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Pharmaceutical Terminology - Vol. Ist

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Pharmaceutical Terminology -Vol. Ist

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B PHARM

SEM -I

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

Unit I:

1. Anatomy

Anatomy is the scientific study of the structure of the human body. It includes both external and internal body parts. This field helps us understand body organization and location of organs. Anatomy is foundational in medicine and health sciences. It is often studied alongside physiology.

2. Physiology

Physiology is the study of how the body functions. It explores processes like digestion, respiration, and circulation. It explains how body systems work together to maintain life. Physiology is essential in understanding disease and health. It often complements the study of anatomy.

3. Homeostasis

Homeostasis refers to the body's ability to maintain internal stability. It keeps factors like temperature and pH within normal ranges. It involves feedback systems like sweating or shivering. Disruptions in homeostasis can lead to health issues. It is a key concept in physiology and medicine.

4. Cell Membrane

The cell membrane encloses the cell and defines its boundary. It controls the movement of substances in and out. It is selectively permeable and composed of a lipid bilayer. It supports cell communication and signaling. It helps maintain the internal environment of the cell.

5. Cytoplasm

Cytoplasm is the fluid inside the cell excluding the nucleus. It supports and suspends organelles within the cell. Many vital biochemical reactions occur here. It helps in movement of materials within the cell. It plays a major role in maintaining cell shape.

6. Organelles

Organelles are specialized structures within cells. Each has a specific function essential for cell survival. Examples include nucleus, mitochondria, and Golgi apparatus.They are suspended in the cytoplasm. They work together to keep the cell functioning properly.

7. Nucleus

The nucleus is the cell's control center, containing DNA that regulates cell functions, gene expression, and heredity. Surrounded by a double membrane, it also aids in cell division, replication, and protein synthesis.

8. Mitochondria

Mitochondria are often referred to as the powerhouse of the cell due to their central role in producing adenosine triphosphate (ATP) through the process of cellular respiration. These organelles possess their own DNA, enabling them to replicate independently of the cell. In addition to energy generation, mitochondria play a key role in various metabolic activities and are essential for maintaining the cell’s energy balance and overall function.

9. Ribosomes

Ribosomes are responsible for synthesizing proteins. They can be free in cytoplasm or attached to rough ER. They read mRNA and link amino acids together. They are made of rRNA and proteins. They are essential for cell growth and repair.

10. Endoplasmic Reticulum (ER)

The endoplasmic reticulum (ER) is an extensive network of membranous tubules and sacs within the cell, playing a key role in intracellular transport and processing. It exists in two forms: the rough ER, which is lined with ribosomes and primarily involved in protein synthesis, and the smooth ER, which is responsible for lipid production and detoxification of harmful substances. The ER also facilitates the movement of materials throughout the cell and is physically connected to the nuclear envelope, ensuring efficient communication and transfer of molecules between the nucleus and the cytoplasm.

11. Golgi Apparatus

The Golgi apparatus processes and packages cellular products. It modifies proteins and lipids from the ER. It sorts and sends materials to their destinations. It forms vesicles for secretion or use within the cell. It is essential for proper protein trafficking.

12. Lysosomes

Lysosomes are the digestive organelles of the cell. They contain enzymes that break down waste and foreign material. They help in recycling cellular components. They are crucial for defense against pathogens. They help maintain cellular cleanliness and health.

13. Cell Junctions

Cell junctions connect adjacent cells together. They provide structural support and communication. Types include tight junctions, gap junctions, and desmosomes. They help form tissues and maintain integrity. They are vital in organs like skin and heart.

14. Osmosis

Osmosis is the movement of water across a semipermeable membrane. Water moves from low to high solute concentration. It helps maintain fluid balance in cells. It is a passive process requiring no energy. It is important in kidney and plant cell function.

15. Diffusion

Diffusion is the movement of molecules from high to low concentration. It occurs until equilibrium is reached. It does not require energy (passive transport). It is essential for gas exchange in lungs and tissues. It helps in nutrient and waste transport.

16. Active Transport

Active transport is the energy-driven movement of substances from low to high concentration, against the gradient. Powered by ATP, it maintains ion balance, supports nutrient uptake, and ensures proper cell function. The sodium-potassium pump is a key example, essential for regulating ions and electrical gradients.

17. Endocytosis

Endocytosis is the process by which cells take in materials. The cell membrane engulfs particles forming a vesicle. It allows uptake of nutrients and macromolecules.

Types include phagocytosis and pinocytosis. It plays a role in immunity and nutrient absorption.

18. Exocytosis

Exocytosis expels materials from the cell to the outside. Vesicles fuse with the cell membrane to release contents. It is vital in hormone and neurotransmitter release.
It also helps remove waste products. It is key in maintaining membrane composition.

19. Paracrine Signaling

Paracrine signaling affects neighboring cells locally. Chemical messengers are released into the surrounding tissue. It is important in tissue growth and immune response. It provides quick, targeted communication between cells. It acts over a short range and for a short duration.

20. Endocrine Signaling

Endocrine signaling uses hormones transported via the bloodstream. It allows communication between distant organs and cells. It regulates growth, metabolism, and reproduction. Hormones are secreted by endocrine glands. It provides long-term regulation of body functions.

Unit II:

21. Epidermis

The epidermis is the skin’s outermost layer, acting as a barrier against pathogens, UV rays, and water loss. Made mainly of keratinocytes, it lacks blood vessels and gets nutrients by diffusion from the dermis. Melanocytes here produce melanin, and the layer renews through cell division.

22. Dermis

The dermis lies beneath the epidermis and contains blood vessels, nerves, glands, and connective tissue. Rich in collagen and elastin, it provides strength, elasticity, and supports sensation and thermoregulation. It also contributes to wound healing.

23. Melanin

A pigment synthesized by melanocytes in the skin. It gives color to skin, hair, and eyes. Melanin protects the skin from harmful ultraviolet (UV) rays. Increased melanin production results in tanning. Genetic and environmental factors affect melanin levels.

24. Keratin

A fibrous structural protein found in the skin, hair, and nails. It provides mechanical strength and water resistance. Keratin is produced by keratinocytes in the epidermis. It plays a role in wound healing. It protects against physical and chemical damage.

25. Sebaceous Glands

Sebaceous glands are linked to hair follicles and secrete sebum, an oily substance that lubricates skin and hair. Sebum prevents dryness and offers antibacterial protection. Overactivity can lead to acne. These glands are most common on the face and scalp.

26. Sweat Glands

Glands responsible for thermoregulation and waste excretion. Two types: eccrine (widespread) and apocrine (armpits/groin). Eccrine glands produce watery sweat for cooling. Apocrine glands become active at puberty and are odor-associated. Sweat also aids in maintaining pH balance.

27. Osteoblasts

Cells that synthesize bone matrix and promote mineralization. They play a critical role in bone formation. Found on the surface of new bone. They eventually become osteocytes. Their activity is influenced by hormones like calcitonin.

28. Osteoclasts

Osteoclasts are large, multinucleated cells that break down bone tissue for remodeling and calcium balance. They use enzymes and acids to dissolve bone matrix and are regulated by parathyroid hormone. Excess activity can cause osteoporosis.

29. Osteocytes

Osteocytes are mature bone cells formed from osteoblasts, residing in lacunae within the bone matrix. They maintain bone tissue, regulate minerals, and detect mechanical stress, signaling for bone remodeling as needed.

30. Axial Skeleton

Includes the skull, vertebral column, and thoracic cage. It provides central support and protects vital organs. Comprises 80 bones. It serves as an attachment for muscles involved in posture and respiration. It is essential for structural integrity.

31. Appendicular Skeleton

Composed of limbs and girdles (pectoral and pelvic). It enables movement and interaction with the environment. Includes 126 bones. It supports locomotion and manipulation. Works with muscles to generate movement.

32. Cartilage

A semi-rigid connective tissue that provides flexibility and cushioning. Found in joints, nose, ear, and between vertebrae. Contains chondrocytes within a matrix. Avascular and heals slowly. Reduces friction and absorbs shock.

33. Ligaments

Bands of tough, fibrous connective tissue. They connect bones at joints and stabilize them. Composed mostly of collagen. Provide joint integrity and prevent dislocation. Injuries can result in sprains or instability.

34. Tendons

Connect muscle to bone and transmit force for movement. Composed of dense regular connective tissue. Enable precise muscle control. Strong but less elastic than ligaments. Injuries include strains and tendonitis.

35. Synovial Joint

Freely movable joints enclosed by a capsule. Contain synovial fluid for lubrication. Include types like hinge, ball-and-socket, and pivot. Allow a wide range of motion. Commonly affected by arthritis.

36. Ball-and-Socket Joint

Spherical head of one bone fits into a round socket of another. Allows movement in all directions. Found in shoulder and hip joints. Provides flexibility and rotation. Prone to dislocation due to high mobility.

37. Hinge Joint

Allows movement in one plane, like a door hinge. Found in the elbow and knee. Permits flexion and extension. Stabilized by ligaments and muscles. Crucial for locomotion and lifting.

38. Sarcomere

The smallest contractile unit of a muscle fiber. Composed of actin and myosin filaments. Repeats along the length of myofibrils. Responsible for striated appearance of skeletal muscle. Enables contraction via sliding filament theory.

39. Actin

Thin filament protein involved in muscle contraction. Binds with myosin to generate force. Plays a role in cell shape and motility. Forms part of the cytoskeleton. Essential for cell movement and structure.

40. Myosin

Thick filament protein in muscle cells. Interacts with actin to produce contraction. Contains ATPase activity for energy use. Crucial for muscle shortening. Drives sarcomere contraction in skeletal and cardiac muscle.

Unit III

41. Plasma

Plasma is the yellowish fluid part of blood, making up about 55% of its volume. It consists mainly of water, proteins, hormones, and nutrients. Plasma transports cells, gases, and waste, and helps maintain blood pressure and volume.

42. Hemoglobin

Hemoglobin is an iron-rich protein in red blood cells that transports oxygen from the lungs to tissues and carries carbon dioxide back. It gives red blood cells their red color and is vital for respiration and energy production.

43. Erythrocytes

Also known as red blood cells (RBCs). Biconcave in shape to increase surface area. Lack a nucleus to carry more hemoglobin. Transport oxygen and carbon dioxide. Produced in bone marrow.

44. Leukocytes

Leukocytes, or white blood cells (WBCs), protect the body from infections and diseases. They include neutrophils, lymphocytes, monocytes, eosinophils, and basophils. Present in blood and lymph, their numbers rise during infections.

45. Platelets

Small, disc-shaped cell fragments in blood. Play a vital role in blood clotting. Aggregate at injury sites to form plugs. Release clotting factors and chemicals. Derived from megakaryocytes in bone marrow.

46. Anemia

A condition with a deficiency of red blood cells or hemoglobin. Results in fatigue, weakness, and shortness of breath. Causes include iron deficiency, blood loss, or chronic disease. Diagnosed by low hemoglobin levels. Treated depending on the cause.

47. Hemopoiesis

The process of blood cell formation. Occurs primarily in red bone marrow. Produces erythrocytes, leukocytes, and platelets. Regulated by growth factors and hormones. Essential for maintaining healthy blood cell levels.

48. Coagulation

The process of blood clotting to prevent excessive bleeding. Involves a cascade of clotting factors. Converts fibrinogen into fibrin to form a mesh. Stabilizes the platelet plug. Disorders include hemophilia and thrombosis.

49. Fibrinogen

A soluble plasma protein produced by the liver. Converted into insoluble fibrin during clotting. Fibrin forms the structural basis of a clot. Activated by thrombin. Essential for wound healing.

50. Blood Groups

Classification based on antigens on red blood cells. Includes A, B, AB, and O types. Determined by presence or absence of A and B antigens. Important for safe blood transfusions. Incompatibility can cause immune reactions.

51. Rh Factor

A protein antigen on red blood cells. Individuals can be Rh-positive or Rh-negative. Important in pregnancy and transfusion compatibility. Rh-negative mothers may require Rh immunoglobulin. Incompatibility can cause hemolytic disease of the newborn.

52. Blood Transfusion

Transfer of blood or components from a donor to a recipient. Used in cases of blood loss, anemia, or surgery. Requires blood type compatibility. Can involve whole blood or components like plasma or RBCs. Monitored for adverse reactions.

53. Antigen

A substance recognized as foreign by the immune system. Stimulates an immune response. Can be proteins, polysaccharides, or toxins. Found on pathogens, cells, or allergens. Basis for vaccine development.

54. Antibody

A Y-shaped protein produced by B cells. Specifically binds to antigens. Helps neutralize or destroy pathogens. Present in blood and lymph. Forms antigen-antibody complexes.

55. Reticuloendothelial System

A network of cells, mainly macrophages. Involved in filtering blood and lymph. Destroys pathogens, old cells, and debris. Found in liver, spleen, and lymph nodes. Plays a role in immune defense.

56. Lymph

Lymph is a clear fluid from interstitial fluid that circulates through the lymphatic system. It contains many lymphocytes vital for immunity, helps transport dietary fats, and removes waste and toxins from tissues, supporting overall balance in the body.

57. Lymph Nodes

Lymph nodes are small, bean-shaped structures in the lymphatic system that filter lymph and trap pathogens. They contain immune cells like lymphocytes and macrophages that identify and destroy harmful microbes. During infections, they often swell. Commonly found in the neck, armpits, and groin, they are crucial for immune defense.

58. Spleen

The spleen is a lymphoid organ in the upper left abdomen that filters and stores blood. It removes old or damaged red blood cells, supports immune responses, and stores white blood cells and platelets.

59. Thymus

A gland located behind the sternum. Site where T lymphocytes mature. Active during childhood and shrinks with age. Essential for developing immune tolerance. Secretes hormones like thymosin.

60. Lymphatic Circulation

The network that transports lymph throughout the body. Composed of lymphatic vessels, nodes, and organs. Returns excess fluid to the bloodstream. Helps in immune surveillance. Maintains fluid balance

Unit IV

61. Central Nervous System (CNS)

The central nervous system (CNS) includes the brain and spinal cord. It processes sensory information, controls movement, and manages higher functions like thinking, memory, and emotions. The CNS is protected by the skull, vertebrae, and cerebrospinal fluid.

62. Peripheral Nervous System (PNS)

The peripheral nervous system (PNS) consists of nerves outside the CNS, including cranial and spinal nerves. It transmits signals between the CNS and body and is divided into somatic and autonomic systems, enabling sensation, movement, and involuntary functions.

63. Neuron

A neuron is the fundamental unit of the nervous system, transmitting electrical signals. It consists of a cell body, axon, and dendrites, and communicates with other cells through synapses, enabling fast signal transmission.

64. Axon

An axon is a long projection of a neuron that carries electrical signals away from the cell body. Often myelinated to speed transmission, it ends in terminals that release neurotransmitters, crucial for neural communication.

65. Dendrites

Dendrites are branched extensions of a neuron that receive signals from other neurons and transmit them toward the cell body. They increase surface area for communication and are important for learning and memory.

66. Synapse

The junction between two neurons or a neuron and muscle. Enables signal transmission via neurotransmitters. Includes presynaptic and postsynaptic membranes. Can be excitatory or inhibitory. Essential for neural networks.

67. Neurotransmitters

Chemical messengers released at synapses. Transmit signals between neurons. Examples include dopamine, serotonin, and acetylcholine. Bind to receptors on target cells. Influence mood, behavior, and muscle activity.

68. Sympathetic Nervous System

The sympathetic nervous system, part of the autonomic nervous system, triggers the "fight-or-flight" response during stress. It raises heart and breathing rates, dilates pupils, and slows digestion to prepare the body for quick action in emergencies.

69. Parasympathetic Nervous System

The parasympathetic nervous system, part of the autonomic system, promotes "rest and digest" functions. It slows heart rate, enhances digestion, and conserves energy, supporting recovery and maintaining balance during restful states.

70. Cranial Nerves

Cranial nerves are twelve pairs of nerves from the brain that control sensory and motor functions in the head and neck. Examples include the optic, facial, and vagus nerves. Each nerve has a specific function and can be sensory, motor, or both.

Unit V:

71. Atrium

The atria are the heart’s upper chambers. The right atrium receives deoxygenated blood from the body, while the left atrium receives oxygenated blood from the lungs. Both pump blood into the ventricles.

72. Ventricle

The ventricles are the heart’s lower chambers that pump blood into arteries. The right ventricle sends deoxygenated blood to the lungs, while the left ventricle pumps oxygenated blood to the body. The left ventricle’s thicker wall generates higher pressure for systemic circulation.

73. Aorta

The aorta is the body’s largest artery, carrying oxygen-rich blood from the left ventricle to the entire body. It branches into smaller arteries to supply organs and tissues. Its thick, elastic walls help manage the high pressure from heartbeats.

74. Pulmonary Artery

The pulmonary artery carries deoxygenated blood from the right ventricle to the lungs for oxygenation. Unlike other arteries, it transports oxygen-poor blood. It divides into left and right branches, each supplying a lung, completing the pulmonary circuit.

75. Sinoatrial (SA) Node

The sinoatrial (SA) node, in the right atrium, acts as the heart's natural pacemaker. It produces electrical impulses that start each heartbeat, setting the heart's rhythm and rate. The autonomic nervous system regulates the SA node to adjust heart rate as needed.

76. Electrocardiogram (ECG)

A test that records the heart's electrical activity. Shows the heart's rhythm and detects abnormalities. Commonly used to diagnose heart conditions. Produces waves like P, QRS, and T. Non-invasive and painless.

77. Blood Pressure

The force of blood against arterial walls. Expressed as systolic/diastolic (e.g., 120/80 mmHg). Maintains blood flow through vessels. Controlled by cardiac output and vessel resistance. Measured using a sphygmomanometer.

78. Hypertension

A condition of persistently high blood pressure. Increases risk of heart disease, stroke, and kidney damage. Often asymptomatic initially. Can be managed with lifestyle changes and medication. Defined as ≥130/80 mmHg

BP102T. PHARMACEUTICAL ANALYSIS (Theory)

UNIT I:

79. Pharmaceutical Analysis

It is a branch of chemistry that deals with analyzing drugs and pharmaceutical substances. It includes identification, quantification, and purification. Ensures drug quality and safety. Supports drug development and formulation. Applies techniques like spectroscopy and chromatography.

80. Qualitative Analysis

Identifies chemical components in a substance. Helps determine the presence of ions or compounds. Often uses color changes or precipitates. No quantity is measured. It forms the basis for further analysis.

81. Quantitative Analysis

Measures how much of a substance is present. Provides accurate concentration values. Used in formulation and quality control. Methods include titration and spectrometry. Ensures dosage precision.

82. Titration

A volumetric method to determine unknown concentrations. A known reagent is added until reaction completion. Indicator signals the endpoint. Commonly used in acid-base or redox reactions. Helps standardize solutions.

83. Molarity (M)

Number of moles of solute per liter of solution. It expresses solution concentration. Essential for stoichiometric calculations. Influences reaction rate and equilibrium. Units are mol/L.

84. Normality (N)

Gram equivalent weight of solute per liter of solution. Depends on reaction type (acid-base, redox). More specific than molarity. Used in titrations. Expressed in eq/L.

85. Primary Standard

A pure, stable compound used to prepare standard solutions. It has a known formula and high purity. Used directly in titrations. Examples include oxalic acid and potassium hydrogen phthalate. Must be non-hygroscopic.

86. Secondary Standard

A solution whose concentration is determined by titration with a primary standard. Less pure and stable. Used when a primary standard isn't available. Must be standardized before use. Example: NaOH.

87. Standardization

The process of accurately determining the concentration of a solution. Involves titrating against a primary standard. Ensures solution reliability. Important for consistent analytical results. Used before analysis.

88. Pharmacopoeia

An official book of drug standards. Lists monographs, tests, and formulations. Guides pharmaceutical manufacturing and quality control. Examples include USP and IP. Legally binding for drug approval.

89. Limit Test

Detects and controls small quantities of impurities. Not quantitative but semi-quantitative. Ensures substances meet pharmacopeial standards. Common for arsenic, chloride, sulfate. Provides visual comparison.

90. Sources of Impurities

Originate from raw materials, manufacturing processes, storage, and containers. May affect drug safety and efficacy. Controlled through GMP and testing. Can include dust, solvents, or metal ions. Require identification and limitation.

91. Error

The difference between observed and true values. Can be systematic or random. Affects accuracy and precision. Must be minimized in analytical procedures. Impacts data reliability.

92. Systematic Error

Caused by consistent faults in instruments or methods. Leads to bias in results. Predictable and correctable. Example: calibration error. Affects accuracy, not precision.

93. Random Error

Occurs unpredictably due to environmental or human factors. Leads to scattered data. Reduces precision. Cannot be completely eliminated. Example: fluctuation in readings.

