JELET Pharmacy Sample Paper-1

Duration: 120 Minutes **Maximum Marks: 100**

Instructions

- This paper contains **100** Multiple Choice Questions (Single Correct).
- Each correct answer carries **+1 marks**.
- Each incorrect answer carries: **−0.25** marks.
- Unattempted questions carry **0** marks.
- Only one option is correct for each question.
- Use of mobile phones, smartwatches, calculators, or any electronic gadgets is strictly prohibited.

Q1. Which of the following mechanisms is responsible for the transport of a drug across a cell membrane against a concentration gradient, requiring energy expenditure?

(A) Passive diffusion

(B) Facilitated diffusion

(C) Active transport

(D) Convective transport

Q2. As per the Drugs and Cosmetics Act, 1940, Schedule M relates to which of the following requirements?

(A) Standards for biological and special products

(B) Good Manufacturing Practices (GMP) for premises and materials

(C) List of prescription drugs

(D) Life period of drugs

Q3. What is the primary purpose of conducting a limit test for iron in pharmaceutical substances?

(A) To determine the precise percentage purity of iron

(B) To control the trace amount of iron contamination using a colorimetric comparison

(C) To measure the iron-binding capacity of the formulation

(D) To evaluate the redox stability of the compound

Q4. In the preparation of a stable emulsion, a combination of surfactants is chosen. If a formulator requires a surfactant system to stabilize an oil-in-water (o/w) emulsion, the HLB value should ideally be within which range?

(A) 1 to 3

(B) 3 to 6

(C) 8 to 16

(D) 16 to 18

Q5. A prescription requires the dispensing of 200 mL of a 0.05% w/v solution of chlorhexidine gluconate. How many milligrams of chlorhexidine gluconate are needed?

(A) 10 mg

(B) 50 mg

(C) 100 mg

(D) 200 mg

Q6. Under the Pharmacy Act 1948, the First Constitution of the Central Council (PCI) is required to be reconstituted every:

(A) 3 years

(B) 5 years

(C) 7 years

(D) 10 years

Q7. In a hospital pharmacy, "ABC Analysis" of inventory control is based primarily on which parameter?

(A) Criticality of the item for patient health

(B) Annual consumption value of the item

(C) Lead time required for procurement

(D) Storage space occupied by the items

Q8. Which specific cranial nerve is responsible for transmitting visual information from the retina to the brain?

(A) Cranial Nerve I

(B) Cranial Nerve II

(C) Cranial Nerve III

(D) Cranial Nerve V

Q9. In the biochemical screening of urine, a green-to-red precipitate obtained upon heating the sample with Benedict's reagent indicates the presence of:

(A) Albumin

(B) Reducing sugars

(C) Ketone bodies

(D) Bile salts

Q10. The biological source *Digitalis purpurea* belongs to which botanical family?

(A) Solanaceae

(B) Scrophulariaceae

(C) Apocynaceae

(D) Rubiaceae

Q11. Which of the following anatomical structures serves as the primary site for nutrient absorption within the digestive system?

(A) Stomach

(B) Duodenum and Jejunum

(C) Descending colon

(D) Esophagus

Q12. What is the biological half-life ($t_{1/2}$) of a drug that follows first-order elimination kinetics, if its elimination rate constant (K_e) is 0.1386 hr^{-1}?

(A) 2 hours

(B) 5 hours

(C) 7 hours

(D) 10 hours

Q13. In the context of national health programs in India, the DOTS strategy is explicitly utilized for the eradication and control of which disease?

(A) Malaria

(B) Tuberculosis

(C) HIV/AIDS

(D) Leprosy

Q14. Which of the following is considered an organoleptic method for the evaluation of crude drugs?

(A) Determination of refractive index

(B) Evaluation by means of organs of sense like color, odor, taste, and texture

(C) Measurement of stomatal index

(D) Estimation of total ash value

Q15. Which region of the nephron is the primary site for the reabsorption of the bulk of filtered water, sodium ions, and all glucose under normal physiological conditions?

(A) Loop of Henle

(B) Distal convoluted tubule

(C) Proximal convoluted tubule

(D) Collecting duct

Q16. When dispensing an aqueous eye drop formulation, which of the following is a critical chemical incompatibility that occurs if a phosphate buffer is used in the presence of calcium ions?

(A) Eutexia

(B) Liquefaction

(C) Precipitation of calcium phosphate

(D) Effervescence

Q17. The metabolic conversion of glucose into pyruvate via the glycolytic pathway occurs entirely within which cellular compartment?

(A) Mitochondrial matrix

(B) Endoplasmic reticulum

(C) Cytoplasm

(D) Lysosome

Q18. Which structural functional group is characteristically present in all local anesthetics belonging to the “amide” class, such as lidocaine?

(A) Ester linkage

(B) Ether linkage

(C) Amide linkage

(D) Secondary amine only

Q19. Which of the following terms describes an infection that a patient acquires specifically while hospitalized or receiving care within a healthcare facility?

(A) Idiopathic infection

(B) Iatrogenic infection

(C) Nosocomial infection

(D) Zoonotic infection

Q20. When counseling a patient who has been prescribed a sublingual nitroglycerin tablet for acute angina, what is the most vital instruction regarding administration?

(A) Swallow the tablet immediately with a full glass of water

(B) Chew the tablet thoroughly before swallowing

(C) Allow the tablet to dissolve entirely under the tongue without swallowing it

(D) Crush the tablet and mix it with food

Q21. According to the Narcotic Drugs and Psychotropic Substances (NDPS) Act, 1985, the cultivation of opium poppy can only be carried out under a license granted by:

(A) State Excise Department

(B) Central Government (Narcotics Commissioner)

(C) Pharmacy Council of India

(D) Director General of Health Services

Q22. Which of the following mechanical forces is predominantly utilized in a fluid energy mill for the reduction of particle size?

(A) Cutting and tearing

(B) Compression

(C) Impact and attrition

(D) Bruising

Q23. An excess accumulation of uric acid crystals in the joints, leading to acute painful inflammation, is the hallmark clinical diagnostic feature of:

(A) Rheumatoid arthritis

(B) Osteoarthritis

(C) Gout

(D) Osteoporosis

Q24. In the chemical assay of Inorganic Pharmaceuticals like Calcium Gluconate, which type of volumetric titration method is traditionally employed?

(A) Acid-base titration

(B) Complexometric titration with EDTA

(C) Non-aqueous titration

(D) Iodometric titration

Q25. Which enzyme is responsible for catalyzing the rate-limiting step in the biosynthesis of cholesterol, and is the primary molecular target for statins?

(A) HMG-CoA reductase

(B) Cyclooxygenase-1

(C) Acetyl-CoA carboxylase

(D) Phosphodiesterase-3

Q26. What type of physical incompatibility occurs when camphor and menthol are rubbed together in a mortar?

(A) Hydrolysis

(B) Formation of a eutectic mixture

(C) Chemical reduction

(D) Polymorphic transition

Q27. The clinical manifestation of "Gray Baby Syndrome" is a severe toxic reaction observed in neonates due to the accumulation of which antibiotic?

(A) Tetracycline

(B) Chloramphenicol

(C) Erythromycin

(D) Streptomycin

Q28. What is the fundamental mechanism of action of the drug Atropine?

(A) Competitive antagonist at muscarinic acetylcholine receptors

(B) Irreversible inhibitor of acetylcholinesterase

(C) Selective agonist at nicotinic receptors

(D) Adrenergic α_1 receptor blocker

Q29. Which of the following cellular organelles contains hydrolytic enzymes capable of breaking down macromolecules and old cellular components, often referred to as the "suicide bags" of the cell?

(A) Golgi apparatus

(B) Lysosomes

(C) Peroxisomes

(D) Mitochondria

Q30. In the cultivation of crude drugs, the process of removing unwanted plants that grow alongside the medicinal crop is known as:

(A) Pruning

(B) Weeding

(C) Coppicing

(D) Fallowing

Q31. Which of the following properties is characteristically exhibited by an ideal pharmaceutical buffer system?

(A) It changes pH drastically with small additions of acid

(B) It maintains a constant pH despite the addition of small amounts of acid or base

(C) It must always be highly acidic

(D) It irreversibly reacts with the drug molecules

Q32. How many grams of sodium chloride are contained in 500 mL of a normal saline solution (0.9% w/v)?

(A) 0.45 g

(B) 4.5 g

(C) 9.0 g

(D) 45.0 g

Q33. Which parameter measures the overall rate and extent to which an active drug ingredient is absorbed from a pharmaceutical dosage form and becomes available at the site of action?

(A) Bioequivalence

(B) Clearance

(C) Bioavailability

(D) Volume of distribution

Q34. The primary mechanism by which paracetamol exerts its antipyretic action is through the inhibition of prostaglandin synthesis in which anatomical region?

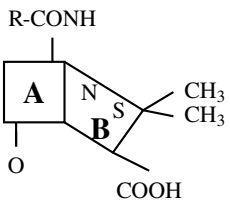
(A) Peripheral inflamed tissues

(B) Hypothalamus in the central nervous system

(C) Gastric mucosa

(D) Renal cortex

Q35. Which structural feature is common to all penicillins and cephalosporins, rendering them susceptible to enzymatic degradation by bacterial resistance mechanisms?



(A) Thiazolidine ring

(B) β-lactam ring

(C) Thiamorpholine ring

(D) Benzene ring

Q36. Which hormone, secreted by the parafollicular cells of the thyroid gland, functions to decrease blood calcium levels by inhibiting bone resorption?

(A) Parathyroid hormone (PTH)

(B) Calcitonin

(C) Thyroxine (T_4)

(D) Triiodothyronine (T_3)

Q37. The purposeful addition of cheaper, inferior, or exhausted substances to a genuine crude drug with an intention to deceive is termed as:

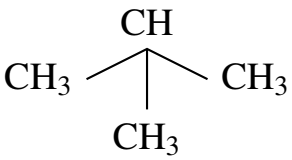
(A) Sophistication

(B) Substitution

(C) Adulteration

(D) Deterioration

Q38. In the structural nomenclature of organic molecules, which of the following represents a structural isomer of *n*-butane?



(A) Cyclobutane

(B) Isobutane (2-methylpropane)

(C) Propane

(D) But-1-ene

Q39. Which of the following materials is highly preferred for the fabrication of primary containers meant for parenteral preparations due to its high hydrolytic resistance?

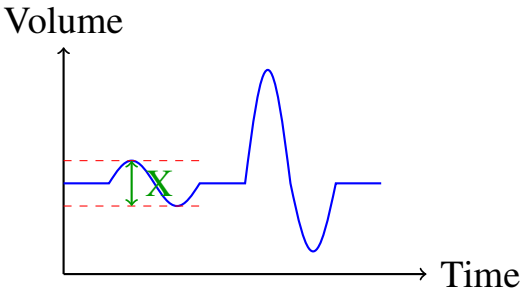
(A) Type I Borosilicate glass

(B) Type II Treated soda-lime glass

(C) Type III Soda-lime glass

(D) NP Non-parenteral glass

Q40. The volume of air that moves into and out of the lungs during a single, normal, quiet respiratory cycle is physiologically defined as the:



(A) Vital capacity

(B) Residual volume

(C) Tidal volume

(D) Inspiratory reserve volume

Q41. Which clinical test is specific for evaluating the structural integrity and intrinsic pathway of blood coagulation, frequently monitored during heparin therapy?

