Q.1. Write detailed notes on conductance and its measurements.

Ans:- Conductance is an expression of the ease with which electric current flows through materials like metals and nonmetals. In equations, an uppercase letter G symbolises conductance. The standard unit of conductance is siemens (S), formerly known as mho. Conductance is essentially a property found in good conductors of electricity, like aluminium and copper. Atoms and molecules in metals like these are in a state of random motion, which causes the electrons in the outer shells to move out of orbit and become free electrons. These free electrons can move from atom to atom. Whenever there is a potential difference, they travel from low potential to high potential.

Measurement:- When a current of 1 ampere (A) passes through a component across which a voltage of 1 volt exists, then the conductance of that component is 1 S. Siemens is equivalent to 1 A per volt.

Q.2. Write about partition coefficient and its applications in pharmacy.

Ans:- Partition coefficients are used to describe the solubility of inhalation anaesthetics in a variety of different solvents. A partition coefficient is simply the ratio of the concentration of anaesthetic in one phase or solvent compared to another. **Applications:-** Partition coefficients are used in the pharmaceutical industry to estimate how a drug may transfer between different biological environments and are regularly used to predict a molecule's hydrophobicity.

Q.3. Discuss intermolecular forces in liquid in detail.

Ans:- Intermolecular forces are electrostatic in nature and include van der Waals forces and hydrogen bonds. Molecules in liquids are held to other molecules by intermolecular interactions, which are weaker than the intramolecular interactions that hold the atoms together within molecules and polyatomic ions.

Q.4. Write short notes on dipole moments.

Ans:- The dipole moment is used for determining the symmetry of the molecules. The molecules with two or more polar bonds within them would not be symmetrical and thus possess some dipole moment.

Q.5. Write short notes on factors affecting reaction rate.

Ans:- There are four main factors that can affect the reaction rate of a chemical reaction:

Reactant concentration. Increasing the concentration of one or more reactants will often increase the rate of reaction. This occurs because a higher concentration of a reactant will lead to more collisions of that reactant in a specific time period.

Physical state of the reactants and surface area. If reactant molecules exist in different phases, as in a heterogeneous mixture, the rate of reaction will be limited by the surface area of the phases that are in contact.

Temperature. An increase in temperature typically increases the rate of reaction. An increase in temperature will raise the average kinetic energy of the reactant molecules.

Presence of a catalyst. A **catalyst** is a substance that accelerates a reaction by participating in it without being consumed.

Q.6. Explain thermochemical reactions in detail.

Ans:- When a balanced chemical equation not only indicates the quantity of the different reactants and products, but also indicates the amount of heat evolved or absorbed, it is called a thermochemical equations. Some conventions about Thermochemical equations: For exothermic reactions, ΔH is negative, for endothermic reactions ΔH is positive.

Q.7. Write short notes on characteristics of acid-base.

Ans:- Acids are chemical substances which are characterized by a sour taste in an aqueous medium. They have the tendency to turn blue litmus red. On the other hand, bases are chemical substances which are characterized by a bitter taste and are slippery to touch. Some bases are soluble in water, while others are not. Water soluble bases are known as alkalis. They have the tendency to turn red litmus blue. Acids and bases react with a wide range of chemical compounds to form salts.

Q.8. Discuss first order and second order reaction kinetics.

Ans:- A first-order reaction is a reaction that proceeds at a rate that depends *linearly* on only one reactant concentration.

A first-order reaction is a chemical reaction in which the rate of reaction depends only on the concentration of one of the reactants. The order of the reaction is 1. For a reaction A→B

The rate of reaction can be defined as $R=k[A]^t$

Where A is the concentration of reactant

This is an example of first-order reaction which gives the relationship of rate of reaction and reactant for first-order reaction. Unit of rate constant for any order is given by $(mol\ L^{-1})^{1-n}s^{-1}$

For first-order reaction n=1. The unit of rate constant for the first-order reaction will be s^{-1}.

Second order :- Second order reactions can be defined as chemical reactions wherein the sum of the exponents in the corresponding rate law of the chemical reaction is equal to two. The rate of such a reaction can be written either as $r = k[A]2$, or as $r = k[A][B]$.

Q.9. Give the differences in physical properties of solid, liquid and gases.

Ans:- Solids:- In the solid state, the individual particles of a substance are in fixed positions with respect to each other because there is not enough thermal energy to overcome the intermolecular interactions between the particles. As a result, solids have a definite shape and volume.

Liquids:- If the particles of a substance have enough energy to partially overcome intermolecular interactions, then the particles can move about each other while remaining in contact. This describes the liquid state. In a liquid, the particles are still in close contact, so liquids have a definite volume.

Gases:- If the particles of a substance have enough energy to completely overcome intermolecular interactions, then the particles can separate from each other and move about randomly in space.