94. Precision

Consistency of repeated measurements. Reflects reproducibility. Independent of accuracy. High precision yields tightly clustered data. Evaluated using standard deviation.

95. Accuracy

Closeness of a measured value to the true value. Indicates correctness. Affected by systematic errors. High accuracy ensures valid results. Measured using error analysis.

96. Significant Figures

Reflect meaningful digits in a number. Include all known digits plus one estimated. Indicate precision of measurement. Important in calculations. Exclude leading/trailing zeros unless necessary.

97. Confidence Interval

A range that likely contains the true value. Expressed with a probability (e.g., 95%). Accounts for uncertainty in measurements. Widens with more variability. Calculated using statistical methods.

98. Calibration

Adjusting and verifying instrument accuracy. Performed using standard references. Ensures reliable results. Required periodically. Essential in pharmaceutical labs.

UNIT II:

99. Acid-Base Titration

A method used to determine the concentration of an acid or base. It involves a neutralization reaction. A known titrant is added to an analyte. The endpoint is detected using an indicator. Common in pharmaceutical and water analysis.

100. Neutralization Reaction

A chemical reaction between an acid and a base. It forms salt and water. The reaction is exothermic. Basis of acid-base titration. Occurs at the equivalence point.

101. Indicator

A chemical that changes color at a specific pH range. Used to detect the endpoint in titrations. Examples include phenolphthalein and methyl orange. Indicates completion of the reaction. Must be suitable for the titration type.

102. Phenolphthalein

A commonly used acid-base indicator. It is colorless in acidic solutions. Turns pink in basic solutions. Suitable for strong base vs. weak acid titrations. Transition pH range is 8.3–10.

103. Methyl Orange

An acid-base indicator with sharp color change. Red in acidic and yellow in basic conditions. Used in strong acid vs. weak base titrations. Transition pH range is 3.1–4.4. Provides clear endpoint detection.

104. Strong Acid

Completely dissociates in water. Produces high concentrations of hydrogen ions (H^+). Examples include HCl, H_2SO_4, HNO_3. Has a very low pH. Reacts rapidly with bases.

105. Weak Acid

Partially dissociates in water. Produces fewer hydrogen ions. Examples include acetic acid and citric acid. Has a higher pH than strong acids. Requires special titration methods.

106. Strong Base

Completely dissociates in water to release hydroxide ions (OH^-). Examples include NaOH and KOH. Has high pH and strong conductivity. Reacts completely with acids. Used in standard titrations.

107. Weak Base

Partially dissociates in water. Produces a small amount of OH^- ions. Example: Ammonia (NH_3). Reacts slowly with acids. Requires appropriate indicators and solvents.

108. Buffer Solution

A buffer solution resists pH changes by containing a weak acid and its conjugate base (or vice versa). It maintains stable pH during titrations and is vital for biological and pharmaceutical stability.

109. Titration Curve

A graph of pH versus volume of titrant added. Shows changes in pH during titration. Helps identify the equivalence point. Shape depends on acid/base strength. Useful for selecting indicators.

110. Equivalence Point

The stage in titration where acid equals base stoichiometrically. All the analyte has reacted. Not always the same as the endpoint. Detected by a sharp pH change or indicator. Crucial for accuracy.

111. Non-Aqueous Titration

A titration carried out in solvents other than water. Used for weakly acidic or basic drugs. Improves solubility and accuracy. Solvents like glacial acetic acid are used. Important in pharmaceutical assays.

112. Acidimetry

Quantitative determination of acidic substances. A standard base is used as titrant. Performed in both aqueous and non-aqueous systems. Requires appropriate indicators. Used in drug analysis.

113. Alkalimetry

Quantitative determination of basic substances. A standard acid is used as titrant. Helps assess purity and strength of bases. May involve aqueous or non-aqueous solvents. Important for dosage formulation.

114. Sodium Benzoate

A preservative found in foods and pharmaceuticals. Can be analyzed using non-aqueous titration. Weakly acidic in nature. Often titrated with strong bases in solvents like methanol. Ensures safety and compliance.

115. Ephedrine HCl

A sympathomimetic drug. Weakly basic, hence estimated by non-aqueous titration. Requires strong acids like perchloric acid in glacial acetic acid. Assures correct dosage. Sensitive to water-based titrations.

116. Solvent System

Medium in which non-aqueous titrations occur. Must dissolve analyte and titrant well. Examples include glacial acetic acid, acetonitrile. Should not interfere with the reaction. Chosen based on analyte properties.

117. Neutralization Endpoint

The point where neutralization is visibly or instrumentally detected. Signaled by color change or pH jump. Indicator choice is critical. Should coincide with the equivalence point. Ensures titration accuracy.

118. Autoprotolysis

Self-ionization of a solvent molecule. One molecule acts as acid, another as base. Example: $2CH_3COOH \rightleftharpoons CH_3COO^- + CH_3COOH_2^+$. Important in non-aqueous titration systems. Influences solvent behavior and pH range.

UNIT III:

119. Precipitation Titration

A titration based on the formation of an insoluble precipitate. Commonly used for halide ions like Cl^-. Silver nitrate is a standard titrant. Endpoint is detected using indicators like dichlorofluorescein. Follows stoichiometric reaction.

120. Mohr's Method

A type of precipitation titration for chlorides and bromides. Uses silver nitrate as titrant and potassium chromate as indicator. Forms red precipitate of silver chromate at endpoint. Performed at neutral pH. Requires careful pH control.

121. Volhard's Method

An indirect titration method. Excess $AgNO_3$ reacts with halide; unreacted Ag^+ titrated with thiocyanate. Uses ferric ion as indicator. Performed in acidic medium. Suitable for colored or turbid samples.

122. Fajans Method

An adsorption indicator-based precipitation titration. Uses dichlorofluorescein as indicator. Detects endpoint by color change on precipitate surface. Requires specific pH and clear solution. Suitable for Cl^- determination.

123. Silver Nitrate ($AgNO_3$)

A standard solution in precipitation titrations. Reacts with halide ions to form precipitates. Used in Mohr's, Volhard's, and Fajans methods. Must be protected from light. Needs accurate standardization.

124. Potassium Chromate (K_2CrO_4)

An indicator in Mohr's method. Forms red silver chromate at endpoint. Used in neutral conditions. Sensitive to pH. Should not be used in acidic media.

125. Ferric Ammonium Sulfate

Acts as an indicator in Volhard’s method. Forms red complex with thiocyanate. Indicates endpoint with color change. Used in acidic medium. Enhances visibility of reaction completion.

126. Adsorption Indicator

An indicator that changes color when adsorbed on the surface of precipitate. Used in Fajans method. Sensitive to pH and ionic strength. Example: dichlorofluorescein. Works well in clear solutions.

127. Thiocyanate Titration

A back titration method. Excess $AgNO_3$ reacts with halide, and leftover Ag^+ titrated with SCN^-. Endpoint detected with ferric ion. Part of Volhard’s method. Useful for complex matrices.

128. Complexometric Titration

Involves formation of a stable complex between metal ions and ligands. EDTA is a common titrant. Used to estimate hardness of water and metal content. Requires metal ion indicators. Highly selective and accurate.

129. EDTA (Ethylenediaminetetraacetic Acid)

A chelating agent used in complexometric titrations. Binds to metal ions in 1:1 ratio. Forms stable, colorless complexes. Requires pH control. Used with indicators like Eriochrome Black T.

130. Metal Ion Indicator

Shows endpoint in complexometric titration. Forms colored complex with metal ions. Replaced by colorless EDTA complex. Examples: Eriochrome Black T, Murexide. Selection depends on metal and pH.

131. Eriochrome Black T

A metallochromic indicator. Used in estimation of Ca^{2+} and Mg^{2+}. Wine-red with metal ions, turns blue when complexed by EDTA. Requires pH ~10. Used in water hardness analysis.

132. Murexide

A metal ion indicator used for calcium and rare earth metals. Forms purple complex with Ca^{2+}. Changes color on complexation. Works in slightly alkaline medium. Useful for determining Ca content in drugs.

133. Masking Agent

A chemical that binds interfering metal ions without reacting with EDTA. Prevents unwanted side reactions. Allows selective titration. Examples: cyanide, triethanolamine. Improves titration specificity.

134. Demasking Agent

Releases masked metal ions for subsequent titration. Breaks metal-ligand complex. Used after masking in sequential titration. Ensures accuracy in multicomponent analysis. Example: formaldehyde.

135. Water Hardness

Caused by presence of Ca^{2+} and Mg^{2+} ions. Measured using complexometric titration with EDTA. Temporary hardness is due to bicarbonates. Permanent hardness due to sulfates/chlorides. Expressed in ppm of $CaCO_3$.

136. Standardization of EDTA

Determining exact concentration of EDTA solution. Done using primary standards like zinc or calcium salts. Required for accurate titration. Involves buffer for pH adjustment. Essential for quantitative analysis.

137. Ligand

A ligand is an ion or molecule that coordinates to a central metal atom or ion, resulting in the formation of a coordination complex. Ethylenediaminetetraacetic acid (EDTA) is an example of a hexadentate ligand, meaning it can form six bonds with a metal center. Ligands may be classified based on the number of donor atoms they possess—monodentate ligands donate one pair of electrons, while polydentate ligands, such as EDTA, can donate multiple pairs. The nature and denticity of a ligand significantly influence the stability of the resulting complex. This principle is fundamental to complexometric analysis, where chelating agents like EDTA are used to quantitatively analyze metal ions.

138. Stability Constant (Kf)

A measure of complex strength between metal and ligand. Higher Kf indicates more stable complex. Affects endpoint sharpness. Depends on pH and ionic strength. Guides selection of ligands.

UNIT IV:

139. Redox Titration

A titration involving oxidation-reduction reactions. One reactant is oxidized, the other reduced. Common titrants include $KMnO_4$ and $K_2Cr_2O_7$. Indicators or self-indication used. Applied in permanganometry, iodometry.

140. Oxidizing Agent

A substance that gains electrons and is reduced in a redox reaction. Causes oxidation of other species. Examples: $KMnO_4$, $K_2Cr_2O_7$, I_2. Used in titrations and disinfection. Strength measured in equivalent weight.

141. Reducing Agent

A substance that loses electrons and is oxidized. Reduces other substances in a redox reaction. Examples: sodium thiosulfate, oxalic acid, ferrous sulfate. Used in iodometry and permanganometry. Sensitive to oxidation by air.

142. Permanganometry

A redox titration using potassium permanganate ($KMnO_4$) as titrant. Acts as self-indicator due to its purple color. Used to estimate oxalic acid, hydrogen peroxide, iron. Requires acidic medium. End-point: pink color persists.

143. Iodometry

A redox method involving iodine and sodium thiosulfate. Indirect method where iodine is liberated and titrated. Used for copper, chlorine, and hydrogen peroxide estimation. Starch used as indicator. End-point: blue to colorless.

144. Iodimetry

A direct redox titration where iodine is used as titrant. Reacts with reducing agents like ascorbic acid. Starch indicator shows blue complex. Performed in slightly acidic medium. End-point is disappearance of blue color.

145. Starch Indicator

Forms a blue complex with iodine. Used in iodometric and iodimetric titrations. Added near endpoint to avoid irreversible binding. Highly sensitive to iodine. Provides visual clarity in titrations.

146. Potassium Dichromate ($K_2Cr_2O_7$)

A strong oxidizing agent used in redox titrations. Stable and primary standard. Requires external indicator like diphenylamine. Used to estimate Fe^{2+} and organic compounds. Works in acidic medium.

147. Sodium Thiosulfate ($Na_2S_2O_3$)

A reducing agent used in iodometric titrations. Reduces iodine to iodide. Standardized with potassium dichromate. Sensitive to air oxidation. Common in chlorine and copper assays.

148. Back Titration

Involves reacting analyte with excess standard reagent, then titrating the unreacted portion. Used when direct titration is not feasible. Ensures accurate endpoint detection. Common in insoluble or slow reactions. Example: calcium with EDTA.

149. Self Indicator

A reagent that changes color by itself at endpoint. No external indicator needed. Example: $KMnO_4$ turns from purple to colorless upon reduction. Useful for simplicity. Ensures easy endpoint detection.

150. Equivalent Weight

The mass of a substance that reacts with or supplies 1 mole of electrons. Depends on the valency or redox state change. Used in normality calculations. Essential in redox titration stoichiometry. Varies between reactions.

151. Primary Standard

A reagent that is pure, stable, non-hygroscopic, and has a known formula weight. Used to standardize solutions. Examples: $K_2Cr_2O_7$, oxalic acid. Ensures accurate titration. Doesn't require frequent re-standardization.

152. Secondary Standard

A solution whose concentration is determined by standardization with a primary standard. Less stable or pure than primary standards. Examples: $KMnO_4$, $Na_2S_2O_3$. Needs regular standardization. Used in routine titrations.

153. End Point

The point in titration where indicator shows that reaction is complete. Should be close to equivalence point. Detected by color change or electrode. Crucial for accurate titration. Depends on proper indicator selection

154. Equivalence Point

The theoretical point where moles of titrant equal moles of analyte. Represents stoichiometric completion. May differ slightly from endpoint. Essential for calculation accuracy. Not always visually detectable.

155. Indicators in Redox Titration

Substances showing color change at endpoint. Internal (like starch) or external (like diphenylamine). Selected based on redox potential. Must not interfere with titration. Sharp color change ensures precision.

156. Normality (N)

A concentration unit representing equivalents per liter. Used in redox, acid-base, and precipitation titrations. Depends on n-factor of solute. Allows direct titration calculations. Related to molarity via equivalent concept.

157. Standardization of $KMnO_4$

Done using primary standards like oxalic acid or sodium oxalate. Ensures accurate concentration for titrations. Requires heating to speed reaction. $KMnO_4$ acts as self-indicator. Freshly prepared solutions preferred.

UNIT V:

158. Conductometry

Measures changes in electrical conductivity during a chemical reaction or titration. Indicates the progress of ionic reactions. Common in acid-base and precipitation titrations. Requires a conductivity cell and meter. Offers simple, rapid analysis without indicators.

159. Electrolyte

A substance that dissociates into ions in solution, enabling electrical conduction. Can be strong or weak based on ionization. Essential for electrochemical cell function. Examples: NaCl, KNO_3. Used in batteries, titrations, and bioelectrical systems.

160. Potentiometry

An electroanalytical method measuring voltage of an electrochemical cell without current flow. Determines ion concentration, especially pH. Requires a reference and indicator electrode. Based on Nernst equation. Used in titrations and pH measurements.

161. Reference Electrode

Maintains a constant potential regardless of the solution environment. Provides a comparison point in potentiometry. Examples: Calomel, Ag/AgCl electrodes. Essential for stable, accurate readings. Combined with indicator electrode for measurements.

162. Indicator Electrode

Responds to the activity or concentration of a specific analyte. Works with a reference electrode in potentiometry. Types include metal and ion-selective electrodes. Used in pH, redox, and ion detection. Provides a variable potential signal.

163. Polarography

Electrochemical technique measuring current as a function of applied voltage. Uses a dropping mercury electrode. Detects trace metals and organic compounds. Offers high sensitivity and quantitative analysis. Suitable for reducible analytes in solution.

164. Dropping Mercury Electrode (DME)

Used in polarography, it releases mercury drops into solution. Provides a renewable surface with reproducible area. Ideal for detecting reducible substances. Minimizes contamination. Offers accurate current-voltage readings.

165. Rotating Platinum Electrode

A mechanically rotated electrode enhancing mass transport. Increases sensitivity and precision in electrochemical analysis. Common in voltammetry. Reduces diffusion layer thickness. Suitable for kinetic and mechanistic studies.

166. Electrochemical Cell

Consists of two electrodes in an electrolyte, facilitating redox reactions. Includes galvanic (spontaneous) and electrolytic (non-spontaneous) cells. Generates or uses electrical energy. Essential for electrochemical analysis. Measurable EMF output.

167. Nernst Equation

Calculates electrode potential based on ion concentration and temperature. Expressed as $E = E^{o} + (0.059/n) \log [\text{oxidized}]/[\text{reduced}]$. Key to understanding potentiometric data. Applied in pH, redox, and electrochemical studies. Reflects reaction equilibrium.

BP103T. PHARMACEUTICS- I (Theory)

168. Pharmacy

The science involving drug discovery, preparation, dispensing, and usage for health care. Ensures safe and effective medication use. Integrates pharmacology and clinical practice. Involves community, hospital, and industrial pharmacy. Requires regulatory and ethical adherence.

169. Pharmacopoeia

An official publication listing drug standards, purity criteria, and formulation protocols. Includes methods of analysis and dosage guidelines. Examples are IP, BP, and USP. Ensures quality assurance of medicines. Legally binding in pharmaceutical industry.

170. Indian Pharmacopoeia (IP)

India's official book for drug quality standards and testing protocols. Published by the Indian Pharmacopoeia Commission. Provides monographs for drugs used in India. Legally enforced for manufacturing and marketing. Ensures safety and efficacy.

171. British Pharmacopoeia (BP)

Official standard reference for medicines in the UK. Contains quality standards and analytical methods. Used by regulators, manufacturers, and pharmacists. Influences global pharmaceutical practices. Updated regularly by British authorities.

172. United States Pharmacopoeia (USP)

Sets quality standards for medicines marketed in the U.S. Influential in global pharmaceutical regulation. Covers identity, strength, purity, and consistency. Published by USP Convention. Used widely in industry and research.

173. Extra Pharmacopoeia

Non-official reference containing additional drug details. Also called Martindale's Extra Pharmacopoeia. Includes drug actions, uses, and chemical properties. Supplementary to official standards. Used by pharmacists and researchers for extended knowledge.

174. Dosage Form

The physical form in which a drug is delivered. Includes tablets, capsules, injections, and syrups. Influences absorption, stability, and patient compliance. Chosen based on route of administration. Ensures effective drug delivery.

175. Solid Dosage Form

Drugs presented in solid state like tablets, capsules, powders. Stable and easy to handle. Offers accurate dosing and long shelf-life. Most commonly used dosage type. Requires specific manufacturing techniques.

176. Liquid Dosage Form

Medications in liquid state like syrups, elixirs, and solutions. Ideal for children and elderly. Allows flexible dosing and rapid absorption. May require preservatives for stability. Easier for swallowing.

177. Prescription

A legal document instructing pharmacists to dispense specific medication. Written by licensed medical professionals. Contains patient name, drug details, and directions. Ensures correct treatment. Must be handled with confidentiality and accuracy.

178. Parts of a Prescription

Includes patient info, superscription (Rx), inscription (drug & dose), subscription (instructions), and signature. Also includes prescriber's name and date. Helps ensure safe and effective drug use. Must be clear and complete. Critical for legal validity.

179. Posology

Study of drug dosage based on various patient-specific factors. Ensures efficacy while avoiding toxicity. Essential in clinical and pediatric pharmacology. Accounts for age, weight, and organ function. Integral to personalized medicine.

180. Factors Affecting Posology

Includes age, weight, sex, health condition, and drug tolerance. Also considers genetic and environmental influences. Alters drug metabolism and response. Determines appropriate dosage for safety. Crucial for individualized treatment.

181. Pediatric Dose Calculation

Process of adjusting adult doses for children. Based on weight, age, or body surface area. Ensures therapeutic effect without toxicity. Common methods include Young’s, Clark’s, and BSA rule. Pediatric pharmacokinetics differ from adults.

182. Young’s Rule

Calculates child dose using age formula: (Age / (Age + 12)) × Adult Dose. Suitable for children above 1 year. Simple and quick estimation. Assumes linear development. May not account for weight variations.

183. Clark’s Rule

Uses child’s weight for dose: (Weight in lbs / 150) × Adult Dose. More accurate than age-based methods. Assumes average adult weight is 150 lbs. Easy for clinical settings. Requires accurate weight measurement.

184. Body Surface Area (BSA) Method

Most precise pediatric dose calculation. Formula: (BSA of child / 1.73) × Adult Dose. Accounts for metabolic activity. Requires BSA chart or nomogram. Preferred in oncology and intensive care.

185. Geriatric Pharmacology

Focuses on drug effects in elderly due to altered physiology. Includes slower metabolism, renal clearance, and increased sensitivity. Polypharmacy is common in this group. Doses must be adjusted. Prevents adverse drug reactions.

186. Toxicology

Science of harmful effects of substances on organisms. Covers dose-response relationships, antidotes, and poisoning management. Includes acute, chronic, and organ-specific toxicity. Essential in forensic and clinical settings. Part of drug safety studies.

187. Medication Errors

Mistakes in prescribing, dispensing, or administering drugs. May lead to adverse outcomes or death. Includes wrong dose, drug, or route. Prevention requires protocols and double-checks. Focus of pharmacovigilance and quality assurance.