(A) Bleeding time

(B) Prothrombin time (PT)

(C) Activated Partial Thromboplastin Time (aPTT)

(D) Erythrocyte Sedimentation Rate (ESR)

Q42. The "Cold Place" storage condition specified in the official pharmacopoeia corresponds to a temperature range of:

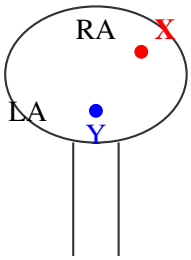
(A) Below 2°C

(B) 2°C to 8°C

(C) 8°C to 25°C

(D) Room temperature

Q43. Which of the following acts as the primary pacemaker of the human heart, generating spontaneous electrical impulses that initiate myocardial contraction?



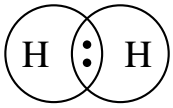
(A) Atrioventricular (AV) node

(B) Bundle of His

(C) Sinoatrial (SA) node

(D) Purkinje fibers

Q44. What type of bond involves the equal sharing of electron pairs between two non-metallic atoms?



(A) Ionic bond

(B) Covalent bond

(C) Hydrogen bond

(D) Coordinate bond

Q45. Which of the following is an example of an Over-The-Counter (OTC) medication commonly used for temporary relief of mild pain and fever without a prescription?

(A) Amoxicillin

(B) Ibuprofen

(C) Alprazolam

(D) Atorvastatin

Q46. In the process of purchasing and procurement for a hospital pharmacy, the legal document issued by the buyer to a seller indicating the types, quantities, and agreed prices for products is called a:

(A) Delivery challan

(B) Invoice

(C) Purchase order

(D) Credit note

Q47. The classification of crude drugs based on their therapeutic uses and pharmacological actions is known as:

(A) Morphological classification

(B) Taxonomical classification

(C) Pharmacological classification

(D) Chemical classification

Q48. Which component of the nervous system is dominant during stressful, emergency "fight-or-flight" situations?

(A) Parasympathetic nervous system

(B) Sympathetic nervous system

(C) Somatic nervous system

(D) Enteric nervous system

Q49. Which structural component of a protein molecule refers to the specific, linear sequence of amino acids linked together by peptide bonds?

(A) Primary structure

(B) Secondary structure

(C) Tertiary structure

(D) Quaternary structure

Q50. A major cause of chemical degradation of drugs containing ester or amide linkages when exposed to moisture during storage is:

(A) Oxidation

(B) Photolysis

(C) Hydrolysis

(D) Polymerization

Q51. Which of the following anti-hypertensive drugs acts as a selective blocker of Angiotensin II (AT_1) receptors?

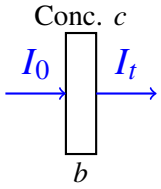
(A) Enalapril

(B) Losartan

(C) Amlodipine

(D) Atenolol

Q52. The fundamental law that forms the mathematical basis for quantitative estimations in spectrophotometric limit tests and colorimetry is:



(A) Beer-Lambert's law

(B) Fick's first law

(C) Stokes' law

(D) Noyce-Whitney equation

Q53. Which of the following components of public health focuses strictly on breaking the chain of transmission of infectious diseases across a community through artificial active immunization?

(A) Sanitation

(B) Vaccination/Immunization programs

(C) Vector control

(D) Sewage treatment

Q54. In family welfare programs, which of the following is categorized as a temporary mechanical barrier method of contraception?

(A) Tubectomy

(B) Vasectomy

(C) Condom

(D) Oral contraceptive pill

Q55. During the compounding of an ointment, the method used to reduce the particle size of a solid medicament by rubbing it in a mortar with a small amount of a liquid in which the solid is insoluble is called:

(A) Trituration

(B) Levigation

(C) Pulverization by intervention

(D) Elutriation

Q56. What type of dosage form is an “Elixir”?

(A) Hydroalcoholic, sweet, pleasant-flavored clear liquid preparation intended for oral use

(B) Coarse aqueous suspension of an insoluble drug

(C) Concentrated viscous aqueous solution of sucrose

(D) Oily liquid preparation meant for external application with friction

Q57. Which of the following vitamins is chemically a lipid-soluble derivative containing a sterol nucleus, and plays a vital role in calcium homeostasis?

(A) Vitamin B12

(B) Vitamin C

(C) Vitamin D

(D) Vitamin K

Q58. What is the primary molecular mechanism of action of the loop diuretic Furosemide?

(A) Inhibition of the $Na^+/K^+/2Cl^-$ cotransporter in the thick ascending limb of the loop of Henle

(B) Competitive inhibition of Aldosterone receptors

(C) Inhibition of Carbonic Anhydrase in the proximal tubule

(D) Blockade of the Na^+/Cl^- symporter in the distal tubule

Q59. The structural feature characterizing a "prodrug" is that it is:

(A) Highly active in vitro but undergoes rapid inactivation in vivo

(B) Pharmacologically inactive until it undergoes metabolic biotransformation within the body

(C) Formulated exclusively for topical application to avoid systemic absorption

(D) Resistant to any enzymatic breakdown

Q60. Which organelle inside the eukaryotic cell is primarily responsible for the generation of adenosine triphosphate (ATP) via oxidative phosphorylation?

(A) Nucleus

(B) Ribosome

(C) Mitochondrion

(D) Centrosome

Q61. Which type of primary packaging material presents the highest risk of chemical leaching and degradation when storing highly reactive liquid organic chemicals?

(A) Glass

(B) Low-Density Polyethylene (LDPE) plastic

(C) Stainless steel

(D) Aluminium foil

Q62. What is the legal requirement for a prescription containing a drug specified under Schedule H of the Drugs and Cosmetics Rules?

(A) It can be dispensed repeatedly without a fresh prescription

(B) It can only be sold by retail on the prescription of a Registered Medical Practitioner

(C) It must be dispensed free of cost under national programs

(D) It does not require any specialized storage record

Q63. Which part of the human brain controls vital autonomic functions such as cardiac output, blood pressure, respiration, and swallowing?

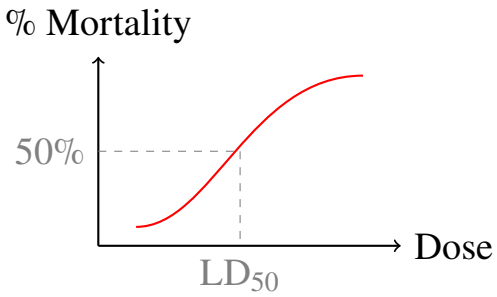
(A) Cerebellum

(B) Cerebrum

(C) Medulla oblongata

(D) Thalamus

Q64. In the context of toxicology, the term "LD50" refers to:



(A) The dose required to cure 50% of the test population

(B) The concentration of drug that inhibits 50% of enzyme activity

(C) The statistically derived single dose of a substance that can be expected to cause death in 50% of the tested animals

(D) The time taken for 50% of the drug to be excreted from the body

Q65. Which chemical constituent is categorized as a major purine alkaloid present in *Camellia sinensis*?

(A) Quinine

(B) Caffeine

(C) Morphine

(D) Reserpine

Q66. The process of modern drug procurement in a hospital setting that involves inviting sealed competitive financial bids from various pre-qualified manufacturers is called:

(A) Open tendering

(B) Direct purchasing

(C) Spot purchasing

(D) Emergency procurement

Q67. Which of the following describes a dynamic, therapeutic interaction where the combined effect of two drugs given together is significantly greater than the algebraic sum of their individual effects?

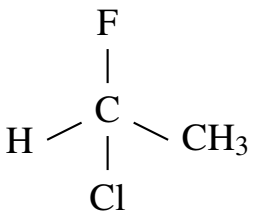
(A) Antagonism

(B) Additive effect

(C) Synergism (Potentiation)

(D) Tolerance

Q68. In organic chemistry, a carbon atom that is bonded to four entirely different atoms or groups of atoms is fundamentally termed as a:



(A) Carbocation

(B) Carbanion

(C) Chiral (Asymmetric) center

(D) Free radical

Q69. Which test is universally performed to detect the presence of carbohydrate molecules by observing a purple ring at the junction of two liquids?

(A) Biuret test

(B) Ninhydrin test

(C) Molisch's test

(D) Halphen's test

Q70. The primary biological function of the hormone Oxytocin, secreted by the posterior pituitary gland, is to stimulate:

(A) Water reabsorption by the kidneys

(B) Uterine smooth muscle contractions during labor and milk ejection

(C) Glycogenolysis in the liver

(D) Spermatogenesis in the testes

Q71. Which morphological class of crude drugs consists of cellular structures derived directly from plant organs, such as leaves, stems, and roots?

(A) Organized drugs

(B) Unorganized drugs

(C) Dried exudates

(D) Mineral drugs

Q72. In a community pharmacy setting, providing clear instructions to a patient on how to correctly use a metered-dose inhaler (MDI) falls under the domain of:

(A) Inventory management

(B) Pharmacovigilance

(C) Patient counselling

(D) Material compounding

Q73. Which of the following inorganic pharmaceutical compounds is widely used as a systemic acidifier?

(A) Sodium bicarbonate

(B) Ammonium chloride

(C) Magnesium hydroxide

(D) Calcium carbonate

Q74. The mechanical unit operation that involves separating solid particles from a fluid by passing the fluid through a porous medium that retains the solids is:

(A) Sedimentation

(B) Centrifugation

(C) Filtration

(D) Drying

Q75. Which type of solution has an effective osmolality identical to that of normal body fluids, causing no net movement of water across semi-permeable red blood cell membranes?

(A) Hypertonic solution

(B) Hypotonic solution

(C) Isotonic solution

(D) Saturated solution

Q76. Which structural component of the male reproductive system serves as the primary site for the physiological maturation and storage of spermatozoa?

(A) Seminiferous tubules

(B) Epididymis

(C) Prostate gland

(D) Seminal vesicles

Q77. The clinical manifestation of "Scurvy", characterized by bleeding gums and delayed wound healing, is directly caused by a nutritional deficiency of:

(A) Vitamin A

(B) Vitamin B1

(C) Vitamin C

(D) Vitamin D

Q78. In the preparation of a secondary container label for a "Liniment", which specific auxiliary warning statement must be prominently printed?

(A) For Oral Use Only

(B) Not for Injection

(C) For External Application Only; Do Not Apply to Broken Skin

(D) Store in a Deep Freezer

Q79. Which of the following is a key requirement for the ideal location and layout of a sterile hospital pharmacy manufacturing unit?

(A) High traffic flow near the outpatient entry

(B) Direct continuous ventilation from the outside environment without filters

(C) Controlled HEPA-filtered laminar airflow system with positive air pressure

(D) Wooden floors to minimize sound echoes

Q80. What is the therapeutic classification of the drug Ciprofloxacin?