Q.10. Discuss surface tension, viscosity and factors affecting them.

Ans:- Surface tension :- Surface tension is the tension of the surface film of a liquid caused by the attraction of the particles in the surface layer by the bulk of the liquid, which tends to minimise surface area. **Viscosity :-** Viscosity is a measure of a fluid's resistance to flow. The unit of viscosity is poiseuille (PI). Its other units are newton-second per square metre ($N\ s\ m^{-2}$) or pascal-second (Pa s.)

Factors affecting Viscosity and surface tension : Impurities, Temperature, Oxidation, Electrification

Q.11. Derive rate constant and half life for first order reaction.

Ans:- Derivation:-

According to integrated law of rate:-

$k=t2.303\log10[A]t[A]o$

where [A]o is at t=0

the concentration of reactant falls to [Ao]/2 at t1/2

∴t=t1/2

$[A]t=Ao/2$

∴ Equation for first order can be written as:-

$k=t1/22.303\log102[A]o[A]o$

$k=t1/22.303\log102=t1/20.693$

$t1/2=k0.693.$

1. What is meant by a thermochemical equation?
   Ans:- Thermochemical Equation is a balanced stoichiometric chemical equation that include the enthalpy charge ΔH.In variable form a thermochemical Equation would look like this . A+B→CΔH=x KJ/mol.

2. What is a bolometer?
   Ans:- A bolometer is a device for measuring radiant heat by means of a material having a temperature-dependent electrical resistance. It

was invented in 1878 by the American astronomer Samuel Pierpont Langley.

3. Define black body and black body radiation.
   Ans:- A black body or blackbody is an idealized physical body that absorbs all incident electromagnetic radiation, regardless of frequency or angle of incidence. The name "black body" is given because it absorbs all colors of light. A black body also emits black-body radiation. Black-body radiation is the thermal electromagnetic radiation within, or surrounding, a body in thermodynamic equilibrium with its environment, emitted by a black body

4. Define quantum efficiency or quantum yield.
   Ans:- The quantum efficiency is defined as the ratio of the number of photons emitted by the phosphor to the number of photons absorbed.

5. The enthalpy changes of a system refers to the amount of heat that is released or absorbed during the dissolving process (at constant pressure). This enthalpy of solution (ΔHsolution) can either be positive (endothermic) or negative (exothermic)..

6. State the second law of thermodynamics.
   Ans:- The Second Law of Thermodynamics states that the state of entropy of the entire universe, as an isolated system, will always increase over time. The second law also states that the changes in the entropy in the universe can never be negative.

7. Isothermal process is *a thermodynamic process in which the temperature of a system remains constant.*

8. Heat of vaporisation (ΔH) of a liquid is is defined as the amount of heat needed to turn 1 g of a liquid into a vapor, without a rise in the temperature of the liquid.

9. What is adiabatic process?
   Ans:- The thermodynamic process in which there is no exchange of heat from the system to its surrounding neither during expansion nor during compression. The adiabatic process can be either *reversible or irreversible.*

10. Write Lambert's law.
   Ans:- Lambert's law of absorption states that equal parts in the same absorbing medium absorb equal fractions of the light that enters them.

11. What are the causes of deviation of real gas from ideal behaviour?
   Ans:- The deviation of real gas from ideal gas behaviour occurs due to the assumption that **if**

pressure increases the volume decreases. The volume will approach a smaller number but will not be zero because the molecules will occupy some space that cannot be compressed further.

12. Explain the behaviour of real gases by van der Waals' equation at low pressure and high pressure.
   Ans:- using the Van der Waals equation, the volume of a real gas is given as (Vm – b), where b is the volume occupied per mole. Therefore, ideal gas law when substituted with $V = V_m – b$ is given as: Because of intermolecular attraction, P was modified as below. Where, V_m: molar volume of the gas R: universal gas constant T: temperature P: pressure V: volume Thus, Van der Waals equation can be reduced to ideal gas law as $PV_m = RT.$

13. What is the effect of temperature on surface tension?
   Ans:- In general, surface tension decreases when the temperature increases because cohesive forces decrease with an increase in molecular thermal activity. The influence of the surrounding environment is due to the adhesive action liquid molecules have at the interface.

14. Explain the term Parachor in detail.
   Ans:- an empirical constant for a liquid that relates the surface tension to the molecular volume and that may be used for a comparison of molecular volumes under conditions such that the liquids have the same surface tension and for determinations of partial structure of compounds by adding values obtained for constituent atoms and structural features

15. What is meant by reaction of second order?
   Ans:- Second order reactions can be defined as chemical reactions wherein the sum of the exponents in the corresponding rate law of the chemical reaction is equal to two. The rate of such a reaction can be written either as $r = k[A]^2$, or as $r = k[A][B]$.

