

CLASS IX CHEMISTRY

COMPLETE BOOK NOTES

Chemistry

Unit: 1 States of Matter and Phase Changes

1. What is Chemistry?

Chemistry is the branch of science which deals with the properties, composition and the structure of substances.

2. What is meant by composition of matter and structure of matter?

Determination of composition represents finding out percentages of elements and compounds in a sample of matter. Structure of matter means the arrangement of atoms in matter.

3. Define Biochemistry.

It deals with the chemical substances and vital processes occurring in living organisms. In this we study life through chemical processes. It helps to study biomolecules such as proteins, carbohydrates, fats, vitamins, DNA, RNA etc.

4. Define Analytical Chemistry.

The branch of chemistry that deals with the analysis of different substances. It involves separation, identification of components present in material things. It helps to analyze the matter. It helps to analyze food.

5. Define Nuclear Chemistry.

It deals with the radioactivity, nuclear processes in the nuclei of atom. It also deals with the reactions taking place in the nucleus of an atom. Nuclear chemistry has many applications in agriculture medicine, industry and research.

6. Define Physical Chemistry.

It deals with the relationship between the composition and physical properties of matter along with the changes in them. It also predicts and change the rates of reaction.

7. Define Environmental Chemistry.

The scientific study of the chemical and biochemical event that occur in this planet. It deals with the sources, reactions, effects, and chemical species in the air, soil, and water environment.

8. Define Geochemistry.

The study of chemical compounds on earth and its sources and minerals is called geochemistry. Apart from its use in minerals exploration, geochemical mapping today has applications in environmental monitoring, forestry and medical research.

9. Define Polymer chemistry.

Polymer chemistry focuses on the properties, structure and synthesis of polymers and macro-molecules. Polymers are large molecules made by linking together a series of building blocks. Many materials present in the living organisms including proteins, cellulose and nucleic acids are naturally occurring polymers.

10. Define Medicinal Chemistry.

It deals with design and synthesis medicine and drugs which are beneficial for mankind. It includes discovery, delivery, and metabolism of drugs in human body.

11. Define Astro chemistry.

It deals with the chemical composition and reactions that occur in space, especially in stars, planets, interstellar clouds, comets, and galaxies.

12. Differentiate b/w Organic and In Organic Chemistry.

Organic chemistry: Organic Chemistry is the study of covalent compounds of carbon and hydrogen (hydrocarbons) and their derivatives.

Inorganic chemistry: Inorganic chemistry deals with the study of all elements and their compounds except those of compounds of carbon and hydrogen (hydrocarbons) and their derivatives.

13. What is an inorganic substance made of?

An inorganic substance can be composed of metals, nonmetals or a mixture of these, salts, acids and bases. Organic compounds are found in all forms of life and are also essential for life.

14. Write uses organic compounds and inorganic compounds.

Organic chemistry: These are used as food, medicines, cosmetics, dyes etc.

Inorganic chemistry: These are used as fuel, catalyst, medicines, mineral etc.

15. Define matter. How many states of matter are there?

Anything which carries weight and occupies space is called matter. E.g. Chair, book etc. There are four states of matter. 1. Solid 2. Liquid 3. gas 4. Plasma

16. Write properties of primary states of matters.

Solid	Liquid	Gas
Particles are closely packed.	Molecules are closely attached.	Molecules are widely apart.
These are incompressible.	These are not easily compressible.	These are easily compressible.
These have high densities.	These have high densities than gases.	These have very low densities.
These have strongest intermolecular forces.	These have strong intermolecular forces.	These have weakest intermolecular forces.
These have definite shape and volume.	These have definite volume, but not definite shape.	These do not have definite shape and volume.

17. Why gases are easily compressible?

Because gas molecules are widely apart empty spaces present between molecules, so they are easily compressible.

18. Define Plasma.

The partially ionized gas containing ions, electrons, and photons is called plasma. It exists in fluorescent tubes, lightning and welding arc.

19. What are Supercritical fluids, Liquid crystal and Graphene?

Supercritical fluids: Supercritical fluids are highly compressible states which shows both properties of gases and liquids.

Liquid crystal: Liquid crystal is a state of matter whose properties are between those of conventional liquids and those of crystalline solids. **Use:** It is used in display devices like monitor, clocks and navigation system.

Graphene: Graphene is two-dimensional crystal a single layer of carbon atoms arranged in hexagonal pattern. It is tough, flexible and high resistance.

20. What are Artificial Elements? Give Example.

Those elements which are created by the scientists in the laboratory are called artificial elements.

Example: Technetium, fermium etc.

21. Write the comparison between elements, compounds and mixture.

Elements	Compounds	Mixture
A Substance which consists of only one kind of atoms is known as element.	A pure substance made of two or more elements chemically combined.	The components of a mixture are not chemically bound together.
Elements are only same kind of atoms.	Compounds always have fixed ratio by mass.	Mixture do not have fixed composition.
It cannot be broken into simpler substances by chemical means.	It Can be broken into elements by chemical means.	It can be separated by physical method.
Gaseous elements exist in the form of independent molecules.	Compounds have homogeneous composition.	Mixture may be homogeneous or heterogeneous in composition.
Examples: O ₂ , H ₂ , Cl ₂ , etc.	Examples: NaCl, H ₂ O, CO ₂ etc.	Examples: Air, Oil, Milk etc.

22. Define allotropy and allotropic forms.

The existence of an element in more than one forms in same physical state is called allotropy and the forms

are called allotropic forms. For example allotropic forms of carbon are: diamond, graphite and Buckminster fullerene and allotropic form of oxygen are oxygen (O_2) and Ozone (O_3).

23. Write physical properties of fullerenes.

i. It is soft. **ii.** It has low melting point. **iii.** It is poor conductor of electricity.

24. Define solute and solvent.

Solute: The component of solution which are present in smaller quantity. **Solvent:** The component of solution present in larger quantity. **Example:** In sugar solution, sugar is solute and water is solvent

25. Define Solution, colloidal solution and suspension.

Solution	Colloidal solution	Suspension
Homogeneous mixture of two or more than two substances is called solution. True Solution: A solution in which solute particles are completely homogenized in solvent	A colloidal solution is a heterogeneous mixture where very fine particles are dispersed uniformly in another substance.	A suspension is a heterogeneous mixture in which the solid particles are large enough to settle after some time.
Example: Sugar in water	Example: Milk, blood, starch in water	Example: a mixture of chalk in water

26. Define saturated solution. Give example-

A solution in which maximum amount of solute has been dissolved at a particular temperature. For example adding sugar to water until no more sugar dissolves.

27. Define unsaturated solution. Give example-

A solution which contains lesser amount of solute than that which is required to saturate it at a given temperature, is called unsaturated solution. For example Take 100g of water in a beaker, add 5g of sugar to it, and stir it. Then sugar will dissolve in water. Then add another 5g of sugar and stir. This will also dissolve.

28. Define solubility. OR What is effect of temperature on solubility?

The amount of solute which can dissolve in 100g of a solvent at a particular temperature.

Effect of temperature: Generally, solubility increases with the increase of temperature. But it depends on the nature of solute. In some cases, solubility increase within increase in temperature and some cases it will decrease.

29. Give examples of substances whose solubility in water increases with increase in temperature.

Silver nitrate, Sodium nitrate, Potassium nitrate and Potassium chloride.

30. Give examples of substances (or compounds) whose solubility in water decreases with increase in temperature.

Lithium carbonate, Calcium chromate and Calcium hydroxide.

31. Why does Sugar have Lower Solubility in Water than Sodium Chloride?

Sugar has lower solubility than salt because attraction between sugar molecules and water is weaker while attraction between NaCl molecules and water is stronger.

32. Why do different compounds have different solubility's in water at particular temperature?

Different compounds have different solubility's due to varying intermolecular forces with water.

33. How Variation of Solubility at different temperatures can be useful for us?

It is important for: Purification of solids and Dissolving of gases in liquids.

34. Why are Soda Water Bottles stored in Refrigerators?

CO_2 gas is more soluble in water at low temperature. Therefore, soda water bottles are stored in refrigerators to keep carbon dioxide gas dissolved in water for a longer period of time.

35. Why NaCl cannot be crystallized from water just like KNO_3 ?

Because NaCl has high solubility, making crystallization from water difficult.

Exercise

Multiple Choice Questions:-

- Matter is present in neon signs in the state of:**
 (a) Supercritical fluid (b) **Plasma ✓** (c) Gas (d) Liquid crystal
- Hazardous effects of shopping bags are studied in:**
 (a) Geochemistry (b) Inorganic chemistry (c) Analytical Chemistry (d) **Environmental chemistry ✓**
- The man-made polymer is:**
 (a) Starch (b) **Polystyrene ✓** (c) Protein (d) Cellulose
- The crystals of which substance has rhombic shape?**
 (a) Brass (b) **Sulphur ✓** (c) Graphite (d) Bronze
- Which liquid among the following is a colloidal solution?**
 (a) **Milk ✓** (b) Slaked lime used for white wash (c) Vinegar solution (d) Mixture of AgCl in water
- Which of the following is a heterogeneous mixture?**
 (a) A solution of calcium hydroxide in water (b) A solution of potassium nitrate in water (c) Hot chocolate (d) **Concrete mixture ✓**
- A state of matter whose properties are between those of liquids and crystalline solids:**
 (a) **Liquid crystal ✓** (b) Supercritical fluid (c) Plasma (d) Dark matter
- When the tiny visible particles of a substance are dispersed through a medium, the mixture is named as:**
 (a) True solution (b) **Colloid ✓** (c) Suspension (d) Saturated solution
- A solution of KClO_3 , has a solubility of about 13.2g per 100 cm³ at 40°C. How its solubility will be affected, if you decrease the temperature?**
 (a) The solubility will increase (b) **The solubility will decrease ✓** (c) The solubility will remain the same (d) The solubility will first increase with temperature and then it will decrease
- You are studying the rate of hydrolysis of starch under different conditions of temperature. In which branch of chemistry this topic will fall?**
 (a) Organic Chemistry (b) Analytical Chemistry (c) Biochemistry (d) **Physical Chemistry ✓**

Exercise Short Questions:-**1. Why is there a need to divide Chemistry into many branches? Give three reasons?**

- It helps in understanding the fundamental principles of chemical reactions and bonding.
- It allows scientists to develop new materials and technologies, improving everything products.
- These branches have distinct areas of study for the scientists to focus on and to achieve breakthrough and advancements.

2. Reactions may take place due to electrons present outside the nucleus or may take place inside the nucleus. Which branches of Chemistry cover these two types of reactions?

Physical chemistry and Nuclear Chemistry.

3. What type of problems are solved in analytical chemistry?

In analytical chemistry, problems related to the identification, composition, and quantification of substances are solved.

4. Both graphite and graphene have hexagonal layered structures. What is the difference?

Graphite: It is a three dimensional layered structure of hexagonal rings of carbon.

Graphene: It is a two dimensional single layer of carbon atoms arranged in hexagonal pattern.

5. Why are supercritical fluids important?

These fluids are used in various processes such as extraction, chromatography and chemical reactions due to their unique properties like high diffusion, low viscosity and high solvating power.

6. In which state does matter exist in the sun?

In the sun, matter primarily exists in the plasma state.

7. What is importance of graphene?

Graphene has many applications in electronics, energy storage devices and sensors and even in medical devices. Because graphene has exceptional properties such as tough, flexible and light material with high resistance.

8. Which form of matter do most of the material things in this world belong to?

Most of the material things in this world belong to the state of matter known as solids.

Constructed Response Questions:-**1. How does a supercritical state looks like?**

In a supercritical state a substance looks like a dense fluid that show properties of gases and liquids. It has not a distinct boundary between liquid and gases.

2. in what way plasma created in fluorescent tube?

When we apply high voltage current at low pressure in tube gas present in tube ionized. This ionization process causes the gas to convert to plasma.

3. Most of the molecules we study in biochemistry are organic in nature. Where does the difference in organic and biochemistry?

Biochemistry	Organic chemistry
In this we study chemical processes and substances that occur in living organisms	In this we study carbon compounds i.e. hydrocarbons and their derivatives.
It focus on biological molecules like protein, nucleic acids, carbohydrates and lipids etc.	It deals with the study of substances both in living organisms and non-living matter.

4. Give the reasons of brilliance shown by diamond. Can you improve it?

Due to high refractive index, high degree of dispersion and internal reflection make diamond so brilliant. For brilliance of diamond it will be cut and polished in specific way to optimize the reflection and refraction of light.

5. Explain the dissolution of NaCl in water?

When NaCl mix in water due to polar nature of water its partially charged ends attract and surround the charged ions of NaCl. Due to this ions of NaCl break apart and NaCl dissolve in water.

6. Why do different compounds have different solubility in water at a particular temperature?

It is due to that different compounds have different shape and size of molecules and different strength of intermolecular forces between the solute molecules and water molecules.

7. Why NaCl cannot be crystallized from water just like KNO₃?

Because NaCl has high solubility, making crystallization from water difficult.