(A) Macrolide antibiotic

(B) Fluoroquinolone antimicrobial

(C) Aminoglycoside antibiotic

(D) β-lactamase inhibitor

Q81. The diagnostic clinical test performed on blood samples to specifically confirm the presence of Salmonella antibodies in a patient suspected of having typhoid fever is the:

(A) Widal test

(B) Mantoux test

(C) ELISA test

(D) Schick test

Q82. According to the Poison Schedule guidelines and toxicology protocols, the primary immediate first-aid treatment for an ingested non-corrosive chemical poison within the first hour, before systemic absorption occurs, is:

(A) Administration of strong systemic acids

(B) Administration of activated charcoal to adsorb the poison

(C) Direct surgical intervention

(D) Intravenous administration of heavy fluids

Q83. Which of the following methods of drug administration completely bypasses the first-pass hepatic metabolism, ensuring 100% systemic bioavailability?

(A) Oral route

(B) Intravenous route

(C) Rectal route

(D) Deep intramuscular route

Q84. What type of functional group is formed by the reaction of a carboxylic acid with an alcohol?

(A) Ether

(B) Ester

(C) Anhydride

(D) Ketone

Q85. In an industrial pharmacy setup, the process of drying a thermolabile biological material (such as a vaccine or blood plasma) by sublimation under a high vacuum is known as:

(A) Spray drying

(B) Fluidized bed drying

(C) Lyophilization (Freeze drying)

(D) Tray drying

Q86. Which structural class of crude drugs includes gums, mucilages, resins, and dried juices that do not possess distinct cellular structures?

(A) Organized drugs

(B) Unorganized drugs

(C) Indigenous drugs

(D) Herbarium specimens

Q87. Under the National Health Mission (NHM) in India, the primary healthcare provider working at the village level as an interface between the community and the public health system is the:

(A) Medical Officer

(B) Accredited Social Health Activist (ASHA)

(C) Chief Pharmacist

(D) Health Inspector

Q88. Which of the following is an example of an inorganic compound widely used as an antacid due to its localized, non-systemic neutralizing capacity?

(A) Sodium carbonate

(B) Aluminium hydroxide gel

(C) Ammonium chloride

(D) Potassium perchlorate

Q89. Which anatomical structural unit is the primary site where gaseous exchange (oxygen and carbon dioxide) takes place between air and blood within the human respiratory system?

(A) Bronchioles

(B) Trachea

(C) Alveoli

(D) Pharynx

Q90. Which of the following is a critical objective of practicing effective inventory control using the "EOQ" model in drug store management?

(A) To maximize the number of expired items in stock

(B) To determine the Economic Order Quantity that minimizes total holding and ordering costs

(C) To bypass the verification of suppliers

(D) To eliminate the use of computer databases

Q91. In a clinical case presenting with acute organophosphate insecticide poisoning, which specific pharmacological agent is considered the first-line antidote to reverse life-threatening muscarinic symptoms?

(A) Physostigmine

(B) Atropine sulfate

(C) Neostigmine

(D) Pilocarpine

Q92. What is the molecular target and mechanism of action of the antibiotic Streptomycin?

(A) Inhibition of bacterial cell wall synthesis

(B) Binding to the 30S ribosomal subunit, causing misreading of mRNA and inhibition of protein synthesis

(C) Inhibition of DNA gyrase enzyme

(D) Disruption of bacterial cytoplasmic membrane integrity

Q93. The specific biochemical test used to detect the presence of proteins and amino acids containing a phenolic benzene ring (such as tyrosine) by forming a yellow-to-orange color upon heating with concentrated nitric acid is the:

(A) Biuret test

(B) Xanthoproteic test

(C) Ninhydrin test

(D) Molisch's test

Q94. Which of the following is a crucial step in the collection and processing of digitalis leaves to prevent the enzymatic hydrolysis of primary glycosides into less active secondary glycosides?

(A) Allowing the leaves to ferment slowly at room temperature

(B) Immediate drying of collected leaves at a temperature below 60°C to inactivate enzymes

(C) Exposing the leaves to direct rainfall

(D) Storing the fresh leaves in a highly humid open environment

Q95. The legal document issued by a registered medical practitioner directed to a pharmacist, containing instructions for compounding and dispensing specific medications for a patient, is called a:

(A) Monograph

(B) Pharmacopoeia

(C) Prescription

(D) Invoice

Q96. What is the fundamental chemical nature of an enzyme molecule?

(A) Complex polysaccharide

(B) Catalytic protein molecule

(C) Long-chain fatty acid derivative

(D) Inorganic mineral compound

Q97. Which of the following is a vital function of the human skeletal system?

(A) Synthesis of insulin hormone

(B) Production of blood cells via hematopoiesis within the red bone marrow

(C) Filtration of metabolic waste products from blood plasma

(D) Conduction of high-velocity electrical impulses

Q98. Which of the following situations describes a chemical incompatibility occurring due to a redox reaction between ingredients in a liquid formulation?

(A) Formation of a eutectic paste by mixing solids

(B) Oxidation of ascorbic acid when formulated in the presence of trace heavy metal ions

(C) Precipitation of an alkaloid by a change in solvent polarity

(D) Adsorption of a drug onto the surface of a container

Q99. The study of the biochemical and physiological effects of drugs and their mechanisms of action at the molecular or macromolecular level is formally defined as:

(A) Pharmacokinetics

(B) Pharmacodynamics

(C) Pharmacognosy

(D) Therapeutics

Q100. Which type of primary glass container is universally prohibited for storing parenteral formulations due to its low hydrolytic resistance and potential to leach high amounts of alkali into aqueous vehicles?

(A) Type I Glass

(B) Type II Glass

(C) Type III Glass

(D) Type IV (NP - Non Parenteral) Glass

Detailed Solutions

Q1.

Solution

Concept: Drug transport across biological membranes occurs primarily via passive mechanisms or carrier-mediated pathways. Active transport is a carrier-mediated process that moves solute molecules uphill against their electrochemical or concentration gradients from an area of lower concentration to an area of higher concentration, requiring chemical energy input, typically derived from adenosine triphosphate (ATP) hydrolysis.

Solution: Step 1: Analyze the criteria stated in the question, which include movement against a concentration gradient (uphill transport) and the explicit requirement of energy expenditure to drive the carrier-mediated process.
Step 2: Passive diffusion relies strictly on the kinetic energy of particles moving down a concentration gradient without any carrier involvement or external energy. Hence, option (A) is incorrect.
Step 3: Facilitated diffusion utilizes a specific membrane carrier protein to speed up transport down a concentration gradient, but it does not require cellular metabolic energy or drive molecules uphill. Hence, option (B) is incorrect.
Step 4: Convective transport, also known as pore transport, involves the movement of molecules through aqueous membrane pores driven by hydrostatic or osmotic pressure differences down a gradient. Hence, option (D) is incorrect.
Step 5: Active transport uses specific primary or secondary carrier proteins that change conformation using energy from ATP to actively pump drug molecules across the hydrophobic cell lipid bilayer against an existing concentration gradient. This exactly matches all requirements.
Final Answer: Active transport

Answer: (C)

Go Back to Question 1

Q2.

Solution

Concept: The Drugs and Cosmetics Act, 1940, and Rules, 1945, regulate the import, manufacture, distribution, and sale of drugs in India. The different schedules annexed to the rules lay down specific standards, classifications, and requirements for various categories of pharmaceutical operations and substances.

Solution: Step 1: Identify the legislative mandate of Schedule M within the framework of the Indian Drugs and Cosmetics Rules. Schedule M explicitly details the minimum requirements for factory premises, hygiene, machinery, equipment, quality control, and manufacturing operations.
Step 2: Evaluate option (A). Standards for biological and special products are governed by Schedule C and Schedule C1, not Schedule M.
Step 3: Evaluate option (B). Schedule M defines the administrative and physical criteria for Good Manufacturing Practices (GMP) to ensure drugs are consistently produced to quality standards.
Step 4: Evaluate option (C). The list of prescription-only drugs is categorized under Schedule H and Schedule H1.
Step 5: Evaluate option (D). The life period and expiry details of various pharmaceutical items are governed by Schedule P. Therefore, Schedule M strictly stands for Good Manufacturing Practices (GMP).
Final Answer: Good Manufacturing Practices (GMP) for premises and materials

Answer: (B)

Go Back to Question 2

Q3.

Solution

Concept: Limit tests are quantitative or semi-quantitative tests designed to detect and limit trace amounts of inorganic impurities present in pharmaceutical chemicals. The limit test for iron is based on the chemical reaction between iron impurities and thioglycolic acid in a medium buffered with citric acid and made alkaline with ammonia.

Solution: Step 1: Review the chemical principle of the limit test for iron. The reaction forms a pale pink to deep reddish-purple coordination complex of ferrous thioglycolate.
Step 2: Understand the regulatory function of this test. It is not an assay designed to quantify percentage purity, which makes option (A) conceptually incorrect.
Step 3: Analyze the methodology. The intensity of the purple color produced in the test solution is compared visually against a standard solution containing a known, permissible threshold concentration of iron.
Step 4: This matching protocol serves as a colorimetric comparison to confirm that trace contamination remains below the officially specified pharmacopoeial limits.
Step 5: Options (C) and (D) are irrelevant because the test does not measure chemical formulation binding capacity or evaluate the redox degradation mechanics.

Final Answer: To control the trace amount of iron contamination using a colorimetric comparison

Answer: (B)

Go Back to Question 3

Q4.

Solution

Concept: The Hydrophilic-Lipophilic Balance (HLB) scale is an empirical numerical system ranging from 1 to 20 used to classify the surface-active properties of amphiphilic surfactants. The value reflects the relative weight percentage of hydrophilic groups versus lipophilic groups within the surfactant molecular architecture.

Solution: Step 1: Recall the standard HLB values and their corresponding pharmaceutical applications for emulsion design.
Step 2: Surfactants with an HLB value between 1 and 3 function primarily as antifoaming agents. Hence, option (A) is incorrect.
Step 3: Surfactants with an HLB value between 3 and 6 are predominantly hydrophobic and act as water-in-oil (w/o) emulsifying agents. Hence, option (B) is incorrect.
Step 4: Surfactants with an HLB value between 8 and 16 possess significant hydrophilic character, enabling them to reduce interfacial tension at the oil-water boundary to effectively stabilize oil-in-water (o/w) emulsions.
Step 5: HLB values from 13 to 15 represent detergents, and values from 16 to 18 represent solubilizers or wetting agents. Therefore, the optimal operational range for formulating a stable o/w emulsion is 8 to 16.
Final Answer: 8 to 16

Answer: (C)

Go Back to Question 4

Q5.

Solution

Concept: Pharmaceutical calculation based on mass-volume percentage concentration. The expression % w/v is defined as the number of grams of solute dissolved in exactly 100 mL of the total liquid preparation.