UNIT II:

188. Imperial System

A traditional system of weights and measures used in some countries. Includes units like ounces (oz), pounds (lb), and pints. Still used in some prescriptions. Not based on decimals. Being replaced by the metric system in many regions.

189. Metric System

A decimal-based universal measurement system. Uses grams, liters, and meters for weight, volume, and length. Preferred in science and pharmacy. Simplifies calculations and conversions. Internationally recognized and standardized.

190. Percentage Solutions

Solutions expressed in % w/v, v/v, or w/w. Common in pharmaceutical preparations. Indicates concentration of solute in 100 units of solvent or total solution. Crucial for accurate dosing. Used in labeling and compounding.

191. Alligation

A method used to mix two solutions of different strengths. Helps obtain a desired concentration. Involves mathematical calculation. Common in compounding pharmacy. Used in both alligation medial and alternate.

192. Proof Spirit

A measure of alcohol strength used in pharmacy. 100° proof equals 57.1% v/v ethanol. Used in making tinctures and alcoholic preparations. Originated from old British standards. Now replaced by % strength in most contexts.

193. Isotonic Solution

Has the same osmotic pressure as body fluids like blood. Prevents cell shrinkage or swelling. Suitable for injections, eye drops, and IV fluids. Ensures patient comfort and safety. Includes 0.9% sodium chloride solution.

194. Eutectic Mixture

A combination of two solids that liquefy when mixed. Happens due to interaction at molecular level. Requires proper handling in powder formulation. Common examples include menthol and camphor. Stored carefully to avoid liquefaction.

195. Geometric Dilution

A mixing method for potent drugs with large amount of diluents. Involves stepwise mixing in equal proportions. Ensures even distribution of active ingredient. Common in compounding. Prevents dosing errors.

196. Dusting Powder

A fine medicated powder for external use. Applied on skin for antiseptic, soothing, or drying effects. Should be free-flowing and non-irritant. Must be sterilized if used on open wounds. Examples: talc-based powders.

197. Effervescent Powder

Contains acid and carbonate components. Releases carbon dioxide gas on contact with water. Enhances taste and improves palatability. Often used for antacids and vitamin C. Should be kept dry in airtight containers.

198. Hygroscopic Powder

Absorbs moisture from the atmosphere. Becomes clumpy or liquefied over time. Requires moisture-proof packaging. Examples include calcium chloride and zinc chloride. Stored in desiccators or tightly sealed containers.

199. Efflorescent Powder

Contains water of crystallization that is released upon exposure to air. Appears damp or clumpy. Loses weight and potency. Example: sodium carbonate decahydrate. Must be stored in tightly closed containers.

200. Simple Powder

Consists of a single powdered drug. Easy to prepare and dispense. Used for direct administration or compounding. Requires accurate weighing. Often used for pediatric or topical use.

201. Compound Powder

Contains two or more active ingredients in powdered form. Designed for synergistic or combined therapeutic effects. Must be mixed uniformly. Used internally or externally. Example: compound sodium bicarbonate powder.

202. Liquid Dosage Form

Drug formulations in a liquid state like solutions, suspensions, and emulsions. Allows easy swallowing, especially for children and elderly. Ensures quick absorption. Requires preservatives. Dosage is flexible.

203. Excipients

Inactive substances added to drug formulations. Aid in drug delivery, stability, taste, and appearance. Examples: binders, preservatives, diluents. Do not have therapeutic effect. Essential for manufacturing quality medicines.

204. Solubility Enhancement

Techniques to increase a drug's solubility. Includes pH adjustment, particle size reduction, surfactants, and complexation. Improves bioavailability and therapeutic efficacy. Crucial for poorly soluble drugs. Applied during formulation development.

205. Suspending Agent

A substance added to suspensions to maintain uniform dispersion. Prevents settling of insoluble particles. Increases viscosity of the formulation. Examples: tragacanth, sodium carboxymethyl cellulose. Ensures accurate dosing.

206. Flocculation

Process where particles form loose aggregates in suspension. Improves redispersibility and prevents hard cake formation. Aids in physical stability. Induced by adding flocculating agents. Leads to a more user-friendly suspension.

207. Deflocculated Suspension

Contains fine particles that remain dispersed longer. Settles slowly but forms hard cake over time. Difficult to redisperse. May affect dose uniformity. Not ideal for long-term stability.

UNIT III:

208. Monophasic Liquid

A single-phase liquid dosage form. Contains dissolved active ingredients in a uniform solution. Examples include syrups, elixirs, and solutions. Offers consistent dosing and ease of administration. Often flavored for better palatability.

209. Biphasic Liquid

A formulation with two immiscible phases, such as oil and water. Includes suspensions (solid in liquid) and emulsions (liquid in liquid). Requires shaking before use to ensure uniformity. Needs stabilizing agents. Common in pediatric and dermatologic preparations.

210. Gargles

Aqueous solutions used to cleanse the throat or relieve irritation. Contain antiseptics or soothing agents. Not meant to be swallowed. Used by tilting the head and gargling at the back of the throat. Commonly used for sore throat and oral infections.

211. Mouthwash

Liquid preparations used for oral hygiene. Contains antiseptics, antifungal, or analgesic agents. Helps reduce bacteria, freshen breath, and treat oral conditions. Usually alcohol-based. Swished in the mouth and expelled.

212. Throat Paint

A viscous, medicated liquid applied directly to the throat mucosa. Used for local treatment of throat infections or inflammation. Applied with a brush or swab. Contains antiseptics, anesthetics, or antifungal agents. Provides localized, prolonged action.

213. Eardrops

Sterile liquid dosage forms used in the ear canal. Treat infections, remove wax, or relieve pain. Must be isotonic and free of irritants. Applied using a dropper. Stored in sterile containers with proper labeling.

214. Nasal Drops

Liquid medication administered through the nose. Used for local or systemic effects (e.g., decongestion, hormone delivery). Should be sterile and isotonic. Convenient for rapid absorption through nasal mucosa. Applied with a dropper.

215. Enema

Liquid preparation administered rectally. Used for bowel evacuation or drug delivery. Can be cleansing or retention type. Acts locally or systemically. Requires careful administration technique.

216. Syrup

Concentrated aqueous solutions of sugar with or without medicinal agents. Sugar provides sweetness and preservation. Masks unpleasant taste. Viscous and stable. Common for pediatric use.

217. Elixir

Clear, sweetened, hydro-alcoholic solutions for oral administration. Used for soluble drugs requiring alcohol as a solvent. Pleasant tasting and easy to administer. Less viscous than syrups. Must be stored tightly closed.

218. Liniment

Medicinal liquids for external use, applied by rubbing. Provides relief from pain, stiffness, or inflammation. Contains counterirritants or analgesics. Should not be applied to broken skin. Alcoholic or oily base.

219. Lotion

Fluid preparations for external application to the skin. Used for cooling, soothing, or protective effects. Applied without rubbing. Often used in dermatological conditions. Contains suspended or dissolved ingredients.

220. Emulsions

Biphasic systems where one liquid is dispersed in another immiscible liquid. Requires emulsifying agents for stability. Can be oil-in-water or water-in-oil type. Needs shaking before use. Used in oral and topical formulations.

221. Emulsifying Agent

A substance that stabilizes emulsions by reducing interfacial tension. Keeps dispersed phase evenly distributed. Examples: lecithin, tweens, gums. Prevents separation of phases. Crucial in stable emulsion formulation.

222. Oil-in-Water Emulsion (O/W)

Oil is the dispersed phase and water is the continuous phase. Non-greasy and water washable. Suitable for oral or topical use. Requires hydrophilic emulsifiers. Used in creams and lotions.

223. Water-in-Oil Emulsion (W/O) – Water is the dispersed phase and oil is the continuous phase. Greasy and occlusive in nature. Suitable for dry skin and ointments. Uses lipophilic emulsifiers. Provides prolonged drug release.

224. Suspension

A biphasic system where solid particles are dispersed in a liquid medium. Particles are not soluble but uniformly distributed. Requires suspending agents. Must be shaken before use. Used for poorly soluble drugs.

225. Flocculated Suspension

Contains particles that form loose aggregates or flocs. Easily redispersible upon shaking. Settles rapidly but does not cake. Offers better physical stability. Preferred over deflocculated systems.

226. Deflocculated Suspension

Particles remain discrete and settle slowly. Risk of forming hard cake upon standing. Difficult to redisperse. Appears more uniform initially. Requires careful formulation to avoid caking.

227. Sedimentation Rate

The rate at which particles settle in a suspension. Depends on particle size, density, and viscosity. Indicates physical stability. Faster in flocculated systems. Should be minimized for uniform dosing.

Unit IV

228. Suppository

A solid dosage form designed to be inserted into body cavities (rectum, vagina, urethra). Releases the drug either for local effect (e.g., hemorrhoids) or systemic absorption. Melts or dissolves at body temperature. Useful for patients who cannot take oral medications. Available in various shapes and sizes based on the cavity of insertion.

229. Rectal Suppository

A suppository intended for insertion into the rectum. Often used for systemic drug absorption or for treating local conditions like hemorrhoids. Provides an alternative to oral administration when a patient is nauseous or vomiting. Melts or dissolves at body temperature. Common drugs include laxatives, antiemetics, and analgesics.

230. Vaginal Suppository

A solid dosage form for insertion into the vagina, typically used for treating infections or delivering hormones. Often contains antifungal, antibacterial, or contraceptive agents. Dissolves or melts at body temperature. Provides localized or systemic effects. Formulated to avoid irritation.

231. Urethral Suppository

A suppository inserted into the urethra, used for localized treatment of urinary tract infections or erectile dysfunction. Absorbs quickly into the bloodstream for rapid effect. Dissolves or melts at body temperature. Administered via a sterile applicator. Can be used to deliver both systemic and localized effects.

232. **Displacement Value**

The volume of a suppository base displaced by the active drug during preparation. Important for calculating the correct amount of base to use. Ensures accurate dosage when mixing active ingredients. Helps in formulating suppositories with correct volume. Calculated based on the density of both drug and base.

233. Pharmaceutical Incompatibility

Occurs when two or more drugs interact in a way that affects their stability, efficacy, or safety. Can be physical (e.g., color change, precipitation) or chemical (e.g., degradation of one drug). Requires careful formulation to avoid adverse reactions. Can result in reduced therapeutic effect or toxicity. Identifying incompatibilities is crucial for drug formulation.

234. Physical Incompatibility

A visible change between drugs that results in an undesirable product, such as precipitation or turbidity. Can occur when drugs are mixed in solution or in a dosage form. Examples include the formation of insoluble complexes or phase separation. May affect the drug's bioavailability. Commonly encountered in parenteral formulations.

235. Chemical Incompatibility

A reaction between drugs that causes decomposition or a loss of potency. Results in a chemical change, such as hydrolysis, oxidation, or reduction. Can render the drug ineffective or harmful. Common in solutions, suspensions, and some solid formulations. Requires careful selection of excipients and storage conditions.

236. Therapeutic Incompatibility

Occurs when the combination of two or more drugs leads to reduced efficacy or increased toxicity. May result from additive, synergistic, or antagonistic interactions.

Important to monitor when drugs are co-administered. Can affect drug therapy outcomes, especially in polypharmacy. Requires knowledge of drug-drug interactions.

237. Eutectic Incompatibility

A situation where two solid drugs, when mixed, form a liquid phase due to a decrease in melting point. Common in certain powder mixtures. Can complicate the formulation of powders or suppositories. Affects the physical stability of the mixture. Requires careful handling to avoid liquefaction.

UNIT V

238. Ointment

A semisolid formulation intended for external application to the skin or mucous membranes. Contains active drug(s) dispersed in a greasy or hydrophobic base. Provides prolonged contact with the skin. Primarily used for local effects like lubrication, protection, or therapeutic actions. Not easily absorbed; used for localized treatment.

239. Cream

A semisolid emulsion, typically consisting of oil and water phases. Used for external application to the skin for moisturizing, healing, or treating skin conditions. Can be oil-in-water (O/W) or water-in-oil (W/O) emulsion. Easily spreadable and absorbs quickly. Commonly used for conditions requiring a non-greasy formulation.

240. Paste

A thick, semisolid preparation containing a high proportion of solids. Provides a protective layer when applied to the skin. Less greasy than ointments and more adherent. Used for localized therapy, especially in conditions like rashes or burns. Often provides a drying effect.

241. **Gel**

A semisolid system consisting of a network of solid particles dispersed in a liquid, giving it a jelly-like consistency. Transparent or translucent and used for topical application. Contains a gelling agent such as carbomers or gelatin. Commonly used for drug delivery due to its ease of spreadability. Offers cooling and soothing effects.

242. Dermal Penetration

The ability of a drug to pass through the skin and reach systemic circulation or target tissue. Depends on the drug's molecular size, lipophilicity, and formulation. Influenced by skin condition and the presence of enhancers. Key in transdermal drug delivery systems. Essential in formulations like patches, creams, and gels.

243. Hydrophilic Base

A water-attracting base used in semisolid formulations like creams and gels. Allows easy absorption of water-soluble drugs. Provides moisturizing effects on the skin. Ideal for creating non-greasy formulations. Commonly used in aqueous-based topical preparations.

244. Lipophilic Base

An oil-based excipient used in semisolid preparations like ointments. Provides a greasy and occlusive layer over the skin, enhancing drug retention. Ideal for delivering lipophilic drugs. Slows down evaporation of water from the skin. Often used for emollient or protective formulations.

245. Absorption Base

A semisolid base capable of absorbing water into its structure. Can incorporate additional active ingredients such as water or aqueous solutions. Useful for preparing creams and lotions. Increases the formulation's ability to hydrate the skin. Examples include anhydrous lanolin.

246. Evaluation of Ointments

Includes tests for consistency, spreadability, drug release, and stability. Measures the texture and feel of the ointment when applied. Ensures uniformity in drug distribution. Tests the ointment's ability to release active ingredients. Includes rheological and physical testing to ensure quality control.

247. Permeation Enhancer

A substance used to increase the absorption of a drug through the skin. Works by altering the skin barrier or increasing the solubility of the drug. Can be surfactants, alcohols, or fatty acids. Used in transdermal drug delivery systems. Helps drugs penetrate the skin more efficiently, improving therapeutic outcomes.

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

UNIT I:

248. Pharmacopoeia

An official reference source that sets standards for the quality, purity, strength, and consistency of drugs and medicinal products. Includes specifications on testing methods, drug formulations, and dosage forms. Serves as a guideline for drug manufacturing, distribution, and regulatory approval. Published by regulatory bodies such as the United States Pharmacopeia (USP) or European Pharmacopoeia (EP). Ensures that pharmaceutical products meet safety and efficacy criteria.

249. Impurities

Unwanted or extraneous substances present in pharmaceutical compounds, affecting their quality, safety, and efficacy. These can result from raw materials, manufacturing processes, or degradation of the active ingredient. Impurities may cause adverse reactions or reduce the therapeutic effect. Can include organic, inorganic, or residual solvents. Proper identification and quantification are critical for drug safety and regulatory compliance.

250. Limit Test

A qualitative or semi-quantitative analysis used to detect and quantify impurities within specified limits. Commonly performed for metals, residues, and contaminants. Ensures that pharmaceutical products do not contain harmful levels of impurities. Typically used for raw materials and finished products. Helps maintain the purity and safety of drugs in compliance with pharmacopoeial standards.

251. Chloride Limit Test

A test used to determine chloride impurities in pharmaceutical substances. Conducted by reacting the sample with silver nitrate in the presence of nitric acid to form a white precipitate. The amount of precipitate is compared with a standard solution to assess chloride concentration. Helps ensure that chloride levels in the product remain within permissible limits. Important for maintaining the quality and safety of the drug.

252. Sulphate Limit Test

A test for the detection of sulfate impurities in pharmaceutical products. Involves reacting the sample with barium chloride and hydrochloric acid, which forms a white precipitate of barium sulfate if sulfates are present. The amount of precipitate indicates the level of sulfate impurities. Ensures the safety and purity of the pharmaceutical compound. Used in conjunction with other impurity tests to maintain drug quality.

253. Iron Limit Test

A test for measuring iron impurities in pharmaceutical preparations. The sample is treated with thioglycolic acid, which forms a reddish color in the presence of iron. The intensity of the color correlates with the iron concentration, which is compared against a standard solution. Helps ensure the product remains within the allowable limits for iron impurities. Critical for avoiding toxicity and ensuring the purity of drugs.

254. Arsenic Limit Test

A method to detect arsenic contamination in pharmaceutical substances. Conducted using Gutzeit's test, which involves the formation of a yellow or brown stain when arsenic is present. This test ensures that arsenic levels do not exceed acceptable limits, as it is a potent toxicant. Essential for maintaining the safety and regulatory compliance of drugs. Often applied to raw materials, intermediates, and finished products.

255. Lead Limit Test

A test for detecting lead impurities in pharmaceutical products. Conducted by reacting the sample with potassium cyanide and sodium sulfide, forming a lead sulfide precipitate if lead is present. The test ensures that lead contamination is below toxic levels. Critical for safeguarding public health by ensuring drugs do not contain harmful heavy metals. Widely used in ensuring the safety of both raw materials and final products.

256. **Heavy Metals Limit Test**

A test used to detect the presence of heavy metals, such as mercury, cadmium, and lead, in pharmaceutical substances. Involves precipitation reactions that identify the presence of heavy metals through sulfide formation. Ensures the product remains within acceptable limits for heavy metal contamination. Essential for product safety and regulatory compliance. Applied to ensure the purity and safety of both ingredients and finished formulations.

257. **Modified Limit Test**

A variation of the standard limit test, tailored to account for the stability, reactivity, or solubility of certain drugs. Used when the standard test procedure does not yield reliable results due to the nature of the drug. Helps ensure that impurities are detected within the specific context of the drug's properties. Adjusted procedures may involve different reagents or reaction conditions. Necessary for more accurate impurity testing, especially in complex formulations.

UNIT II:

258. **Buffer**

A buffer is a solution that resists pH changes when acids or bases are added. It usually contains a weak acid and its conjugate base or vice versa. Buffers maintain stable pH in biological and pharmaceutical systems, protecting enzyme activity and other processes. Common examples are acetate and phosphate buffers.

259. Buffer Capacity

Buffer capacity is the ability of a buffer solution to resist changes in pH upon the addition of an acid or base. The greater the concentration of the buffer components, the higher the buffer capacity. It is also influenced by the pH range of the buffer and its components. This property is important in maintaining the stability of drug formulations, particularly in intravenous and oral medications. Buffer capacity is measured by how much acid or base can be added before the pH shifts significantly.

260. Buffered Isotonic Solutions

Buffered isotonic solutions have the same osmotic pressure as body fluids, ensuring they do not disrupt cellular function when administered. They are formulated to maintain a physiological pH, often using buffer systems like phosphate or citrate. These solutions are essential in intravenous therapies and eye drops, as they prevent irritation and maintain the normal functioning of cells. Such solutions are critical for maintaining homeostasis in the body. An example is saline solution with a buffered pH to match body fluids.

261. Tonicity

Tonicity refers to the measure of osmotic pressure exerted by a solution compared to body fluids. It determines whether a solution will cause cells to shrink, swell, or remain unchanged. A solution’s tonicity is classified as isotonic, hypotonic, or hypertonic based on the osmotic pressure. Isotonic solutions have equal osmotic pressure to body fluids, while hypertonic and hypotonic solutions can cause cell shrinkage or swelling, respectively. Tonicity is critical for safe intravenous drug administration.

262. Isotonicity Adjustments

Isotonicity adjustments involve modifying the osmolarity of a solution to match that of body fluids, typically using sodium chloride equivalents. This ensures that the solution does not cause cells to shrink or swell when administered intravenously or through other routes. Sodium chloride is commonly used to adjust the osmolarity of solutions, often in eye drops, injections, and oral rehydration therapies. Ensuring isotonicity prevents potential irritation and discomfort. The adjustment process also involves calculating the amount of NaCl needed to achieve the desired osmolarity.

263. **Sodium Chloride (NaCl)**

Sodium chloride is a vital electrolyte used in intravenous (IV) therapy to maintain fluid balance and proper hydration. It helps regulate blood pressure and is crucial in nerve function and muscle contraction. In pharmaceutical preparations, NaCl is used in isotonic solutions to match body fluids' osmolarity, such as in saline injections. It is commonly used in rehydration therapy and wound care. Sodium chloride also plays a key role in maintaining pH and electrolyte balance in the body.

264. **Potassium Chloride (KCl)**

Potassium chloride is a vital electrolyte that supports nerve function, muscle contraction, and fluid and acid-base balance. Used in IV therapy and supplements, it treats low potassium levels (hypokalemia). Potassium is essential for heart health, but excess can cause dangerous arrhythmias, so KCl is given carefully to avoid hyperkalemia.