8. Why graphite is slippery to touch? Which property of graphite enables it to be used as lubricant?

Graphite layers are not bonded strongly; they can slip past each other. Due to this graphite used as lubricant.

Unit: 2 Atomic Structure

1. Who proposed the idea of atom first?

The idea of atom was first proposed in Greece when the philosopher Democritus declared that all matter is made of tiny particles. He named this particle as atom, a particle that cannot be further subdivided.

2. Who provided experimental evidence for the existence of atom?

Around 1800, the English chemist John Dalton did many experiments with compounds that provided the evidence for the existence of atom.

3. What was done in discharge tube experiments?

In the last decade of nineteenth century, a group of scientists were trying to pass electricity through gases at reduced pressure. During the course of these experiments known as 'Discharge Tube Experiments'.

4. What did discharge tube experiments discover about atoms?

They discovered that atoms are no longer the smallest particles of matter; rather there exist particles that are even smaller than atoms.

5. What are atoms made of?

Atoms are composed of negatively charged particles called electrons and positively charged particles called protons.

6. How heavy is a proton compared to an electron?

A proton is 1836 times heavier than an electron.

7. How was the presence of electrons confirmed?

In a discharge tube, the presence of the negatively charged particles was ascertained because of their deflection towards the positive plate in an electric field.

8. How was the presence of protons confirmed?

The presence of positively charged particles was confirmed due to their deflection towards the negative plate

9. Write the names of fundamental particles of atoms?

Electron, proton and neutron.

10. Write properties of Cathode particles.

These rays have negative charge. These rays are deflected by magnetic field. These rays bend towards the positively charged plate.

11. Write properties of Neutron particles.

They are neutral. They are highly penetrating. Their mass is equal to mass of proton.

12. Write properties of proton particles or Positive rays Or Canal rays or Anode rays.

These rays have positive charge. These rays travel in straight lines. They travel in opposite direction to cathode ray.

13. Who discovered Electron, proton and Neutron?

Electron (J.J. Thomson-1897) Proton (E. Goldstien-1886) Neutron (James Chadwick-1933)

14. Write the name of particles present in nucleus.

1. Proton 2. Neutron

15. Write the difference b/w shell and subshell.

Shell: A shell is the path or level around the nucleus where electrons move. Shells are denoted by K, L, M, N.

Subshell: A subshell is a division of a shell and represents a more specific region where electrons are located. Subshells are denoted by s, p, d, f.

16. Write number of electrons in K, L, M and N shells.

Number of electrons in shell can be calculated by using formula $2n^2$ where n is the no of shell for K, n=1, for L, n=2 and so on.

K	L	M	N
2	8	18	32

17. Write the name of subshells and also write no. of electron in each subshell?

s=2 electrons

p=6 electrons

d=10 electrons

f=10 electrons

18. Why shells or orbits are called energy levels?

Because electron present in each shell has a fixed energy.

19. Define electronic configuration. Write down the formula.

The arrangement of electrons around the nucleus is called electronic configuration. A shell can accommodate maximum $2n^2$ electrons.

20. What is atomic number and Mass number?

Atomic Number / Proton number:

The number of protons present in the nucleus of an atom is called atomic number. Symbol: Z

Atomic mass / Mass Number / Nucleon number:

The total number of protons and neutrons present in an atom is called mass number. Symbol: A

21. Write the formula to find number of neutrons in an atom.

$$N = A - Z$$

22. Calculate the number of neutrons, protons and electrons in barium $^{137}_{56}\text{Ba}$.

Number of protons=56 Number of electrons=56

Number of neutrons=137 – 56 = 81

23. Define isotopes and radioactive isotopes with examples.

Isotopes: Atoms of the same element having same atomic number but different mass number. E.g. isotope of hydrogen is protium, deuterium and tritium.

Radioactive Isotopes: The isotopes which emit energy in the form of radiation are called radioactive isotopes. E.g. uranium, radium etc.

24. Why isotopes of an elements show same chemical properties while their physical properties are different?

The isotopes have same chemical properties, because they have same atomic numbers. And different physical properties, because they have different mass number.

25. Write three uses of isotopes. OR Write uses of radioactive isotopes.

1. It is used in medical imaging.
2. They are used to find oil fields.
3. Doctors use them to diagnose the disease.

26. What is Radiocarbon dating?

Radiocarbon dating is a method to find the age of once-living things by measuring the leftover carbon-14 in them.

27. Why does a radioactive isotope emit radiation?

Because it has unstable nuclei, so it emits radiations. Nucleus is unstable because the particles of nuclei have imbalance force between them.

28. Why it is said that almost all the mass of an atom is concentrated in the nucleus?

Protons and neutrons lie in the nucleus, so almost all mass is concentrated in nucleus. Rutherford's experiment proved that the whole mass of an atom is located at its center.

29. What is Relative Atomic Mass?

The average mass of an atoms of that element as compared to $1/12^{\text{th}}$ the mass of an atom of carbon-12 isotope. It is represented by unit atomic mass unit (amu). $1\text{amu} = 1.67377 \times 10^{-27} \text{ kg}$.

Exercise

Multiple Choice Questions:-

- 1. How many electrons can be accommodated at the most in the third shell of the elements?**
 (a) 8 (b) 18✓ (c) 10 (d) 32
- 2. What information was obtained from discharge tube experiments?**
 (a) Structure of atom was discovered. (b) Neutrons and protons were discovered. (c) Electrons and protons were discovered. ✓ (d) Presence of nucleus in an atom was discovered.
- 3. Why have isotopes not been shown in the periodic table?**

- (a) Periodic table cannot accommodate a large number of isotopes of different elements. (b) Some of the isotopes are unstable and they give rise to different elements (c) All the isotopes have same atomic number; so there is no need to give them separate places. ✓ (d) Isotopes do not show periodic behavior.
- 4. Which particle is present in different number in the isotopes?**
 (a) Electron (b) Neutron ✓ (c) Proton (d) Both neutron and proton
- 5. In which isotope of oxygen there are the equal number of protons, electrons and neutrons?**
 (a) O^{17} (b) O^{16} ✓ (c) O^{18} (d) None of these
- 6. What will be the relative atomic mass of nitrogen given the abundances of its two isotopes, ^{14}N and ^{15}N are 99.64 and 0.35 respectively.**
 (a) 14.0210 (b) 14.0021 ✓ (c) 14.2100 (d) 14.1200
- 7. How is radiocarbon dating useful for archeologists?**
 (a) It helps determine the age of organic matter. ✓ (b) It helps determine the composition of matter. (c) It helps determine the usefulness of matter. (d) It helps determine whether the matter is radioactive or not.
- 8. What does keep the particles present in the nucleus intact?**
 (a) Particles are held together by strong nuclear force. ✓ (b) Particles are held together by weak nuclear force. (c) Particles are held together by electrostatic force. (d) Particles are held together by dipolar force.
- 9. How do electrons keep themselves away from the oppositely charged nucleus?**
 (a) By keeping themselves stationary (b) By revolving around the nucleus ✓ (c) Due to their wave-like nature (d) A magnetic field around the nucleus keeps them away
- 10. Rubidium consists of two isotopes ^{85}Rb and ^{87}Rb . The percent abundance of the light isotope is 72.2% What is the percent abundance of the heavier isotope? Its atomic mass is 85.47**
 (a) 15% (b) 27.8% ✓ (c) 37% (d) 72%

Exercise Short Questions:-**1. Why is it said that almost all the mass of an atom is concentrated in its nucleus?**

Almost all the mass of an atom is concentrated in its nucleus because both the heavy particles proton and neutron are found to be present here.

2. Why are elements different from one another?

Because they have different number of protons and neutrons.

3. How many neutrons are present in $^{210}Bi_{83}$?

Atomic mass (A) = 210, Atomic No (Z) = 83, No of Neutron = ?

Neutron = A – Z

210 – 83 = 127

4. Why tritium a radioactive element?

Tritium emit radiations. That's why a radioactive element.

5. How can atom absorb and evolve energy?

When an electron jump in atom from lower to higher orbit it absorb energy and when it jump from higher to lower it release energy.

Constructed Response Questions:-**1. Why does the energy of electron increase as we move from first shell to second shell?**

Since electrons in the outer shell are further from the nucleus. The energy of the electrons in that shell increase.

2. Why is it needed to lower the pressure of the gas inside the discharge tube?

Because on normal temperature gases does not pass the current that why it's needed to lower the pressure.

3. What is classical concept of an electron? How has this concept changed with time?

According to classical views, the electron is a small negatively charged particle that moves around the nucleus in a shell. However according to modern theory electrons resemble a cloud of negative charge and their exact location around the nucleus cannot be determined.

4. Why the nuclei of the radioactive elements are unstable?

Because there is an unbalanced force between the particles with in the nucleus.

5. During discharge tube experiments, how did the scientists conclude that the same type of electron and proton are present in all elements?

Scientists made the following observations: Identical emission spectra and identical charge on protons.

Unit: 3 Chemical Bonding

1. Why do atoms combine with other atoms?

Atoms have a tendency to decrease their energy and increase their stability by combining with other atoms.

2. Give names of Noble Gases.

He, Ne, Ar, Kr and Xe.

3. How many electrons does helium have in its outermost shell?

Helium has two electrons in its outermost shell.

4. How many electrons do other noble gases have in their outermost shells?

All other noble gases have eight electrons in their outermost shells.

5. Why noble gases were considered stable? OR Why Noble gases are considered non-reactive?

Noble gases are non-reactive because their valence shells are full and they do not have space to gain, lose, or share electrons.

6. What is sign of stability for atoms?

Having two electrons or eight electrons in the outermost shell meant stability and hence un-reactivity.

7. Define duplet and octet rule.

Duplet Rule: Attaining 2 electrons in the valence shell is called duplet rule.

Octet Rule: Attaining 8 electrons in the valence shell is called octet rule.

8. Why does sodium lose one electron?

It is easy for sodium atom to lose one electron and stabilize itself than to gain seven electrons.

9. What is a chemical bond?

A chemical bond is a force of attraction between atoms which holds them together in the form of a molecule or a compound.

10. What happens when atoms of different substances approach each other?

If the forces of attraction between them dominate the forces of repulsion, the energy of the system gets lowered and the two atoms react to form a new molecule. Conversely, the two atoms simply move away from each other.

11. What are the two types of forces between atoms?

Forces of attraction and forces of repulsion.

12. Define chemical bond. Write their types.

The force of attraction which keeps the atoms together is called chemical bond.

Types: (i). Ionic bond (ii). Covalent bond (iii). Coordinate covalent bond.

13. Which electrons are involved in chemical bonding?

Chemical reaction, come only from the outermost shells of the atoms.

14. Define electronic configuration.

Non-Polar Covalent Bond

When a covalent bond is formed between two non-identical atoms. E.g. HCl, H₂O etc.

When a covalent bond is formed between identical atoms. E.g. H₂, Cl₂

25. Define metallic bond.

A type of chemical bond which has positively charged ions bound together by the mobile electrons.

26. On which factors strength of metallic bond depends?

i. Number of free electrons. ii. Number of positive charges on positive ions.

27. Why alkaline earth metals are less reactive than alkali metals.

Because alkaline earth metals lose their valence electron less easily than alkali metals

28. Write properties of metals.

i. It shows metallic luster ii. They are good conductor of electricity & heat iii. They are hard & heavy

29. Why metals are good conductor of electricity?

Metals are good conductors of electricity and heat because they have free or mobile electrons.

30. Differentiate between electropositive character and electronegative character.

Electropositive character: The ability of metals to lose electrons is called electropositive character.

Electronegative character: The ability of metals to gain electron is called electronegative character.

31. Why ionic compounds are good conductor of electricity in aqueous or molten form?

Because their ions move freely towards their respective electrodes.

32. Why ionic compounds do not conduct electricity in solid form?

Because in solid form ionic compounds are tightly packed and can't move.

33. Why covalent compounds are not generally soluble in water?

Covalent compounds are not soluble in water because they are non-polar and water is polar.

34. Why do lower molecular mass covalent compounds exist as gases or low boiling liquids?

Due to very weak attractive forces between their molecules, these compounds exist as gases or low boiling liquids.

35. Write three properties of covalent compounds.

1. They have low melting and boiling points.
2. They are bad conductors of heat and electricity.
3. They are insoluble in water.
4. They are made by 2 or more non-metals.

36. Write three properties of ionic compounds and metals.

Ionic compounds	Metals.
They have high melting and boiling points.	They have high melting and boiling points.
They are good conductors of heat and electricity.	They are good conductors of heat and electricity.
They are soluble in water.	They show metallic luster.
It is neutral compound.	They are hard and heavy

37. What is the difference between Ionic Compound and Covalent Compound?

Ionic Compound	Covalent Compound
The compound in which ionic bonding exists are called ionic compounds.	The compound in which covalent bonding exists are called covalent compounds.
They have high melting points.	They have low melting points.
They are soluble in polar solvents like water.	They are soluble in non-polar solvents like ether
They are usually good conductor of electricity in molten state or in solution form.	They are usually bad conductor of electricity.
Example: NaCl, CaCl ₂	Example: H ₂ , Cl ₂

38. What are intermolecular forces?

The forces present between molecules called intermolecular forces. Intermolecular forces are weaker as compared to chemical bond. eg: H-Cl-----HCl-----HCl

39. Define Dipole-Dipole interaction.

Dipole-dipole interaction is a force between polar molecules. It happens when the positive end of one molecule is attracted to the negative end of another. This attraction helps keep the molecules together.
E.g. $\text{H}-\text{Cl} \cdots \cdots \text{HCl} \cdots \cdots \text{HCl}$.

