Note: In Pure Chemistry, most questions are based on table and diagram analysis, whereas the following are concept-based questions.

Chapter 1 Experimental Chemistry

Q: Name the method to collect ammonia gas [1]-

Upwards delivery method

Q: Name the method to collect Chlorine gas [1]-

Downward delivery method

Q: Name the method to collect hydrogen gas [1]-

Water displacement method

Q: Suggest a method to separate iron filings from sand [1]-

Magnetic attraction

Q: Suggest how pure copper(II) sulfate crystals can be obtained from its solution [3]-

Gently heat the solution until the solution becomes saturated . Cool the solution and Copper(ii) sulfate crystals will form . Filter the saturated solution , and copper(ii) sulfate crystals are obtained as residue . Wash the copper(ii) sulfate crystals with little distilled water and dry it on sheets of filter paper .

Q: How to separate oil from water . [1]-

Using a separating funnel. Since water is denser , it will be on the bottom , while oil is at the top .

Q: How to identify colourless substances in a chromatography test . [1]-

Use Ultraviolet light and locating agents
Q: suggest the purpose of boiling chips in fractional distillation. [1] -

To ensure smooth and even heating

Q: Describe how the chromatography of a pure substance will look like . [1]

One dot on the chromatogram .

Chapter 2 Kinetic particle theory

Q: Describe the movement and arrangement of a solid . [3]-

Particles of a solid are arranged in a very closely packed and orderly manner. Particles can only vibrate about their fixed positions .

Q: Describe the movement and arrangement of a liquid. [3]-

Particles of a liquid are arranged in a closely packed and disorderly manner . Particles can slide past each other .

Q: Describe the movement and arrangement of a gas. [3]-

Particles of a gas are far apart and disorderly . Particles of gas move around freely and randomly in all directions .

Q: Describe the change in movement and arrangement when a substance changes from solid to liquid state. [4]-

As temperature increases , particles gain more kinetic energy and vibrate faster about their fixed positions , eventually , the particles with increased kinetic energy overcome the strong forces of attraction and change to liquid state . Movement of particles change from vibrating about their fixed position to being able to slide past each other . Arrangement of particles also changed from orderly and very close arrangement to disorderly and close arrangement .

Q: Describe the change in movement and arrangement when a substance changes from liquid to gas state. [4]-

As temperature increases , the particles gain more kinetic energy and eventually overcome the strong forces of attraction between particles . Causing the movement of particles to change from sliding past each other to being able to move quickly and randomly in all directions . The arrangement of particles also changes from close and disorderly arrangement to far apart and disorderly arrangement .

Q: Describe the change in movement and arrangement when a substance changes from gaseous to liquid state. [4]-

As temperature decreases , particles have less energy and are drawn closer together by the forces of attraction . Particles movement changed from moving quickly and randomly in all directions to being able to slide past each other . Arrangement of particles also changed from far apart and disordered arrangement to closer apart and disordered arrangement .

Q: Describe the change in movement and arrangement when a substance changes from liquid to solid state. [4]-

As temperature decreases , particles have less energy and are drawn closer together by the forces of attraction , eventually changing to solid state . The particles' movement changed from sliding past each other to being able to only vibrate about their fixed positions . The arrangement of particles also changes from disordered and close arrangement to ordered and very close arrangement .

Q: Define diffusion . [1]-

Net movement of particles from a region of higher concentration to a region of lower concentration , down a concentration gradient.

Q: Explain why ammonia diffuses faster than chlorine gas. [2]-

Since ammonia gas is lighter than chlorine gas , it requires less kinetic energy to move around and thus ammonia gas diffuses faster than chlorine gas at the same temperature .

Chapter 3 Atomic structure

Q: Define atoms . [1]-

Atoms are basic building blocks of matter .

Q: Define isotopes [2]-

Isotopes are atoms with the same number of protons but different number of neutrons .

Q: Explain why isotopes have similar chemical properties , while different physical properties .[3]-

Since isotopes have the same number of electrons and electrons shells , they have similar chemical properties . However , since isotopes are different in atomic mass , they have different physical properties .