265. **Calcium Gluconate**

Calcium gluconate is a calcium supplement used to treat calcium deficiency and hypocalcemia. Administered intravenously, it quickly restores calcium levels. Calcium is vital for nerve signaling, muscle contraction, and blood clotting. It also protects the heart during hyperkalemia. Calcium gluconate is favored over calcium chloride because it causes less injection site irritation.

266. Oral Rehydration Salts (ORS)

Oral Rehydration Salts (ORS) are an electrolyte solution used to treat dehydration, especially caused by diarrhea or vomiting. The mixture typically includes sodium chloride, potassium chloride, glucose, and citrate, which help restore electrolyte balance and promote water absorption in the intestines. ORS is an essential and cost-effective treatment for dehydration, particularly in developing countries. It is used to prevent and treat dehydration in children and adults. WHO and UNICEF recommend ORS for managing dehydration in cases of diarrhea.

267. Physiological Acid-Base Balance

Physiological acid-base balance refers to the body's regulation of pH through buffer systems and organ functions, primarily the respiratory and renal systems. The body maintains a pH of approximately 7.35-7.45 in blood through a combination of buffers, ventilation (CO_2 regulation), and kidney excretion of hydrogen ions and bicarbonate. Disruption in acid-base balance can lead to conditions such as acidosis or alkalosis, which can impair cellular function and metabolism. Buffers like bicarbonate are key to stabilizing pH. This balance is essential for proper enzyme function and overall homeostasis.

268. Dentifrices

Dentifrices are substances used for cleaning teeth and maintaining oral hygiene. They typically contain abrasives, fluoride, and detergents to aid in plaque removal, cavity prevention, and breath freshening. Toothpaste is the most common form of dentifrice, but powders and gels are also available. Dentifrices are formulated to reduce the risk of gum disease and tooth decay while ensuring safety and effectiveness. Fluoride-containing dentifrices are recommended to strengthen enamel and prevent cavities.

269. Fluoride Therapy

Fluoride therapy involves the use of fluoride compounds to prevent dental caries (cavities) and strengthen tooth enamel. It can be administered topically through toothpaste or mouth rinses, or systemically through water fluoridation or supplements. Fluoride helps to remineralize enamel, making it more resistant to decay. It is commonly used in pediatric dentistry to prevent cavities in developing teeth. Excessive fluoride intake can lead to dental fluorosis, so careful regulation is important.

270. Sodium Fluoride

Sodium fluoride is a fluoride salt commonly used in toothpaste and dental treatments to prevent tooth decay. It helps to remineralize and strengthen tooth enamel by enhancing the absorption of calcium and phosphate. Sodium fluoride is also used in water fluoridation programs to reduce the incidence of dental cavities. It can be applied in topical fluoride treatments in dental offices. However, its usage must be monitored to avoid fluoride toxicity.

271. Zinc Eugenol Cement

Zinc eugenol cement is a dental material used for temporary fillings and as a base for other restorative materials. It has analgesic and antiseptic properties due to eugenol, which helps reduce pain and inflammation. The cement is easy to work with, offering excellent adhesion to tooth structures. It is commonly used in endodontics and as a temporary filling material following root canal treatments. Zinc eugenol cement is also used for making impressions and as a periodontal dressing.

272. Desensitizing Agents

Desensitizing agents, such as potassium nitrate, are compounds used to reduce tooth sensitivity, especially to hot or cold stimuli. These agents work by blocking the nerve signals that cause discomfort, providing relief to sensitive teeth. Potassium nitrate is commonly found in toothpaste for sensitive teeth, along with other agents like strontium chloride and calcium phosphates. Desensitizing agents may also form a protective layer over exposed dentin, further reducing sensitivity. They are especially useful for patients undergoing dental procedures or those with gum recession.

UNIT III

273. Gastrointestinal Agents

Gastrointestinal agents are drugs used to treat various digestive system disorders such as acid reflux, indigestion, constipation, and diarrhea. These agents work through different mechanisms, including acid neutralization, gastric protection, or stimulation of digestive enzymes. They are essential in managing symptoms of gastrointestinal diseases like peptic ulcers and irritable bowel syndrome (IBS). These medications can either act locally in the digestive tract or be absorbed into the bloodstream to provide systemic effects. Examples include antacids, laxatives, and antiemetics.

274. Acidifiers

Acidifiers are compounds like ammonium chloride that increase gastric acidity, aiding in digestion. They are used in conditions where gastric acid levels are low, such as hypochlorhydria or achlorhydria. By enhancing gastric acid production, acidifiers help promote the breakdown of food and absorption of nutrients. These agents are also used to treat certain metabolic disorders where there is a need to acidify the urine. Ammonium chloride is a common acidifier in clinical settings for managing urinary tract alkalinity.

275. Dilute Hydrochloric Acid (Dil. HCl)

Dilute hydrochloric acid is a supplement used to aid digestion in individuals with hypochlorhydria (low stomach acid levels). It helps to replace missing gastric acid, improving food digestion and absorption of nutrients. The acid works by lowering the pH in the stomach, which activates pepsinogen to pepsin, an enzyme involved in protein digestion. Dilute hydrochloric acid is commonly used as a short-term treatment to enhance digestive function in patients with low stomach acidity. It can also be used to test for gastric acid production levels.

276. Antacids

Antacids neutralize stomach acid to relieve heartburn, indigestion, and acid reflux by raising stomach pH. Common types include magnesium hydroxide, calcium carbonate, and aluminum hydroxide. They offer symptom relief and are often combined with other treatments for GERD or ulcers. Overuse may cause constipation or diarrhea.

277. Sodium Bicarbonate

Sodium bicarbonate is a systemic antacid that neutralizes gastric acid and raises the pH in the stomach. It works by reacting with hydrochloric acid to produce carbon dioxide, water, and sodium chloride. This reaction helps relieve symptoms of indigestion, heartburn, and gastric acidity. It is also used to treat conditions like metabolic acidosis and kidney dysfunction. However, sodium bicarbonate should be used with caution in patients with heart disease or kidney issues, as it can alter electrolyte balance.

278. **Aluminum Hydroxide Gel**

Aluminum hydroxide gel is a non-systemic antacid that not only neutralizes stomach acid but also provides a protective coating to the gastric lining. It is often used to treat peptic ulcers, indigestion, and gastritis. By neutralizing gastric acidity, it helps reduce irritation and pain caused by acid reflux. Aluminum hydroxide also has a mild constipating effect, which may be beneficial in patients with diarrhea. The gel form is preferred for its slow release and longer duration of action in the stomach.

279. Magnesium Hydroxide

Magnesium hydroxide is both a laxative and an antacid. As an antacid, it neutralizes stomach acid, providing relief from indigestion and heartburn. As a laxative, it works by drawing water into the intestines, promoting bowel movement and relieving constipation. Magnesium hydroxide is commonly found in over-the-counter preparations for both conditions. It is well-tolerated, but excessive use can lead to electrolyte imbalances, particularly elevated magnesium levels, which can affect heart and kidney function.

280. Cathartics

Cathartics are agents that promote defecation by stimulating bowel movements or increasing the water content in the intestines. They are used to treat constipation, either by promoting peristalsis or softening stool. There are several types of cathartics, including stimulant laxatives, osmotic laxatives, and bulk-forming agents. Stimulant cathartics, such as bisacodyl, act on the colon to induce muscle contractions. Osmotic cathartics, such as magnesium sulfate, draw water into the intestines to soften stool.

281. **Magnesium Sulfate**

Magnesium sulfate is an osmotic laxative that increases water retention in the intestines, softening stool and promoting bowel movements. It is commonly used to treat constipation and as a bowel preparation before surgeries or colonoscopies. Magnesium sulfate can also be used intravenously to treat magnesium deficiency and to prevent seizures in pregnant women with preeclampsia. While effective, it should be used cautiously as excessive intake can lead to hypermagnesemia, causing cardiovascular issues.

282. Sodium Orthophosphate

Sodium orthophosphate is a bowel-cleansing agent used before colonoscopy procedures. It works by increasing the osmotic pressure within the colon, leading to water retention and softening of stools, facilitating bowel evacuation. This preparation is used to clear the intestines of fecal matter to provide a clear view during colonoscopy. It is typically administered in oral or enema form and must be used with caution in patients with renal impairment, as it may cause electrolyte imbalances.

283. Kaolin and Bentonite

Kaolin and bentonite are clay-based adsorbents used to treat diarrhea by absorbing excess water and toxins in the intestines. Kaolin is an alumino-silicate mineral, while bentonite is a type of clay that absorbs fluid in the gastrointestinal tract. These agents help reduce the frequency of stools and are often included in anti-diarrheal formulations. They also provide soothing effects for the gut lining. Kaolin and bentonite are typically used in combination with other agents, such as pectin, for more effective diarrhea management.

284. Antimicrobial Agents

Antimicrobial agents are substances that kill or inhibit the growth of microorganisms, such as bacteria, viruses, fungi, or parasites. These agents are essential in treating infections caused by harmful pathogens. Antimicrobials can be classified into antibiotics, antivirals, antifungals, and antiparasitics, depending on the type of organism they target. They can work through various mechanisms, such as inhibiting cell wall synthesis, disrupting protein synthesis, or interfering with viral replication. Proper use of antimicrobial agents is crucial in preventing resistance.

285. Potassium Permanganate

Potassium permanganate is a strong oxidizing agent with antiseptic properties. It is used in dilute solutions for treating skin conditions such as fungal infections, eczema, and ulcers. It works by releasing oxygen when dissolved, which helps cleanse wounds and inhibit the growth of bacteria and fungi. Potassium permanganate is also used in water purification and as a disinfectant. It should be used with caution, as concentrated solutions can cause skin irritation or staining.

286. Boric Acid

Boric acid is an antimicrobial agent used in ophthalmic and dermatological applications. It has antiseptic, antifungal, and antiviral properties, making it effective for treating eye infections, skin irritations, and wounds. Boric acid is commonly used in the form of eye drops to relieve symptoms of conjunctivitis and other ocular conditions. It is also found in some topical powders for fungal infections. Due to its toxicity, boric acid should be used in appropriate concentrations and under medical supervision.

287. Hydrogen Peroxide

Hydrogen peroxide is a disinfectant and antiseptic that decomposes into oxygen and water, which helps cleanse wounds and disinfect surfaces. It is commonly used for cleaning minor cuts and abrasions. Hydrogen peroxide works by releasing oxygen, which helps to kill bacteria and cleanse the wound. It is also used in some mouthwashes and dental products for its antibacterial properties. While effective, it should be diluted properly to avoid tissue irritation.

288. Chlorinated Lime

Chlorinated lime is a bleaching and disinfecting agent with antimicrobial properties. It is used for water purification, sanitation, and disinfection of surfaces, particularly in areas prone to contamination. Chlorinated lime releases chlorine when dissolved in water, which kills bacteria and other pathogens. It is used in industrial and municipal water treatment processes to purify drinking water. However, chlorinated lime should be handled with care as it is corrosive and can cause irritation to the skin and eyes.

289. Iodine Preparations

Iodine preparations are antiseptic formulations containing iodine, commonly used for wound disinfection and skin antisepsis. Iodine has broad-spectrum antimicrobial properties, effective against bacteria, viruses, fungi, and protozoa. Iodine tinctures, iodophors, and iodine solutions are used in medical settings for preparing skin before surgery or for treating infections. While iodine is highly effective, it can cause skin irritation or allergic reactions in some individuals. Iodine-based antiseptics are also used in water purification in emergency situations.

UNIT IV

290. Expectorants

Expectorants are drugs that promote the clearance of mucus from the respiratory tract, easing breathing. They work by thinning and loosening mucus, which helps to expel it from the lungs, bronchi, and trachea. This makes coughing more productive and reduces congestion in conditions like bronchitis, asthma, and common colds. The most common expectorant is guaifenesin, which is often included in cough syrups and tablets. Expectorants are commonly used in combination with other drugs to treat respiratory infections and allergies.

291. Potassium Iodide

Potassium iodide is an expectorant that helps to loosen mucus in the respiratory tract, making it easier to clear. It is also used as a supplement for iodine, which is essential for thyroid function. Potassium iodide is particularly effective in the treatment of chronic respiratory conditions such as bronchitis and asthma. Additionally, it is used in emergency situations to protect the thyroid from radioactive iodine exposure, such as after a nuclear accident. Potassium iodide can also treat certain skin conditions, such as dermatitis herpetiformis.

292. Ammonium Chloride

Ammonium chloride is used as an expectorant to promote the clearance of mucus in the respiratory tract. It also serves as a systemic acidifier, helping to lower the pH in the blood. This makes it useful in treating conditions like chronic cough, bronchitis, and respiratory tract infections. By reducing the viscosity of mucus, ammonium chloride helps relieve chest congestion. However, it should be used with caution in individuals with kidney or liver diseases, as it can alter electrolyte balance.

293. Emetics

Emetics are agents that induce vomiting, typically to expel toxic substances from the stomach after ingestion of poisons or drugs. They work by stimulating the vomiting center in the brain to trigger the emetic response. Emetics are used in emergency situations, such as poisoning, to remove harmful substances before they are absorbed into the bloodstream. However, they are not always appropriate, particularly in cases of caustic poisoning or if the patient is unconscious. Activated charcoal is often used alongside emetics for better toxin absorption.

294. Copper Sulfate

Copper sulfate is a potent emetic commonly used in the past for the treatment of poisoning. When ingested, it irritates the stomach lining and induces vomiting, helping to expel toxic substances. It is less commonly used today due to safer alternatives, but it may still be employed in certain situations under medical supervision. Copper sulfate also has antifungal and algicidal properties, making it useful in agriculture. However, excessive ingestion can lead to copper toxicity, causing symptoms such as nausea, vomiting, and liver damage.

295. Sodium Potassium Tartrate

Sodium potassium tartrate is a salt with both laxative and emetic properties. It works as an osmotic laxative by drawing water into the intestines, facilitating bowel movements. When ingested in larger amounts, it can also act as an emetic, inducing vomiting. This compound has historical use in emergency poisoning situations but is now largely replaced by safer options. It is sometimes used in laboratory settings for specific chemical reactions due to its unique properties.

296. **Haematinics**

Haematinics are substances that stimulate the production of red blood cells (RBCs) or increase hemoglobin levels in the blood. These agents are primarily used in the treatment of anemia, particularly iron-deficiency anemia, and are essential for maintaining optimal oxygen-carrying capacity in the blood. Common haematinics include iron salts, vitamin B12, and folic acid. They help in the synthesis of hemoglobin and the formation of healthy RBCs. Haematinics can be taken orally or administered through injections, depending on the severity of anemia.

297. Ferrous Sulfate

Ferrous sulfate is an iron supplement used to treat iron-deficiency anemia. It supplies iron needed for hemoglobin production and oxygen transport. Usually taken orally, intravenous forms exist for severe cases or malabsorption. Side effects like stomach upset and constipation can be reduced by taking it with food or using alternative iron types.

298. **Ferrous Gluconate**

Ferrous gluconate is a well-absorbed iron supplement used to treat iron-deficiency anemia. It provides a gentler alternative to ferrous sulfate, causing fewer gastrointestinal side effects such as constipation or stomach upset. Ferrous gluconate is typically administered orally and is preferred for patients who have difficulty tolerating other iron supplements. Like other iron supplements, it works by replenishing iron stores and aiding in the production of hemoglobin and red blood cells.

299. **Poisons**

Poisons are toxic substances that can cause harm or death to living organisms when absorbed or ingested in sufficient quantities. They can affect various bodily systems, including the nervous system, respiratory system, and cardiovascular system. Poisons may be chemical, biological, or physical in nature and include substances like heavy metals, pesticides, and certain plants and animals. Poisoning can occur through ingestion, inhalation, or skin absorption, and prompt treatment is essential to minimize damage.

300. Antidotes

Antidotes are substances used to neutralize or counteract the effects of poisons. They work through various mechanisms, such as binding to the toxin to prevent absorption, neutralizing its effects, or enhancing its elimination from the body. Antidotes are critical in the management of poisoning and can significantly improve patient outcomes. Some common antidotes include activated charcoal for drug overdoses, naloxone for opioid toxicity, and atropine for organophosphate poisoning. The effectiveness of an antidote depends on the type of poison and the timing of administration.

301. **Sodium Thiosulfate**

Sodium thiosulfate is an antidote used in cases of cyanide and arsenic poisoning. It works by converting cyanide into a less toxic substance called thiocyanate, which can then be excreted by the kidneys. Sodium thiosulfate is often used in combination with other treatments, such as sodium nitrite, to treat cyanide poisoning in emergency situations. It is administered intravenously and is effective in preventing the lethal effects of cyanide, which can interfere with cellular respiration.

302. **Activated Charcoal**

Activated charcoal is a universal adsorbent used to treat drug overdoses and poisoning. It works by binding to toxins and preventing their absorption into the bloodstream. Activated charcoal is most effective when administered within one hour of ingestion and can be used for a variety of substances, including drugs, chemicals, and some poisons. It is commonly used in emergency departments for poisoning cases and can be administered orally or via a nasogastric tube. However, it is not effective for all toxins, particularly those that are corrosive or absorbed slowly.

303. **Sodium Nitrite**

Sodium nitrite is an antidote used to treat cyanide poisoning. It works by converting hemoglobin into methemoglobin, which has a high affinity for cyanide, thereby binding it and preventing it from affecting cellular respiration. Sodium nitrite is typically administered intravenously in emergency settings, often in combination with sodium thiosulfate, to treat cyanide toxicity. While effective, the use of sodium nitrite must be carefully monitored, as excessive methemoglobin levels can be harmful.

304. Astringents

Astringents are agents that contract body tissues and reduce secretions. They are used to control bleeding, reduce inflammation, and promote tissue healing. Astringents work by causing the proteins in the tissue to coagulate, which helps tighten the skin or mucous membranes. They are commonly used in dermatological treatments, as well as in oral care products. Examples of astringents include aluminum acetate, tannins, and zinc oxide. They are useful in conditions like hemorrhoids, skin abrasions, and excessive sweating.

305. Zinc Sulfate

Zinc sulfate is an astringent commonly used in ophthalmic and dermatological applications. It has antiseptic and astringent properties that help treat eye irritations, conjunctivitis, and minor skin wounds. Zinc sulfate can also be used as a supplement to support immune function and wound healing. In ophthalmic formulations, it helps reduce swelling and inflammation in the eye. Zinc sulfate is available in various forms, including ointments, drops, and tablets, for both topical and systemic use.

306. **Potash Alum**

Potash alum is an astringent with a wide range of applications in wound healing and water purification. It helps contract tissues and stop bleeding by causing protein coagulation. In wound healing, potash alum is applied topically to reduce inflammation and prevent infection. It is also used in water treatment processes to clarify and disinfect water by coagulating impurities. Potash alum is available as a powder or solution and is used in both industrial and medicinal applications.

UNIT V:

307. Local Anesthetics

Local anesthetics are drugs that block the sensation of pain in a specific area of the body without affecting consciousness. They work by inhibiting nerve signal transmission, typically by blocking sodium channels in nerve fibers. Commonly used in dental procedures, minor surgeries, and diagnostic tests, they provide temporary relief from pain. Examples include lidocaine, novocaine, and benzocaine. Local anesthetics are usually administered via injection, topical application, or as a gel, and are often combined with vasoconstrictors to prolong their effect.

308. Lidocaine

Lidocaine is a widely used local anesthetic that provides rapid and effective pain relief. It works by blocking sodium channels, preventing nerve cells from transmitting pain signals. Lidocaine is commonly used in dental procedures, minor surgeries, and to treat arrhythmias. It can be administered topically, via injection, or as a patch. In addition to its anesthetic properties, lidocaine also has antiarrhythmic effects, which makes it useful in treating heart rhythm disorders.

309. **Procaine**

Procaine is a local anesthetic commonly used for dental and minor surgical procedures. It works by blocking sodium channels, which prevents the propagation of nerve impulses and thus eliminates the sensation of pain in the area where it is applied. Procaine is typically administered via injection and is often used in combination with epinephrine to prolong its action. Although effective, procaine is less commonly used today in favor of newer anesthetics like lidocaine, which have a quicker onset and longer duration of action.

310. **Benzocaine**

Benzocaine is a local anesthetic commonly used for relieving pain in the skin and mucous membranes, especially for conditions such as sore throats, sunburns, and insect bites. It works by inhibiting nerve signal transmission in the affected area. Benzocaine is often found in over-the-counter topical products, including lozenges, gels, and ointments. Although it is effective for short-term pain relief, benzocaine can cause methemoglobinemia in rare cases, particularly when used in large quantities or in young children.