40. Define Hydrogen Bonding? Explain with a suitable example

The electrostatic force of attraction present between partial positively charged hydrogen atom and highly electronegative atom (F; O or N) is called hydrogen bonding.

For example, in H_2O , The O—H bonds are highly polar. Due to this, strong attractive forces are developed between water molecules as.

41. Write uses of coal, graphite and diamond.

Coal	Graphite	Diamond
It is used as fuel to produce electricity.	It is used as lubricants.	It is used as cutting, polishing tool.
It is used in industry.	It is used as electrode.	It is used in jewelry.
It is used in railway engines.	It is used in pencils.	It is used in lenses.

42. Why do covalent compounds behave differently from ionic compounds?

Covalent compounds behave differently because their atoms are joined by covalent bonds and have weak intermolecular forces. Example: Nitrogen (N_2), oxygen (O_2), fluorine (F_2), and chlorine (Cl_2).

43. Why do covalent molecules have low densities and low boiling points?

Due to very weak forces of attraction between their molecules.

44. In which forms do solid covalent elements exist?

They exist in amorphous and crystalline forms.

45. What are the amorphous and crystalline forms of carbon?

Coal is the amorphous form, while diamond and graphite are crystalline forms.

46. Why is diamond the hardest substance?

Each carbon atom in diamond is strongly bonded with four other carbon atoms, making a rigid structure.

47. Why is graphite used as a lubricant?

Because its layers can slip past each other easily.

48. Why is graphite a good conductor of electricity?

Because it has mobile electrons between its layers.

49. Name some covalent compounds that are gases at room temperature.

Methane (CH_4), Ammonia (NH_3),
hydrogen sulphide (H_2S),
hydrogen chloride (HCl),
carbon dioxide (CO_2), and
sulphur dioxide (SO_2).

50. Why does water have a high boiling point?

Due to strong intermolecular forces between water molecules.

51. How do hydrogen chloride, sulphuric acid, and nitric acid behave in water?

They ionize completely in water and act as strong acids.

Exercise

Multiple Choice Questions:-

- When molten copper and molten zinc are mixed together, they give rise to a new substance called brass. Predict what type of bond is formed between copper and zinc.
(a) Coordinate covalent bond (b) Ionic bond (c) Metallic bond ✓ (d) Covalent bond
- Which element is capable of forming all the three types of bonds; covalent, coordinate covalent and ionic?

- (a) Carbon ✓ (b) Oxygen (c) Magnesium (d) Silicon
- 3. Why is H_2O a liquid while H_2S is a gas?**
- (a) Because in water, the atomic size of oxygen is smaller than that of Sulphur (b) Because water is a polar compound and there exists strong forces of attraction between its molecules ✓ (c) Because H_2O molecule is lighter than H_2S (d) Because water can easily freeze into ice
- 4. Which of the following bonds is expected to be the weakest?**
- (a) C-C (b) Cl-Cl (c) O-O (d) F-F ✓
- 5. Which form of carbon is used as a lubricant?**
- (a) Coal (b) Diamond (c) Graphite ✓ (d) Charcoal
- 6. Keeping in view the intermolecular forces of attraction, indicate which compound has the highest boiling point.**
- (a) H_2O ✓ (b) H_2S (c) HF (d) NH_3
- 7. Which metal has the highest melting point?**
- (a) Li (b) Na (c) K (d) Rb ✓
- 8. Which ionic compound has the highest melting point?**
- (a) NaCl ✓ (b) KCl (c) LiCl (d) RbCl
- 9. Which compound contains both covalent and ionic bonds?**
- (a) $MgCl_2$ (b) NH_4Cl ✓ (c) CaO (d) PCl_3
- 10. Which among the following has a double covalent bond?**
- (a) Ethane ✓ (b) Methane (c) Ethylene (d) Acetylene

Short Questions:-**1. What type of elements lose their outer electron easily and what type of elements gain electrons easily?**

Metals lose their electrons easily due to large atomic size and low ionization energies.

Non-metals gain electron easily due to small size atom and low electron affinity.

2. Why do lower molecular mass covalent compounds exist as gases or low boiling liquids?

Due to weak intermolecular forces present in lower molecular mass covalent compound.

3. Give one example of an element which exists as a crystalline solid and it has covalent bonds between its atoms?

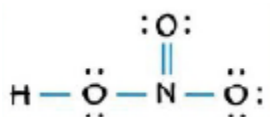
Diamond is an example of an element which exists as a crystalline solid and it has covalent bonds between its atoms.

4. Which property of metals make them malleable and ductile?

When pressure is applied on the metals, the upper rows of atoms slip past the lower rows. As a result their shapes are changed. This property of metals make them malleable and ductile.

5. Is coordinate covalent bond a strong bond?

Coordinate Covalent bond is a strong bond but not stronger than covalent bond. The electron pair donated by one atom is held tightly between the two atoms creating a stable molecular structure.

6. Write down the Dot cross structure of Nitric Acid.**Constructed Response Questions:-****1. Why HF is a liquid while HCl is a gas?**

It is because HF has strong Hydrogen bonding while HCl has much weaker intermolecular forces (dipole dipole forces).

2. Why covalent compounds are generally not soluble in water?

Covalent compound have non polar structure and water has polar structure thus there is no strong attraction between the water molecules and molecules of covalent compounds.

3. How do metals conduct heat?

The presence of freely moving electrons in metals makes them good conductor of heat and electricity.

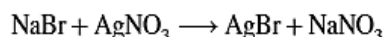
4. How many oxides does nitrogen form? Write down formulae of oxides?

Nitrogen forms several oxides including.

- i. Nitrous Oxide (N_2O). ii. Nitric Oxide (NO). iii. Nitrogen dioxide NO_2 .
iv. Dinitrogen trioxide N_2O_3 . v. Dinitrogen pentaoxide N_2O_5

5. What will happen if NaBr is treated with $AgNO_3$ in water?

If NaBr is treated with $AgNO_3$ in water, a white precipitate of AgBr is formed along with Sodium Nitrate $NaNO_3$.

**6. Why does iodine exist as a solid while Cl_2 exists as a gas?**

Iodine exist as a solid while Cl_2 exists as a gas because iodine has larger atomic size more contact surfaces for intermolecular forces as compared to Cl_2 .

Unit: 4 Stoichiometry

1. Define Stoichiometry.

Stoichiometry is an important concept in chemistry which helps us to calculate the amounts of reactants and products by using a balanced chemical equation.

2. Which law provide the basis of Stoichiometry?

It is based on the law of conservation of mass which states that matter can neither be created nor destroyed.

3. What do you know about stoichiometric coefficient?

The stoichiometric coefficient used to balance a chemical equation provides the mole ratio between reactants and products.

4. Write applications of stoichiometry.

Stoichiometry is used in industry quite often to determine the amount of raw materials required to produce the desired amount of the products.

5. Define reactants and products. Give example.

Reactants: In a chemical reaction, the reacting substances are called reactants.

Products: In a chemical reaction, the produced substances are called products. Example: $C + O_2 \rightarrow CO_2$

6. In which forms do elements exist in nature?

Elements exist in different forms in this world. Some elements exist in the form of aggregate of atoms.

Therefore they are represented by their symbols alone, for example, Na, Ca, C and Fe. While others exist as discrete molecules such as O_2 , N_2 and H_2 .

7. Why is sodium chloride represented by NaCl?

Sodium chloride exists in the form of ions which are bonded together in the form of a crystal.

Since the ratio between its ions is 1:1, sodium chloride is represented by the formula unit NaCl.

8. Give examples of covalent compounds.

Covalent compounds are HCl, HF, H_2S , PH_3 , H_2O_2 , H_2SO_4 , CO_2 , CO, C_6H_6 , etc.

9. Define Chemical equation. Give example.

Representing a chemical change in terms of symbols and formulas is called chemical equation.

Example: $C + O_2 \rightarrow CO_2$

10. Define reversible reaction. Give example.

The reaction in which products recombine to produce reactants is called reversible reaction. e.g. $H_2 + I_2 \rightleftharpoons 2HI$

11. Define Chemical formula. Give example.

The representation of chemical compound in terms of symbols and valences is called chemical formula.

Example sodium chloride (NaCl). Barium nitride (B_3N_2).

12. Differentiate b/w molecular formula and empirical formula.

The molecular formula represents the actual number of atoms present in the molecule of the element is called molecular formula. e.g. Benzene (C_6H_6)

The empirical formula represents the whole number ratio of atoms present in that compound is called molecular formula. e.g. Benzene (CH)

13. Give two examples of the compounds which have same empirical and molecular formulas.

Compounds	Molecular formula	Empirical formula
Ammonia	NH_3	NH_3
Methane	CH_4	CH_4

14. How can we calculate the molecular formula of a compound?

Molecular formula is then calculated by the following relationship. Molecular formula = n (Empirical Formula)

$$\text{Where } n = \frac{\text{Molar Mass}}{\text{Empirical Formula mass}}$$

15. Write down the names of three compounds which have different empirical and molecular formula.

Compounds	Molecular formula	Empirical formula
Benzene	C_6H_6	CH
Glucose	$C_6H_{12}O_6$	CH_2O
Hydrogen peroxide	H_2O_2	H_2O_2

16. Define molar mass. Give example.

The mass of one mole of a substance is called molar mass. E.g. Molar mass of carbon atom = 12g

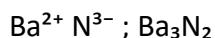
17. Define Chemical change. Give example.

When two or more substances combine in such a way that a new substance is formed which has entire different properties from its constituents is called chemical change. E.g. $C + O_2 \rightarrow CO_2$

Exercise**Multiple Choice Questions:-**

- How many atoms are present in one gram of H_2O ?
(a) 1002×10^{23} atoms (b) 6.022×10^{23} atoms (c) 0.334×10^{23} atoms ✓ (d) 2.004×10^{23} atoms
- Which is the correct formula of calcium phosphide?
(a) CaP (b) CaP_2 (c) Ca_2P_3 (d) Ca_3P_2 ✓
- How many atomic mass units (amu) are there in one gram?
(a) 1 amu (b) 10^{23} amu (c) 6.022×10^{23} amu ✓ (d) 6.022×10^{22} amu
- Structural formula of 2-hexene is $CH_3-CH=CH-(CH_2)_2-CH_3$ what will be its empirical formula?
(a) C_2H_2 (b) CH (c) C_6H_{12} (d) CH_2 ✓
- How many moles are there 25g of H_2SO_4 ?
(a) 0.765 moles (b) 0.51 moles (c) 0.255 moles ✓ (d) 0.4 moles
- A necklace has 6g of diamonds in it. What are the number of carbon atoms in it?
(a) 6.02×10^{23} (b) 12.04×10^{23} (c) 1.003×10^{23} (d) 3.01×10^{23} ✓
- What is the mass of Al in 204g of aluminium oxide, Al_2O_3 .
(a) 26 g (b) 27 g (c) 54 g (d) 108 g ✓
- Which one of the following compounds will have the highest percentage of the mass of nitrogen?
(a) Carbon (b) N_2H_4 ✓ (c) NH_3 (d) NH_2OH
- When one mole of each of the following compounds is reacted with oxygen, which will produce the maximum amount of CO_2 ?
(a) Carbon (b) Diamond (c) Ethane (C_2H_6) ✓ (d) Methane (CH_4)
- What mass of 95% $CaCO_3$ will be required to neutralize 50 cm of 0.5M HCl solution?
(a) 9.5g (b) 1.25g (c) 1.32g ✓ (d) 1.45g

Short Questions:-**1. Write down the chemical formula of barium nitride?**



2. Find out the molecular formula of a compound whose empirical formula is CH₂O and its molar mass is 180?

Empirical formula = CH₂O Molar Mass = 180 g mol⁻¹ Molecular formula = ?

Calculations: Molecular Formula = n(Empirical formula)

$$n = \frac{\text{Molar Mass}}{\text{Empirical Formula mass}}$$

$$n = \frac{180}{30} = 6$$

Molecular Formula = (CH₂O) = C₆H₁₂O₆

3. How many molecules are present in 1.5g H₂O?

Mass of H₂O = 1.5g No of Molecules = ? H₂O molar mass=180g mol⁻¹

No of moles = 1.5 / 18 = 0.0833mol

No of Molecules = no of moles × N_A

$$= 0.0833 \times 6.02 \times 10^{23} = 0.501 \times 10^{23}$$

4. What is the difference between mole and Avogadro's no?

Mole	Avogadro's No
The quantity of a substance containing A Avogadro's No of particles (N _A) is called a mole.	Avogadro's No is the number (6.02 × 10 ²³) of units in one mole of a substance
It is abbreviated as "mol"	It is represented by N _A .