Q: Define Metallic bond . [1]-

Electrostatic forces of attraction between the positive ions and the sea of delocalised electrons in a metal .

Chapter 4 and 5

Q: Describe the differences between mixtures and compounds. [3]-

Mixtures do not have fixed ratios of its constituent , but compounds have fixed ratios of its constituent . Mixtures do have similar properties from its constituent elements , while compounds do not have similar properties from its constituent elements . Mixtures have boiling and melting points over a range of temperatures , while compounds have fixed boiling and melting points .

Q: Explain why alloys tend to be less malleable and less ductile than pure metals .[2]-

Since alloys are made of atoms of different sizes , causing the regular lattice arrangement to be disrupted , thus larger force is needed to make the layers slide past each other .

Q: Explain why diamond is more hard than graphite , in terms of structure and bonding . [4]

In diamond , each carbon atom is covalently bonded to 4 other carbon atoms in tetrahedral arrangement, thus it has a strong covalent bond . While for graphite , it has a layered structure made up of flat hexagons , where each carbon atom is covalently bonded to 3 other carbon atoms . The intermolecular forces of attraction are weak and the layers can slide past each other easily .

Q: Suggest and explain 1 physical property which graphite and diamond differ in . [3]-

Diamond can’t conduct electricity while graphite can . As diamonds do not have any free moving electrons , however , graphite contains carbon atoms bonded to 3 other carbon atoms , leaving one outer electron to move freely and carry electricity .

Q: Explain the electricity conductivity of silver metal . [2]-

Silver metal conducts electricity . As there are delocalised electrons to conduct electricity .

Q: Explain why ionic compounds have high melting and boiling points. [3]-

Ionic compounds have a giant crystal lattice structure . A large amount of energy is needed to overcome the strong electrostatic forces of attraction between positive and negative ions .

Q: Explain why ionic compounds cannot conduct electricity at solid state but can conduct electricity at aqueous state. [3]-

As at aqueous state , ions are free to move and conduct electricity . However , in solid state , ions are held at fixed positions and unable to move around .

Q: Explain why diamonds have high melting points . [3]-

Since diamonds are a giant covalent molecule and have each carbon atom covalently bonded to 4 other carbon atoms , a large amount of energy is required to overcome the strong covalent bonds , thus diamonds have high melting points.

Q: Explain why graphite can be used as lubricant . [3] -

Graphite has a layered structure made up of hexagons , with each carbon atom covalently bonded to 3 other carbon atoms . The intermolecular forces of attraction between the layers are weak , and the layers can slide over each other when a force is applied , causing graphite to be slippery .

Q: Suggest and explain boiling points of metals . [3]-

Metals have high boiling points , as a large amount of energy is required to overcome the strong electrostatic forces of attraction between positive ions and the sea of delocalised electrons .

Q: Suggest the electrical conductivity of metals . [2]-

Metals conduct electricity in all states . As metals contain a sea of delocalised electrons that carry charge and conduct electricity .

Q: Explain why metals are malleable and ductile . [2]-

Metals have a giant metallic lattice structure . Metal ions are closely packed in an orderly arrangement , which allows the ions to slide over one another easily when force is applied .

Chapter 8 Acid and Bases

Q: Define weak acid . [1]-

An acid that partially ionises in aqueous solution to give H+ ions .

Q: Define strong acid. [1]-

An acid that is completely ionised in aqueous solution to give H+ ions .

Q: Explain why the reaction between Na and HCL is faster than Na and ethanoic acid . [3]-

HCl is a strong acid that fully ionises which gives a higher concentration of H+ ions , while ethanoic acid is a weak acid that partially ionises giving a lower concentration of H+ ions . Since Na reacts with H+ ions , thus HCl reacts faster with Na .

Q: State a chemical used to treat acidic soil . [1]-

Calcium hydroxide .

Q: Explain why ammonium salt should not be used together with Calcium Hydroxide . [2]-

As ammonium salt will react with Calcium hydroxide , ammonia gas evolved will escape .This reduces the nitrogen content and effectiveness of the fertilizer.