311. General Anesthetics

General anesthetics are drugs that induce a state of unconsciousness and lack of sensation throughout the entire body. These agents are typically used in surgeries and invasive procedures to ensure the patient does not feel pain or discomfort. General anesthetics can be administered via inhalation, intravenously, or as a combination of both. Examples include halothane, isoflurane, and propofol. These drugs work by affecting the central nervous system, specifically by depressing brain activity and inhibiting pain signals.

312. **Isoflurane**

Isoflurane is a volatile anesthetic used during surgery to induce general anesthesia. It is administered via inhalation and produces rapid onset and recovery times. Isoflurane is known for its ability to provide muscle relaxation and adequate analgesia during surgical procedures. It is considered safer than older agents like halothane, as it has a lower incidence of liver toxicity. However, isoflurane may cause respiratory depression and requires careful monitoring during use.

313. **Halothane**

Halothane is a volatile inhalational anesthetic that was commonly used for general anesthesia during surgery. It is known for its potent anesthetic effects and quick onset. While halothane was widely used for many years, it has largely been replaced by newer anesthetics such as isoflurane and sevoflurane due to concerns over its potential for liver toxicity and arrhythmias. Halothane is still used in some developing countries for certain surgeries, but its use has decreased significantly in modern anesthesiology.

314. **Propofol**

Propofol is a fast-acting intravenous anesthetic used to induce general anesthesia and provide sedation. It enhances GABA activity, causing central nervous system depression. Commonly used in surgeries, ICUs, and short procedures, it requires careful monitoring because it can depress breathing and heart function.

315. Nitrous Oxide

Nitrous oxide, also known as laughing gas, is a colorless, odorless gas used for mild sedation and pain relief, particularly in dental procedures and labor. It is commonly mixed with oxygen and inhaled by patients. Nitrous oxide works by depressing the central nervous system and has analgesic and anxiolytic properties. It is fast-acting and has a short duration of action, allowing for quick recovery after use. Nitrous oxide is generally considered safe but can cause dizziness or nausea if used in high concentrations.

316. Analgesics

Analgesics are drugs used to relieve pain without causing unconsciousness. They can be classified into non-opioid and opioid analgesics. Non-opioid analgesics, such as acetaminophen and NSAIDs, are used for mild to moderate pain, while opioids, such as morphine and oxycodone, are used for more severe pain. Analgesics work through various mechanisms, including inhibition of pain receptors, reduction of inflammation, and modulation of neurotransmitter release. They are widely used in conditions like arthritis, injury, and postoperative pain.

317. **Acetaminophen**

Acetaminophen is a widely used over-the-counter pain reliever and fever reducer. It treats mild to moderate pain like headaches, cramps, and toothaches by blocking prostaglandin production in the brain. Generally safe when used properly, overdoses can cause liver damage. It’s often combined with other drugs in pain relief products.

318. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

NSAIDs relieve pain, reduce inflammation, and lower fever by blocking the cyclooxygenase (COX) enzyme, which produces pain-causing prostaglandins. Common examples are ibuprofen, aspirin, and naproxen. They are effective for arthritis, muscle pain, and headaches but may cause stomach irritation, ulcers, or kidney issues with long-term or high-dose use.

319. **Aspirin**

Aspirin is a well-known NSAID used to relieve pain, reduce inflammation, and lower fever. It also prevents blood clots by inhibiting platelet aggregation, helping in heart disease and stroke prevention. However, it can cause stomach irritation, ulcers, and bleeding, especially with long-term use. Aspirin is not recommended for children with viral infections due to the risk of Reye’s syndrome.

320. Opioid Analgesics

Opioid analgesics are powerful pain-relieving medications used for severe pain management. They work by binding to opioid receptors in the brain and spinal cord, blocking pain signals and altering the perception of pain. Common opioids include morphine, oxycodone, and fentanyl. Opioids are effective for managing pain after surgery or injury but carry a high risk of addiction, tolerance, and respiratory depression. Due to these risks, opioids are typically prescribed with caution and for short-term use.

B PHARM

SEM -II

BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

UNIT I:

321. Neuron

The neuron is the fundamental structural and functional unit of the nervous system, responsible for transmitting electrical impulses to enable communication between the brain and body. It consists of three main parts: the cell body (soma), containing the nucleus and organelles; dendrites, which receive incoming signals; and a single axon that sends outgoing signals to other neurons, muscles, or glands. Neurons play a crucial role in sensation, motor control, and cognitive functions.

322. Neuroglia

Neuroglia, or glial cells, are non-neuronal cells in the nervous system that support and protect neurons. They maintain the extracellular environment, form the myelin sheath, and assist in signal transmission, ensuring proper neural function and homeostasis. Key types include astrocytes, which provide structural support and regulate the chemical environment; oligodendrocytes and Schwann cells, which produce myelin in the central and peripheral nervous systems, respectively; and microglia, which serve as immune defenders by clearing debris and pathogens from neural tissue.

323. Nerve Fiber

A nerve fiber is an elongated extension of a neuron, such as an axon or dendrite, involved in the transmission of electrical impulses. Nerve fibers are responsible for conducting action potentials over long distances, allowing for communication between the central nervous system (CNS) and peripheral tissues. They are surrounded by myelin, which speeds up signal transmission.

324. **Electrophysiology**

Electrophysiology is the branch of science that examines the electrical characteristics of living cells and tissues, especially focusing on nerve and muscle cells. It explores how electrical signals are created and transmitted within the nervous system, including the processes behind action potentials, communication between neurons at synapses, and how cells respond to electrical inputs.

325. **Action Potential**

An action potential is a rapid and transient change in the electrical membrane potential of a neuron or muscle cell. It occurs when a neuron's membrane depolarizes, leading to the generation of a signal that travels down the axon to communicate with other cells. This electrical signal is essential for nerve transmission and muscle contraction.

326. Nerve Impulse

A nerve impulse refers to the propagation of an action potential along a nerve fiber. The impulse moves through the axon, triggering neurotransmitter release at synapses, and allowing communication between neurons or between neurons and muscles or glands. Nerve impulses enable the nervous system to coordinate sensory perception, movement, and physiological responses.

327. Receptor

A receptor is a protein or specialized cell structure located on the surface of neurons or other cells, which detects specific stimuli such as light, sound, or chemical signals. Receptors play a critical role in sensory systems, including vision, hearing, and smell, and in the nervous system, where they trigger neural responses upon stimulus detection.

328. Synapse

A synapse is a specialized connection that allows communication between two neurons or between a neuron and another type of cell, like a muscle or gland. At this junction, signals are passed either electrically or chemically from the sending (presynaptic) neuron to the receiving (postsynaptic) cell. In chemical synapses, neurotransmitters are released from vesicles in the presynaptic neuron, then bind to receptors on the postsynaptic cell, initiating a response. This mechanism is crucial for coordinating neural activity and ensuring smooth communication within the brain and throughout the nervous system.

329. Neurotransmitters

Neurotransmitters are chemicals that carry signals between neurons at synapses. They attach to receptors on the receiving neuron to trigger a response. Examples include dopamine (reward and movement), serotonin (mood), acetylcholine (muscle control), and glutamate (excitatory).

330. Central Nervous System (CNS)

The central nervous system (CNS) includes the brain and spinal cord. It processes sensory information, controls movement, and manages thinking by coordinating signals from the peripheral nervous system (PNS).

331. Meninges

The meninges are three protective membranes surrounding the brain and spinal cord. They include the tough dura mater, the web-like arachnoid mater, and the delicate pia mater, which closely covers the CNS surface. Besides protection, they help circulate cerebrospinal fluid (CSF), cushioning and maintaining the CNS environment.

332. Ventricles of Brain

The ventricles are connected cavities inside the brain filled with cerebrospinal fluid (CSF). They include two lateral ventricles, a third, and a fourth ventricle. These spaces store CSF, which cushions the brain, removes waste, and maintains a stable environment in the CNS. CSF circulation through the ventricles supports brain and spinal cord health.

333. Cerebrospinal Fluid (CSF)

Cerebrospinal fluid (CSF) is a transparent fluid that flows around the brain and spinal cord. It protects the brain by absorbing shocks, supplies nutrients, and clears away waste. Additionally, CSF regulates pressure within the skull and maintains a balanced chemical environment necessary for the nervous system to work correctly.

334. Cerebrum

The cerebrum is the brain’s largest and most advanced part, responsible for complex functions like thinking, perception, voluntary movements, memory, and emotions. It has two halves, the left and right hemispheres, each controlling the opposite side of the body. Each hemisphere is divided into four main lobes: the frontal lobe, which handles decision-making, problem-solving, and motor skills; the parietal lobe, which processes sensory input; the temporal lobe, related to hearing and memory; and the occipital lobe, which manages vision.

335. Brain Stem

The brainstem connects the cerebrum to the spinal cord and includes the midbrain, pons, and medulla oblongata. It controls essential involuntary functions like breathing, heart rate, and blood pressure, as well as reflexes such as swallowing, coughing, and vomiting, which are vital for survival.

336. Cerebellum

Located beneath the cerebrum at the back of the brain, the cerebellum coordinates voluntary movements and helps maintain balance and posture. It receives sensory and spinal input to fine-tune motor actions for smooth, accurate movements. The cerebellum also supports motor learning, enabling improved movement through practice.

337. **Spinal Cord**

The spinal cord is a long, tube-like structure extending from the brainstem, protected by the vertebrae. It serves as the main pathway for transmitting sensory signals to the brain and motor commands to muscles and glands. It also controls reflexes, which are quick, automatic reactions that protect the body.

338. Afferent Nerve Tract

Afferent nerve tracts carry sensory signals from the body's tissues to the central nervous system. They transmit information about touch, pain, temperature, and body position, enabling the brain to perceive the surrounding environment.

339. Efferent Nerve Tract

Efferent nerve tracts transmit motor commands from the central nervous system to muscles and glands. They control voluntary movements, gland activity, and regulate internal organ functions, allowing the body to respond to stimuli.

340. Reflex Activity

Reflex activity involves automatic, involuntary reactions to stimuli, controlled by the spinal cord or brainstem without conscious input. Reflexes like the knee-jerk help protect the body by enabling quick responses to pain or posture changes without involving the brain.

Unit II:

341. Gastrointestinal (GI) Tract

The GI tract is the pathway through which food passes, and it is responsible for digestion and nutrient absorption. It includes the mouth, esophagus, stomach, small intestine, large intestine, and anus. The GI tract also plays a critical role in water absorption, electrolyte balance, and the elimination of waste products.

342. Stomach

The stomach is an important digestive organ that breaks down food by releasing gastric juices such as hydrochloric acid and enzymes like pepsin. It stores food temporarily and gradually releases it into the small intestine. The stomach mainly aids in protein digestion and transforms food into a semi-liquid mixture called chyme to help nutrient absorption later in the digestive process.

343. **Pepsin**

Pepsin is an enzyme produced in the stomach that breaks down proteins into smaller peptides. It is secreted as pepsinogen and activated by the acidic environment of the stomach. Pepsin plays a central role in the digestion of proteins, converting them into absorbable forms.

344. Acid Production in Stomach

Acid production in the stomach is primarily regulated by the parasympathetic nervous system, which stimulates gastric cells to secrete hydrochloric acid. This acid is essential for the activation of pepsin and the breakdown of food. The secretion of acid is also influenced by the presence of food and hormonal signals such as gastrin.

345. Small Intestine

The small intestine is the primary organ for nutrient absorption and is divided into the duodenum, jejunum, and ileum. Its inner lining has tiny finger-like projections called villi that increase surface area, improving nutrient uptake. This allows carbohydrates, proteins, fats, vitamins, and minerals to be absorbed into the bloodstream for the body's use.

346. Large Intestine

The large intestine absorbs water and electrolytes from leftover food, turning it into solid waste to be expelled. It includes the cecum, colon, rectum, and anus. It also contains beneficial bacteria that ferment undigested fiber, produce vitamins like vitamin K, and support digestive health.

347. **Salivary Glands**

The salivary glands are responsible for producing saliva, which contains enzymes like amylase that begin the digestion of carbohydrates. Saliva also contains mucus to lubricate food, antimicrobial agents to protect against infections, and bicarbonate to neutralize acids.

348. **Pancreas**

The pancreas, located behind the stomach, serves both digestive and hormonal functions. It secretes enzymes like amylase, lipase, and proteases into the small intestine to break down carbs, fats, and proteins. It also produces hormones such as insulin and glucagon to regulate blood sugar levels.

349. **Liver**

The liver is an essential organ that metabolizes nutrients, detoxifies harmful substances, and produces bile. Bile, stored in the gallbladder, helps digest and absorb fats in the small intestine. The liver also processes nutrients absorbed from the digestive tract.

350. GIT Movements

Gastrointestinal movements include peristalsis and segmentation. Peristalsis is the wave-like contraction of muscles that propels food through the digestive tract, while segmentation involves the back-and-forth movement of food in the intestines to mix it and increase nutrient absorption.

351. Digestion

Digestion is the biochemical process by which food is broken down into smaller, absorbable components. It begins in the mouth with enzymatic breakdown of carbohydrates, continues in the stomach with protein digestion, and is completed in the small intestine, where nutrients are broken down into their simplest forms and absorbed.

352. Absorption

Absorption is the process where nutrients from digested food are taken into the bloodstream or lymph from the gastrointestinal tract. This mainly happens in the small intestine, where substances like amino acids, fatty acids, glucose, and vitamins are absorbed.

353. GIT Disorders

Gastrointestinal tract disorders encompass conditions like gastritis (stomach lining inflammation), ulcers (sores in the stomach or duodenum), irritable bowel syndrome (IBS), celiac disease, and Crohn's disease. These illnesses can disrupt normal digestion and nutrient absorption.

354. ATP (Adenosine Triphosphate)

ATP is the primary energy carrier in cells, storing and transferring energy necessary for various cellular processes. ATP is produced through cellular respiration, particularly in mitochondria, and is utilized for muscle contraction, protein synthesis, and other metabolic activities.

355. Creatinine Phosphate

Creatinine phosphate (also known as phosphocreatine) is a molecule found in muscle cells that stores energy. It can rapidly release phosphate to regenerate ATP during short bursts of intense activity, making it essential for high-energy processes such as muscle contraction during exercise.

356. Basal Metabolic Rate (BMR)

Basal metabolic rate (BMR) is the energy the body uses at rest to support vital functions like breathing, blood flow, and cell maintenance. It varies based on age, sex, body weight, and muscle mass, reflecting the lowest energy needed to sustain life.

Unit III:

357. Respiratory System

The respiratory system is responsible for the intake of oxygen and the elimination of carbon dioxide. It includes structures such as the lungs, airways, and muscles that facilitate breathing, enabling the body to acquire oxygen for cellular processes and expel the byproduct, CO_2.

358. Lungs

The lungs are the primary organs of respiration where gas exchange occurs. Oxygen from inhaled air diffuses into the blood, and carbon dioxide, a waste product of metabolism, diffuses out of the blood to be exhaled. The lungs contain alveoli, small sacs where this exchange happens.

359. Mechanism of Respiration

Respiration involves two main processes: inhalation, where oxygen is taken in through the respiratory tract into the lungs, and exhalation, where carbon dioxide is expelled from the body. The diaphragm and intercostal muscles facilitate these movements by expanding and contracting the thoracic cavity.

360. Regulation of Respiration

Breathing rate and depth are regulated by respiratory centers in the brainstem, mainly the medulla and pons. They detect blood carbon dioxide levels and adjust breathing to keep the body's balance.

361. **Lung Volumes and Capacities**

Lung volumes and capacities help evaluate lung health. Important measures include tidal volume—the air inhaled or exhaled per breath—and vital capacity—the largest amount of air exhaled after a deep breath. These tests aid in diagnosing lung diseases.

362. **Transport of Respiratory Gases**

Oxygen travels in the blood mainly by attaching to hemoglobin in red blood cells. Carbon dioxide moves in three forms: dissolved in plasma, bound to hemoglobin, or as bicarbonate ions in plasma, which help regulate blood pH.

363. Artificial Respiration

Artificial respiration refers to techniques used to assist or stimulate breathing in individuals who are not breathing adequately. This includes methods like mouth-to-mouth resuscitation or mechanical ventilation, often used in emergencies to maintain oxygenation.

364. Resuscitation Methods

Resuscitation methods, such as cardiopulmonary resuscitation (CPR), are used to restore breathing and circulation when an individual has stopped breathing or their heart has stopped beating. CPR combines chest compressions and rescue breaths to provide circulation and oxygen to vital organs.

365. **Urinary System**

The urinary system filters waste from the blood, balances fluids and electrolytes, and helps control blood pressure. It includes the kidneys, ureters, bladder, and urethra, which work together to create, store, and release urine.

366. **Kidney**

The kidneys are essential urinary organs that filter blood to eliminate waste, extra water, and electrolytes. They maintain fluid balance, produce urine, and help regulate blood pressure and the body's acid-base (pH) balance.

367. Nephron

The nephron is the kidney's basic working unit, handling filtration, reabsorption, and secretion. It includes the renal corpuscle, where blood is filtered, and the renal tubule, where water, nutrients, and electrolytes are reabsorbed. This process removes waste while preserving essential substances in the blood.

368. **Urinary Tract**

The urinary tract consists of the kidneys, ureters, bladder, and urethra. The kidneys filter blood to create urine, which flows through the ureters to the bladder for storage. During urination, urine exits the body via the urethra.

369. Urine Formation

Urine is formed through filtration, reabsorption, and secretion. Blood is filtered in the glomerulus, allowing waste and excess substances into the renal tubule. Essential nutrients and water are reabsorbed back into the blood, while extra waste is secreted into the urine for elimination.

370. Micturition Reflex

Micturition is the act of emptying the bladder. It occurs through a reflex that causes the bladder muscles to contract and the urethral sphincter to relax, triggered by nerve signals when the bladder is full.

371. Acid-Base Balance

The kidneys regulate the body's acid-base balance by removing hydrogen ions (acid) and reclaiming bicarbonate (base) to keep blood pH stable. This balance is crucial for proper cell function and overall health.

372. Renin-Angiotensin System (RAS)

The renin-angiotensin system controls blood pressure and fluid balance. When blood pressure drops, the kidneys release renin, starting a chain reaction that produces angiotensin II. This hormone narrows blood vessels to raise blood pressure and prompts aldosterone release, which helps the body retain sodium and water.

Unit IV:

373. Endocrine System

The endocrine system is made up of glands that release hormones directly into the blood. These hormones control various body processes such as metabolism, growth, emotions, and reproduction. Major glands in this system include the pituitary, thyroid, adrenal glands, and pancreas.

374. **Hormones**

Hormones are chemical messengers produced by endocrine glands that travel through the bloodstream to regulate various physiological processes. They control functions such as metabolism, immune response, growth, and reproduction. Examples include insulin, adrenaline, and thyroid hormones.

375. **Mechanism of Hormone Action**

Hormones exert their effects by binding to specific receptors on target cells. This binding triggers a cascade of cellular events, leading to a physiological response. The action can be direct, as with steroid hormones, or through second messengers, as with peptide hormones.

376. **Pituitary Gland**

Often referred to as the "master gland," the pituitary gland regulates other endocrine glands, including the thyroid, adrenal glands, and gonads. It produces hormones like growth hormone (GH), thyroid-stimulating hormone (TSH), and adrenocorticotropic hormone (ACTH), which influence various bodily functions.

377. **Thyroid Gland**

The thyroid gland produces thyroid hormones (T3 and T4), which regulate metabolism, energy production, and growth. These hormones affect almost every cell in the body and are critical for maintaining normal metabolic processes and body temperature.

378. **Parathyroid Gland**

The parathyroid glands produce parathyroid hormone (PTH), which plays a crucial role in regulating calcium and phosphate levels in the blood. PTH increases blood calcium levels by stimulating calcium release from bones, increasing calcium absorption in the intestines, and reducing calcium excretion by the kidneys.

379. **Adrenal Gland**

The adrenal glands produce several hormones involved in stress response and metabolism, including cortisol, adrenaline (epinephrine), and aldosterone. Cortisol helps manage the body's stress response, while aldosterone regulates sodium and water balance.

380. **Pancreas**

The pancreas has both endocrine and exocrine functions. The endocrine portion of the pancreas releases hormones like insulin, which lowers blood sugar, and glucagon, which raises blood sugar. These hormones work together to maintain blood glucose homeostasis.

381. **Pineal Gland**

The pineal gland produces the hormone melatonin, which regulates the sleep-wake cycle, or circadian rhythm. Melatonin secretion is influenced by light exposure, with higher levels being released in the dark to promote sleep.