5. Write down the equation of following?

Copper + Sulphuric Acid → Copper Sulphate + Sulphur dioxide + water



Constructed Response Questions:-

1. Different compounds will never have same molecular formula but they can have the same empirical formula.

Different compounds will never have the same molecular formula because each compound has unique type of atoms in a fixed ratio by mass. They can have same empirical formula because ratio between atoms of different compounds can be the same.

2. Write down the chemical formulas of following:

Name	Formula
Calcium sulphate	Ca ₃ (PO ₄) ₂
Aluminium Nitride	AlN
Sodium Acetate	CH ₃ COONa
Ammonium Carbonate	(NH ₄) ₂ CO ₃
Bismuth Sulphate	Bi ₂ (SO ₄) ₃

3. Why does Avogadro's no have an immense importance in chemistry?

In chemistry we deal with substances which are composed of atoms, molecules and formula units. The counting of these particles is not possible for the chemists. The concepts of Avogadro's No facilitated the counting of particles that contained in the given mass of substance.

4. Calculate the percentage composition. Given:-

Mass of compound = 8.657g

Mass of carbon= 5.127g Mass of oxygen= 2.478g Mass of hydrogen= 0.962g

Percentage of each element in the compound = ?

$$\text{Percentage of carbon} = \frac{5.127}{8.657} \times 100 = 59.22\%$$

$$\text{Percentage of hydrogen} = \frac{0.962}{8.657} \times 100 = 11.11\%$$

$$\text{Percentage of oxygen} = \frac{2.478}{8.657} \times 100 = 28.62\%$$

5. How can you calculate the masses of the products formed in reversible reactions?

We can calculate the mass of the products formed in a reversible reaction multiplying the number of moles of products formed with the molar mass of product.

Unit: 5 Energetics**1. What are the two main forms of energy in chemical energetics? Give their name.**

In chemical energetics mainly concerned with two of energy. (i) Chemical energy (ii) Heat energy.

2. Differentiate between Heat energy and chemical energy.

Chemical Energy	Heat Energy
This energy is store in a molecule in which atoms are bonded to each other.	This form of energy in released when a bond is formed and absorbed when it is broken.

3. What are the causes of energy changes during a chemical reaction?

In energetics we study the energy changes that take place during a chemical reaction. These changes are caused by the making and breaking of bonds during a reaction.

4. Define energetics or chemical energetics.

The study of energy changes during a chemical reaction is called energetics. We study the flow of energy in a chemical reaction.

5. Define thermochemical reaction. Write its types.

It is the chemical reaction which takes place with the release or absorption of heat.

Types: 1. Exothermic reaction 2. Endothermic reaction

6. Differentiate b/w exothermic reactions and endothermic reaction.

A reaction in which heat energy is given out is called exothermic reaction. E.g. $C + O_2 \rightarrow CO_2 + \text{Heat}$

A reaction in which heat energy is absorbed is called endothermic reaction.

e.g. $H_2 + I_2 \rightarrow 2HI$

7. What is enthalpy, and how is it represented? Also write its unit.

Enthalpy is the total heat content of a system under standard conditions, represented by (H). Its unit is $KJ\ mol^{-1}$

8. How is enthalpy different from heat?

Heat: Heat is the form of energy that flows from hot body to a cold body because of different temperatures.

Unit: Joule

Enthalpy: The total amount of thermal energy stored in a compound. Symbol: H, Unit: KJ/mol

9. What changes occur in enthalpy when energy is absorbed or evolved in a chemical reaction?

When the energy is absorbed during a reaction, the total enthalpy of the system increases. When energy is evolved during a reaction, the total enthalpy of the system decreases.

10. Who used the word "energy" first? Thomas Young first used the word 'energy' in physics in 1802.

11. What is the relationship between energetics and thermodynamics?

Chemical energetics is part of chemistry called thermodynamics. In Energetics we study the flow of energy in a chemical reaction. Thermodynamics deals with the energy changes during chemical reactions and how these changes affect the properties of a chemical system.

12. Define system and surrounding.

System: Any physical or chemical change under study is called a system.

Surrounding: Everything else which does not fall in this system is called surrounding.

Example: If we boil water in beaker, water is system while beaker, burner are surroundings.

13. How is the energy evolved during a chemical reaction used in everyday life?

Energy evolved during a chemical reaction is used in everyday life for cooking, heating, lighting, transportation and much more.

14. What is the standard enthalpy of reaction(ΔH°)?

It is the enthalpy change when reactants in their standard states react to form products in their standard states.

15. What does a negative ΔH value indicate about a reaction?

A negative ΔH value indicates an exothermic reaction, where heat is released to the surroundings. A Positive ΔH value indicates an endothermic reaction, where heat is released to the system.

16. What are the standard conditions for measuring enthalpy?

Standard conditions are 0°C temperature and 760 mm (1 atm) pressure.

17. Does the given reaction express an endothermic or exothermic reaction?

The reaction in this system is thus exothermic evolving 566 kJ of heat energy which is given to the surrounding.

$$2\text{CO}_{(g)} + \text{O}_{2(g)} \longrightarrow 2\text{CO}_{2(g)} \quad \Delta H^{\circ} = -566.0 \text{ kJ}$$

18. How are Heat evolved and heat absorbed during chemical reactions used in self-heating and self-cooking packs?

These packs contain reactants that undergo an exothermic or an endothermic reaction providing high or low temperature.

19. Can energy be transferred in a form other than heat?

Yes e.g. chemical reactions can transfer energy in the form of light.

20. Why heat is transferred from hot to cold body?

Due to temperature difference heat is transferred from hot to cold body.

21. Why it is not possible to calculate the enthalpy of a system.

Because it is extensive property. So we can measure change in enthalpy.

22. How does a reaction take place?

When two reactant molecules are mixed together. They start colliding with each other. If these collision have enough energy and proper orientation, the molecules may form a transition state, and after a short time, products are formed.

23. What is activation energy?

The minimum energy required to start a reaction called activation energy.

24. Define catalyst. Give example.

The substance which can change the rate of reaction and remains unchanged itself called catalyst. Catalyst speed up the chemical reaction. E.g. platinum acts as catalyst in the production of H_2SO_4 .

25. Differentiate b/w aerobic and anaerobic respiration.

Aerobic Respiration: The respiration process which takes place in the presence of oxygen.

Anaerobic respiration: The respiration process which takes place in the absence of oxygen.

26. Define glycolysis and lipids.

Glycolysis: Glycolysis is the process of breaking down glucose into pyruvate, releasing energy in the form of ATP and NADH.

Lipids: Lipids are group of organic compounds including fats, waxes etc.

27. Explain the role of lipids in our body.

It provides energy, keep us warm and helps to absorb vitamins.

28. What is glycogen? Where it is stored? Also write its role in our body.

It is the primary storage form of glucose. It is stored in liver and muscles. It is a source of carbohydrate in our body.

29. In which organisms does anaerobic respiration occur?

In certain organisms like bacteria and algae respiration occurs in the absence of oxygen.

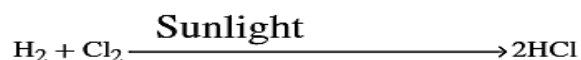
30. Where is excess food stored in the body?

It is stored in the liver and muscles.

Exercise

Multiple Choice Questions:-

1. The following reaction is an exothermic reaction.



- (a) By collisions between the molecules (b) From sunlight ✓ (c) From the surrounding (d) By collisions of the molecules with the walls of the container

2. Which of the following reactions has the least value of activation energy?

- (a) $\text{H}_{2(g)} + \frac{1}{2} \text{O}_{2(g)} \longrightarrow \text{H}_2\text{O}_{(g)}$ (b) $\text{C}_{(s)} + \text{O}_{2(g)} \longrightarrow \text{CO}_{2(g)}$
 (c) $\text{NaCl}_{(aq)} + \text{AgNO}_{3(aq)} \longrightarrow \text{AgCl}_{(s)} + \text{NaNO}_{3(aq)}$ ✓ (d) $\text{H}_{2(g)} + \text{I}_{2(s)} \longrightarrow 2\text{HI}_{(g)}$

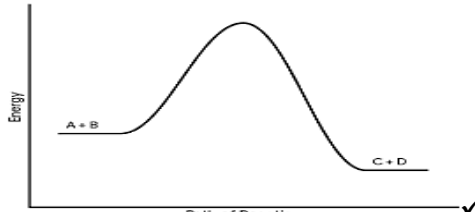
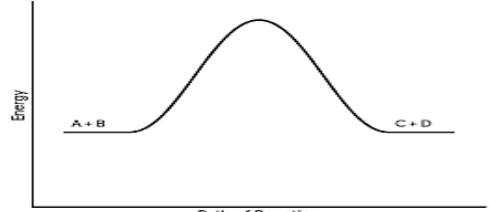
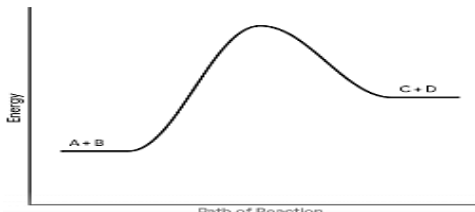
3. Formation of which hydrogen halide from the elements is an endothermic reaction?

- (a) HCl (b) HF (c) HBr (d) HI ✓

4. What are the products of anaerobic respiration?

- (a) ATP + CO₂ + H₂O (b) CO₂ + H₂O (c) ATP + Ethanol + H₂O ✓ (d) Ethanol + H₂O

5. Which reaction do you expect to be a reversible reaction?

- (a)  (b) 
 (c)  (d) 

6. What does it show when a chemical reaction is exothermic?

- (a) It shows the bonds which break are weaker than those are formed ✓ (b) It shows the bond which break are stronger than those are formed (c) Exothermic nature of the reaction is not concerned with bond formation or bond breakage (d) It shows that the reactants are more stable than the products

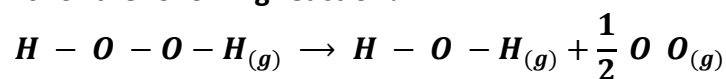
7. When NaOH and HCl are mixed the temperature increases. The reaction is:

- (a) Endothermic with a positive enthalpy change. (b) Endothermic with a negative enthalpy change. (c) Exothermic with a positive enthalpy change. (d) Exothermic with a negative enthalpy change ✓

8. The average bond dissociation energy for the C-H bond is 412 kJ mol⁻¹?

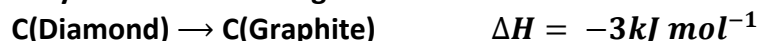
- (a) $\text{CH}_4(g) \rightarrow \text{C}_{(g)} + 2\text{H}_{2(g)}$ (b) $\text{CH}_4(g) \rightarrow \text{C}_{(g)} + 2\text{H}_{2(g)}$
 (c) $\text{CH}_4(g) \rightarrow \text{C}_{(g)} + 4\text{H}_{(g)}$ (d) $\text{CH}_4(g) \rightarrow \text{C}_{3(g)} + \text{H}_{(g)}$ ✓

9. The average bond energy for O – O and O = O are 146 and 496 kJ mol respectively. Find the enthalpy in kJ for the following reaction?



- (a) – 102 kJ ✓ (b) + 102 kJ (c) + 350 kJ (d) + 394 kJ

10. Why does the following exothermic reaction not occur?



- (a) Structure of diamond is more stable than that of graphite (b) Diamond has strong covalent bonds than does the graphite.
 (c) The change from diamond to graphite has high activation energy ✓ (d) Density of graphite is less than that of diamond

Short Questions:-**1. What is difference between enthalpy and enthalpy change?**

Enthalpy	Enthalpy change
The quantity of enthalpy is equal to the total heat content of a system.	An enthalpy change is the heat evolved or absorbed when a reaction take place at constant pressure.
The total enthalpy of a system cannot be measured directly.	The change in enthalpy ΔH brought about in system can be measured easily.
Enthalpy of a system is represented by (H).	The change in enthalpy which a system undergoes represented by ΔH .

2. Why is breaking of a bond an endothermic process?

Because it requires heat to overcome the attractive forces between atoms.

3. Depict the transition state for the reaction of $H_2 + Cl_2 \rightarrow 2HCl$?

The transition state for the reaction $H_2 + Cl_2 \rightarrow 2HCl$ can be visualized as a linear arrangement where the H-H and Cl-Cl bonds are partially broken, and new H-Cl bonds are forming. This transition state is higher in energy than both the reactants and products, representing the energy barrier that must be overcome for the reaction to proceed.

4. Draw the reaction profiles for two exothermic reactions one of which moves faster than the other?

The faster reaction profile will have a lower activation energy hump, indicating a lower energy barrier. The faster reaction profile will have a steeper downward slope, indicating a faster rate of product formation.

5. What is the role of glycogen?

Glycogen is the primary storage form of glucose. It is stored in the liver and muscles. It helps to regulate blood sugar level in our body.