Q: Describe the ‘liming’ process of the soil . [2]-

Soil that is too acidic is treated with bases such as calcium hydroxide , to neutralise the acid, and increase the pH of the soil .

Chapter 9 Salts

Q: Describe how a pure and dry sample of copper(II) sulfate can be obtained from copper(II) oxide and a named acid . [4]-

Mix warm sulfuric acid with excess copper(ii) oxide .
Filter to remove the excess copper(II) oxide as residue
Heat up the filtrate to obtain a saturated solution .
Cool the saturated solution to let copper(ii) sulfate crystals to form .
Filter off the saturated solution to obtain dry copper(ii) sulfate crystals .
Wash the crystals with little distilled water .
Dry the crystals by pressing gently on filter paper .

Q: Briefly describe the procedure to prepare sodium phosphate .[5]-

Pipette a fixed volume of 25.0cm3 of phosphoric acid into a conical flask . Add a few drops of methyl orange indicator into the conical flask . Titrate against the NaOH until the solution turns orange . record the volume of NaOH used . Repeat the experiment without the indicator . Heat the resulting solution until a saturated solution forms . Cool the saturated solution for sodium phosphate crystals to form . FIlter the saturated solution to obtain sodium phosphate crystals as residue . Wash the sodium phosphate crystals with little distilled water and then dry them on filter paper .

Q: Describe a test for Carbon dioxide gas. [1]-

When bubbling gas into limewater , White precipitate forms in limewater in the presence of Carbon dioxide gas .

Q: Describe the procedure to prepare barium sulfate. [5]-

Mix barium nitrate with sulfuric acid . A white precipitate of barium sulfate is formed . Filter the mixture to obtain barium sulfate as residue . Wash the barium sulfate residue with little distilled water and dry them on filter paper .

Chapter 10 Ammonia

Q: The industrial application of the Haber process uses an optimal pressure of 250 atm . Suggest why . [2]-

As it is cost efficient and reduces the cost of equipment.

Q: Suggest how Nitrogen gas and hydrogen gas are extracted . [2]-

Nitrogen is extracted from fractional distillation of liquid air .
Hydrogen is extracted from the cracking of crude oil fractions .

Chapter 11 Qualitative analysis

Q: Gas X turns damp blue litmus paper red . Deduce the 2 possible gas . [2]-

Carbon dioxide and sulfur dioxide

Q: Test to determine whether a compound contains calcium ions or zinc ions . [3]-

When acidified with aqueous ammonia , white ppt formed will be soluble in excess , giving a colourless solution in the presence of zinc ions . When acidified with aqueous ammonia , white ppt formed will be insoluble in excess , in the presence of calcium ions .

Q: How to test for the presence of oxygen gas . [1]-

A glowing splint will be relighted in the presence of O_2 gas .

Q: How to test for the presence of hydrogen gas . [1]-

A lighted splint will be extinguished with a ‘ pop’ sound in the presence of hydrogen gas .

Q: How to test for the presence of chlorine gas . [1]-

Chlorine gas will bleach damp blue litmus paper

Q: Describe the test for Carbonate ions [1]-

When dilute hydrochloric acid is added , CO_2 gas will form white precipitate (calcium carbonate) in lime water , in the presence of Carbonate ions.

Q: Describe the test for iodide ions . [1]-

When acidified with dilute nitric acid and add aqueous silver nitrate , yellow precipitate will be formed in the presence of iodide ions .

Q: Describe the test for nitrate ions . [1]-

When acidified with aqueous NaOH and then added with aluminium foil , upon heating , ammonia gas will form in the presence of nitrate ions .

Chapter 13. Electrolysis

Q: Define the term *electrolyte [1]-*

A substance which conducts electricity , typically in liquid or aqueous state and also contains mobile ions which act as mobile charge carriers to conduct electricity .