Solution: Step 1: State the fundamental mathematical relation for mass-volume percentage:

$$\text{Weight of solute (g)} = \frac{\text{Percentage concentration (w/v)} \times \text{Total volume (mL)}}{100}$$

Step 2: Substitute the known values into the equation to calculate the mass of chlorhexidine gluconate in grams:

$$\text{Weight} = \frac{0.05 \times 200}{100} = \frac{10}{100} = 0.1 \text{ g}$$

Step 3: Convert the weight from grams into milligrams. Since 1 g = 1000 mg:

$$\text{Weight in mg} = 0.1 \times 1000 = 100 \text{ mg}$$

Step 4: Verify the calculations step-by-step to eliminate arithmetic distribution errors. A 0.05% w/v solution contains 0.05 g per 100 mL. Therefore, 200 mL must contain exactly 0.1 g, which translates to 100 mg.

Final Answer: 100 mg

Answer: (C)

Go Back to Question 5

Q6.

Solution

Concept: The Pharmacy Act, 1948, provides for the regulation of the profession and practice of pharmacy in India. The Pharmacy Council of India (PCI) is constituted by the Central Government as the apex regulatory council. The statutory framework sets a definitive tenure for the operational lifespan of each newly elected or nominated council before it must be reconstituted.

Solution: Step 1: Review the statutory composition and administrative provisions under Chapter II of the Pharmacy Act, 1948.
Step 2: The council comprises elected members representing UGC and AICTE, nominated members by the Central and State governments, and ex-officio members such as the Director General of Health Services and the Drugs Controller General of India.
Step 3: Section 7 of the Act mandates that an elected or nominated member of the Central Council shall hold office for a term of 5 years from the date of nomination or election.
Step 4: Consequently, the entire Central Council must be formally reconstituted every 5 years to ensure proper continuous governance and updating of educational standards in pharmacy.
Final Answer: 5 years

Answer: (B)

Go Back to Question 6

Q7.

Solution

Concept: ABC analysis (Always Better Control) is a widely used material management and inventory control technique used in hospital pharmacies. It segregates items based on the Pareto Principle (80-20 rule), which states that a small percentage of inventory items accounts for the vast majority of total monetary expenditure.

Solution: Step 1: Understand the classification parameters of ABC analysis. It divides the inventory into three distinct categories based on annual usage cost.
Step 2: 'A' items represent high-value inventory, accounting for approximately 70% to 80% of the annual budget while making up only 10% to 15% of items.
Step 3: 'B' items represent moderate value, while 'C' items are low-value items comprising the largest bulk of quantity but requiring minimal financial cost.
Step 4: Evaluate option (A). Criticality for patient health determines the VED (Vital, Essential, Desirable) analysis, not ABC.
Step 5: Options (C) and (D) determine the lead-time procurement and physical warehouse layout respectively. Therefore, ABC analysis depends explicitly on the annual consumption value of the item.
Final Answer: Annual consumption value of the item

Answer: (B)

Go Back to Question 7

Q8.

Solution

Concept: Cranial nerves are twelve pairs of nerves that emerge directly from the brain and brainstem to provide sensory and motor innervation to the head and neck. Each nerve has specialized functional pathways dedicated to autonomic, motor, or sensory signaling.

Solution: Step 1: Match the specific physiological functions of the cranial nerves listed in the options.
Step 2: Cranial Nerve I is the Olfactory nerve, which is solely responsible for the special sense of smell. Hence, option (A) is incorrect.
Step 3: Cranial Nerve II is the Optic nerve. It is a purely sensory nerve that originates from the ganglion cells of the retina and conducts visual impulses to the lateral geniculate nucleus of the thalamus and the primary visual cortex.
Step 4: Cranial Nerve III is the Oculomotor nerve, which controls most of the extraocular eye muscles and pupillary constriction. Hence, option (C) is incorrect.
Step 5: Cranial Nerve V is the Trigeminal nerve, responsible for facial sensation and mastication. Hence, option (D) is incorrect.
Final Answer: Cranial Nerve II

Answer: (B)

Go Back to Question 8

Q9.

Solution

Concept: Benedict's reagent is an alkaline chemical solution containing copper(II) sulfate, sodium citrate, and sodium carbonate. It is used as a diagnostic test to detect the presence of reducing sugars in clinical pathology samples such as urine.

Solution: Step 1: Understand the biochemistry behind Benedict's test. Reducing sugars possess a free aldehyde or ketone group that can act as a reducing agent.
Step 2: When boiled with Benedict's solution, the blue cupric ions (Cu^{2+}) are reduced to insoluble red cuprous oxide (Cu_2O) precipitate.
Step 3: The color changes progressively from blue (negative) to green, yellow, orange, and finally brick-red, depending on the concentration of the reducing sugar present.
Step 4: Albumin in urine is tested via the sulfosalicylic acid or heat coagulation test. Hence, option (A) is incorrect.
Step 5: Ketone bodies are detected via Rothera's test, and bile salts via Hay's sulfur test. Therefore, the green-to-red precipitate indicates reducing sugars like glucose.
Final Answer: Reducing sugars

Answer: (B)

Go Back to Question 9

Q10.

Solution

Concept: Pharmacognostic evaluation requires the memorization of the correct biological sources, active chemical constituents, and botanical families of crude plant drugs. Digitalis consists of the dried leaves of *Digitalis purpurea*, a vital cardiotonic drug.

Solution: Step 1: Identify the taxomomical classification of the plant *Digitalis purpurea*.
Step 2: Family Solanaceae includes tropane alkaloid-containing drugs such as Belladonna, Datura, and Hyoscyamus. Hence, option (A) is incorrect.
Step 3: Family Scrophulariaceae is the official botanical family to which *Digitalis purpurea* belongs.
Step 4: Family Apocynaceae includes medicinal plants like Vinca and Rauwolfia, which contain indole alkaloids. Hence, option (C) is incorrect.
Step 5: Family Rubiaceae contains Cinchona and Ipecacuanha. Therefore, Digitalis is definitively classified under the family Scrophulariaceae.
Final Answer: Scrophulariaceae

Answer: (B)

Go Back to Question 10

Q11.

Solution

Concept: The human digestive system is anatomically and physiologically divided into regions specialized for ingestion, digestion, absorption, and egestion. Nutrient absorption requires a vast mucosal surface area provided by specialized structures like villi and microvilli.

Solution: Step 1: Examine the functional role of each digestive organ listed. The stomach is primarily involved in mechanical churning and initial enzymatic digestion of proteins, but its absorptive capacity is limited to water, alcohol, and certain lipid-soluble drugs. Thus, option (A) is incorrect.
Step 2: The small intestine is divided into the duodenum, jejunum, and ileum. The structural adaptations of the duodenum and jejunum, including the plicae circulares, villi, and brush-border microvilli, make them the primary site for absorbing digested carbohydrates, amino acids, and fatty acids.
Step 3: The descending colon is part of the large intestine, which functions to absorb remaining water and electrolytes, forming feces. Thus, option (C) is incorrect.
Step 4: The esophagus is a simple muscular conduit. Therefore, the duodenum and jejunum are the primary sites for nutrient absorption.
Final Answer: Duodenum and Jejunum

Answer: (B)

Go Back to Question 11

Q12.

Solution

Concept: Pharmacokinetic modeling of first-order elimination processes indicates that the rate of drug elimination is directly proportional to the plasma drug concentration. The elimination half-life ($t_{1/2}$) is an intrinsic property of the drug that represents the time required for the plasma concentration to decrease by 50%.

Solution: Step 1: State the fundamental mathematical equation relating the first-order elimination rate constant (K_e) to the half-life ($t_{1/2}$):

$$t_{1/2} = \frac{\ln(2)}{K_e} = \frac{0.693}{K_e}$$

Step 2: Substitute the provided value of $K_e = 0.1386\ \text{hr}^{-1}$ into the equation:

$$t_{1/2} = \frac{0.693}{0.1386}$$

Step 3: Perform the numerical division step-by-step:

$$t_{1/2} = \frac{6930}{1386} = 5 \text{ hours}$$

Step 4: Double check the arithmetic operation to ensure there are no decimal point errors. Since $5 \times 0.1386 = 0.693$, the calculation confirms that the half-life is exactly 5 hours.

Final Answer: 5 hours

Answer: (B)

Go Back to Question 12

Q13.

Solution

Concept: National Health Programs are structured initiatives launched by the government to manage, control, and eliminate highly prevalent communicable or non-communicable public health conditions. DOTS is a globally recognized clinical management strategy.

Solution: Step 1: Identify the full form and operational goal of the DOTS acronym. DOTS stands for Directly Observed Treatment, Short-course.
Step 2: This health strategy was developed to prevent irregular drug administration and the emergence of multi-drug resistant strains of *Mycobacterium tuberculosis*.
Step 3: Under this program, health workers directly observe patients swallowing their prescribed anti-tubercular medication combinations.
Step 4: It does not form the core strategy for Malaria control (which relies on vector control and artemisinin-based combination therapies), HIV/AIDS care (ART centers), or Leprosy management (MDT therapy). Thus, DOTS is explicitly deployed for Tuberculosis control.
Final Answer: Tuberculosis

Answer: (B)

Go Back to Question 13

Q14.

Solution

Concept: The standardization and evaluation of crude drugs involve physical, chemical, biological, microscopic, and organoleptic techniques. Organoleptic evaluation refers specifically to qualitative evaluation using the human sensory organs.

Solution: Step 1: Define organoleptic evaluation. It means inspecting a crude drug sample using macroscopic sensory attributes such as color, odor, taste, size, shape, surface texture, and fracture appearance.
Step 2: Evaluate option (A). Measuring the refractive index is a quantitative physical evaluation method requiring a refractometer instrument.
Step 3: Evaluate option (C). Stomatal index determination is a detailed microscopic evaluation technique.
Step 4: Evaluate option (D). Total ash estimation is a physical evaluation method using a muffle furnace to measure inorganic residue.
Step 5: Therefore, evaluating a sample using sensory attributes like color, odor, taste, and texture is the correct definition of an organoleptic method.
Final Answer: Evaluation by means of organs of sense like color, odor, taste, and texture

Answer: (B)

Go Back to Question 14

Q15.

Solution

Concept: The nephron is the structural and functional unit of the human kidney, responsible for urine formation via glomerular filtration, tubular reabsorption, and tubular secretion. Different segments of the nephron possess specialized epithelium tailored to transport specific solutes.

Solution: Step 1: Analyze the physiological workload of the renal tubule segments. Glomerular filtration creates an ultrafiltrate containing water and small solutes.
Step 2: The proximal convoluted tubule (PCT) is lined with simple cuboidal epithelium featuring a prominent brush border of microvilli that increases the surface area.
Step 3: Under normal conditions, the PCT reabsorbs approximately 65% of filtered water and sodium ions, along with virtually 100% of vital nutrients like glucose and amino acids via secondary active transport.
Step 4: The loop of Henle primary regulates urine concentration and water-salt balancing. The distal tubule and collecting ducts handle fine-tuning under hormonal control. Thus, the PCT is the primary site for bulk reabsorption.
Final Answer: Proximal convoluted tubule

Answer: (C)

Go Back to Question 15

Q16.