Constructed Response Questions:-**1. Physical changes which usually occur around us are given. Write down whether they are exothermic or endothermic.**

Conversion of hydrated salt into anhydrous (**endothermic**), Burning of Paper (**exothermic**),
 Vaporizing liquid nitrogen (**endothermic**), Evaporation of dry ice (**endothermic**),
 conduction of electricity by metals (**exothermic**), dissolving ammonium chloride in water (**endothermic**),
 Formation of rain from clouds (**exothermic**), dissolving sodium carbonate in water (**exothermic**).

2. Why reaction between oxygen and nitrogen only take place in the presence of lightening?

At normal condition these two gases never react. The reaction is endothermic and requires high temperature. Thus in the presence of lightening these gases react to give NO. The reaction stops as lightening stop due decrease in temperature.

3. Why Natural gas and oxygen do not react until you show match stick.

When we show a burning match stick the reaction starts immediately because activation energy for the reaction is provided. Then it continues until one of them used up because heat, oxygen and fuel are required to sustain this reaction.

Unit: 6 Equilibria**1. Differentiate b/w reversible and irreversible reactions.**

Reversible reactions: A reaction in which products recombine to form reactants is called is called reversible reaction. e.g. $H_2 + I_2 \leftrightarrow 2HI$

Irreversible reactions: A reaction in which products does not recombine to form reactants is called irreversible reaction. e.g. $2H_2 + O_2 \rightarrow 2H_2O$

2. Which type of reactions will never go to completion?

Reversible reactions will never go to completion because the products formed can react again to form the original reactants, leading to a dynamic equilibrium where both reactants and products are present.

3. Why are combustion reactions generally irreversible?

Combustion reactions are generally irreversible because they produce stable products like carbon dioxide and water, release a large amount of energy, and involve permanent chemical changes that cannot easily be reversed.

4. What will happen if the temperature of the reaction is increased?

By increasing temperature, reaction will move in forward direction.

5. What is the effect of the presence of catalyst in the reversible reaction?

A catalyst is a substance which increase the speed of a chemical reaction. A catalyst can increase the rate of forward and reverse reaction of reversible reaction.

6. Write the properties (or characteristics) of Reversible reaction.

They never goes to completion. They proceed in both ways. These are represented by double arrow.

7. Write the properties (or characteristics) of Irreversible reaction.

The reactions are supposed to be complete. They proceed in one direction.

8. How the reversible reaction can be disturbed? Write down the possible ways.

Reversible reaction can be disturbed by: i. changing temperature ii. Changing pressure

9. What is Chemical equilibrium?

When the rates of forward and reverse reaction become equal at chemical equilibrium state, it is called chemical equilibrium. e.g. $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$

10. Difference between static equilibrium and dynamic equilibrium.

Static equilibrium: When reaction ceases to proceed, it is called static equilibrium.

Dynamic equilibrium: In dynamic equilibrium reaction does not stop but the rates of forward and reverse reaction become equal at chemical equilibrium state, it is called dynamic equilibrium.

11. Can physical changes be reversible? Give example.

Yes, physical changes can be reversible. e.g. $\text{Ice} \rightleftharpoons \text{Water}$

12. What is the effect of changing of temperature on the state of equilibrium?

In exothermic reactions, increasing temperature shifts the equilibrium in the backward direction.

In endothermic reactions, increasing temperature shifts the equilibrium in the forward direction.

13. What is the effect of change of pressure on the state of equilibrium?

Increasing pressure shifts the equilibrium toward the side with fewer gas molecules.

Decreasing pressure shifts it toward the side with more gas molecules.

Exercise

Multiple Choice Questions:-**1. What will happen if the rates of forward and reverse reactions are very high?**

- | | | | |
|---|---|--|--|
| (a) The equilibrium point will reach very soon. ✓ | (b) The equilibrium point will reach very late. | (c) The reaction will not attain the state of dynamic equilibrium. | (d) The reaction will be practically irreversible. |
|---|---|--|--|

2. Predict which components of the atmosphere react in the presence of lightning.

- | | | | |
|---|---|--------------------------------------|-----------------------------------|
| (a) N_2 and H_2O | (b) O_2 and H_2O | (c) CO_2 and O_2 ✓ | (d) N_2 and O_2 |
|---|---|--------------------------------------|-----------------------------------|

3. An inorganic chemist places one mole of PCl_5 in a container A and one mole of each Cl_2 and PCl_3 in container B. Both the containers were sealed and heated to the same temperature to reach the state of equilibrium. Guess about the composition of mixtures in both the containers.

- | | | | |
|---|--|--|--|
| (a) Both the containers will have the same composition of mixtures. ✓ | (b) Container A will have more concentration of PCl_5 , than B. | (c) Container A will have less concentration of PCl_5 , than B. | (d) Both the containers will have zero concentration of its reactants. |
|---|--|--|--|

4. **CaO or lime is used extensively in steel, glass and paper industries. It is produced in an exothermic reversible reaction by the decomposition of lime (CaCO_3). Choose the conditions to produce maximum amount of lime.**

- (a) Heating at high temperature in a closed vessel (b) Heating at high temperature in an open vessel ✓ (c) Cooling it in a closed vessel (d) Cooling it in an open vessel

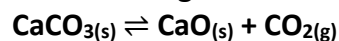
5. **What condition should be met for the reversible reaction to achieve the state of equilibrium?**

- (a) All the reactants should be converted into the products. (b) 50% of the reactants should be converted into products. (c) The concentrations of all the reactants and the products should become constant. ✓ (d) One of the products should be removed from the reaction mixture.

6. **Why the gas starts coming out when you open a can of fizzy drink?**

- (a) Because the solubility of the gas increases (b) Because the gas is insoluble in water (c) Because the gas is dissolved under pressure hence it comes out when pressure is decreased ✓ (d) Because the solubility of the gas decreases at high pressure

7. **The following reaction is performed in a closed vessel.**



How the equilibrium will be affected if you increase the pressure?

- (a) The forward reaction will be favoured (b) The backward reaction will be favoured ✓ (c) No effect on backward reaction (d) No effect on forward or backward reaction

8. **When a reaction will become a reversible one?**

- (a) If the activation energy of the forward reaction is comparable to that of backward reaction ✓ (b) If the activation energy of the forward reaction is higher than that of backward reaction (c) If the activation energy of the forward reaction is lower than that of backward reaction (d) If the enthalpy change of both the reactions is zero.

9. **Is reversible reaction useful for preparing compounds on large scale?**

- (a) No (b) Yes (c) They are useful only when equilibrium lies far to the right side ✓ (d) They are useful only when equilibrium lies far to the left side

10. **What will happen to the concentrations of the products if a reversible reaction at equilibrium is not disturbed?**

- (a) They will remain constant ✓ (b) They will keep on increasing (c) They will keep on decreasing (d) They will remain constant for some time and then start decreasing

Short Questions:-

1. **How is dynamic equilibrium different from static equilibrium?**

DYNAMIC EQUILIBRIUM	STATIC EQUILIBRIUM
The reaction keep on going at this state of equilibrium in both direction forward and reverse.	The reaction ceased to proceed and system is at rest position.

2. How decomposition of water affected if temperature is increased?

An increase in temperature to produce more oxygen and hydrogen forward reaction will move in the forward direction.

3. How can you get the maximum yield in a reversible reaction?

We can get the maximum yield in a reversible reaction by removing products continuously from the reaction mixture. Increase temperature if the reaction is endothermic. Decreasing pressure if the number of moles of reactants is less than number of moles of products.

4. How can you decrease the time to attain the position of equilibrium in a reversible reaction?

By adding catalyst we can decrease the time to attain the position of equilibrium.

5. What is the effect of increasing pressure on the following reaction at equilibrium?

There will be no effect of increasing pressure on the given reaction because the number of the moles of the reactants is equal to the number of moles of products.

Constructed Response Questions:-**1. Why some of reactions are irreversible while others are reversible?**

Some of the reactions are irreversible because the products formed are sufficiently stable under the reaction conditions and are not converted back into the reactants while others are reversible because the products formed are unstable under the reaction conditions and are thus converted back into the reactants again.

2. Can you make an irreversible reaction reversible and vice versa?

Yes. By changing conditions like temperature, pressure can sometime make an irreversible reaction reversible and vice versa.

3. How do you know if a reaction is reversible or irreversible?

Reversible reaction reach equilibrium and proceed in both directions.

Irreversible reaction never reaches to equilibrium and proceeds in one direction.

4. Do the phase changes in water reversible or irreversible?

Phase changes in water (solid to liquid, liquid to vapor) are reversible. It means we can change the water back to its original state by altering the temperature conditions.

Unit: 7 Acid Base Chemistry

1. Write down properties of Acids and Bases?

Acids and bases have been known to mankind since centuries.

Acids	Bases
Acids have sour taste. For Example, unripe citrus fruits or lemon juice.	Bases have bitter taste and feel slippery. For Example, soap is slippery to touch.
They turn blue litmus paper into red.	They turn red litmus paper into blue.
They are corrosive in concentrated form.	They are non-corrosive except concentrated forms of NaOH and KOH.
Their aqueous solutions conduct electric current.	Their aqueous solutions conduct electric current.

2. Write names of sour substances that contain Acids.

Curd, tamarind, lemon, vinegar, tomatoes and lime, etc.

3. Write some common examples of Acids.

Common examples of acids include acetic acid, hydrochloric acid, nitric acid, sulphuric acid and tartaric acid.

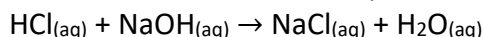
4. Give Examples of Basic Oxides.

Examples of basic oxides are calcium oxide (CaO), zinc oxide (ZnO) and magnesium oxide (MgO).

5. Define Neutralization reaction. Give example.

A reaction between an acid and a base is called a neutralization reaction. It produces a salt and water.

Acid + Base → Salt + Water (Neutralization)



6. Define Acid and Base according to Arrhenius Concept.

Acid is a substance which dissociates in water to give hydrogen ions. E.g. $\text{HCl} + \text{H}_2\text{O} \rightleftharpoons \text{H}^+ + \text{Cl}^-$ etc.

Base is a substance which dissociates in water to give hydroxyl ions. E.g. $\text{NaOH} + \text{H}_2\text{O} \rightleftharpoons \text{Na}^+ + \text{OH}^-$

7. Define Acid and Base according to Bronsted- Lowry concept.

Acid is a substance that can donate a proton. Base is a substance that can accept a proton.

Example: $\text{HCl} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{Cl}^-$ HCl act as an acid while H_2O act as a base.

8. Write 2 physical properties of salts.

These are neutral compound. These have high melting and boiling points.

9. Differentiate between strong and weak acids.

Strong acids: Acid which is fully ionized in water is called strong acid. e.g. H_2SO_4 , HNO_3 etc.

Weak acids: Acid which is partially ionized is called weak acid. e.g. CH_3COOH

10. Differentiate between strong and weak bases (or alkalis).

Strong base: Base which is fully ionized in water is called strong base. e.g. NaOH , KOH etc.

Weak base: Base which is partially ionized is called weak base. e.g. NH_4OH , $\text{Al}(\text{OH})_3$

11. What is acid rain?

Acid rain is formed by dissolving acidic air pollutants like oxides of sulphur and nitrogen by rain water. As a result pH of the rain water become 4.2-4.4. Acid rain damages animals, plants, buildings, water bodies and even increase the soil acidity.

1. Write the name of gases which causes acid rain.

Acid rain is caused by SO_2 and NO_2 .

13. How most of the acids are available in aqueous solution and why?

They are available in aqueous solution as they can easily dissolve in water.

14. Differentiate between organic (natural acids) and inorganic acids.

Organic acids: Acids obtained from natural sources are called organic acids. e.g. CH_3COOH

In Organic acids: Acids obtained from minerals are called mineral acids. e.g. HCl , HNO_3 , H_2SO_4

15. All alkalis are bases, but all bases are not alkalis. Why?

An alkali is a base that dissolves in water. Because all bases are not soluble in water, so all bases are not alkalis.

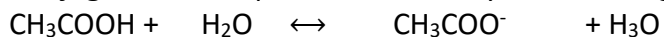
16. Define amphoteric substance. Give example.

The substance which behaves as an acid as well as base is called amphoteric substance. e.g. water

17. Differentiate between conjugate acid and base.

Conjugate acid: A substance formed by accepting a proton from a base.

Conjugate base: A product formed by the donating proton by an acid.



Acid Base Conjugate Base Conjugate Acid

18. Why the metal oxides are basic in nature?

Because they form salt and water when they react with acid.

19. Write down importance of oxalic acid OR Write uses of oxalic acid.

It removes stains from clothes. It cleans bathroom surfaces easily.

Exercise

Multiple Choice Questions:-

1. Which acid is not used as a food or mixed with food?

- (a) Tartaric acid (b) Ascorbic acid (c) Citric acid (d) Formic acid ✓

2. While baking, which gas is responsible for raising the bread and making it soft?

- (a) Oxygen (b) Carbon dioxide ✓ (c) Nitrogen (d) Carbon monoxide

3. Predict the main characteristics of the reactions of metals with acids.

- (a) Metals are dissolved (b) Metals are converted into salts (c) Hydrogen gas is evolved (d) All the above mentioned characteristics are true ✓

4. How many hydroxide ions, calcium hydroxide will release in water?

- (a) 1 (b) 2 ✓ (c) Zero (d) 3

5. In a neutralization reaction between KOH and H_3PO_4 , how many molecules of KOH will react with one molecule of H_3PO_4 ?