Q: Describe how copper can be purified using electrolysis [4]-

Set up a circuit with impure copper as the anode and pure copper as the cathode . During electrolysis , at the anode , Cu anode will dissolve/oxidise to form Cu2+ ions . While at the cathode , Cu 2+ ions will be selectively discharged / reduced, forming pure copper that is deposited onto the cathode .

Q: Evaluate the use of hydrogen fuel [3]-

Hydrogen fuel cells are more efficient than fuel-burning electricity sources , and only produce water as a by-product . However , hydrogen is highly flammable at room temperature and pressure which makes it difficult to store .

Chapter 14 . Periodic table

Q: State the Chemical properties of group 1 metals .[1]-

Group 1 metals' reactivity increases down the group

Q: State the Physical properties of group 1 metals .[2]-

Group 1 metals are soft and can be cut easily . They also have low melting and boiling points and have low densities .

Q: State the chemical properties of Halogens .[1]-

Reactivity of Halogens decreases down the group .

Q: State the Physical properties of Halogens .[1]-

Halogens are coloured and have low melting and boiling points .

Q: State the properties of noble gases . [3]-

Noble gases are:

- Unreactive
- Insoluble in water

- Monatomic nonmetals
- Colourless gases at room temperature
- Have low melting and boiling points

Q: State the properties of Transition metals . [2]-

Transition metals have variation of oxidation states , have high densities , high melting and boiling points , and also form coloured compounds .

Q: Appearance at r.t.p (state and colour) [3]-

Chlorine : Yellowish-green gas

Bromine : Reddish - Brown liquid

Iodine : purple - black solid

Chapter 15. The Reactivity Series .

Q: Describe the conditions for rusting. [1]-

Oxygen gas and water

Q: State the 2 types of methods of rust prevention. [1]-

Using Sacrificial metal and using protective layers .

Q: Describe the method of galvanising and its advantages . [2]-

Galvanising involves dipping the iron object into molten zinc . This layer of zinc is coated onto the object and corrodes in place of iron or steel .
The metal does not rust even if the zinc layer is scratched . This is because zinc is more reactive than iron , so Zinc will corrode instead of iron .

Q: Describe the method of tin-plating and its disadvantages. [2]-

Tin plating is by coating a layer of tin on the object via electroplating , so that the object will not be in contact with oxygen and water , and will not corrode .
However , if the tin layer is scratched , the iron beneath it is exposed and starts to rust .

Chapter 16. Chemical Energies

Q: Define *activation energy .* [1]-

The minimum amount of energy that colliding particles must possess to react with each other

Q: Define *bond energy .* [1]-

The amount of energy absorbed to break one mole of chemical bond , and the amount of energy released when one mole of that bond is formed .

Q: fill in the table [3]-

	Endothermic	Exothermic
Heat	Absorbed (temp. Decrease)	Released (temp.increase)

ΔH	>0	<0
Total energy	Total energy absorbed for bond breaking > total energy released for bond making	Total energy absorbed for bond breaking < total energy released for bond making

Chapter 17 Rate of reaction

Q: Using the idea of colliding particle theory , explain why the rate of reaction increases as temperature increases . [4]-

As temperature increases , the particles gain more kinetic energy and move around faster , increasing frequency of effective collisions . Moreover , more particles possess energy higher or equal to the activation energy , thus the rate of reaction increases .

Q: Using the idea of colliding particle theory , explain why the rate of reaction increases as concentration of reactants increases . [3]-

As concentration increases, there are more particles per unit volume , increasing the frequency of effective collisions between reactant particles , thus the rate of reaction increases .

Q: Using the idea of colliding particle theory , explain why the rate of reaction increases as pressure increases . [3]-

As pressure increases , there are more particles per unit volume , increasing the frequency of effective collisions between particles , thus the rate of reaction increases.

Q: Using the idea of colliding particle theory , explain why the rate of reaction increases as particle size decreases . [3]-

When particle size decreases , particles have larger surface area , this increases frequency of effective collisions , thus increasing rate of reaction .