Solution

Concept: Pharmaceutical incompatibilities occur when mixing components results in physical, chemical, or therapeutic changes that compromise the safety, appearance, or efficacy of a formulation. Chemical incompatibility involves interactions like precipitation, redox reactions, or gas evolution.

Solution: Step 1: Analyze the chemical ions present in the scenario described: phosphate anions (PO_4^{3-}) from the buffer and calcium cations (Ca^{2+}).
Step 2: Eutexia is a physical incompatibility involving the liquefaction of crystalline solids with low melting points when mixed, which is not applicable to an aqueous eye drop solution. Thus, option (A) and (B) are incorrect.
Step 3: When soluble calcium salts encounter soluble inorganic phosphate buffers in an aqueous medium, they react to form calcium phosphate:

$$3Ca^{2+} + 2PO_4^{3-} \rightarrow Ca_3(PO_4)_2 \downarrow$$

Step 4: Calcium phosphate has extremely low solubility in water, leading to immediate chemical precipitation. This visible precipitate destroys clarity, making the formulation dangerous for ophthalmic use.
Final Answer: Precipitation of calcium phosphate

Answer: (C)

Go Back to Question 16

Q17.

Solution

Concept: Glycolysis, also known as the Embden-Meyerhof-Parnas (EMP) pathway, is a sequence of ten enzyme-catalyzed reactions that breaks down one molecule of glucose into two molecules of pyruvate, generating a net yield of two ATP molecules and two NADH molecules.

Solution: Step 1: Identify the cellular localization of metabolic pathways. The enzymes responsible for catalyzing the ten sequential steps of glycolysis are soluble proteins dissolved within the cell sap.
Step 2: Consequently, glycolysis occurs entirely within the cytoplasm (cytosol) of both prokaryotic and eukaryotic cells, requiring no specialized membrane-bound organelles.
Step 3: The mitochondrial matrix is the site for downstream aerobic processes, including the Krebs cycle (Citric Acid Cycle) and β-oxidation of fatty acids. Thus, option (A) is incorrect.
Step 4: The endoplasmic reticulum handles protein and lipid synthesis, and lysosomes manage macromolecular degradation. Therefore, the cytoplasm is the correct cellular site for glycolysis.
Final Answer: Cytoplasm

Answer: (C)

Go Back to Question 17

Q18.

Solution

Concept: Clinically utilized local anesthetics are structurally categorized into two major chemical classes based on the nature of the intermediate linkage that connects the lipophilic aromatic ring to the hydrophilic tertiary amine group: amino-esters and amino-amides.

Solution: Step 1: Examine the chemical structural design of local anesthetics. Procaine, Tetracaine, and Benzocaine contain an ester linkage ($-COO-$) and belong to the ester group.
Step 2: Lidocaine (Lignocaine), Prilocaine, and Bupivacaine contain an amide linkage ($-NHCO-$) connecting the aromatic ring to the hydrocarbon chain.
Step 3: The presence of this amide bond makes lidocaine more resistant to enzymatic hydrolysis by plasma pseudocholinesterases compared to ester-type anesthetics.
Step 4: This structural difference gives amide local anesthetics a longer duration of action and greater metabolic stability, as they require hepatic microsomal enzymes for clearance. Therefore, the characteristic functional group is an amide linkage.
Final Answer: Amide linkage

Answer: (C)
Go Back to Question 18

Q19.

Solution

Concept: Epidemiological and public health classification of human infectious diseases based on their environmental origin, transmission patterns, and healthcare association.

Solution: Step 1: Define the specific medical terms used to describe disease etiology in the options.
Step 2: An idiopathic infection or condition is one that arises spontaneously from an obscure or completely unknown cause. Hence, option (A) is incorrect.
Step 3: An iatrogenic infection or illness is directly induced by a physician's diagnostic or therapeutic medical interventions, procedures, or drug treatments. Hence, option (B) is incorrect.
Step 4: A nosocomial infection, also termed a hospital-acquired infection (HAI), is defined as an infection that manifests in a patient who was admitted for a different clinical reason, and was neither present nor incubating at the time of admission.
Step 5: Zoonotic infections are diseases transmitted from non-human animals to humans. Thus, option (C) is the correct answer.
Final Answer: Nosocomial infection

Answer: (C)
Go Back to Question 19

Q20.

Solution

Concept: Patient counseling requires translating biopharmaceutic and pharmacokinetic knowledge into clear administration instructions. Sublingual delivery involves placing a drug under the tongue to achieve rapid absorption via the sublingual microvasculature.

Solution: Step 1: Evaluate the therapeutic goal of sublingual nitroglycerin. It is used to terminate acute angina pectoris attacks, requiring immediate systemic onset of action.
Step 2: Swallowing the tablet with water (option A) sends it down the gastrointestinal tract, where it undergoes extensive first-pass hepatic metabolism (> 90%), rendering it ineffective.
Step 3: Chewing or crushing the tablet (options B and D) leads to swallowing and subsequent inactivation by liver enzymes.
Step 4: Placing the tablet sublingually allows it to dissolve completely in salivary fluids. The dissolved drug diffuses directly across the thin epithelial membrane into systemic circulation via the deep lingual veins, bypassing the liver entirely. This provides rapid clinical relief within 1 to 3 minutes.

Final Answer: Allow the tablet to dissolve entirely under the tongue without swallowing it

Answer: (C)

Go Back to Question 20

Q21.

Solution

Concept: The Narcotic Drugs and Psychotropic Substances (NDPS) Act, 1985, creates legal controls over the cultivation, production, manufacture, possession, sale, purchase, and transport of narcotic drugs and psychotropic substances to balance medical availability with abuse prevention.

Solution: Step 1: Analyze the regulatory framework for the cultivation of narcotic crops like the opium poppy (*Papaver somniferum*).
Step 2: Because opium is highly addictive and strictly regulated under international treaties, its cultivation cannot be authorized by local state bodies or educational boards. Thus, option (A) and (C) are incorrect.
Step 3: The statutory authority is centralized under the Central Government of India. The Narcotics Commissioner, heading the Central Bureau of Narcotics (CBN), is legally empowered to issue permits and licenses defining the exact land area and parameters for opium cultivation.
Step 4: This keeps all processing under federal security oversight, preventing illicit diversion.

Final Answer: Central Government (Narcotics Commissioner)

Answer: (B)

Go Back to Question 21

Q22.

Solution

Concept: Size reduction (comminution) is a unit operation that increases the surface area of solid materials to improve dissolution rates, mixing uniformity, and formulation stability. Different industrial mills use specific mechanical forces like cutting, compression, impact, and attrition.

Solution: Step 1: Analyze the mechanism of a fluid energy mill (also known as a micronizer). This mill contains a shallow chamber with specialized nozzles that inject high-pressure air or inert gas to create a high-velocity sonic loop.
Step 2: Solid particles are suspended in this rapid turbulent gas stream, causing them to collide repeatedly with each other and the chamber walls at high speeds.
Step 3: Inter-particulate collisions cause structural fracture via impact forces, while rubbing actions between sliding surfaces cause particle breakdown via attrition.
Step 4: A fluid energy mill does not use moving mechanical components like blades or heavy rollers, relying entirely on impact and attrition to achieve micron-scale particle sizing.
Final Answer: Impact and attrition

Answer: (C)

Go Back to Question 22

Q23.

Solution

Concept: Pathophysiology of metabolic and skeletal disorders. Purine metabolism yields uric acid as an end product, which is normally cleared by the kidneys. Hyperuricemia can lead to the precipitation of monosodium urate crystals in synovial fluids.

Solution: Step 1: Evaluate the clinical definitions of the joint diseases listed in the options.
Step 2: Rheumatoid arthritis is a chronic autoimmune disease characterized by immune-mediated inflammation of the synovial membrane. Hence, option (A) is incorrect.
Step 3: Osteoarthritis is a degenerative joint disease caused by the mechanical breakdown of articular cartilage from wear and tear. Hence, option (B) is incorrect.
Step 4: Gout is a specific metabolic disease where needle-like monosodium urate crystals deposit in joints, frequently targeting the first metatarsophalangeal joint. This triggers an inflammatory response, causing acute, intense pain and swelling.
Step 5: Osteoporosis involves reduced bone mineral density, not crystal deposition. Thus, gout is the correct diagnosis.
Final Answer: Gout

Answer: (C)

Go Back to Question 23

Q24.

Solution

Concept: Volumetric analysis of inorganic pharmaceuticals utilizes titrimetric methods tailored to the chemical properties of the analyte, including acid-base, redox, precipitation, and complexometric titrations.

Solution: Step 1: Examine the chemical composition of Calcium Gluconate ($C_{12}H_{22}CaO_14$). It is a calcium salt containing divalent calcium ions (Ca^{2+}).
Step 2: Divalent and trivalent metal ions can react with hexadentate chelating ligands like disodium ethylenediaminetetraacetate (EDTA) to form stable, soluble chelate complexes.
Step 3: The assay of Calcium Gluconate is performed via complexometric titration. It uses an indicator like Mordant Black II or Patton and Reeder's indicator under alkaline conditions (pH $\approx$ 12) achieved with a sodium hydroxide solution.
Step 4: The EDTA titrant displaces the indicator from the metal ions, causing a distinct color change that marks the exact stoichiometric equivalence point.
Final Answer: Complexometric titration with EDTA

Answer: (B)

Go Back to Question 24

Q25.

Solution

Concept: Biochemical pathways of lipid metabolism and mechanism-targeted pharmacology. Endogenous cholesterol biosynthesis occurs in the liver via a multi-step enzymatic pathway starting from acetyl-CoA.

Solution: Step 1: Identify the rate-limiting enzyme that dictates the overall biosynthetic flux of the cholesterol pathway.
Step 2: The conversion of 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) to mevalonic acid is catalyzed by the intrinsic membrane protein HMG-CoA reductase. This step is the primary rate-limiting bottleneck of the pathway.
Step 3: Statins (such as atorvastatin and simvastatin) are structural analogs of HMG-CoA that act as competitive inhibitors of this enzyme.
Step 4: Inhibiting HMG-CoA reductase decreases intracellular cholesterol levels, upregulating hepatic LDL receptors to clear cholesterol from the blood.
Step 5: Cyclooxygenase-1 is targeted by NSAIDs, acetyl-CoA carboxylase regulates fatty acid synthesis, and phosphodiesterase-3 affects cardiovascular contractility.
Final Answer: HMG-CoA reductase

Answer: (A)

Go Back to Question 25

Q26.

Solution

Concept: Pharmaceutical incompatibilities are classified into physical, chemical, and therapeutic categories. A physical incompatibility occurs when the mixing of two or more substances leads to an undesirable change in the physical state, appearance, or solubility of the components, without involving a breakdown or modification of their primary covalent structures.

