uses plants to absorb metal compounds. The plants are harvested and then burned to form ash that contain metal compounds.

They do not involve digging, moving and disposing of large amounts of rocks.

A liquid removed from the ground containing dissolved substances from the ground.

Bioleaching uses bacteria to produce leachate solutions that contain metal compounds.

These are assessments of the environmental impact of a product at each stage of its life.

By displacement reactions with scrap iron or by electrolysis.

Use of water, resources, energy resources and the production of some waste.

Extracting and processing raw materials; manufacturing and packaging of product; use and operation of product; disposal of product.

Selective or abbreviated LCAs can be misused to reach pre-determined conclusions (e.g. for advertising campaigns).

Pollutant effects.

Using resources

List three ways end users can sustainably use resources.

Ways of reducing the use of resources.

Using resources

Name four effects of reduction in the use of materials.

Ways of reducing the use of resources.

Using resources

Name five materials which are produced from limited resources.

Ways of reducing the use of resources.

Using resources

Name two methods of obtaining raw materials from the earth.

Ways of reducing the use of resources.

Using resources

What is the effect of obtaining materials by these methods?

Ways of reducing the use of resources.

Using resources

Explain how glass products can be reused.

Ways of reducing the use of resources.

Using resources

What happens to other products which cannot be reused?

Ways of reducing the use of resources.

Using resources

Describe how metals can be recycled.

Ways of reducing the use of resources.

Using resources

What does the amount of separation required for recycling depend upon?

Ways of reducing the use of resources.

Using resources

How can scrap steel be recycled?

Ways of reducing the use of resources.

Reduce use of limited resources, reduce use of energy sources, reduction in waste and environmental impacts

Reduction in use, reuse and recycling.

Quarrying and mining.

Metals, glass, building materials, clay ceramics and plastics.

Glass bottles can be crushed and melted to make different glass products.

Environmental impacts.

By melting, recasting or reforming into different products.

They are recycled for a different use.

Scrap steel can be added to iron from a blast furnace to reduce the amount of iron that needs to be extracted from iron ore.

Depends on the material and the properties required of the final product.