Q: Using the idea of colliding particle theory , explain why the rate of reaction increases when a catalyst is added . [3]-

When a catalyst is added , it lowers the activation energy , causing more particles to collide with energy higher or equal to the activation energy , increasing the frequency of effective collisions , thus rate of reaction increases .

Chapter 18-19 Organic Chemistry

Q: Explain why the fractional distillation process in oil refineries cannot be replaced by simple distillation . [3]-

Crude oil consists of a mixture of hydrocarbons with boiling points close to each other . Simple distillation only separates mixtures with large differences in boiling

points , using simple distillation for separating useful oil fractions in crude oil will not be efficient .

Q: With reference to bonding and structure , describe why the different crude oil fractions have different boiling points . [3]-

Crude oil fractions have different boiling points as different fractions have different chain length , and larger molecules have stronger intermolecular forces of attraction , a higher amount of energy is needed to boil the fractions , resulting in higher boiling points .

Q: Is ethanol a hydrocarbon? Explain your answer . [2]-

Ethanol is not a hydrocarbon as it contains oxygen . Hydrocarbons are molecules that only contain hydrogen and carbon .

Q: Evaluate the use of ethanol as a fuel for cars . [2]-

Ethanol is a renewable resource and can be used as a fuel for cars as it produces large amounts of energy with less carbon dioxide output . However , ethanol production can lead to deforestation for land space .

Q: Describe the physical properties of Alkane and Alkene . [2]-

Alkanes have low melting and boiling points , insoluble in water but soluble in organic solvents .
For alkanes , melting and boiling points increases, also becoming more viscous and less flammable down the group .

Alkenes melting and boiling points increase down the group as molecular sizes increase , intermolecular forces of attraction increase. Alkenes are insoluble in water but soluble in organic solvents .

Q: State the difference between alkene and alkane . [3]-

Alkenes contain C=C double bond while Alkanes contain C-C single bonds .
Alkenes are very reactive , while Alkanes are generally unreactive .
Alkenes are unsaturated compounds , while Alkanes are saturated compounds .
Alkenes undergoes addition reactions , while Alkanes undergoes substitution reactions.
Alkenes decolourises aqueous bromine , while Alkanes do not react with aqueous bromine .

Q: Describe the manufacture of margarine from vegetable oils . [2]-

Hydrogenation . Vegetable oil (unsaturated) react with hydrogen gas at about 200°C with Nickel catalyst , to form margarine (saturated)

Q: Suggest why the enthalpy change of combustion for two isomers are different. [3]-

Since isomers have different structure and bonding , the energy absorbed for bond breaking differs for the two isomers , thus enthalpy change of combustion is different .

Chapter 20 Polymers

Q: Give a reason why poly(ethene) is a better choice than tin for lining iron food cans . [2]-

Poly(ethene) is waterproof and resists corrosion caused by dilute acids , while tin is easily corroded by dilute acids . Thus , poly(ethene) helps to prevent iron food cans from rusting .

Q: Explain the terms macromolecules and addition polymerisation .[3]-

Macromolecules are very large molecules made up of many smaller molecules .

Addition polymerisation is a reaction in which unsaturated monomers are joined together without losing any molecules or atoms .

Q: Describe 3 differences between addition and condensation polymerisation reactions . [3]-

For addition polymerisation , the hydrocarbons used are unsaturated , while for condensation polymerisation , the hydrocarbons used are saturated .

For addition polymerisation , only C=C double bonds are needed, while for condensation polymerisation , two functional groups are required .

For addition polymerisation , no atoms or molecules are lost , while for condensation polymerisation , water is lost as a byproduct .

Q: Explain the importance of recycling plastics . [2]-

Recycling plastics reduces the waste of resources , pollution to the ocean, and threat to aquatic ecosystems .

Q: Explain how depolymerisation of plastics can help to reduce pollution. [4]-

Depolymerisation breaks long-chain plastics into their original **monomers**, which can be **reused to make new plastics** or other products. This reduces the need to make new plastics from crude oil and prevents plastic waste from accumulating in the environment, **reducing pollution** and harm to wildlife.