- (a) 2 (b) 1 (c) 3 ✓ (d) 4

6. Which acid is used in the preparation of soap?

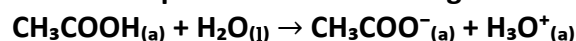
- (a) Tartaric acid (b) Citric acid (c) Stearic acid ✓ (d) Oxalic acid

7. Which compound is formed when SO_2 is dissolved in water?

- (a) SO_3 (b) H_2SO_3 ✓ (c) H_2SO_4 (d) $H_2S_2O_7$

8. Which of the following contains oxalic acid?

- (a) Tomato ✓ (b) Orange (c) Tamarind (d) Sour milk

9. Which compound in the following reaction is behaving as a conjugate base?

- (a) CH_3COOH (b) H_2O (c) CH_3COO^{-} ✓ (d) CH_3COO^{-}

10. When a chemical reaction is carried out with a substance Z; a gas is produced which turns red litmus paper blue. What is the reaction?

- (a) Reaction of an acid with a metal carbonate (b) Reaction of an acid with metal hydrogen carbonate (c) Reaction of an alkali with an acid (d) Reaction of an alkali with ammonium salt ✓

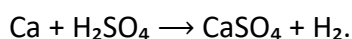
Short Questions:-

1. Choose Arrhenius acids? HF , NH_4^+ , H_2SO_3 , SO_3 , H_2S , H_2O ?

Arrhenius acids: HF , H_2SO_3 , H_2O

2. How does calcium metal react with dilute H_2SO_4 ?

Calcium metal react with dilute sulphuric acids and form calcium sulphate and hydrogen gas.

**3. Which salt formed when hydrochloric acid react with barium carbonate?**

Barium chloride salt is formed $HCl + BaCO_3 \rightarrow BaCl_2 + H_2$

4. How will you justify that HSO_4^- is bronsted - lowry acids?

HSO_4^- is considered a bronsted-lowry acid because it can donate proton to another substance.

5. What is the chemical name of soap?

Chemical name of soap is sodium stearate ($C_{17}H_{35}COONa$).

Constructed Response Questions:-**1. Why hydrochloric is not edible although it is present in the stomach and responsible for digestion of food?**

Because the hydrochloric acid present in stomach is mild, safe and controlled. Therefore it is not edible.

2. In the presence of a drop of acid, water is known to ionize what we can give name of acid base are salt?

Water can act both as an acid as well as base therefore it will be called amphoteric compound.

3. Why does Sodium carbonate behave like a base in water?

Since it produced a strong base and a weak acid upon dissolving in water, it acts as a base in water.

4. Is Sodium hydrogen carbonate $NaHCO_3$ a base or an acid?

Sodium hydrogen carbonate is a weak base.

5. What is difference between a strong acid and a concentrated acid?

Strong acid

Concentrated acid

An acid which ionizes completely in aqueous solution is called a strong acid	An acid which is relatively more Concentrated have less water is called Concentrated acid.
HCl, H ₂ SO ₄ ,	18M H ₂ SO ₄

Unit: 8 Periodic Table and Periodicity

1. What is basis of arrangement of elements in modern periodic table?

The modern periodic table is based upon the arrangement of elements according to increasing atomic number.

2. Difference between periods and Groups?

Period: The horizontal rows of elements in the periodic table are called periods. There are 7 periods in modern periodic table.

Groups: The vertical columns of elements in the periodic table are called groups. There are 18 groups in modern periodic table.

3. Why elements in a period show different properties?

In the modern periodic table, the electronic configuration of the elements continues changing when we move from left to right in a period. Due to this, the elements in a period show a gradual change in the properties.

4. Why do elements in a group show similar properties?

Elements present in a group possess similar electronic configurations in their outermost shells. Therefore, the elements in a group show similar chemical properties.

5. Define short period of periodic table.

First period of periodic table called short period and it's consist of 2 elements only.

6. Which periods of periodic table called normal periods? Also write number of elements of each.

2nd and 3rd periods of periodic table called normal periods and they consist 8 elements each.

7. Define Long periods of periodic table.

4th and 5th periods of periodic table called long periods and they consist 18 elements each.

8. Define Very Long periods of periodic table.

6th and 7th periods of periodic table called very long periods and they consist 32 elements each.

9. What is meant by "periodicity"?

As a whole the periodic table shows the repetition of the properties of elements after regular intervals. This trend is called periodicity in the properties.

10. Write 3 salient features of periodic table.

- (i). It has seven horizontal rows called periods.
- (ii). First period consists of only two periods.
- (iii). Elements of a group show similar chemical properties.

11. Difference between lanthanides and actinides.

Due to space problem, two series were placed at bottom of periodic table.

The first series starts after lanthanum (La = 57) and it is called lanthanides.

The second series start after actinium (Ac = 89) and it is called actinides.

12. Why the elements of group are called family?

Because their valence shell electronic configuration is same.

13. Write electronic configuration of noble gases.

$ns^2 np^6$

14. What is the reason of arranging elements in a group?

The elements of a group have similar electronic configuration i.e. same number of electrons present in their valence shell. Hence, elements of a group show similar chemical properties.

15. What are the elements of group 17 called? And write their electronic configuration.

Elements of group 17 called Halogens. Electronic configuration: $[ns^2 np^5]$

16. Define Transition Elements or Transition Metals.

The elements of group 3 to 12 are called transition Elements.

17. Define blocks. And write the name of different blocks.

Elements with similar sub shell electronic configuration are called blocks. e.g. s, p, d, and f blocks.

18. What is s-block, p-block, d-block, and f-block elements?

s-block	Elements of group 1 and 2 are called s-block elements because in them s-subshells of the outermost shell is being filled.
p-block	Elements present in group 13 to 18 are called p-block elements because p-subshells is filled in these elements.
d-block	The d-block elements lie between s and p block.
f-block	The f-block elements in the form of two rows lie at the bottom of the periodic table.

19. Why elements of group 1 known as electropositive metals?

All elements of group 1 have one electron in their outermost shells, so they show a strong tendency to lose their electron forming cations. They are thus known as electropositive metals.

20. Define atomic radius. Give its unit.

Atomic radius is defined as half the distance between the nuclei of the two identical bonded atoms. It is expressed in pm ($1\text{pm} = 10^{-12}\text{m}$).

21. Why atomic size cannot be defined directly?

The electron cloud of an atom has no definite limit. Because of this, the size of an atom cannot be defined exactly.

22. Define Electronegativity. Give Example.

The ability of atom to attracts the shared pair of electrons towards itself in a bond.

23. Define Ionization energy (I.E) Give an example.

Ionization energy is the amount of energy required to remove the most loosely bound electron from the valence shell of an isolated gaseous atom. It is expressed in kJ mol^{-1} .

For example, the first ionization energy of sodium atom is $+496 \text{ kJ mol}^{-1}$.

24. Define Electron Affinity. Give an example.

Electron affinity is the amount of energy change when an electron is added up in the outermost shell of an isolated gaseous atom. For example, 328 kJmol^{-1} energy is released when an electron enters in the fluorine atom.

25. What is metallic character, and how does it relate to ionization energy?

Metallic character is the tendency of an element to lose electrons and form cations. It increases as ionization energy decreases.

26. Why does metallic character increase down a group?

Ionization energy decreases down a group, making it easier for elements to lose electrons, increasing metallic character.

27. How does metallic character change across a period?

Metallic character decreases from left to right across a period due to increasing nuclear charge, which holds valence electrons more tightly.

28. Why does chemical reactivity decrease across a period from left to right?

Reactivity decreases because the increasing number of valence electrons makes it harder for atoms to lose electrons.

29. What happens to reactivity as we move from metals to non-metals in a period?

Reactivity decreases initially for metals and then increases again as we move towards non-metals.

30. How does density change down a group?

Density generally increases down a group due to the increase in atomic mass and size.

31. What is the unit of density? Density is expressed in g/cm^3 .**32. Why is sodium more reactive than magnesium in the second period?**

Sodium has a lower ionization energy and fewer valence electrons, making it easier to lose electrons compared to magnesium.

Exercise

Multiple Choice Questions:-

- In which period and group will you place the element which is an important part of the solar cell?**
 (a) Third period and 14th group (b) Second period and 14th group ✓ (c) Third period and 15th group (d) Third period and 16th group
- Identify the electronic configuration of the outermost shell of a transition metal.**
 (a) $ns^2 np^1$ (b) $nd^x ns^2$ ✓ (c) $ns^2 np^6$ (d) $ns^2 np^5$
- Which is the softest metal?**
 (a) Na ✓ (b) Ca (c) Al (d) Zn
- A yellow solid element exists in allotropic forms which is also present in fossil fuels. Indicate the name.**
 (a) Carbon (b) Iodine (c) Aluminium (d) Sulphur ✓
- How many electrons can nitrogen accept in its outermost shell?**
 (a) 2 (b) 3 ✓ (c) 4 (d) 5
- Which element is the most reactive element?**
 (a) Oxygen (b) Chlorine (c) Fluorine ✓ (d) Nitrogen
- Which Elements has the highest melting point?**
 (a) Na ✓ (b) K (c) Rb (d) Cs
- In what order does the metallic character change in the second group?**
 (a) $Mg > Ca > Ba > Sr$ (b) $Sr > Ba > Ca > Mg$ (c) $Mg > Sr > Ca > Ba$ (d) $Ba > Sr > Ca > Mg$ ✓
- Which of the following best describe the correct order of oxygen, fluorine, and nitrogen's atomic radii?**
 (a) $O < F < N$ (b) $N < F < O$ (c) $F < O < N$ ✓ (d) $O < N < F$
- The element having less value of ionization energy and less value of electron affinity is likely to belong to:**
 (a) Group 1 ✓ (b) Group 13 (c) Group 16 (d) Group 17

Short Questions:-

1. Why were atomic number chosen to arrange the elements in the periodic table?

Atomic number is more fundamental property of atom because atomic number of every element is fixed and it increases regularly by 1 from element to element. No two elements have the same atomic number.

2. What is significance of the word periodic?

The word periodic in periodic table refers to the repeating pattern of properties that elements exhibit when they are arranged in order of increasing atomic number. This repeating pattern occurs in group or periods that is why it is called the periodic table.

3. Why the size of period increases as we move down the periodic table?

Each period represents the completion of a shell. Since the number of electrons to be accommodated in next shell is increases so the number of elements in a period also increases.

4. In a group the elements have the same number of electrons in the outermost shell. Why is it so?

Group number of element shows the number of electrons in its valence shell so each element in a same group has same no of electrons in its outermost shell.

5. Do you expect calcium to be more reactive than sodium?

Calcium is less reactive than sodium because sodium atomic size is more than calcium and sodium have only one electron in its outermost shell which is easy to remove as compared to calcium has two electrons in its outermost shell.

6. Which element has the maximum atomic radius and which has minimum in the third period?

Sodium has maximum atomic radius and Argon has minimum atomic radius in third period.

7. Why most electronegative elements are present in sixth and seventh groups?

Because they have high nuclear charge and smallest atomic sizes therefore most electronegative elements are present in sixth and seventh groups.

8. Why 1st ionization energy of magnesium is less than 2nd one?

Because the size of ion is less than atom of same element and nuclear attraction for remaining electron is increases in cation so it becomes difficult to remove second electron.

9. Is it possible for two metals or non-metals to form an ionic bond?

No it is not possible that two metals form ionic bond because both are electropositive elements and non-metals also not form ionic bond because both are electronegative elements.

10. Which element has the least ionization energy and which element has the highest electronegativity?

Cesium has the least ionization energy 377KJ/mol due to largest atomic size.

Fluorine has highest electronegativity 4.0 due to small atomic size.

Constructed Response Questions:-

1. Suppose a new element discovered. Where would you like to accommodate in table?

First of all, we have to know its atomic number than we decide the accommodation of this element.

2. What is the first element of the periodic table will it loss or gain electron?

Hydrogen atom with atomic number 1 is the 1st element of periodic table it can lose electron if react with non-metals and can gain electron when react with metals.

3. Atomic radii of boron and Aluminum are 88pm and 125pm respectively. Which can lose electron easily?

The atom with large atomic size can easily lose electron so Aluminum can lose electron easily.

4. How would you find the atomic radius of an atom?

By using X-Ray Diffraction and Spectroscopy methods.

5. Why is it not possible for oxygen atom to accept three electrons like nitrogen?

Oxygen atom have only 2 electron deficiency in its outermost shell to complete its octet and get noble gas configuration so it can only accept 2 electrons.

Unit: 9 Group Properties & Elements

1. Differentiate b/w metals and non-metals.

Metals: The elements who can lose electrons to form positive ions. e.g. iron, gold etc.

Non-Metals: The elements who can gain electrons to form negative ions. e.g. oxygen, carbon etc.