382. **Thymus**

The thymus plays a key role in the immune system by promoting the development and maturation of T-lymphocytes (T-cells), which are essential for immune responses. The thymus is particularly active in childhood and gradually shrinks with age.

383. Endocrine Disorders

Endocrine disorders occur when there is an imbalance in hormone production or regulation. Examples include diabetes (insulin deficiency or resistance), hyperthyroidism (overactive thyroid), Addison's disease (insufficient adrenal hormone production), and hypothyroidism (underactive thyroid).

Unit V:

384. **Reproductive System**

The reproductive system is responsible for producing gametes (sperm and eggs) and hormones necessary for reproduction. In males, it involves the testes, while in females, the ovaries are key. It also supports fertilization, pregnancy, and childbirth processes.

385. Male Reproductive System

The male reproductive system includes the testes (producing sperm), vas deferens (tubes carrying sperm to the urethra), prostate gland (producing seminal fluid), and other structures that work together to produce and deliver sperm.

386. Female Reproductive System

The female reproductive system consists of the ovaries (which produce eggs), fallopian tubes (where fertilization occurs), and uterus (where the embryo develops). It also includes structures like the vagina and cervix, which facilitate reproduction.

387. Sex Hormones

Testosterone in males and estrogen and progesterone in females are key hormones that regulate reproductive processes. These hormones influence sexual development, gamete production, menstrual cycles, and pregnancy.

388. Menstruation

Menstruation is the monthly process of shedding the uterine lining (endometrium) when fertilization has not occurred. This cycle typically lasts about 28 days and is regulated by hormones like estrogen and progesterone.

389. Fertilization

Fertilization occurs when a sperm cell from a male combines with an egg cell from a female, forming a zygote. This typically happens in the fallopian tubes and marks the beginning of pregnancy.

390. **Spermatogenesis**

Spermatogenesis is the process of sperm formation in the testes. It involves the division and maturation of germ cells into mature sperm capable of fertilizing an egg.

391. **Oogenesis**

Oogenesis is the process by which egg cells (ova) are produced in the ovaries. It begins before birth, pauses, and resumes during puberty, with one egg maturing each month during the menstrual cycle.

392. **Pregnancy**

Pregnancy is the period during which a fertilized egg (zygote) develops into a fetus inside the uterus. It typically lasts around 40 weeks, divided into three trimesters, and is regulated by hormones like human chorionic gonadotropin (hCG), estrogen, and progesterone.

393. Parturition

Parturition is the process of childbirth. It involves the stages of labor, including cervical dilation, the descent of the baby, and the delivery of the newborn and placenta.

394. Chromosomes

Chromosomes are long, thread-like structures composed of DNA that contain the genetic instructions essential for the development and functioning of living organisms. In humans, there are 23 pairs of chromosomes—one chromosome of each pair inherited from each parent. These chromosomes house genes, which are specific segments of DNA responsible for determining inherited traits and controlling various cellular processes.

395. Genes

Genes are specific sequences of DNA that contain the instructions for producing proteins or RNA molecules. They serve as the basic units of heredity, carrying the information that determines inherited characteristics, such as eye color or the likelihood of developing particular diseases, from one generation to the next.

396. DNA (Deoxyribonucleic Acid)

DNA (deoxyribonucleic acid) is the molecule that carries the genetic blueprint for the growth, development, and functioning of all living organisms. It is composed of two long strands that coil around each other to form a double helix structure. These strands consist of sequences of nucleotides, each containing one of four bases: adenine, thymine, cytosine, and guanine, which encode the genetic information.

397. Protein Synthesis

Protein synthesis is the process by which cells build proteins based on genetic instructions in DNA. It involves two main stages: transcription (where DNA is copied into mRNA) and translation (where mRNA is used to assemble amino acids into proteins).

398. Genetic Inheritance

Genetic inheritance is the process by which traits are passed from parents to offspring through genes. It follows patterns such as Mendelian inheritance, where dominant and recessive alleles determine the expression of traits.

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

UNIT-I:

398. Organic Compounds

These are carbon-based molecules that typically include hydrogen and may also contain oxygen, nitrogen, sulfur, phosphorus, or halogens. They form the basis of all life and include categories like alkanes, alcohols, acids, and more.

399. **IUPAC Nomenclature**

This is a standardized system developed by the International Union of Pure and Applied Chemistry to name organic compounds unambiguously. It ensures consistent naming based on structure, functional groups, and chain length.

400. Common Nomenclature

Unlike IUPAC names, this system uses traditional or historical names based on the compound's origin or use, such as acetic acid (instead of ethanoic acid) or formaldehyde (instead of methanal).

401. Carbocyclic Compounds

Organic molecules containing closed rings made entirely of carbon atoms. These include cycloalkanes, cycloalkenes, and aromatic compounds like benzene.

402. **Open Chain Compounds**

Organic compounds with a straight or branched chain structure that does not form rings. Examples include alkanes like propane and alkenes like butene.

403. Structural Isomerism

Occurs when compounds have the same molecular formula but different structural arrangements of atoms, resulting in different physical and chemical properties.

404. Chain Isomerism

A subtype of structural isomerism where compounds differ in the arrangement or branching of their carbon skeleton, such as butane and isobutane.

405. **Position Isomerism**

Another subtype of structural isomerism where functional groups are attached at different positions on the carbon chain, like 1-butanol and 2-butanol.

406. **Functional Isomerism**

Compounds with the same molecular formula but different functional groups, such as ethanol (alcohol) and dimethyl ether (ether), showing distinct chemical behavior.

407. **Tautomerism**

A dynamic equilibrium between two structural isomers (tautomers), typically involving the shift of a proton and double bond. A common example is keto-enol tautomerism found in carbonyl compounds.

UNIT-II:

408. **Alkanes**

Saturated hydrocarbons containing only single bonds between carbon atoms; general formula is C_nH_{2n+2}. They are relatively unreactive and undergo substitution reactions.

409. **SP³ Hybridization**

A type of orbital hybridization in carbon where one s and three p orbitals mix to form four equivalent tetrahedral orbitals, characteristic of alkanes.

410. Halogenation of Alkanes

A substitution reaction where halogen atoms replace hydrogen atoms in alkanes, typically initiated by UV light and proceeding via a free radical mechanism.

411. **Paraffins**

Another name for alkanes, reflecting their "little affinity" or low reactivity due to the stability of C–C and C–H single bonds.

412. Alkenes

Unsaturated hydrocarbons that contain at least one carbon-carbon double bond; general formula C_nH_{2n}. They are more reactive than alkanes.

413. SP² Hybridization

In alkenes, carbon atoms involved in the double bond use one s and two p orbitals to form three sp^2 orbitals in a trigonal planar geometry.

414. Electrophilic Addition

A reaction typical of alkenes where an electrophile reacts with the double bond, forming a more stable carbocation intermediate.

416. E1 Reaction

A two-step unimolecular elimination reaction where the rate-determining step involves formation of a carbocation intermediate, followed by loss of a proton to form an alkene.

417. E2 Reaction

A single-step bimolecular elimination mechanism where a base removes a proton while the leaving group departs, forming an alkene.

418. Carbocation Rearrangement

A structural change of a carbocation intermediate to a more stable carbocation through hydride or alkyl shifts during reactions like E1 or SN1.

419. **Saytzeff's Rule**

States that in elimination reactions, the more substituted (and more stable) alkene is the major product.

420. **Markovnikov's Rule**

In the addition of HX to an alkene, the hydrogen attaches to the carbon with more hydrogen atoms (less substituted), and the halide to the more substituted carbon.

421. **Anti-Markovnikov Addition**

Opposite of Markovnikov's rule; in the presence of peroxides, HX adds to alkenes such that hydrogen attaches to the less substituted carbon.

422. Ozonolysis

A reaction where ozone cleaves the carbon-carbon double bond in alkenes, producing aldehydes or ketones upon reductive or oxidative workup.

423. **Conjugated Dienes**

Dienes with alternating single and double bonds which allow delocalization of electrons and exhibit unique stability and reactivity.

424. Diels-Alder Reaction

A [4+2] cycloaddition reaction between a conjugated diene and a dienophile to form six-membered cyclic compounds.

425. **Allylic Rearrangement**

A reaction where a double bond shifts position due to the presence of an allylic carbocation, often leading to different isomeric products.

UNIT-III:

426. **Alkyl Halides**

Organic compounds containing halogens attached to an alkyl group.

427. **SN1 Reaction**

Unimolecular nucleophilic substitution occurring in two steps.

428. **SN2 Reaction**

Bimolecular nucleophilic substitution occurring in one step.

429. **Steric Hindrance**

Prevention of reactions due to bulky groups.

430. **Ethyl Chloride**

A volatile alkyl halide used as a local anesthetic.

431. **Chloroform**

A halogenated solvent with anesthetic properties.

432. **Trichloroethylene**

An industrial solvent with degreasing properties.

433. **Dichloromethane**

A solvent used in paint removers and decaffeination.

434. **Iodoform**

A yellow crystalline antiseptic compound.

435. **Alcohols**

Organic compounds containing hydroxyl (-OH) groups.

436. **Ethanol**

The main type of alcohol found in alcoholic beverages.

437. **Methanol**

A toxic alcohol used as a solvent and antifreeze.

438. **Benzyl Alcohol**

Used in cosmetics and pharmaceuticals as a preservative.

439. **Glycerol**

A sweet-tasting alcohol used in medicines and food.

440. **Propylene Glycol**

A humectant used in food and cosmetics.

UNIT-IV:

441. **Aldehydes**

Organic compounds with a -CHO functional group.

442. **Ketones**

Organic compounds containing a carbonyl group bonded to two carbons.

443. **Electromeric Effect**

Temporary polarization of π-electrons in the presence of an electrophile.

444. **Aldol Condensation**

Reaction forming β-hydroxy aldehydes or ketones.

445. **Cannizzaro Reaction**

Disproportionation of non-enolizable aldehydes in the presence of base.

446. **Benzoin Condensation**

Reaction forming benzoin from benzaldehyde.

447. **Perkin Reaction**

Synthesis of cinnamic acid derivatives.

448. **Formaldehyde**

A preservative and disinfectant.

449. **Acetone**

A solvent commonly used in nail polish remover.

450. **Vanillin**

A flavoring agent found in vanilla beans.

451. **Cinnamaldehyde**

The main component of cinnamon oil.

UNIT-V:

452. **Carboxylic Acids**

Organic acids with a -COOH functional group.

453. **Acetic Acid**

Main component of vinegar.

454. **Lactic Acid**

Produced during anaerobic respiration in muscles.

455. **Citric Acid**

Found in citrus fruits and used in food preservation.

456. **Salicylic Acid**

Used in acne treatment and aspirin synthesis.

457. **Benzoic Acid**

A preservative in food and cosmetics.

458. **Esters**

Organic compounds formed from acids and alcohols.

459. **Amides**

Derivatives of carboxylic acids with a -CONH2 group.

460. **Basicity of Amines**

The ability of amines to accept protons.

461. **Ethanolamine**

A precursor for detergents and pharmaceuticals.

462. **Amphetamine**

A stimulant affecting the central nervous system.

BP203 T. BIOCHEMISTRY (Theory)

UNIT I:

463. **Biomolecules**

These are organic compounds crucial for life processes, including carbohydrates, lipids, proteins, and nucleic acids. They perform structural, functional, and regulatory roles in living organisms. Each biomolecule class has distinct monomers and biological significance. They are synthesized and broken down via metabolic pathways. Their balance is essential for homeostasis and health.

464. **Carbohydrates**

Carbohydrates are organic molecules made of carbon, hydrogen, and oxygen, often in a 1:2:1 ratio. They are key energy sources and structural materials in organisms. Simple sugars like glucose provide immediate energy. Complex carbohydrates such as starch serve as energy reserves. They are also components of cell walls and signaling molecules.

465. **Monosaccharides**

Monosaccharides are the simplest carbohydrates that cannot be hydrolyzed further. Examples include glucose, fructose, and galactose. They are water-soluble and sweet-tasting. These sugars act as building blocks for more complex carbohydrates. Their structures vary as aldoses or ketoses depending on their functional groups.

466. **Disaccharides**

These are formed by joining two monosaccharide units via a glycosidic bond. Common examples include sucrose (glucose + fructose) and lactose (glucose + galactose). They are broken down into monosaccharides during digestion. Disaccharides serve as transport forms of sugars in plants and energy sources in humans. Enzymes like sucrase and lactase help in their hydrolysis.

467. **Polysaccharides**

These are long chains of monosaccharides linked by glycosidic bonds. They include storage forms like starch in plants and glycogen in animals. Structural polysaccharides like cellulose and chitin support plant cell walls and exoskeletons. They are generally insoluble and tasteless. Their function varies based on branching and monomer composition.

468. **Lipids**

Lipids are hydrophobic biomolecules including fats, oils, waxes, and steroids. They are essential for energy storage, insulation, and making up cell membranes. Lipids are not polymers but consist of fatty acids and glycerol components. They also act as signaling molecules and hormones. Their insolubility in water makes them distinct from other biomolecules.

469. **Fatty Acids**

These are long hydrocarbon chains with a terminal carboxylic acid group. They can be saturated (no double bonds) or unsaturated (one or more double bonds). Saturated fatty acids are solid at room temperature, while unsaturated ones are liquid. They serve as energy sources and membrane components. Their structure affects membrane fluidity and health impacts.

470. **Triglycerides** (TGs)

TGs are esters formed from one glycerol and three fatty acid molecules. They are the primary form of fat storage in animals and plants. Triglycerides provide insulation and long-term energy. High levels in the blood are linked to cardiovascular risks. They are broken down by lipase enzymes during digestion.

471. **Phospholipids**

These are amphipathic lipids with a hydrophilic phosphate head and two hydrophobic fatty acid tails. They form bilayers that make up cellular membranes. This bilayer structure is critical for compartmentalization and cell function. They also participate in signaling pathways. Variations in head groups contribute to membrane diversity.

472. **Steroids**

Steroids are lipids with a four-ring carbon structure, including hormones like testosterone and estrogen. Cholesterol is a key steroid that maintains membrane fluidity. Steroids act as signaling molecules regulating growth, metabolism, and reproduction. They are synthesized from squalene in the body. Overuse of synthetic steroids can cause health issues.

473. **Nucleic Acids**

They are macromolecules composed of nucleotide monomers. DNA and RNA are the two main types, essential for genetic information storage and transfer. They contain a sugar, phosphate group, and nitrogenous base. Nucleic acids play roles in protein synthesis and heredity. Mutations in nucleic acids can lead to genetic disorders.

474. **DNA (Deoxyribonucleic Acid)**

DNA stores genetic information in the form of a double helix. It is composed of nucleotide pairs: adenine–thymine and cytosine–guanine. DNA replication ensures genetic continuity across generations. It is mostly confined to the nucleus in eukaryotes. Mutations in DNA can cause genetic diseases or cancer.

475. **RNA (Ribonucleic Acid)**

RNA is single-stranded and plays a vital role in gene expression and protein synthesis. It comes in several forms—mRNA, tRNA, and rRNA—each with specific functions. RNA uses uracil instead of thymine. It is synthesized from DNA during transcription. RNA viruses use RNA as their genetic material.

476. **Amino Acids**

These are organic compounds with both amino and carboxylic acid groups. There are 20 standard amino acids used in protein synthesis. They differ in their side chains (R-groups), influencing their properties. Some are essential and must be obtained from the diet. Peptide bonds link them into proteins.

477. **Proteins**

Proteins are complex polymers of amino acids that perform various functions like catalysis (enzymes), transport, and structural support. Their function depends on their 3D shape. Proteins are involved in nearly every biological process. They are synthesized in ribosomes using mRNA templates. Denaturation affects their functionality.

478. **Primary Structure of Protein**

This term describes the precise order of amino acids in a polypeptide chain, known as the primary structure of a protein. This sequence is critical because it dictates how the protein will fold into its functional three-dimensional shape. Even a single amino acid change can significantly impact the protein's function, as exemplified by sickle cell anemia. The primary structure is established during the process of translation and provides the essential framework upon which more complex protein structures are built.

479. Secondary Structure

This level of protein structure refers to the localized folding of the polypeptide chain into patterns such as alpha-helices and beta-sheets. These shapes are stabilized by hydrogen bonds between the backbone atoms of the amino acids. Alpha-helices form spiral-like coils, while beta-sheets consist of strands arranged in a pleated, sheet-like formation. Secondary structure plays a key role in determining the protein's overall shape and stability, and it is especially important in structural proteins like keratin.

480. **Tertiary Structure**

This level of protein structure represents the complete three-dimensional folding of a single polypeptide chain, known as the tertiary structure. It is stabilized by various interactions, including hydrogen bonds, disulfide bridges, hydrophobic interactions, and ionic bonds between amino acid side chains. The tertiary structure is crucial because it defines the protein's functional shape and biological activity. Proper folding at this level is essential for protein stability and function, while misfolding can result in diseases such as Alzheimer's.

481. Quaternary Structure

This involves the assembly of multiple polypeptide subunits into a functional protein complex. Examples include hemoglobin and DNA polymerase. These interactions may be stabilized by non-covalent forces or disulfide bonds. It adds functionality through subunit cooperation. Disruption can impair protein activity.

482. **Free Energy (ΔG)**

Free energy is the amount of energy available to do work in a chemical reaction. A negative ΔG indicates a spontaneous reaction. It helps determine reaction feasibility in biological systems. Free energy changes are calculated from enthalpy and entropy. Cellular processes like ATP hydrolysis rely on free energy.

483. **Endergonic Reaction**

This is a reaction that absorbs energy from the surroundings. These reactions have a positive ΔG and are non-spontaneous. They often require ATP or other energy input. Examples include photosynthesis and active transport. They are essential for biosynthesis and cell growth.

484. **Exergonic Reaction**

This is a spontaneous reaction that releases energy, with a negative ΔG. Examples include cellular respiration and ATP hydrolysis. The energy released can be harnessed for biological work. Exergonic reactions often drive endergonic ones in coupled systems. They maintain energy flow in living organisms.

485. **Redox Potential**

It measures the tendency of a substance to gain or lose electrons. It is critical in electron transport chains and metabolic reactions. A higher redox potential means a stronger tendency to gain electrons (reduction). It is measured in volts under standard conditions. Redox reactions underlie cellular respiration and photosynthesis.

486. **ATP (Adenosine Triphosphate)**

ATP is the primary energy carrier in cells. It stores energy in high-energy phosphate bonds. Hydrolysis of ATP to ADP releases energy for cellular activities. It is regenerated via cellular respiration or photosynthesis. ATP powers muscle contraction, active transport, and biosynthesis.

487. **Cyclic AMP (cAMP)**

cAMP is a secondary messenger derived from ATP. It is involved in intracellular signaling pathways, such as those activated by hormones like adrenaline. cAMP activates protein kinases, regulating various cellular responses. It plays a role in metabolism, gene expression, and memory. Its levels are regulated by enzymes like phosphodiesterase.

UNIT II:

488. **Glycolysis**

Glycolysis is a metabolic process that converts glucose into pyruvate while generating a modest amount of ATP. This pathway takes place in the cytoplasm and involves a sequence of ten enzyme-driven reactions. Since glycolysis does not depend on oxygen, it is considered an anaerobic process. In addition to ATP, it produces two molecules of NADH for each glucose molecule broken down. Glycolysis is essential for energy production in cells, particularly in tissues that lack mitochondria or when oxygen is scarce.

489. **Hexokinase**

Hexokinase is the enzyme responsible for adding a phosphate group to glucose, converting it into glucose-6-phosphate during the initial stage of glycolysis. Found in many tissues throughout the body, it plays a vital role in starting the breakdown of glucose for energy production. Hexokinase has a high affinity for glucose, operating effectively even when glucose levels are low. Its activity is controlled through feedback inhibition by glucose-6-phosphate, the very molecule it produces. This regulatory mechanism is crucial for maintaining proper glucose balance within cells.

490. **Phosphofructokinase**

It is a key regulatory enzyme in glycolysis, catalyzing the conversion of fructose-6-phosphate to fructose-1,6-bisphosphate. It is considered the rate-limiting step of glycolysis. The activity of phosphofructokinase is regulated by various metabolites, such as ATP (inhibitor) and AMP (activator). This regulation ensures that glycolysis occurs when energy is needed. Phosphofructokinase plays a critical role in controlling the overall flux of glycolysis.

491. **Citric Acid Cycle (Krebs Cycle)**

It’s a central metabolic pathway that generates ATP, NADH, and FADH2 by oxidizing acetyl-CoA. It occurs in the mitochondria and consists of a series of eight enzymatic steps. The cycle produces carbon dioxide as a byproduct, which is exhaled. The high-energy electron carriers NADH and FADH2 produced are used in the electron transport chain. The citric acid cycle is crucial for cellular respiration and energy production.