Solution: Step 1: Analyze the specific behavior of the solid volatile organic compounds mentioned, namely camphor and menthol. Both are crystalline solid structures at ambient room temperature.
Step 2: When these two specific compounds are mixed or rubbed together in a mortar, they form an intermolecular system where the compounds mutually lower each other's melting points.
Step 3: This specific thermodynamic behavior results in a liquid phase at room temperature because the melting point of the combined mixture drops below the ambient environmental temperature.
Step 4: This physical phenomenon is termed the formation of a eutectic mixture. It is a classic example of a physical incompatibility because no new covalent chemical bonds are broken or formed, yet the solid formulation liquefies into an unmanageable paste.
Step 5: Hydrolysis and chemical reduction are distinct chemical pathways that involve the breaking of chemical bonds, while polymorphic transition involves the rearrangement of a single substance into alternative crystalline lattices. Therefore, this process represents the formation of a eutectic mixture.

Final Answer: Formation of a eutectic mixture

Answer: (B)

Go Back to Question 26

Q27.

Solution

Concept: Pediatric pharmacology requires a detailed understanding of drug metabolic pathways, enzyme maturity, and potential toxicities unique to neonates. Neonatal hepatic systems lack a fully developed suite of metabolic enzymes, which can cause specific toxic accumulations of certain antimicrobial agents.

Solution: Step 1: Review the metabolic clearance pathway of the broad-spectrum antibiotic chloramphenicol. Chloramphenicol is normally metabolized in the liver via conjugation with glucuronic acid, a reaction catalyzed by the enzyme UDP-glucuronosyltransferase (UGT).
Step 2: In newborn infants and premature neonates, the hepatic expression of the UDP-glucuronosyltransferase enzyme is highly deficient and immature. Additionally, neonatal renal clearance mechanisms are not fully operational.
Step 3: Because the infant cannot efficiently conjugate or excrete the drug, plasma levels of chloramphenicol rise significantly. This excessive systemic accumulation causes a breakdown in mitochondrial electron transport within tissues.
Step 4: The resulting clinical manifestation is characterized by severe cardiovascular collapse, metabolic acidosis, hypothermia, loose green stools, and a characteristic ashen-gray skin discoloration. This cluster of signs is known as Gray Baby Syndrome.
Step 5: Tetracyclines cause bone growth suppression and tooth discoloration, erythromycin can cause cholestatic hepatitis in adults, and streptomycin exhibits prominent ototoxicity. Therefore, chloramphenicol is the specific causative agent.
Final Answer: Chloramphenicol

Answer: (B)

Go Back to Question 27

Q28.

Solution

Concept: The autonomic nervous system is regulated by specific neurotransmitters acting on specific receptor families. Acetylcholine acts on both nicotinic and muscarinic receptors to mediate parasympathetic signaling. Autonomic drugs are designed to block or stimulate these pathways to achieve specific clinical outcomes.

Solution: Step 1: Identify the biological origin and pharmacological profile of Atropine. Atropine is a tertiary amine alkaloid extracted from *Atropa belladonna* that acts as a classic parasympatholytic agent.
Step 2: Analyze the molecular mechanism of Atropine. It binds with high affinity to muscarinic acetylcholine receptors (M_1, M_2, M_3, M_4, M_5) across various effector organs.
Step 3: Atropine exerts competitive antagonism by occupying the active binding pocket of the muscarinic receptor, which physically prevents endogenous acetylcholine from binding and activating downstream G-protein coupled signaling pathways.
Step 4: This antagonism can be overcome by increasing the local concentration of acetylcholine, confirming its competitive nature.
Step 5: Atropine does not inhibit acetylcholinesterase, nor does it block nicotinic receptors or alpha-adrenergic pathways at standard therapeutic doses. Therefore, its primary mechanism is acting as a competitive antagonist at muscarinic acetylcholine receptors.
Final Answer: Competitive antagonist at muscarinic acetylcholine receptors

Answer: (A)

Go Back to Question 28

Q29.

Solution

Concept: Eukaryotic cells contain specialized, membrane-bound sub-cellular compartments called organelles, each configured to run specific biochemical processes. Intracellular macromolecular recycling and waste management require segregated zones containing concentrated degradative enzymes.

Solution: Step 1: Analyze the specific enzymatic profiles and functional roles of the organelles listed in the options.
Step 2: The Golgi apparatus is primarily involved in the post-translational modification, sorting, and packaging of proteins. Hence, option (A) is incorrect.
Step 3: Peroxisomes handle oxidative reactions and the catabolism of long-chain fatty acids, producing hydrogen peroxide as a byproduct. Hence, option (C) is incorrect.
Step 4: Mitochondria are dedicated to cellular respiration and ATP generation through oxidative phosphorylation. Hence, option (D) is incorrect.
Step 5: Lysosomes are spherical vesicles that contain an internal acidic environment (pH $\approx$ 4.5–5.0) populated with over forty types of hydrolytic enzymes, including proteases, nucleases, and lipases.
Step 6: If the lysosomal membrane ruptures or undergoes programmed autolysis, these hydrolases leak into the cytosol and digest the cell from within. For this reason, they are nicknamed the suicide bags of the cell.
Final Answer: Lysosomes

Answer: (B)

Go Back to Question 29

Q30.

Solution

Concept: The commercial cultivation of medicinal plants requires systematic agricultural management practices to optimize biomass yield, active secondary metabolite concentration, and crop purity. These practices include soil management, irrigation, pruning, and protection from competing flora.

Solution: Step 1: Review the definitions of the specific agricultural techniques listed in the options to isolate the correct horticultural term.
Step 2: Pruning refers to the selective removal of specific parts of a plant, such as branches, buds, or roots, to shape the plant or encourage fresh growth. Hence, option (A) is incorrect.
Step 3: Weeding is the agricultural process of identifying and removing unwanted, non-cultivated, or invasive plants (weeds) that grow alongside the primary medicinal crop.
Step 4: Removing weeds is critical because they compete with the medicinal plants for essential soil nutrients, sunlight, space, and water, which can significantly reduce the overall yield and purity of the harvest.
Step 5: Coppicing is a traditional method of woodland management where tree stems are cut down near ground level to stimulate regrowth, and fallowing means leaving land uncultivated for a period to restore fertility. Thus, weeding is the correct term.
Final Answer: Weeding

Answer: (B)

Go Back to Question 30

Q31.

Solution

Concept: Pharmaceutical chemistry utilizes chemical principles to optimize the chemical stability and biological compatibility of solutions. A buffer solution is a chemical system consisting of a mixture of a weak acid and its conjugate base, or a weak base and its conjugate acid, designed to resist rapid fluctuations in hydronium ion concentration.

Solution: Step 1: Examine the chemical function and operational definition of a buffer system within a liquid dosage form.
Step 2: The main purpose of a buffer is to minimize variations in pH when small amounts of strong acids (H^+) or strong bases ($-OH$) are introduced, or when environmental exposure leads to minor chemical changes during shelf-life storage.
Step 3: This stabilization is mathematically governed by the Henderson-Hasselbalch equation:

$$pH = pK_a + \log\left(\frac{[\text{Conjugate Base}]}{[\text{Weak Acid}]}\right)$$

Step 4: Evaluate the options. Option (A) describes the opposite of a buffer's function. Options (C) and (D) are incorrect because buffers can be configured across a wide range of acidic, neutral, or basic values, and they should remain inert rather than permanently modifying the drug structure. Therefore, maintaining a stable pH is the core property.
Final Answer: It maintains a constant pH despite the addition of small amounts of acid or base

Answer: (B)

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Q32.

Solution

Concept: Pharmaceutical compounding calculations rely heavily on mass-volume percentage concentrations. The expression percentage weight-in-volume (% w/v) expresses the exact number of grams of an active pharmaceutical ingredient or solute contained within exactly 100 mL of the final solution.

Solution: Step 1: Interpret the target concentration stated in the prompt, which is normal saline at 0.9% w/v of sodium chloride (NaCl) in water.
Step 2: Write down the proportional relationship defined by this concentration:

$$0.9\%\ \text{w/v} \implies 0.9\ \text{g of NaCl is present in 100 mL of solution}$$

Step 3: Set up a ratio to determine the total mass of sodium chloride required to prepare a larger volume of 500 mL:

$$\text{Mass of NaCl} = \frac{0.9\ \text{g}}{100\ \text{mL}} \times 500\ \text{mL}$$

Step 4: Solve the arithmetic expression step-by-step to prevent calculation errors:

$$\text{Mass of NaCl} = 0.9 \times 5 = 4.5\ \text{g}$$

Step 5: Verify the resulting value. A volume of 500 mL is exactly five times greater than 100 mL. Multiplying 0.9 g by 5 yields 4.5 g, which confirms option (B) is correct.
Final Answer: 4.5 g

Answer: (B)

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Q33.

Solution

Concept: Biopharmaceutics and clinical pharmacokinetics trace the time course of a drug after administration. Bioavailability is a core pharmacokinetic parameter used to evaluate how the choice of dosage form, route of administration, and physiological environment affect systemic drug absorption.

Solution: Step 1: Review the formal definitions of the primary pharmacokinetic parameters listed in the options.

Step 2: Bioequivalence refers to the comparative evaluation of two proprietary drug products containing the same active ingredient, showing no significant difference in the rate and extent of absorption. Hence, option (A) is incorrect.

Step 3: Clearance defines the volume of plasma cleared of drug per unit time, and volume of distribution links the total amount of drug in the body to its plasma concentration. Hence, options (B) and (D) are incorrect.

Step 4: Bioavailability (F) is defined as the rate and extent to which an active drug ingredient or therapeutic moiety is absorbed from a pharmaceutical product and becomes available at the systemic site of action.

Step 5: For intravenous administration, the drug enters systemic circulation directly, giving it a baseline bioavailability of 100% ($F = 1.0$). For extravascular routes (like oral tablets), bioavailability is usually lower due to incomplete absorption or first-pass hepatic metabolism.

Final Answer: Bioavailability

Answer: (C)

Go Back to Question 33

Q34.

Solution

Concept: Central nervous system and non-narcotic analgesic pharmacology. Paracetamol (Acetaminophen) is an effective antipyretic and analgesic agent, but it exhibits minimal peripheral anti-inflammatory action compared to classical NSAIDs.

Solution: Step 1: Analyze the mechanism of fever production. Pyrogens stimulate the release of interleukin-1, which induces the synthesis of prostaglandin E_2 (PGE_2) within the preoptic area of the hypothalamus, raising the thermal set-point of the body.
Step 2: Paracetamol works to reduce fever by inhibiting cyclooxygenase (COX) enzymes, thereby blocking prostaglandin synthesis.
Step 3: Unlike peripheral NSAIDs, the cyclooxygenase inhibition by paracetamol occurs primarily in the brain, where peroxide concentrations are low. Peripheral inflamed tissues contain high concentrations of peroxides that counteract paracetamol's inhibitory effects.
Step 4: By selectively inhibiting prostaglandin synthesis within the hypothalamus, paracetamol resets the hypothalamic thermoregulatory center back to its normal temperature. This triggers peripheral vasodilation and sweating to dissipate body heat.
Final Answer: Hypothalamus in the central nervous system

Answer: (B)

Go Back to Question 34

Q35.