2. Write properties of metals and non-metals.

Metals	Non-metals
They are malleable and ductile.	They are brittle.
They are lustrous.	They are dull.
They have high melting and boiling point.	They have low melting and boiling point.
They are good conductor of heat and electricity.	They are bad conductor of heat and electricity.

3. Why metals generally tough and strong whereas non-metals are neither tough nor strong?

Metals are tough and strong due to metallic bonding, while non-metals are weak due to weak intermolecular forces.

4. Why elements of group 1 are called alkali metals?

Because they have 1 electron in their valence shell.

5. How alkali metals react with oxygen?

Alkali metal reacts with oxygen to produce oxides. $4K + O_2 \rightarrow 2K_2O$

6. Why the group 1 metals become softer and their melting point decreases down the group?

Because increase in atomic size reduces melting point and hardness.

7. Why the density of group 1 metals increases down the group?

Because increase in mass of the elements is greater than the increase in volume.

8. Why the elements of group 17 are called halogens?

Because they produce salt products when they react with metals.

9. Define transition elements. Give examples.

Elements from group 3 to 12 are called transition elements. e.g. nickel, cobalt etc.

10. Write down the properties of transition elements.

These are metals. They have high densities. They have high melting and boiling points. They are malleable and ductile.

11. Why are transition metals important in chemical industries?

Transition metals and their compounds act as catalysts in many important chemical reactions.

12. How do metal catalysts work?

Metals absorb other substances on their surface and activate them, increasing the rate of reaction.

13. What is the Haber process?

It is an industrial process used to manufacture ammonia (NH₃) from nitrogen and hydrogen. Iron (Fe) is used as a catalyst in the Haber process. Ammonia is used to manufacture urea fertilizer.

**14. Which catalyst was originally used in the Contact process?**

Platinum was originally used as a catalyst.

15. Why is platinum no longer preferred in the Contact process?

Platinum becomes inactive due to arsenic impurities present in sulphur dioxide.

16. Which catalyst is now used in the Contact process?

Vanadium pentoxide (V₂O₅).

17. V₂O₅ catalyst is preferred over platinum in the oxidation of sulphur dioxide. Give reason.

Because V₂O₅ as compared to platinum is less expensive, more efficient and remains stable during oxidation process.

18. Write the equation for the Contact process.**19. What is a catalytic converter?**

A device used in the exhaust of vehicles, converts harmful gases into the gases which do not pollute the air. E.g. platinum, palladium etc.

20. Define noble gases. Give examples.

The elements of group 18 are called noble gases. e.g. helium, neon etc.

21. Why noble gases show very little reactivity.

Because their valence shells are complete, so they show very little reactivity.

22. Which noble gas should have lowest boiling point and why?

Helium because its atomic size is smallest, so intermolecular forces become weakest.

23. What is malleability?

The property by which metals can be hammered into thin sheets is called malleability.

24. What is ductility?

The property by which metals can be drawn into wires is called ductility.

25. Why are metals good conductors of heat and electricity?

Metals are good conductors because of metallic bonding and the presence of free electrons.

26. Why do metals usually have high melting and boiling points?

Metals have high melting and boiling points due to strong metallic bonding.

27. Why do metals generally have high densities?

Metals have high densities because their atoms are closely packed together.

28. Which metals are exceptions to the general hardness of metals?

Alkali metals are soft and are exceptions.

29. Why do non-metals generally not conduct heat and electricity?

Non-metals do not have free electrons to carry heat and electric current.

30. Which non-metal is an exception and conducts electricity?

Graphite is an exception and conducts electricity.

31. Why does graphite conduct electricity?

Graphite conducts electricity because it has loosely held electrons that can move freely between its layers.

32. Why non-metals cannot be polished?

Because they exist in powder or gaseous form.

Exercise**Multiple Choice Questions:-**

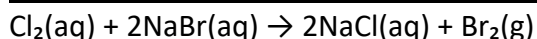
1. Which halogen will have the least reactivity with alkaline earth metals?
 (a) Chlorine (b) Iodine ✓ (c) Bromine (d) Flourine
2. Which compound do you expect to be colored?
 (a) KCl (b) BaCl₂ (c) AlCl₃ (d) NiCl₂ ✓
3. In which element there exists the strongest forces of attraction between atoms?
 (a) Mg ✓ (b) Ca (c) Sr (d) Ba
4. Elements of which group are all colored?
 (a) Second group (b) Sixth group ✓ (c) Fourth group (d) Fifth group
5. Which halogen acid is unstable at room temperature?
 (a) HBr (b) HI ✓ (c) HCl (d) HF
6. Which oxide is the most basic oxide?
 (a) Na₂O ✓ (b) Li₂O (c) MgO (d) CO
7. Which group elements are the most reactive elements?
 (a) Transition metal (b) First group ✓ (c) Second group (d) Third group group
8. The following solutions of a halogen and a sodium halide are mixed together. Which solution will turn dark because of a reaction?
 (a) Br₂ and NaCl (b) Br₂ and NaF (c) Cl₂ and NaF (d) Cl₂ and NaI ✓
9. X is a monoatomic gas, which statement about this is correct?
 (a) X burns in air (b) X is coloured (c) X is unreactive ✓ (d) X will displace iodine from it
10. Which property is correct for group 1 elements?
 (a) Low catalytic activity ✓ (b) High density (c) Low electrical conductivity (d) High melting point

Short Questions:-**1. Why does it become easier to cut an alkali metal when we move from top to bottom in a group I?**

As we move down Group I, the atomic size increases and the force between atoms decreases. Therefore, alkali metals become softer and easier to cut.

2. Predict the reactivity of potassium towards halogens.

Potassium is highly reactive with halogens. It reacts quickly with chlorine and bromine to form potassium chloride (KCl) and potassium bromide (KBr).

3. In the following reaction, chlorine acts as an oxidising agent. Which is the reducing agent?

NaBr is the reducing agent because it loses electrons and helps chlorine gain electrons.

4. Why does iodine exist in the solid state at room temperature?

Iodine is a solid at room temperature because its molecules have strong intermolecular forces.

5. How does Ni catalyse the reaction involving hydrogenation of oil?

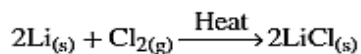
Nickel (Ni) acts as a catalyst and helps convert liquid oils into solid margarine (Banaspati ghee).

Constructed Response Questions:-**1. Which noble gas should have the lowest boiling point and why?**

Helium has the lowest boiling point because it is very small and has very weak intermolecular forces.

2. Compare the reactions of alkali metals with chlorine.

Alkali metals react with chlorine to form chlorides. The reaction becomes more vigorous down the group.



3. Why are almost all the metals solids while non-metals generally exist as gases and liquids?

Metals have strong metallic bonds, so they are usually solids. Non-metals have weaker forces, so many exist as gases or brittle solids.

4. Name any three elements in the periodic table which exist as liquids.

Mercury (Hg), Bromine (Br), Gallium (Ga)

5. Why are transition elements different from normal elements?

Transition elements have special properties due to inner shell electrons.

6. Compare the reactivity of chlorine and bromine as an oxidizing agent.

Chlorine is a stronger oxidizing agent than bromine because it is smaller in size and gains electrons more easily.

7. Which element is the most reactive and which is the least reactive among halogens? Give two reasons to explain your answer.

Most reactive: Fluorine, highly electronegative and smallest atomic size.

Least reactive: Iodine, less electronegative and largest atomic size.

Unit: 10 Environmental Chemistry

1. What is environmental chemistry?

The branch of Chemistry which deals with the study of chemicals and other pollutants in the environment is called environmental chemistry. It also covers the adverse effects of these chemicals on living and non-living things.

2. What is the effect of fossil fuel gases on the atmosphere?

The gases which are released due to the increasing use of fossil fuels (natural gas, coal and petroleum) have polluted the atmosphere up to such an extent that it is difficult to breathe air in some areas of metropolitan cities.

3. What is the effect of fertilizers, insecticides and pesticides?

The excessive use of fertilizers, insecticides and pesticides, etc. for agriculture purposes has proved to be harmful for animals, birds and human beings.

4. What is the current situation of environmental pollution?

The situation is turning serious for every passing day and there is an urgent need to control the emission of pollutants to the atmosphere.

5. Write down the definition of atmosphere.

Earth is covered with a blanket of air called the "atmosphere" which is made up of several layers of gases.

6. Write importance of air?

Air is essential for life on Earth, for animals to breathe and for plants to make their food. It contains more nitrogen than any other gas.

7. Define air pollutant. Also name major Air pollutants.

Any substance (solid, liquid or gas) in the air which has adverse effect on human health and quality of life is called an air pollutant. Major Air Pollutants:

1	Carbon dioxide	(CO ₂)
2	Carbon monoxide	(CO)
3	Oxides of nitrogen	(NO ₃ NO ₂) Collectively referred to as NO _x
4	Oxides of Sulphur	(SO ₂ SO ₃) Collectively referred to as SO _x

5	Hydrocarbons	(Methane, ethane, etc)
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8. Give names of sources of air pollutants.

By human activities, Fossil Fuels, natural processes, Smog and Ozone

9. How do natural processes contribute to air pollution?

Natural processes release pollutants into the air. For example, volcanic eruptions release large quantities of carbon dioxide, sulphur dioxide, and particulate matter.

10. Which factors are mainly responsible for environmental pollution?

Rapid population growth, urbanization, industrialization, and transportation are the main factors responsible for environmental pollution.

11. How is ozone formed in the atmosphere?

Ozone (O_3) is formed when heat and sunlight cause a chemical reaction between nitrogen oxides (NO_x) and volatile organic compounds (hydrocarbons).

12. What is smog and how is it formed?

Smog is formed when smoke present in the atmosphere mixes with fog during winter. It is caused by industrial pollution, vehicle emissions, and crop burning, which release nitrogen oxides, sulphur dioxide, particulate matter, and volatile organic compounds into the air.

13. Describe the harmful effects of the major pollutants present in the air?

1	Carbon dioxide (CO_2)	It causes global warming, melting of ice caps, rising sea levels, and extreme weather changes.
2	Carbon monoxide (CO)	It is a poisonous gas that can cause suffocation and death by reducing oxygen supply in the body.
3	Oxides of nitrogen NO_x	They damage lungs, irritate eyes, harm plants, and cause acid rain.
4	Oxides of Sulphur (SO_x)	They irritate the eyes, cause breathing problems, and produce acid rain.
5	Hydrocarbons	They cause coughing, pneumonia, lung diseases, and contribute to global warming.
6	Particulates Matter	It irritates the eyes, causes breathing problems, makes clothes dirty, and reduces visibility by producing haze.
7	Ozone (O_3)	Breathing ozone can cause chest pain, coughing, throat irritation, and congestion.

14. Define Greenhouse effect. Also define Global warming.

It is the progressive warming up of earth's surface due to blanketing effect of man-made CO_2 , methane etc. in atmosphere. **Global warming:** Global warming is the gradual increase in Earth's average temperature due to excess greenhouse gases. It is mainly caused by human activities like burning fossil fuels and deforestation.

15. Write the sources of greenhouse gases.

Methane, CO_2 and burning of fossil fuels

16. Write the adverse/ harmful effects of global warming.

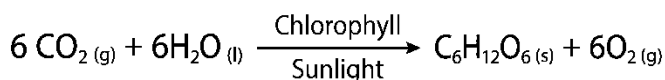
Rise in sea level. Increase in rain fall. Hot summer and winter.

17. Give names of mainly responsible for the extremely Polluted air especially in big cities?

Burning fossil fuels. Automobiles, airplanes, industrial machines and coal-fired electricity generating plants, etc. are mainly responsible for the extremely polluted air especially in big cities.

18. Planting trees is very helpful in removing the air pollution. Justify.

Planting trees is thought to be very helpful in removing the air pollution. A well-known process carried out by plants is photosynthesis in which plants clean the air through absorption of carbon dioxide and releasing oxygen.

**19. Define air quality index (AQI)? Write its value when air quality is good.**

A rating system which shows how bad the atmosphere is around us. AQI under 50 is expected well in quality.

20. How to avoid harmful effects of air pollution?

Reduce your outdoor spent time. Wear face mask. Install carbon monoxide detector.

21. Define flue gas.

The mixture of waste gases produced when fossil fuels are burnt in power plants

Exercise**Multiple Choice Questions:-**

1. Which gases are responsible for greenhouse effect?

(a) SO ₂ , NO ₂	(b) NO ₂ , CO	(c) CO ₂ , CH ₄ ✓	(d) O ₂ , N ₂
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2. Indicate the source of sulphur which is responsible for the presence of oxides of sulphur in the atmosphere.

(a) Decomposition of vegetation	(b) Waste gases from digestion of animals	(c) Photochemical smog	(d) Combustion of fossil fuels ✓
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3. Concentration of which gas in the atmosphere is decreased by photosynthesis in plants?

(a) Oxygen	(b) Nitrogen	(c) Carbon dioxide ✓	(d) Water vapours
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4. Which substance remains unaffected in the catalytic converter fixed in the exhaust of the automobiles?