16. Derive an expression for rate constant of second-order reaction involving one reactant only.
   Ans:- Considering the scenario where one second order reactant forms a given product in a chemical reaction, the differential rate law equation can be written as follows:

$$\frac{-d[R]}{dt} = k[R]^2$$

In order to obtain the integrated rate equation, this differential form must be rearranged as follows: $\frac{d[R]}{[R]^2} = -kdt$

Now, integrating on both sides in consideration of the change in the concentration of reactant between time 0 and time t, the following equation is attained. $\int_{[R]_0}^{[R]_t} \frac{d[R]}{[R]^2} = -k \int_0^t dt$

From the power rule of integration, we have:

$\int \frac{dx}{x^2} = -\frac{1}{x} + C$ Where C is the constant of Integration. Now, using this power rule in the previous equation, the following equation can be attained. $\frac{1}{[R]_t} - \frac{1}{[R]_0} = kt$ Which is the required integrated rate expression of second order reactions.

17. Describe some characteristics of second order reaction.
   Ans:-
   - Chemical reactions of which the rate of reaction depends on molar concentration of two reactants or the second power of one reactant involved in the reaction.
   - the rate of a second order reaction depends on the second power of the concentration term in the rate equation.
   - if we increase the concentration of reactant by 2 times, the rate of reaction will increase by 4 times.
   - the rate of all second order reaction depends on either a single reactant or two reactants

18. Describe some important applications of adsorptions.
   Ans:-Air pollution masks, Separation of noble gases by Dewar's flask process, Purification of water, Removal of moisture and humidity,Adsorption chromatography, Ion exchange method, In metallurgy

19. Characteristics of acid-base.
   Ans:- Acids are chemical substances which are characterized by a sour taste in an aqueous medium. They have the tendency to turn blue litmus red. On the other hand, bases are chemical substances which are characterized by a bitter taste and are slippery to touch. Some bases are soluble in water, while others are not.

20. Consequences of light absorption.
   Ans:- The absorption of light makes an object dark or opaque to the wavelengths or colors of the incoming wave: Wood is opaque to visible light. Some materials are opaque to some wavelengths of light, but transparent to others.

Glass and water are opaque to ultraviolet light, but transparent to visible light.

21. Quantum efficiency.
   Ans:- Quantum efficiency (QE) is the measure of the effectiveness of an imaging device to convert incident photons into electrons. For example, if a sensor had a QE of 100% and was exposed to 100 photons, it would produce 100 electrons of signal.

22. Explain thermochemical reactions in detail.
   Ans:- Thermochemistry is the study of the energy and heat associated with chemical reactions and/or physical transformations. A reaction may release or absorb energy, and a phase change may do the same, such as in melting and boiling.

23. Third law of thermodynamics.
   Ans:- The third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

24. Define surface tension. Give it's one application.
   Ans:- Surface tension is the tendency of liquid surfaces at rest to shrink into the minimum surface area possible. Surface tension is what allows objects with a higher density than water such as razor blades and insects to float on a water surface without becoming even partly submerged. **Application:** Cleaning of clothes by soaps and detergents which lowers the surface tension of the water.

25. What is the Le Chatelier principle for chemical equilibrium?
   Ans:- Le Chatelier's principle, also called Chatelier's principle, is a principle of chemistry used to predict the effect of a change in conditions on chemical equilibria.Le Chatelier's principle describes what happens to a system when something momentarily takes it away from equilibrium. This section focuses on three ways in which we can change the conditions of a chemical reaction at equilibrium: (1) changing the concentration of one of the components of the reaction (2) changing the pressure on the system (3) changing the temperature at which the reaction is run.

26. Define conductance for a solution.
   Ans:- Conductivity is an important measurement for many applications [1,2]. When done properly it is a quick and easy way to measure the purity of water. However, there are some key ideas that must be understood

before starting to make conductivity measurements.

To start there are three important definitions:
   - Electrical current is the movement of charged particles (measured in Amps, A).
   - Conductance is a measure of how easily those charge particles move through a solution/material (measured in Siemens, S).
   - Conductivity is the conductance (S) measured across a specified distance through a material/solution (measured in Siemens per centimetre, S/cm)

27. Define heat capacity.
   Ans:- Heat capacity or thermal capacity is a physical property of matter, defined as the amount of heat to be supplied to an object to produce a unit change in its temperature. The SI unit of heat capacity is joule per kelvin. Heat capacity is an extensive property.

28. What is fluorescence?
   Ans:- Fluorescence is the emission of light by a substance that has absorbed light or other electromagnetic radiation. It is a form of luminescence. In most cases, the emitted light has a longer wavelength, and therefore a lower photon energy, than the absorbed radiation.