Solution

Concept: Medicinal chemistry and structural classification of antimicrobial agents. β-lactam antibiotics are characterized by a highly strained core cyclic amide ring system that is essential for binding to and inhibiting penicillin-binding proteins (PBPs) involved in bacterial cell wall synthesis.

Solution: Step 1: Analyze the chemical structure of the core penicillin framework shown in the TikZ diagram. The structure consists of a fused bicyclic system where a four-membered cyclic amide ring is fused to a five-membered sulfur-containing thiazolidine ring.
Step 2: Identify the specific cyclic amide system labeled as **A** in the diagram. This four-membered hetero-atomic ring contains three carbon atoms and one nitrogen atom, with a carbonyl group (= O) adjacent to the nitrogen. This structure is known as a β-lactam ring.
Step 3: The β-lactam ring possesses substantial ring strain, making it highly reactive. This ring strain allows the carbonyl carbon to easily acylate the active-site serine residue of bacterial transpeptidase enzymes, permanently disabling them.
Step 4: However, this high ring strain also makes the structure susceptible to enzymatic hydrolysis by bacterial resistance enzymes known as β-lactamases (penicillinases). These enzymes open the ring, rendering the antibiotic completely inactive.
Step 5: The ring labeled **B** is the thiazolidine ring. While present in penicillins, cephalosporins feature a different six-membered dihydrothiazine ring fused to the same core β-lactam ring. Therefore, the common, vulnerable structural feature across all these classes is the β-lactam ring.
Final Answer: β-lactam ring

Answer: (B)

Go Back to Question 35

Q36.

Solution

Concept: Endocrine physiology and the regulation of mineral homeostasis. Blood calcium levels are kept within narrow physiological limits through the balanced actions of three primary hormones: parathyroid hormone, calcitonin, and active vitamin D. These hormones act on target receptors in bone, renal tubules, and the gastrointestinal tract.

Solution: Step 1: Match the specific physiological functions and cellular origins of the hormones listed in the options.
Step 2: Parathyroid hormone (PTH) is secreted by the parathyroid glands in response to hypocalcemia. It acts to increase blood calcium levels by stimulating osteoclast activity and bone resorption. Hence, option (A) is incorrect.
Step 3: The thyroid gland contains two distinct endocrine cell populations: follicular cells that synthesize thyroid hormones (T_3 and T_4), and parafollicular cells (also known as C-cells).
Step 4: The parafollicular cells secrete the peptide hormone calcitonin in response to hypercalcemia. Calcitonin works to lower blood calcium levels by inhibiting the bone-resorbing activity of osteoclasts and increasing renal calcium excretion.
Step 5: Thyroid hormones (T_3 and T_4) primary regulate systemic basal metabolic rates, rather than acute mineral homeostasis. Thus, calcitonin is the hormone responsible for decreasing blood calcium.
Final Answer: Calcitonin

Answer: (B)

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Q37.

Solution

Concept: Pharmacognostic quality control and legal terminology for crude drug commerce. Adulteration covers various forms of degradation, debasement, or intentional manipulation of crude botanical drugs that compromise the purity and authenticity of the supply.

Solution: Step 1: Evaluate the definitions of the terms listed in the options to identify the correct category of intentional manipulation.
Step 2: Substitution involves completely replacing a genuine crude drug with an entirely different botanical species or substance due to scarcity or high cost. Hence, option (B) is incorrect.
Step 3: Deterioration refers to an unintentional decline in the quality or active constituent content of a drug caused by poor storage conditions, aging, moisture, or insect infestation. Hence, option (D) is incorrect.
Step 4: Adulteration is a broad term that describes any form of debasement of a crude drug. However, when the debasement specifically involves the intentional addition of cheaper, inferior, or exhausted materials to imitate a genuine drug for fraudulent economic gain, it is classified as sophistication.
Step 5: Sophistication represents a calculated, highly deliberate form of economic adulteration intended to deceive buyers.
Final Answer: Sophistication

Answer: (A)

Go Back to Question 37

Q38.

Solution

Concept: Organic chemistry and structural isomerism. Isomers are compounds that share an identical molecular formula but possess different structural arrangements of their atoms in space, resulting in distinct physical and chemical properties.

Solution: Step 1: Determine the molecular formula of *n*-butane. *n*-butane is a straight-chain alkane containing four carbon atoms linked in a continuous line:

$$CH_3–CH_2–CH_2–CH_3 \implies \text{Molecular Formula} = C_4H_{10}$$

Step 2: Analyze the structural parameters of the options. Cyclobutane is a cyclic alkane with a molecular formula of C_4H_8. It is not an isomer of *n*-butane because it has a different number of hydrogen atoms. Hence, option (A) is incorrect.

Step 3: Propane contains three carbon atoms (C_3H_8), and but-1-ene is an alkene containing a double bond (C_4H_8). Hence, options (C) and (D) are incorrect.

Step 4: Examine the structure shown in the TikZ diagram. It displays a branched three-carbon chain with a methyl group appended to the central carbon atom. This compound is 2-methylpropane, commonly known as isobutane.

Step 5: Counting the atoms in isobutane yields four carbon atoms and ten hydrogen atoms (C_4H_{10}). Since it shares the same molecular formula as *n*-butane but features a branched skeletal arrangement, it is a structural (chain) isomer.

Final Answer: Isobutane (2-methylpropane)

Answer: (B)

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Q39.

Solution

Concept: Pharmaceutical manufacturing requires selecting packaging materials that maintain container-closure integrity and prevent chemical interactions with the formulation. Primary glass containers are classified into distinct pharmacopoeial types based on their chemical composition and resistance to water leaching (hydrolytic resistance).

Solution: Step 1: Review the structural composition and properties of the official glass classifications.
Step 2: Type I glass is a highly chemical-resistant glass formulated by replacing a portion of the network-modifying sodium ions with boron oxide (B_2O_3). This is known as highly resistant borosilicate glass.
Step 3: The addition of boron reduces the thermal expansion coefficient and minimizes the leaching of alkaline oxides into aqueous solutions. This gives Type I glass superb hydrolytic resistance, making it the preferred choice for packaging sensitive parenteral products, including blood derivatives and small-volume injections.
Step 4: Type II glass is a treated soda-lime glass where surface alkali ions are neutralized using sulfur dioxide gas at high temperatures. While it has good surface resistance, its bulk structure remains susceptible to leaching if scratched.
Step 5: Type III glass is standard soda-lime glass with moderate hydrolytic resistance, suitable for dry powders or oily injections, and NP glass is non-parenteral glass used only for oral or topical liquids. Therefore, Type I Borosilicate glass is the most preferred material.
Final Answer: Type I Borosilicate glass

Answer: (A)

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Q40.

Solution

Concept: Respiratory physiology and the evaluation of pulmonary volumes and capacities using spirometry. Lung capacities are combinations of distinct, non-overlapping respiratory volumes that change predictably based on physiological demands or underlying disease states.

Solution: Step 1: Interpret the graphical spirometer tracing shown in the accompanying TikZ diagram. The vertical axis monitors changes in lung volume, and the horizontal axis tracks time.
Step 2: The small, regular waves labeled as **X** represent the volume of air inspired or expired during standard, resting, quiet respiration without extra muscular effort.
Step 3: The physiological term for this normal resting volume is the tidal volume (V_T). In a healthy adult male, it typically averages approximately 500 mL per breath.
Step 4: Analyze the remaining options. Vital capacity represents the maximum volume of air a person can expel from the lungs after a maximum inhalation.
Step 5: Residual volume is the volume of air remaining in the lungs after a maximal forced expiration, and inspiratory reserve volume is the extra volume that can be inspired above a normal tidal inspiration. Thus, the volume labeled **X** is explicitly the tidal volume.
Final Answer: Tidal volume

Answer: (C)

Go Back to Question 40

Q41.

Solution

Concept: Clinical hematology and the diagnostic monitoring of coagulation pathways. Hemostasis is maintained via a cascade of enzymatic steps divided into the intrinsic, extrinsic, and common pathways, each evaluated using specific laboratory assays.

Solution: Step 1: Analyze the physiological pathways tested by the various coagulation assays listed in the options.
Step 2: Bleeding time measures the functional integrity of platelets and microvascular vasoconstriction, rather than specific plasma clotting factor cascades. Hence, option (A) is incorrect.
Step 3: Prothrombin time (PT) is a clinical assay used to evaluate the extrinsic coagulation pathway (specifically Factor VII) and the common pathway. It is commonly used to monitor oral anticoagulant therapy with warfarin. Hence, option (B) is incorrect.
Step 4: Activated Partial Thromboplastin Time (aPTT) is a specialized test that evaluates the functional integrity of the intrinsic coagulation pathway (Factors VIII, IX, XI, and XII) and the common pathway.
Step 5: Unfractionated heparin works by accelerating the inhibitory action of antithrombin III, which primarily targets thrombin and activated Factor X within the intrinsic and common pathways. Consequently, aPTT is highly sensitive to heparin levels and serves as the primary laboratory test for monitoring heparin therapy.

Final Answer: Activated Partial Thromboplastin Time (aPTT)

Answer: (C)

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Q42.

Solution

Concept: Pharmaceutical manufacturing, regulatory compliance, and warehouse logistics. Official pharmacopoeias mandate clear temperature definitions for storage areas to prevent the thermal acceleration of chemical degradation or physical instability in drug products.

Solution: Step 1: Recall the official temperature definitions specified in the general chapters of pharmacopoeias like the IP, BP, and USP.
Step 2: A freezer or deep freeze storage area corresponds to a temperature range maintained between $-25°C$ and $-10°C$.
Step 3: A cold place is officially defined as an environment where the temperature is maintained between $2°C$ and $8°C$. This is the standard operational range for domestic refrigerators used to store thermolabile items like insulin, vaccines, and reconstituted biological materials.
Step 4: A cool place corresponds to a temperature range between $8°C$ and $25°C$, while room temperature typically implies the ambient temperature of a working environment, usually between $20°C$ and $30°C$. Therefore, a cold place corresponds exactly to $2°C$ to $8°C$.
Final Answer: 2°C to 8°C

Answer: (B)

Go Back to Question 42

Q43.

Solution

Concept: Cardiovascular physiology and the intrinsic electrical conduction system of the heart. The regular contraction of cardiac muscle depends on specialized neuromuscular tissue that generates and propagates rhythmic action potentials without external nervous system stimulation.

Solution: Step 1: Analyze the schematic heart diagram provided in the TikZ layout. The diagram outlines the upper chambers (atria) and the primary intraventricular septum pathways.
Step 2: Observe the node labeled as **X** located in the superior, posterior wall of the right atrium (RA), near the opening of the superior vena cava. This structure is the sinoatrial (SA) node.
Step 3: The SA node has the fastest intrinsic rate of spontaneous diastolic depolarization (automaticity) among all cardiac tissues, generating action potentials at a basal rate of 60 to 100 impulses per minute. This allows it to suppress slower latent pacemakers and dictate the overall heart rate, making it the primary pacemaker of the heart.
Step 4: The node labeled Y represents the atrioventricular (AV) node, which introduces a crucial physiological delay to allow complete ventricular filling before contraction.
Step 5: The impulses travel from the AV node down the Bundle of His and into the Purkinje fibers to activate the ventricular myocardium. Therefore, the structure labeled **X** is the sinoatrial (SA) node.