(a) CO ₂ ✓	(b) CO	(c) NO	(d) NO ₂
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5. People of which age groups are most affected by the air pollution?

(a) Young adults	(b) Middle age people	(c) Children	(d) Both children and aged people ✓
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6. In which area there is a greater possibility of acid rain?

(a) Around village	(b) Around big cities	(c) Around industrial area ✓	(d) Around water bodies
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7. Why is smog not felt in summer?

(a) Because fog is not present in summer ✓	(b) Because due to heat of the Earth the smoke rises up	(c) Because in summer smoke and fog cannot mix with each other	(d) Because less fossil fuels are burnt in summer
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8. Which catalyst is used in the catalytic converter fixed in the exhaust systems of automobiles?

(a) Ni	(b) Cu	(c) Pt, Pd and Rh ✓	(d) CaO
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9. Which components are essential for the formation of photochemical smog?

(a) CO, NO ₂ , CO ₂	(b) NO ₂ , volatile organic compounds, sunlight ✓	(c) CO ₂ , NO ₂ , sunlight	(d) Volatile organic compounds, NO, CO
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10. Which gases contribute towards the formation of acid rain?

(a) Oxides of carbon	(b) Oxides of Sulphur	(c) Oxides of nitrogen	(d) Both the oxides of nitrogen and sulphur ✓
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Short Questions:-**1. What is the main objective of environmental education?**

The main objective of environmental education is to enlighten the people particularly the students about the importance of protection and conservation of our environment.

2. How is particulate matter released in the atmosphere?

Particulate matter is released into the atmosphere through natural processes like volcanic eruptions and dust storms, along with human activities such as industrial emissions, burning fossil fuels, vehicle exhaust, and construction.

3. Which gas is more poisonous, CO₂ or CO?

CO (carbon monoxide) is more poisonous than CO₂ (carbon dioxide). CO binds more effectively and causes acid rain..

4. How does acid rain affect forests?

It damages tree leaves, makes the soil more acidic and hinders plant growth.

5. In what way sulfur present in fossil fuels becomes dangerous?

When fossil fuels are burned, sulfur is released as SO_2 , causes acid rain.

6. How can wind energy be beneficial for us?

Wind energy is useful because it proves to be a highly effective method for generating electricity without harming the environment. It is a renewable and clean source of energy.

Constructed Response Questions:-**1. How is the excessive use of insecticides and pesticides harmful for birds?**

By contaminating their food and water sources. Birds that consume contaminated insects or seeds may suffer from poisoning or reproductive issues.

2. Percentage of CO_2 in air is only 0.04%. Then how does it become harmful for the ecosystem?

Although the percentage of CO_2 in air is only 0.04% but it plays an important role in maintaining the earth's temperature through greenhouse effect.

3. Why only some pollutant gases present in the atmosphere cause greenhouse effect while others do not?

Only certain gases can absorb and release infrared radiation, trapping heat in the atmosphere. Gases like oxygen (O_2) and nitrogen (N_2) do not have this ability, so they don't play a role in the greenhouse effect.

4. How can you reduce the emission of CO present in the gases emitted by the burning of fuel in the automobile engines?

By using catalytic converter, we can reduce the emission of CO present in the gases emitted by the burning of fuel in the automobile engines. Because it oxidizes carbon monoxide (CO) to carbon dioxide (CO_2).

5. Mention three different ways in which solar energy can be useful for us.

1. Solar cells convert sunlight into electricity that is used in our houses.
2. Solar energy is used to run irrigation systems and agricultural machinery.
3. It is used to heat water for daily use, saving energy.

Unit: 11 Hydrocarbons

1. What are hydrocarbons?

Hydrocarbons are organic compounds of carbon and hydrogen elements. They are alkanes, alkenes, alkynes and aromatics. e.g: CH_4 , C_2H_6 etc.

2. Why are hydrocarbons considered as parent organic compounds?

Hydrocarbons are those compounds which are made up of only carbon and hydrogen elements. Hydrocarbons are regarded as the parent organic compounds since other organic compounds are considered to be derived from them by replacing of one or more hydrogen atoms by other atoms or group atoms.

3. What does LPG & CNG stands for?

CNG stands for compressed natural gas and LPG stands for liquefied petroleum gas.

4. Which property of alkanes make them distinct from other compounds?

This distinguishing feature of alkanes make them distinct from other compounds is their lack of reactivity towards usual chemical reagents.

5. Which is the simplest alkane & Give its uses?

The simplest alkane is methane having formula CH_4 .

Uses: It is mainly used as a fuel but it is also used to make hydrogen gas, carbon black, carbon disulphide, chloroform, hydrocyanic acid, etc.

6. Why alkanes are called paraffin's?

Alkanes are saturated hydrocarbons. In these compounds all the bonds of carbon atoms are single that means valences, of carbon atoms are fully satisfied (saturated). Therefore they are least reactive. That is the reason alkanes are called paraffin's.

7. IUPAC stands for?

IUPAC stands for International Union of Pure and Applied Chemistry.

8. Describe three parts of IUPAC name of organic compound.

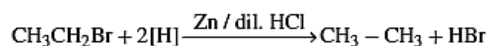
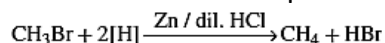
Root: It tells us the number of carbon atoms in the longest continuous chain present in the molecule.

Suffix: It is added after the root and tells us about the class of organic compounds.

Prefix: It is indicated before the root and tells us about the group or groups attached to the longest chain.

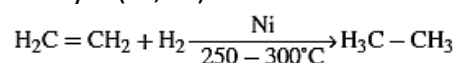
9. How are alkyl halides reduced?

Reduction means addition of nascent hydrogen. In fact, it is a replacement of a halogen atom with a hydrogen atom. This reaction takes place in presence of Zn metal and HCl. e.g.



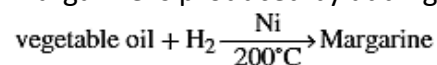
10. What do you know about hydrogenation of alkenes?

Hydrogenation means addition of molecular hydrogen to an unsaturated hydrocarbon in presence of a catalyst (Ni, Pt) to form saturated compound e.g.



11. How is margarine produced?

Margarine is produced by adding molecular hydrogen to vegetable oil at 200°C in the presence of catalyst (Ni).



Greater the amount of hydrogen is added, the more solid the margarine becomes.

12. Why does the burning of alkanes require sufficient supply of oxygen?

Complete combustion takes place in excess of air or oxygen to produce CO_2 , and H_2O



Whereas in the limited supply of oxygen, there is incomplete combustion. As a result, carbon monoxide is produced that creates suffocation and causes death.

13. Why are the alkanes used as fuel?

Alkanes burn in the presence of excess of air or oxygen to produce a lot of heat, carbon dioxide and water. This reaction takes place in automobile combustion engines, domestic heaters and cooking appliances. It is highly exothermic reaction and because of its alkanes are used as fuel. $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{heat}$

14. What is substitution reaction?

Reaction which involves the replacement of hydrogen of alkanes by an atom or group of atoms like halogen are called substitution reaction.

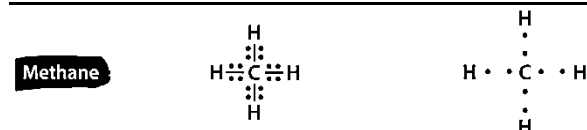
15. How alkanes are prepared?

BY Cracking of higher Hydrocarbons and by Reduction of alkenes and alkynes

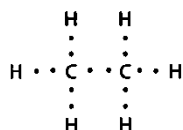
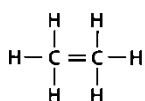
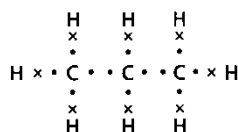
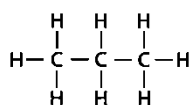
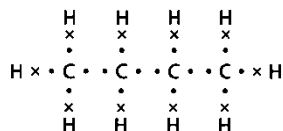
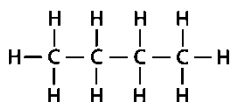
16. Why alkanes are considered non-polar?

Alkanes contain carbon and hydrogen. The electronegativity values of carbon (2.6), and hydrogen (2.1) do not differ appreciably and the bonding electrons between C-H and C-C are almost equally shared. This makes alkane non-polar.

17. Write electron cross and dot structures of methane.



18. Write electron cross and dot structures of ethane.

Ethane**19. Write electron cross and dot structures of propane.****Propane****20. Write electron cross and dot structures of butane.****Butane****Exercise****Multiple Choice Questions:-**

- Which other atom is almost always present along with carbon atom in all organic compounds?
 - Oxygen
 - Nitrogen
 - Hydrogen ✓
 - Halogen
- Which other metal can be used to reduce alkyl halides?
 - Al
 - Mg ✓
 - Ni
 - Co
- If naphtha undergoes a combustion reaction what products do you expect it to form?
 - Alkanes
 - Alkenes
 - CO₂ and H₂O ✓
 - Both alkanes and alkenes
- Why does a mixture of zinc and hydrochloric acid acts as a reducing agent?
 - Because zinc acts as a reducing agent.
 - Because atomic hydrogen is produced with Zn / HCl which acts as a reducing agent.
 - Because molecular hydrogen is produced with Zn/ HCl which acts as a reducing agent. ✓
 - Because chloride ions are produced with Zn / HCl which act as a reducing agent.
- Which alkane will evolve the most amount of heat when it is burnt with oxygen?
 - Ethane
 - Propane
 - n-Butane ✓
 - iso-Butane
- Which reaction is not given by alkanes?
 - Substitution
 - Combustion
 - Addition ✓
 - Cracking
- Which hydrocarbon is responsible for explosions in coal mines?
 - Butane
 - Pentane
 - Methane ✓
 - Ethene
- Which product will be formed when ethyl bromide (CH₃-CH₂-Br) is treated with Zn/HCl
 - CH₄
 - CH₃-CH₃ ✓
 - CH₃-CH₂-CH₂-CH₃
 - CH₃-
- Which of the following is not a process of halogenation of alkanes?
 - Cracking ✓
 - Chlorination
 - Bromination
 - Iodination
- How many moles of oxygen will be required to completely burn propane?
 - 4 moles
 - 5 moles ✓
 - 3 moles
 - 6 moles

Short Questions:-**1. Differentiate between an organic and an inorganic compound.**

Organic Compound	Inorganic Compound
These are the compounds which contain covalently bonded carbon as an essential component.	These compounds are made up of almost all elements of periodic table except those compounds of carbon and hydrogen (hydrocarbons).
They are found in living things i.e., plants and animals.	They are found in non-living things i.e., rocks and animals.
For example: carbohydrates and proteins.	For example: NaCl and CaCO ₃ .

2. Why are organic compounds found in large numbers?

Because can make stable chains and rings which makes different structures. That's why they are found in large numbers.

3. Name the products which are obtained when natural gas is oxidized under controlled conditions.

Water, Heat energy and Carbon Dioxide.

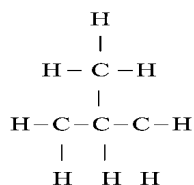
4. How naphtha fraction is decomposed to give lower hydrocarbons?

Through cracking, where large hydrocarbons are broken down into smaller molecules using heat and catalyst.

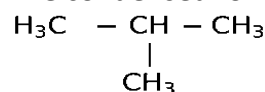
5. Write down the molecular formula, structural formula and the condensed structural formula for iso-butane.

The molecular formula of iso-butane is C_4H_{10}

The structural formula of iso-butane is:



The condensed formula of iso-butane is:

**6. How are organic compounds useful for us?**

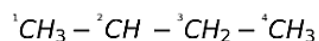
Because they are used as food, clothes, fuel and medicine.

7. Write down the names of five such organic compounds which exist naturally?

1. Methane 2. Glucose 3. Citric acid 4. Starch 5. Nucleic acids (DNA & RNA)

8. Give IUPAC name to the following compound.

Given compound IUPAC name are Methyl Butane.

**9. How do the melting and boiling points of alkanes change when we move from lower members to higher members?**

Because of increase in molecular size there is increase in the attractive forces among molecules.

Constructed Response Questions:-**1. Why do alkanes show little reactivity towards the other reagents?**

Because alkanes are non-polar and have strong bonds of C-H and C-C.

2. Why does a mixture of natural gas and air explode?

Natural gas primarily contain methane which is very flammable that is why mixture of natural gas and air explode.

3. How do you compare the melting and boiling points of inorganic and organic compounds?

Due to weak forces of attraction, the melting and boiling points of organic compounds are lower than those of inorganic compounds.

4. Reactions of alkanes with chlorine takes place in the presence of sunlight. What is the role of sunlight in the reaction?

Sunlight provides the energy to break chlorine into chlorine radicals, thereby initiating the reaction.

5. How do you compare the boiling point of n-butane with that of iso-butane?

Straight chain structured compounds have strong intermolecular forces than branched chain compounds and hence higher boiling point. n-butane has straight chain while iso-butane has branch chain. So, n-butane has higher boiling point than iso-butane.

6. Why are organic compounds not generally soluble in water?

Organic compounds are mostly non-polar in nature. Water is a polar solvent, so generally organic compounds are not soluble in water.