492. **HMP Shunt (Pentose Phosphate Pathway)**

This metabolic pathway, known as the hexose monophosphate (HMP) shunt or pentose phosphate pathway, produces NADPH and ribose-5-phosphate, both of which are crucial for anabolic processes. Operating alongside glycolysis in the cytoplasm, it generates NADPH used in biosynthetic reactions like fatty acid and nucleotide synthesis. Additionally, ribose-5-phosphate produced by this pathway is vital for the formation of nucleotides and nucleic acids. The HMP shunt also helps protect cells against oxidative damage by supplying NADPH, which supports antioxidant defenses.

493. **G6PD Deficiency**

Glucose-6-phosphate dehydrogenase (G6PD) deficiency is a hereditary condition characterized by a lack of adequate activity of the G6PD enzyme. This enzyme plays a vital role in the pentose phosphate pathway by producing NADPH, which helps protect red blood cells from oxidative damage. People with this deficiency are more vulnerable to oxidative stress, which can trigger the breakdown of red blood cells, or hemolysis, especially after exposure to certain medications, infections, or foods.

G6PD deficiency is most commonly found in males of African and Mediterranean ancestry and can result in episodes of hemolytic anemia.

494. **Glycogen Metabolism**

It refers to the processes of glycogen synthesis (glycogenesis) and breakdown (glycogenolysis) to regulate blood glucose levels. Glycogenesis involves the enzyme glycogen synthase, while glycogenolysis is catalyzed by glycogen phosphorylase. Glycogen metabolism is tightly regulated by hormonal signals such as insulin (promoting glycogenesis) and glucagon (stimulating glycogenolysis). This process ensures that glucose is available during fasting and after meals. Dysregulation can lead to metabolic disorders.

495. **Gluconeogenesis**

Gluconeogenesis is the metabolic process by which glucose is produced from non-carbohydrate sources such as lactate, certain amino acids, and glycerol. This pathway primarily takes place in the liver, with some activity in the kidneys. While it largely reverses the steps of glycolysis, gluconeogenesis uses distinct enzymes to bypass the irreversible reactions in glycolysis. This pathway is especially important during periods of fasting or extended physical activity, helping maintain blood glucose levels and providing a steady energy supply for glucose-dependent organs like the brain.

496. **Glycogen Storage Diseases**

Glycogen storage diseases are a collection of inherited disorders resulting from defects in the enzymes responsible for the synthesis or breakdown of glycogen. These enzyme deficiencies disrupt normal glycogen metabolism, leading to a range of symptoms such as muscle weakness, enlargement of the liver, and low blood sugar levels. The specific manifestations depend on which enzyme is affected. Among the most recognized forms are von Gierke’s disease and Pompe’s disease. Treatment typically aims to manage symptoms and maintain metabolic balance to improve patients’ quality of life.

497. **Diabetes Mellitus**

Diabetes mellitus is a long-term metabolic condition marked by elevated blood glucose levels caused either by the body's inability to produce enough insulin or by resistance to insulin's effects. In Type 1 diabetes, the immune system attacks and destroys the insulin-producing beta cells in the pancreas. In contrast, Type 2 diabetes primarily results from the body's reduced responsiveness to insulin. If not properly managed, diabetes can lead to serious complications including heart disease, kidney failure, and nerve damage. Effective treatment involves lifestyle modifications such as healthy eating and regular physical activity, along with medications like insulin or oral drugs to help regulate blood sugar levels. Maintaining consistent blood glucose control is essential to minimizing the risk of long-term complications.

498. **Electron Transport Chain (ETC)**

The electron transport chain (ETC) consists of a sequence of protein complexes embedded in the inner membrane of mitochondria. Its primary function is to transfer electrons from carriers such as NADH and FADH2 to molecular oxygen, which is ultimately reduced to water. This electron transfer drives the pumping of protons across the mitochondrial membrane, creating an electrochemical gradient. The energy stored in this proton gradient powers ATP synthesis through oxidative phosphorylation. The ETC plays a vital role in aerobic respiration, and its efficiency directly impacts the cell's ability to produce energy.

499. **Oxidative Phosphorylation**

This is the process by which ATP is synthesized using the energy generated from the electron transport chain. It occurs in the mitochondria and involves the transfer of electrons to oxygen, creating a proton gradient. This gradient powers ATP synthase to convert ADP and inorganic phosphate into ATP. Oxidative phosphorylation is the primary method of ATP production in aerobic organisms. Disruptions in this process can lead to mitochondrial diseases and energy deficits.

500. **Uncouplers**

These are molecules that disrupt ATP synthesis by dissipating the proton gradient across the mitochondrial membrane. They allow protons to flow back into the mitochondrial matrix without passing through ATP synthase. This process results in the release of energy as heat instead of producing ATP. Uncouplers are naturally found in brown adipose tissue, where they generate heat for thermoregulation. Some synthetic uncouplers, like dinitrophenol, have been studied for weight loss but are toxic.

UNIT III:

501. **β-Oxidation**

It is the metabolic pathway responsible for breaking down fatty acids to generate energy. It occurs in the mitochondria, where fatty acids are cleaved into two-carbon units, forming acetyl-CoA. Each cycle of β-oxidation generates NADH and FADH2, which are used in the electron transport chain for ATP production. This process is essential for energy production during fasting or prolonged exercise. Disorders in β-oxidation can lead to metabolic diseases, such as fatty acid oxidation defects.

502. **Ketone Bodies**

These are water-soluble molecules produced during the breakdown of fatty acids in the liver, primarily during periods of fasting or carbohydrate restriction. These molecules include acetoacetate, β-hydroxybutyrate, and acetone, and serve as an alternative fuel source for tissues, such as the brain, when glucose is scarce. Ketone bodies are important in energy metabolism, especially for individuals with diabetes or those on ketogenic diets. Excessive ketone body production can lead to a condition called ketoacidosis. The liver produces ketone bodies through a process called ketogenesis.

503. **Ketoacidosis**

It is a metabolic condition characterized by an excessive accumulation of ketone bodies in the blood, leading to a decrease in blood pH. It typically occurs in uncontrolled diabetes, where insulin deficiency prevents proper glucose utilization, resulting in increased fat metabolism and ketone production. Ketoacidosis can cause symptoms like nausea, vomiting, abdominal pain, and confusion. If left untreated, it can lead to coma or death. The condition requires immediate medical attention and is managed by correcting blood sugar levels and fluid balance.

504. **De Novo Fatty Acid Synthesis**

This is the metabolic process in which fatty acids are synthesized from acetyl-CoA, primarily in the liver and adipose tissue. This process involves multiple enzymes, with acetyl-CoA carboxylase and fatty acid synthase being key players. De novo synthesis is activated when energy levels are high, such as after a meal, and occurs in the cytoplasm. The primary product of de novo fatty acid synthesis is palmitate, which can be further modified into other fatty acids. Dysregulation of fatty acid synthesis can contribute to metabolic diseases like obesity.

505. **Cholesterol Metabolism**

It refers to the biosynthesis, conversion, and regulation of cholesterol in the body. Cholesterol is a vital component of cell membranes and a precursor for steroid hormones, bile acids, and vitamin D. It is synthesized from acetyl-CoA through the mevalonate pathway in the liver. Cholesterol can also be obtained from dietary sources. Excessive cholesterol buildup in the blood is a risk factor for cardiovascular diseases, such as atherosclerosis, and is regulated by enzymes like HMG-CoA reductase.

506. **Bile Acids**

These are cholesterol-derived molecules synthesized in the liver that play a key role in fat digestion and absorption. They are conjugated with taurine or glycine to form bile salts, which emulsify dietary fats in the small intestine. This process increases the surface area for lipase enzymes to break down fats. Bile acids are also involved in the absorption of fat-soluble vitamins (A, D, E, and K). After aiding digestion, bile acids are reabsorbed in the ileum and returned to the liver in a process called enterohepatic circulation.

507. **Steroid Hormones**

These are hormones derived from cholesterol and are involved in various physiological processes. These hormones include cortisol, aldosterone, progesterone, estrogen, and testosterone. They are synthesized in the adrenal glands, ovaries, testes, and placenta, depending on the hormone. Steroid hormones regulate functions such as metabolism, immune response, salt balance, and reproductive processes. They exert their effects by binding to intracellular receptors and influencing gene expression.

508. **Hypercholesterolemia**

It is a condition characterized by elevated levels of cholesterol in the blood, which can increase the risk of cardiovascular diseases, such as heart attacks and strokes. It can be caused by genetic factors, such as familial hypercholesterolemia, or by lifestyle factors like poor diet and lack of exercise. High cholesterol levels can lead to the accumulation of cholesterol in the arteries, forming plaques and leading to atherosclerosis. Treatment typically involves lifestyle changes, statin medications, and other lipid-lowering agents. Monitoring blood cholesterol levels is key to managing the condition.

509. **Atherosclerosis**

It is a condition where plaque builds up inside the arteries, leading to their hardening and narrowing. The plaques consist of cholesterol, fatty substances, and cellular debris, which can restrict blood flow and increase the risk of blood clots. Atherosclerosis is a major cause of cardiovascular diseases such as coronary artery disease, stroke, and peripheral artery disease. Risk factors include high cholesterol, high blood pressure, smoking, and diabetes. Prevention involves managing these risk factors through lifestyle changes and medications.

510. **Fatty Liver**

Fatty liver disease is a condition marked by the buildup of excess fat in liver cells. It commonly arises from heavy alcohol use, known as alcoholic fatty liver disease, or from metabolic factors like obesity and diabetes, referred to as non-alcoholic fatty liver disease (NAFLD). This fat accumulation causes the liver to enlarge and can impair its normal function. While early stages often show no symptoms, the condition can advance to inflammation, scarring (cirrhosis), and even liver failure if left untreated. Effective management typically involves lifestyle modifications, including losing weight, increasing physical activity, and limiting alcohol consumption.

511. **Obesity**

Obesity is a medical condition defined by an excessive accumulation of body fat that increases the risk of health problems such as heart disease, diabetes, and some types of cancer. It is often assessed using the body mass index (BMI), with a BMI of 30 or above indicating obesity. This condition arises when calorie intake consistently exceeds energy expenditure, influenced by a combination of genetic, environmental, and lifestyle factors. Managing obesity usually involves adopting healthier eating habits, increasing physical activity, and sometimes using medications or undergoing surgical procedures. Preventative measures emphasize maintaining a balanced diet and regular exercise to sustain a healthy weight.

512. **Transamination**

Transamination is a biochemical process where an amino group is transferred from one amino acid to a keto acid, resulting in the formation of a new amino acid. This reaction is facilitated by enzymes called transaminases or aminotransferases, including alanine aminotransferase (ALT) and aspartate aminotransferase (AST). Transamination is crucial for producing non-essential amino acids and plays a significant role in overall amino acid metabolism. It helps maintain nitrogen balance in the body and enables adaptation to different levels of protein intake. This process primarily occurs in the liver and kidneys.

513. **Deamination**

It is the removal of an amino group (-NH2) from an amino acid, resulting in the formation of a corresponding keto acid and ammonia. The ammonia is then converted into urea in the liver and excreted through urine. Deamination is a crucial step in the catabolism of amino acids, especially when the body needs to use amino acids for energy or when excess nitrogen needs to be eliminated. This process contributes to nitrogen balance and is important for maintaining metabolic homeostasis. Disorders in deamination can lead to toxic accumulation of ammonia.

514. **Decarboxylation**

It is the enzymatic removal of a carboxyl group (-COOH) from an amino acid, producing an amine and carbon dioxide. This process is important in the synthesis of neurotransmitters such as serotonin and dopamine. Decarboxylation reactions are catalyzed by enzymes known as decarboxylases. The production of biogenic amines through decarboxylation is crucial for the nervous system, influencing mood, cognition, and movement. A lack of decarboxylation can lead to metabolic disorders or neurotransmitter imbalances.

515. **Urea Cycle**

The urea cycle is a metabolic process that transforms ammonia, a harmful byproduct of amino acid breakdown, into urea, which is then eliminated from the body through urine. This cycle occurs primarily in the liver and involves multiple enzymes, such as carbamoyl-phosphate synthetase and ornithine transcarbamylase. It plays a vital role in maintaining the body's nitrogen balance by safely removing excess nitrogen. Defects in the urea cycle can cause hyperammonemia, a dangerous buildup of ammonia that can damage the brain. The cycle is carefully regulated to ensure effective detoxification and prevent ammonia toxicity.

516. **Phenylketonuria (PKU)**

PKU is a genetic disorder that affects the metabolism of phenylalanine, an amino acid. In PKU, the enzyme phenylalanine hydroxylase is deficient or absent, leading to the accumulation of phenylalanine in the blood and brain. This buildup can cause intellectual disability, developmental delays, and other neurological problems if untreated. PKU is typically detected through newborn screening, and treatment involves a strict low-phenylalanine diet. Early detection and dietary management can prevent the harmful effects of the disorder.

UNIT IV:

517. **Purine Nucleotides**

Purines are nitrogen-containing bases that include adenine (A) and guanine (G), essential components of the nucleotides in DNA and RNA. In the genetic code, purines pair with pyrimidines—thymine in DNA, uracil in RNA, and cytosine in both DNA and RNA—to maintain the structure of the nucleic acids. Beyond their role in genetics, purine nucleotides like ATP and GTP are crucial for cellular energy transfer and signaling. They participate in key metabolic processes such as DNA replication and transcription. Disorders in purine metabolism can result in health issues like gout and kidney stone formation.

518. **Pyrimidine Nucleotides**

These are nitrogenous bases that include cytosine (C), thymine (T), and uracil (U). These pyrimidines form base pairs with purines in DNA (thymine with adenine) and RNA (uracil with adenine). Pyrimidine nucleotides are integral to the synthesis of DNA and RNA and play a role in cellular energy transfer, with CMP, TMP, and UMP being involved in various metabolic processes. Disorders in pyrimidine metabolism can lead to diseases such as orotic aciduria.

519. **Hyperuricemia**

Hyperuricemia is a medical condition marked by elevated uric acid levels in the bloodstream. It results either from overproduction of uric acid or from inadequate elimination by the kidneys. This condition is closely linked to gout, where uric acid crystals accumulate in joints causing pain and inflammation. Contributing factors include diet, obesity, genetics, and some health disorders. Treatment aims to reduce uric acid levels through medication and lifestyle adjustments.

520. **Gout**

Gout is a type of arthritis caused by the deposition of uric acid crystals within the joints, often leading to intense pain, swelling, and redness, frequently affecting the big toe. It typically develops from hyperuricemia, where excess uric acid builds up in the blood. Triggers include alcohol intake, consumption of purine-rich foods, obesity, and impaired kidney function. Managing gout involves medications to relieve symptoms and prevent future flare-ups, alongside dietary and lifestyle modifications.

521. **DNA Replication**

DNA replication is the biological process where a cell duplicates its DNA, producing two identical copies. This occurs during the S phase of the cell cycle and is essential for cell division. The process begins with the unwinding of the double helix, followed by enzymes like DNA polymerase adding complementary nucleotides to each original strand. Accurate replication ensures the preservation of genetic information and minimizes mutations.

522. **Semi-Conservative Model**

The semi-conservative model describes DNA replication whereby each new DNA molecule consists of one original (parental) strand paired with one newly synthesized strand. This mechanism was demonstrated by the Meselson-Stahl experiment in 1958. During replication, the DNA double helix unwinds, and each strand serves as a template for creating a complementary strand, ensuring faithful transmission of genetic information.

523. **Transcription**

It is the process of synthesizing RNA from a DNA template. During transcription, an RNA polymerase enzyme binds to a specific region of the DNA and transcribes the genetic code into a complementary RNA strand. This RNA strand, known as messenger RNA (mRNA), carries the genetic instructions from the DNA to the ribosomes for protein synthesis. Transcription occurs in the nucleus in eukaryotes, while in prokaryotes, it occurs in the cytoplasm. Transcription is regulated by various factors, including promoters, enhancers, and transcription factors.

524. Genetic Code

The genetic code is the set of rules that translates the nucleotide sequence of DNA into amino acids during protein synthesis. It is made up of codons—groups of three nucleotides—each specifying a particular amino acid. Although there are 64 possible codons, only 20 amino acids are encoded, leading to some redundancy. This code is nearly universal among organisms, allowing consistent protein production across species. It is fundamental to transcription and translation.

525. **Translation**

This is the process by which proteins are synthesized from mRNA in ribosomes. During translation, the mRNA codons are read by the ribosome, and corresponding amino acids are brought by tRNA to form a polypeptide chain. This process involves initiation, elongation, and termination phases. The ribosome reads the mRNA sequence in sets of three nucleotides (codons), matching them with the appropriate tRNA anticodons. Once the entire mRNA is translated, the resulting polypeptide folds into a functional protein.

526. **Ribosomes**

Ribosomes are cellular organelles responsible for synthesizing proteins. Composed of ribosomal RNA (rRNA) and proteins, they can be free-floating in the cytoplasm or attached to the rough endoplasmic reticulum. Ribosomes decode mRNA sequences and facilitate the assembly of amino acids into polypeptides by matching mRNA codons with tRNA anticodons. Prokaryotic ribosomes are smaller (70S) compared to those in eukaryotes (80S). Their function is tightly regulated to ensure accurate protein production..

527. **mRNA (Messenger RNA)**

This is a type of RNA that carries genetic information from the DNA in the nucleus to the ribosomes in the cytoplasm, where protein synthesis occurs. It is transcribed from a DNA template and serves as a blueprint for building proteins. mRNA undergoes processing in eukaryotes, including splicing, capping, and polyadenylation, before being exported from the nucleus. The sequence of codons in mRNA dictates the order of amino acids in the corresponding protein. mRNA is central to the flow of genetic information in cells, following the central dogma of molecular biology.

528. **tRNA (Transfer RNA)**

Transfer RNA (tRNA) is a type of RNA molecule that delivers amino acids to the ribosome during protein synthesis. Each tRNA contains an anticodon region that pairs specifically with a complementary codon on the messenger RNA (mRNA). Attached to the opposite end of the tRNA is the amino acid corresponding to that codon. By matching codons with their correct amino acids, tRNA plays a vital role in translating the genetic information in mRNA into a precise sequence of amino acids, ultimately forming a polypeptide chain. There are various tRNA molecules, each specific to a particular amino acid, ensuring accuracy during the translation process.

529. **rRNA (Ribosomal RNA)**

It is the RNA component of ribosomes, the cellular structures responsible for protein synthesis. rRNA molecules provide structural support and catalytic activity to the ribosome, facilitating the assembly of amino acids into polypeptides. In eukaryotes, ribosomes are composed of a small (40S) and large (60S) subunit, while in prokaryotes, ribosomes are smaller (30S and 50S). rRNA is essential for the translation process, as it ensures the proper alignment of mRNA and tRNA during protein synthesis. rRNA also has enzymatic functions in catalyzing peptide bond formation.

UNIT V:

530. **Enzymes**

Enzymes are biological catalysts that speed up chemical reactions by lowering the activation energy required for the reaction to occur. They are highly specific to their substrates and function efficiently under mild conditions, such as body temperature and neutral pH. Enzymes are crucial for various biological processes, including digestion, metabolism, and DNA replication. Their activity can be regulated by environmental factors like temperature and pH, as well as by the presence of inhibitors or activators. Without enzymes, most biochemical reactions would occur too slowly to sustain life.

531. **Active Site**

Active site is the specific region of an enzyme where the substrate binds and undergoes a chemical reaction. It is typically a pocket or groove on the enzyme's surface that is precisely shaped to fit the substrate. The active site facilitates the conversion of substrate into product by providing an environment conducive to the reaction. The binding of the substrate often induces a conformational change in the enzyme, which is essential for catalysis. The specificity of the active site is key to the enzyme's function and its ability to recognize only certain substrates.

532. **Cofactors**

Cofactors are non-protein chemical compounds that are required for the proper functioning of enzymes. They can be metal ions (such as magnesium, zinc, or iron) or organic molecules. Cofactors help enzymes achieve the correct structural configuration, or they may assist in the catalytic process by stabilizing intermediate molecules during reactions. Many enzymes would be inactive without their cofactors. They can be tightly or loosely bound to the enzyme, and their role is crucial in maintaining enzymatic activity.

533. **Coenzymes**

Coenzymes are a subset of cofactors that are organic molecules, often derived from vitamins, and assist in enzyme-catalyzed reactions. Coenzymes participate in the transfer of chemical groups between enzymes and substrates during metabolic processes. Examples of coenzymes include NAD+, FAD, and coenzyme A, which play significant roles in energy production. Coenzymes are usually not permanently bound to the enzyme and can be reused in multiple reactions. They are essential for the proper functioning of many enzymes involved in cellular metabolism.