29. Define quantum mechanics.
   Ans:- Quantum mechanics is a fundamental theory in physics that provides a description of the physical properties of nature at the scale of atoms and subatomic particles. It is the foundation of all quantum physics including quantum chemistry, quantum field theory, quantum technology, and quantum information science.

30. Give the formula of rate constant for first-order kinetics.
   Ans:- For first-order reaction, n = 1. Unit of rate constant = sec^{-1}. The unit of rate constant for a first-order reaction is sec^{-1}. For first-order reactions, equation $\ln[A] = -kt + \ln[A]_0$ is the same as the equation of a straight line (y = mx + c) with slope -k.

31. What is half-life?
   Ans:- Half-life is the time required for a quantity to reduce to half of its initial value. The term is commonly used in nuclear physics to describe how quickly unstable atoms undergo radioactive decay or how long stable atoms survive. The term is also used more generally to characterize any type of exponential decay.

32. Discuss parachor, refractive index and optical rotation. Also discuss different

types of dipole interaction.

Ans:- Parachor: Parachor is a quantity related to surface tension that was proposed by S. Sugden in 1924. It is defined according to the formula: $P = \gamma^{1/4} M /$, where γ is the surface tension, M is the molar mass, ρ_L is the liquid density, and ρ_V is the vapor density in equilibrium with liquid. **Refractive index:** The refractive index of an optical medium is a dimensionless number that gives the indication of the light bending ability of that medium. The refractive index determines how much the path of light is bent, or refracted, when entering a material. **Optical rotation:** Optical rotation, also known as polarization rotation or circular birefringence, is the rotation of the orientation of the plane of polarization about the optical axis of linearly polarized light as it travels through certain materials. **Dipole interaction:** In dipole–dipole interaction, molecules with permanent dipoles attract each other electrostatically; the positive end of one molecule attracts the negative end of another molecule, and so on, leading to an alignment of the molecules

33. **Discuss first and second law of thermodynamics.**

    Ans:- The **First Law** of thermodynamics is a formulation of the law of conservation of energy, adapted for thermodynamic processes. A simple formulation is: "the total energy in a system remains constant, although it may be converted from one form to another. **Second Law:** The second law of thermodynamics is a physical law based on universal experience concerning heat and energy interconversions. One simple statement of the law is that heat always moves from hotter objects to colder objects, unless energy in some form is supplied to reverse the direction of heat flow.

34. **Explain entropy and enthalpy.**

    Ans:- Entropy:entropy, the measure of a system's thermal energy per unit temperature that is unavailable for doing useful work. Because work is obtained from ordered molecular motion, the amount of entropy is also a measure of the molecular disorder, or randomness, of a system. **Enthalpy :** Enthalpy, a property of a thermodynamic system, is the sum of the system's internal energy and the product of its pressure and volume. It is a state function used in many measurements in chemical, biological, and

physical systems at a constant pressure, which is conveniently provided by the large ambient atmosphere

35. **What do you understand by colligative properties? Discuss any two in detail.**

    Ans:- colligative properties are those properties of solutions that depend on the ratio of the number of solute particles to the number of solvent particles in a solution, and not on the nature of the chemical species present.[1] The number ratio can be related to the various units for concentration of a solution such as molarity, molality, normality (chemistry), etc. The assumption that solution properties are independent of nature of solute particles is exact only for ideal solutions, which are solutions that exhibit thermodynamic properties analogous to those of an ideal gas, and is approximate for dilute real solutions.

36. **Discuss various uses and applications of quantum approach in chemistry in pharmacy.**

    Ans:- MRI scanners for medical imaging, Lasers, Solar cells, Electron microscopes, Atomic clocks used for GPS

37. **Jablonski diagram**

    Ans:- Jablonski diagram is a diagram that illustrates the electronic states and often the vibrational levels of a molecule, and also the transitions between them. The states are arranged vertically by energy and grouped horizontally by spin multiplicity. Nonradiative transitions are indicated by squiggly arrows and radiative transitions by straight arrows. The vibrational ground states of each electronic state are indicated with thick lines, the higher vibrational states with thinner lines.[1] The diagram is named after the Polish physicist Aleksander Jabłoński.

38. **Biocatalysis and biocatalyst.**

    Ans:- Biocatalysis is defined as the use of natural substances that include enzymes from biological sources or whole cells to speed up chemical reactions. Enzymes have pivotal role in the catalysis of hundreds of reactions that include production of alcohols from fermentation and cheese by breakdown of milk proteins. **Biocatalyst:-** Biocatalysts, including both enzymes and whole cells, are important in the production of specialty chemicals, especially chiral compounds that are difficult to make by chemical synthesis.