534. **Enzyme Inhibition**

It is the process by which the activity of an enzyme is reduced or halted by certain molecules, known as inhibitors. Inhibition can occur in various ways, including through the blocking of the active site or through changes in the enzyme's structure. Enzyme inhibitors can be reversible or irreversible, depending on how they bind to the enzyme. Inhibitors are important in regulating metabolic pathways, and many drugs are designed to inhibit specific enzymes. For example, many antibiotics work by inhibiting bacterial enzymes involved in cell wall synthesis.

535. **Allosteric Regulation**

It refers to the regulation of an enzyme's activity by binding molecules at sites other than the active site, known as allosteric sites. These molecules, called allosteric effectors, can either enhance (positive regulation) or inhibit (negative regulation) the enzyme’s activity. Allosteric regulation plays a key role in metabolic control, allowing enzymes to respond to changes in cellular conditions. This regulation is important for maintaining homeostasis, as it ensures that enzyme activity is finely tuned based on the needs of the cell. The binding of allosteric effectors often results in a conformational change in the enzyme that alters its activity.

BP 204T.PATHOPHYSIOLOGY (THEORY)

Unit I:

536. **Homeostasis**

Homeostasis is the ability of the body to maintain a stable internal environment despite external changes. This process is critical for ensuring that conditions like temperature, pH, and ion concentrations remain within optimal ranges for cellular function. Homeostasis is regulated by feedback systems, sensors, and effectors. Disruptions in homeostasis can lead to diseases or dysfunctions in body systems. Examples of homeostatic mechanisms include thermoregulation, blood glucose regulation, and fluid balance.

537. **Feedback System**

It refers to a biological mechanism that regulates homeostasis through feedback loops, which can be either positive or negative. Negative feedback loops work to counteract changes, restoring balance (e.g., temperature regulation). Positive feedback loops amplify the changes, leading to an intensified response (e.g., childbirth contractions). These feedback systems are essential for maintaining stability in physiological processes. Both types of feedback are crucial for adaptive responses to environmental or internal stimuli.

538. **Cell Injury**

It occurs when a cell is damaged by factors such as toxins, infections, or ischemia, leading to its dysfunction. Cellular injury can result in various outcomes, including reversible damage or irreversible death. The extent of injury depends on the severity of the insult and the cell's ability to adapt. If the injury is severe and beyond the cell's repair mechanisms, it can lead to necrosis or apoptosis. The response to cell injury often involves inflammation and immune responses to attempt repair.

539. **Atrophy**

Atropy is the decrease in cell size due to reduced workload, aging, or ischemia. It can occur in organs or tissues that are not used or subjected to reduced blood flow. Atrophic cells may have fewer organelles and less protein synthesis, which results in a smaller size and decreased function. Common causes include disuse, malnutrition, hormonal changes, or aging. In some cases, atrophy is reversible if the underlying cause is addressed.

540. **Hypertrophy**

It refers to the increase in cell size due to enhanced functional demand, often in response to exercise or hormonal changes. This process involves the enlargement of individual cells and may affect organs or tissues like muscles or the heart. Hypertrophy leads to greater functional capacity, such as improved muscle strength or cardiac output. It is commonly observed in skeletal muscle after regular resistance training or in the heart due to high blood pressure. Unlike hyperplasia, hypertrophy does not involve an increase in cell number.

541. Hyperplasia

It refers to the increase in cell number due to hormonal stimulation, chronic irritation, or injury. It often occurs in tissues where cells can divide, such as epithelial or glandular tissues. Hyperplasia can be a normal physiological process, such as the enlargement of the uterus during pregnancy. However, in some cases, it can be pathological, leading to abnormal tissue growth. Conditions like benign prostatic hyperplasia or skin warts are examples of pathological hyperplasia.

542. **Metaplasia**

This is the reversible transformation of one cell type into another, often due to persistent irritation or injury. This process allows tissues to better withstand stress but can lead to abnormal cell growth. For example, chronic smoking can lead to the transformation of normal ciliated epithelial cells in the lungs to squamous cells, which are more resistant to damage but less effective in their original function. Metaplasia may also increase the risk of developing dysplasia or cancer in some cases.

543. **Dysplasia**

It refers to abnormal cell growth and development, often marked by irregularities in size, shape, and organization of cells. Dysplasia is considered a pre-cancerous condition, as it has the potential to progress to malignancy if left unchecked. It is often associated with chronic irritation, viral infections, or other factors that alter the normal cellular architecture. Dysplasia can be observed in tissues such as the cervix (e.g., cervical dysplasia), where it can be detected through screening. Early detection and intervention are crucial to prevent cancer.

544. **Calcification**

This is the deposition of calcium salts in tissues, often resulting in hardening of the affected area. It can occur in various tissues, including arteries (arterial calcification) and organs such as the kidneys and lungs. Calcification may be pathological, as in atherosclerosis, where calcium deposits contribute to plaque formation and hardening of the arteries. It can also be a physiological process, like bone formation. The presence of calcification in soft tissues often indicates underlying tissue damage or degeneration.

545. **Apoptosis**

Apoptosis is programmed cell death that helps eliminate damaged, infected, or unnecessary cells without causing inflammation. Unlike necrosis, which is a form of uncontrolled cell death, apoptosis is a controlled process that occurs through a series of biochemical events. It plays a crucial role in development, immune regulation, and tissue homeostasis. Apoptosis is initiated by internal signals (such as DNA damage) or external signals (like cytokines). Disruption in apoptotic pathways can lead to diseases such as cancer or neurodegenerative disorders.

546. **Necrosis**

Necrosis is the uncontrolled death of cells resulting from injury or damage, often leading to inflammation in the surrounding tissue. Unlike apoptosis, necrosis disrupts the cell membrane and releases cellular contents, triggering an inflammatory response. Common causes of necrosis include physical trauma, ischemia, infections, and toxins.

The dead cells may cause damage to surrounding tissues, leading to further complications. Necrosis can occur in tissues such as the heart (myocardial infarction) or liver (hepatitis).

547. **Inflammation**

Inflammation is the body's protective response to injury, infection, or harmful stimuli, characterized by redness, swelling, heat, and pain. It aims to eliminate the initial cause of injury, clear out dead cells, and initiate tissue repair. Inflammation is mediated by various immune cells, cytokines, and signaling pathways. Acute inflammation is a short-term response, while chronic inflammation can lead to tissue damage and is associated with conditions such as rheumatoid arthritis or inflammatory bowel disease. Proper regulation of inflammation is critical for health.

548. **Vascular Permeability**

It refers to the ability of blood vessels to allow the passage of fluids, cells, and proteins to the site of injury or infection. Increased vascular permeability is a key feature of inflammation, allowing immune cells and proteins like antibodies to reach the affected tissues. It is regulated by various mediators such as histamines, bradykinin, and cytokines. While beneficial for immune defense, excessive vascular permeability can contribute to edema and tissue damage. It is also involved in conditions like anaphylaxis or sepsis.

549. **Leukocyte Migration**

It is the process by which white blood cells (WBCs) move toward an area of infection or injury in response to chemical signals. This migration is crucial for the immune response, allowing WBCs to target and eliminate pathogens, dead cells, or foreign substances. It involves the activation of surface receptors on leukocytes, enabling them to exit blood vessels and enter tissues. Key molecules involved in this process include chemokines and adhesion molecules. Dysregulation of leukocyte migration can lead to autoimmune diseases or chronic inflammation.

550. **Cytokines**

Cytokines are signaling proteins secreted primarily by immune cells to coordinate and regulate immune responses. They are essential for cell-to-cell communication in the immune system, playing key roles in inflammation, immunity, and cell growth. Depending on their function, cytokines may promote inflammation—such as interleukins (IL-1, IL-6) and tumor necrosis factor-alpha (TNF-α)—or suppress it, as seen with interleukin-10 (IL-10). Their expression is tightly controlled to prevent excessive immune activity, which can result in tissue injury or autoimmune disorders. Dysregulation of cytokine production has been linked to diseases such as rheumatoid arthritis, sepsis, and various cancers.

Unit II:

551. **Hypertension**

Hypertension is a condition marked by persistently elevated blood pressure, often without noticeable symptoms—hence called the "silent killer." It increases the risk of heart attack, stroke, and kidney damage. Common risk factors include genetics, obesity, high salt intake, and inactivity. While manageable with medication and lifestyle changes, untreated hypertension can gradually harm arteries and vital organs.

552. **Congestive Heart Failure (CHF)**

CHF is a condition where the heart cannot pump blood efficiently, causing fluid buildup in the lungs and other tissues. Common symptoms are breathlessness, fatigue, and swelling. It often results from conditions like coronary artery disease, high blood pressure, or past heart attacks. Treatment includes medications such as diuretics, ACE inhibitors, and beta-blockers, with advanced cases possibly requiring surgical intervention or a heart transplant.

553. **Ischemic Heart Disease (IHD)**

IHD occurs when narrowed or blocked coronary arteries reduce blood flow to the heart, often due to atherosclerosis. This leads to chest pain, and if untreated, can cause heart attacks or heart failure. Contributing factors include smoking, high cholesterol, diabetes, and family history. Treatment involves lifestyle modifications, medications, and sometimes procedures like angioplasty or bypass surgery to restore blood flow.

554. **Angina Pectoris**

Angina is chest pain or discomfort caused by reduced oxygen supply to the heart muscle, typically due to ischemic heart disease. It's often triggered by exertion, stress, or heavy meals. Two main types exist: stable angina, which is predictable and relieved by rest or medication, and unstable angina, which is unpredictable and more serious. Treatment involves lifestyle changes, medications, and sometimes procedures like angioplasty.

555. Myocardial Infarction (MI)

Myocardial infarction, or heart attack, occurs when a coronary artery is completely blocked, usually by a blood clot over a ruptured plaque, cutting off blood flow to part of the heart muscle. This leads to tissue damage. Symptoms include intense chest pain, shortness of breath, sweating, and nausea. Emergency treatment with medications like aspirin or thrombolytics, and procedures like angioplasty or bypass surgery, aims to restore blood flow and reduce damage.

556. **Asthma**

Asthma is a long-term condition where inflamed and narrowed airways cause breathing difficulty, wheezing, and coughing. Triggers include allergens, cold air, exercise, and infections. Attacks can vary from mild to severe. Management involves bronchodilators for quick relief and corticosteroids to reduce inflammation. While not curable, asthma can be effectively controlled with proper treatment and trigger avoidance.

557. **Chronic Obstructive Pulmonary Disease (COPD)**

COPD is a progressive lung disorder that includes chronic bronchitis and emphysema, mainly caused by long-term exposure to irritants like cigarette smoke. It results in airflow blockage and breathing difficulties. Common symptoms are chronic cough, mucus production, and shortness of breath. Though incurable, COPD can be managed with medications, oxygen therapy, and lifestyle changes—

especially quitting smoking—to improve quality of life and slow disease progression.

558. Acute Renal Failure (ARF)

Sudden loss of kidney function causing waste buildup in blood. Causes include dehydration, infections, drugs, or urinary blockage. Symptoms: low urine output, swelling, confusion, fatigue. Prompt treatment (fluids, meds, dialysis) can reverse it; untreated may lead to chronic failure.

559. Chronic Renal Failure (CRF)

Gradual, irreversible kidney decline from diabetes, hypertension, or glomerulonephritis. Symptoms appear late: fatigue, fluid retention, electrolyte imbalance. Managed by controlling cause, diet, meds; dialysis or transplant needed in advanced stages.

Unit III:

560. Anemia

Low red blood cells or hemoglobin reducing oxygen delivery. Symptoms: fatigue, pale skin, dizziness. Causes: nutrition deficits, chronic disease, blood loss, genetics. Treatment targets cause; may include supplements, injections, transfusions.

561. Iron Deficiency Anemia

Insufficient iron to make hemoglobin, causing low red blood cells. Common from poor diet, blood loss, or absorption issues. Symptoms: fatigue, pale skin, brittle nails. Treated with iron supplements and diet changes; severe cases need infusions.

562. Megaloblastic Anemia

Vitamin B12 or folate deficiency causes large, immature red cells. Symptoms: fatigue, weakness, pale skin, cognitive problems. Caused by poor diet or absorption. Treatment includes B12 shots or folic acid supplements.

563. Sickle Cell Anemia

Genetic disorder causing crescent-shaped red cells that block blood flow, causing pain, organ damage, infections. Inherited mostly in certain ethnic groups. Managed by pain relief, infection prevention, transfusions; bone marrow transplant is a cure.

564. Thalassemia

Inherited abnormal hemoglobin production causing anemia and red cell destruction. Symptoms: fatigue, weakness, delayed growth. Common in Mediterranean, Middle Eastern, Southeast Asian populations. Treated with transfusions, iron chelation, possibly transplant.

565. Hemophilia

Genetic clotting disorder causing prolonged bleeding due to missing clotting factors. Mainly affects males; females can be carriers. Symptoms: easy bruising, nosebleeds, joint pain. Managed by regular clotting factor infusions.

566. Diabetes Mellitus (DM)

Metabolic disease with high blood sugar due to insulin deficiency (type 1) or resistance (type 2). Symptoms: thirst, frequent urination, fatigue, blurred vision. Managed by lifestyle, monitoring, insulin or medications to prevent complications.

567. Hyperthyroidism

Excess thyroid hormone causes high metabolism. Symptoms: weight loss, rapid heartbeat, anxiety, tremors, sweating. Causes: Graves' disease, nodules, inflammation. Treated with meds, radioactive iodine, or surgery.

568. Hypothyroidism

Low thyroid hormone slows metabolism. Symptoms: fatigue, weight gain, cold intolerance, dry skin, depression. Causes: autoimmune disease, iodine deficiency. Treated with hormone replacement.

569. Cushing's Syndrome

Excess cortisol from adrenal or pituitary tumors or steroids. Symptoms: weight gain (face, abdomen), high blood pressure, thin skin, osteoporosis. Treatment: surgery, meds, radiation.

570. Addison's Disease

Adrenal failure causing low cortisol and aldosterone. Symptoms: fatigue, weight loss, muscle weakness, low blood pressure. Caused by autoimmune damage or infections. Treated with lifelong hormone replacement.

Unit IV:

571. Epilepsy

Neurological disorder with recurrent seizures from abnormal brain electrical activity. Causes include genetics, injury, infection. Managed with anticonvulsants, surgery, or diet.

572. Parkinson's Disease

Progressive movement disorder due to dopamine neuron loss. Symptoms: tremor, rigidity, slow movement, balance issues. Treated with medications like levodopa and therapy.

573. Stroke

Sudden brain damage from blood flow loss (clot or bleed). Symptoms: weakness, speech problems, coordination loss. Requires urgent treatment; rehabilitation aids recovery.

574. Depression

Mental disorder with persistent sadness, hopelessness, loss of interest. Affects mood, behavior, physical health. Causes: genetic, biological, environmental. Treated with therapy, medication, lifestyle changes.

575. Schizophrenia

Chronic psychiatric illness causing delusions, hallucinations, disorganized thought, cognitive impairment. Begins in adolescence or early adulthood. Managed with antipsychotics and therapy.

576. Alzheimer's Disease

Progressive dementia marked by memory loss and cognitive decline due to brain plaques and tangles. No cure; treatment slows symptoms.

577. Peptic Ulcer

Sores in stomach or small intestine lining caused by acid or H. pylori infection. Symptoms: burning pain, bloating, nausea. Treated with acid blockers, antibiotics, lifestyle changes.

578. Inflammatory Bowel Disease (IBD)

Chronic GI inflammation (Crohn's, ulcerative colitis). Symptoms: abdominal pain, diarrhea, weight loss. Cause: immune dysfunction. Treated with anti-inflammatories, immunosuppressants, surgery.

579. Jaundice

Yellowing of skin and eyes due to high bilirubin from liver disease or red cell breakdown. Causes include hepatitis, gallstones. Treatment targets cause.

580. Hepatitis

Liver inflammation from viruses, alcohol, or drugs. Symptoms: fatigue, pain, jaundice. Managed with antivirals, steroids, vaccines.

581. Cirrhosis

Chronic liver scarring from diseases like hepatitis or alcohol abuse, leading to liver failure. Managed by treating cause and symptoms; transplant if needed.

582. Gout

Arthritis from uric acid crystal buildup in joints, causing pain and swelling. Triggered by diet, obesity, genetics. Treated with uric acid-lowering drugs and lifestyle changes.

583. Rheumatoid Arthritis

Autoimmune joint inflammation causing pain, stiffness, and damage. Treated with DMARDs, biologics, and steroids.

584. Osteoporosis

Weak bones prone to fracture due to low density, often postmenopausal or from other diseases. Silent until fracture occurs. Treated with medications, calcium, vitamin D, exercise.

Unit V:

585. Meningitis

Inflammation of brain/spinal cord membranes caused by infection. Symptoms: headache, fever, stiff neck. Treated with antibiotics or antivirals urgently.

586. Typhoid Fever

Bacterial infection from Salmonella typhi causing prolonged fever, abdominal pain. Spread via contaminated food/water. Treated with antibiotics; vaccine available.

587. Leprosy

Chronic infection by Mycobacterium leprae causing skin lesions, nerve damage. Spread by respiratory droplets. Treated with multidrug therapy.

588. Tuberculosis (TB)

Lung infection by Mycobacterium tuberculosis spread by air. Symptoms: cough, weight loss, fever. Treated with prolonged antibiotics; drug resistance complicates treatment.

589. Urinary Tract Infection (UTI)

Bacterial infection in urinary tract causing frequent, painful urination. More common in women. Treated with antibiotics; prevention includes hydration.

590. HIV/AIDS

Viral infection weakening the immune system, transmitted via blood, sex, or childbirth. ART controls HIV; no cure yet.

591. Syphilis

A bacterial sexually transmitted infection caused by *Treponema pallidum*. It progresses through four stages—primary (painless sores), secondary (rashes), latent, and tertiary (severe organ damage). Early treatment with penicillin prevents complications.

592. Gonorrhea

A common bacterial STI caused by *Neisseria gonorrhoeae*, affecting mucous membranes of the urethra, cervix, rectum, and throat. Symptoms include painful urination and discharge, though it can be asymptomatic. Treated with antibiotics; resistance is a concern.

593. Carcinogenesis

The multi-step process where normal cells transform into cancer cells due to genetic mutations affecting growth and apoptosis. Causes include carcinogens, genetics, and inflammation. It occurs in initiation, promotion, and progression stages.

594. Benign Tumor

A non-cancerous growth that remains localized and grows slowly. Usually removable by surgery and rarely harmful but can cause issues if pressing on nearby structures.

595. Malignant Tumor

A cancerous tumor that invades nearby tissues and can metastasize to distant organs. Characterized by uncontrolled cell growth. Treatment includes surgery, chemotherapy, and radiation.

596. Metastasis

The spread of cancer cells from the primary tumor through blood or lymph to form secondary tumors. It worsens prognosis and requires systemic therapy.

597. Chemotherapy

Treatment using drugs to kill rapidly dividing cancer cells. It also affects normal cells, causing side effects. Used alone or with other treatments to shrink or eliminate tumors.

598. Radiation Therapy

Uses high-energy radiation to damage cancer cell DNA, inhibiting growth. Delivered externally or internally to target tumors while sparing healthy tissue.

599. Immunotherapy

Enhances the immune system to attack cancer cells, including monoclonal antibodies and checkpoint inhibitors. Effective in some cancers but may cause immune-related side effects.

600. Targeted Therapy

Drugs designed to block specific molecules involved in cancer growth, minimizing damage to normal cells. Used in cancers with known molecular targets.

601. Biomarkers

Molecules indicating cancer presence or progression, used for diagnosis and monitoring. Examples include PSA for prostate cancer and CA-125 for ovarian cancer.

602. Angiogenesis

Formation of new blood vessels essential for tumor growth and metastasis. Tumors secrete factors like VEGF to stimulate this. Anti-angiogenic drugs block vessel growth to starve tumors.

603. Cancer Stem Cells (CSCs)

A subset of cancer cells capable of self-renewal and driving tumor growth and recurrence. They resist many treatments, making them key targets in therapy development.

604. Carcinoma in Situ

An early-stage cancer confined to its original location without invasion. Often curable if detected early, preventing progression to invasive cancer.

605. Staging

Assessment of cancer extent based on tumor size (T), lymph node involvement (N), and metastasis (M). Guides treatment and prognosis.

606. Epigenetics in Cancer

Study of gene expression changes without DNA sequence alteration, such as DNA methylation. Epigenetic modifications can promote or suppress cancer. Therapies aim to reverse these changes.

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Pharmaceutical Terminology - Vol. Ist

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