Final Answer: Sinoatrial (SA) node

Answer: (C)

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Q44.

Solution

Concept: Fundamental chemical bonding and atomic interactions. Chemical bonds form when valence shell electrons are redistributed between atoms to establish a stable electronic configuration, typically matching a noble gas octet structure.

Solution: Step 1: Analyze the structural mechanics illustrated in the accompanying TikZ diagram. The diagram depicts two hydrogen atoms (H) whose outer atomic orbitals overlap.
Step 2: In the region of orbital overlap, a pair of electrons is shared between the two nuclei. Each hydrogen atom contributes one electron to form a single bond, allowing both to achieve a stable duplet configuration.
Step 3: When two non-metallic atoms with similar electronegativities share one or more pairs of valence electrons, the electrostatic attraction between the shared electrons and the positive nuclei forms a covalent bond.
Step 4: Compare this with other bond types. An ionic bond involves the complete transfer of electrons from a metal to a non-metal, creating oppositely charged ions.
Step 5: A hydrogen bond is a weak electrostatic attraction involving hydrogen and a highly electronegative atom like oxygen or nitrogen, and a coordinate bond involves a single atom donating both electrons to the shared pair. Thus, the diagram illustrates a covalent bond.
Final Answer: Covalent bond

Answer: (B)

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Q45.

Solution

Concept: Regulatory classification of consumer medications. Over-The-Counter (OTC) drugs are medications approved for sale directly to consumers without requiring a prescription from a licensed healthcare professional, as they have a well-established safety profile when used according to package directions.

Solution: Step 1: Analyze the legal and prescription criteria for the specific pharmaceutical agents listed in the options.
Step 2: Amoxicillin is an aminopenicillin antibiotic. To prevent the development of bacterial resistance and manage hypersensitivity risks, it is classified as a prescription-only drug. Hence, option (A) is incorrect.
Step 3: Ibuprofen is a non-steroidal anti-inflammatory drug (NSAID). In many regulatory frameworks, lower strengths of ibuprofen are approved as OTC medications for the short-term management of mild-to-moderate pain, inflammation, and fever.
Step 4: Alprazolam is a benzodiazepine classified under strict prescription schedules (such as Schedule H or Schedule X) due to its high potential for addiction, misuse, and physical dependence. Hence, option (C) is incorrect.
Step 5: Atorvastatin is an HMG-CoA reductase inhibitor used to manage hypercholesterolemia, requiring regular clinical monitoring of liver function. Thus, ibuprofen is the correct OTC drug choice.
Final Answer: Ibuprofen

Answer: (B)

Go Back to Question 45

Q46.

Solution

Concept: Hospital pharmacy administration, materials management, and financial auditing. The purchasing loop requires executing standardized commercial documents to ensure legal clarity, financial tracking, and inventory control between the healthcare institution and manufacturers.

Solution: Step 1: Review the functional sequence of documentation involved in the procurement cycle of a hospital or community pharmacy.
Step 2: A delivery challan is a document prepared by the seller that accompanies the physical shipment of goods, detailing the items sent but not necessarily listing financial costs. Hence, option (A) is incorrect.
Step 3: An invoice is a bill generated and sent by the seller to the buyer, demanding payment for items that have already been supplied. Hence, option (B) is incorrect.
Step 4: A purchase order (PO) is an official legal commercial document created and sent by the buyer (the hospital procurement department) to a vendor or seller. It specifies the types, quantities, packaging configurations, and agreed prices for the pharmaceutical items requested.
Step 5: Once accepted by the vendor, the purchase order forms a legally binding contract. A credit note is issued to adjust for returned or damaged goods. Thus, option (C) is the correct answer.
Final Answer: Purchase order

Answer: (C)

Go Back to Question 46

Q47.

Solution

Concept: Classification methodologies in pharmacognosy. Crude drugs obtained from natural plant, animal, or mineral sources can be systematically categorized using multiple taxonomic schemes to simplify identification, chemical study, and clinical application.

Solution: Step 1: Evaluate the organizational parameters of the classification frameworks listed in the options.
Step 2: Morphological classification groups crude drugs based on the plant organ from which they are derived, such as leaves, roots, seeds, or bark. Hence, option (A) is incorrect.
Step 3: Taxonomical classification organizes drugs based on their botanical evolutionary relationships, including class, order, family, genus, and species. Hence, option (B) is incorrect.
Step 4: Pharmacological classification categorizes crude drugs according to their primary therapeutic applications, clinical indications, and underlying mechanisms of action on biological systems.
Step 5: For example, under a pharmacological scheme, digitalis, strophanthus, and squill are grouped together as cardiotonic drugs because they share similar therapeutic actions on cardiac muscle. Chemical classification groups drugs based on their primary active constituents, such as alkaloids or glycosides.
Final Answer: Pharmacological classification

Answer: (C)

Go Back to Question 47

Q48.

Solution

Concept: Neuroanatomy and physiological division of the nervous system. The autonomic nervous system regulates involuntary visceral functions and is divided into the sympathetic and parasympathetic pathways, which exert antagonistic effects to maintain homeostasis.

Solution: Step 1: Identify the operational conditions that activate the different divisions of the autonomic nervous system.
Step 2: The parasympathetic nervous system is responsible for rest-and-digest functions. It acts to conserve metabolic energy, slow the heart rate, and stimulate gastrointestinal motility during non-threatening situations. Hence, option (A) is incorrect.
Step 3: The sympathetic nervous system is activated by stressful, emergency, alarming, or life-threatening situations. This activation triggers an immediate fight-or-flight response.
Step 4: Sympathetic stimulation causes pupillary dilation (mydriasis), bronchodilation to improve gas exchange, an increase in heart rate and myocardial contractility, and a redistribution of blood flow from the digestive tract to skeletal muscle.
Step 5: The somatic nervous system governs voluntary skeletal muscle movements, and the enteric nervous system locally regulates the GI tract. Thus, the sympathetic division dominates during emergency stress.
Final Answer: Sympathetic nervous system

Answer: (B)

Go Back to Question 48

Q49.

Solution

Concept: Structural biochemistry and protein architecture. Proteins are complex macromolecular polymers constructed from long structural chains of amino acid monomers. Protein folding occurs in a hierarchical series of structural stages that dictate the final three-dimensional shape and biological function.

Solution: Step 1: Analyze the architectural definitions of the four distinct levels of protein structure.
Step 2: The primary structure refers to the exact linear sequence of amino acid residues linked together by covalent peptide bonds along a polypeptide chain. This sequence is directly determined by the genetic code within DNA.
Step 3: The secondary structure refers to localized, repeating spatial arrangements of the polypeptide backbone stabilized by hydrogen bonds, such as the α-helix and β-pleated sheet. Hence, option (B) is incorrect.
Step 4: The tertiary structure defines the overall three-dimensional folding of a single polypeptide chain, stabilized by hydrophobic interactions, disulfide bridges, and ionic bonds. Hence, option (C) is incorrect.
Step 5: The quaternary structure describes the spatial arrangement and assembly of multiple polypeptide subunits. Therefore, the linear sequence of amino acids represents the primary structure.
Final Answer: Primary structure

Answer: (A)

Go Back to Question 49

Q50.

Solution

Concept: Pharmaceutical stability and pathways of chemical degradation. Active pharmaceutical ingredients are susceptible to structural degradation when exposed to environmental factors like moisture, oxygen, light, and elevated temperatures during storage.

Solution: Step 1: Identify the specific chemical functional groups present in the drug molecules mentioned, namely ester (−COO−) or amide (−CONH−) linkages.
Step 2: Oxidation involves the loss of electrons or interaction with oxygen, often targeting phenolic or unsaturated double bonds. Hence, option (A) is incorrect.
Step 3: Photolysis refers to chemical breakdown induced by radiant energy or light exposure, typically affecting molecules like nitroprusside. Hence, option (B) is incorrect.
Step 4: Hydrolysis is a chemical degradation pathway where a molecule interacts with water, causing a cleavage of chemical bonds.
Step 5: When drugs containing ester groups (such as aspirin or procaine) or amide groups (such as lidocaine or penicillins) are exposed to moisture, water molecules attack the carbonyl carbon. This breaks the ester or amide linkage, splitting the molecule into its corresponding acid and alcohol or amine components and causing a loss of therapeutic potency.
Final Answer: Hydrolysis

Answer: (C)

Go Back to Question 50

Q51.

Solution

Concept: The renin-angiotensin-aldosterone system (RAAS) is a key hormonal cascade that regulates systemic blood pressure and fluid balance. Angiotensin II is a potent vasoconstrictor that exerts its primary physiological actions by binding to specific G-protein coupled receptors, primarily the AT_1 receptor subtype.

Solution: Step 1: Review the pharmacological mechanisms of the anti-hypertensive drug classes listed in the options.
Step 2: Enalapril is an Angiotensin-Converting Enzyme (ACE) inhibitor that blocks the conversion of Angiotensin I to Angiotensin II. It does not directly block the receptor itself. Hence, option (A) is incorrect.
Step 3: Losartan belongs to the class of Angiotensin Receptor Blockers (ARBs). It acts as a highly selective, competitive antagonist at the Angiotensin II type 1 (AT_1) receptor.
Step 4: By binding to the AT_1 receptor, Losartan blocks the vasoconstrictor, aldosterone-secreting, and renal sodium-reabsorbing effects of Angiotensin II, leading to smooth muscle relaxation and decreased blood pressure.
Step 5: Amlodipine is a dihydropyridine calcium channel blocker, and Atenolol is a selective β_1-adrenergic receptor antagonist. Therefore, Losartan is the specific AT_1 receptor blocker.
Final Answer: Losartan

Answer: (B)

Go Back to Question 51

Q52.

Solution

Concept: Spectrophotometric and colorimetric analyses are common methods used in pharmaceutical quality control to evaluate trace impurities. These optical methods rely on measuring how a substance interacts with electromagnetic radiation at specific wavelengths.

Solution: Step 1: Analyze the physical setup illustrated in the accompanying TikZ diagram. An incident light beam of intensity I_0 passes through a sample cell (cuvette) of path length b containing a solution at concentration c. The transmitted light beam emerges with a lower intensity I_t.

Step 2: The reduction in light intensity is governed by the Beer-Lambert Law, which states that the absorbance (A) of a monochromatic light beam passing through a homogeneous absorbing medium is directly proportional to both the concentration of the absorbing solute and the path length of the medium.

Step 3: This relationship is mathematically expressed as:

$$A = \log\left(\frac{I_0}{I_t}\right) = a \cdot b \cdot c$$

where a is the absorptivity coefficient of the substance.

Step 4: Evaluate the other options. Fick's first law governs mass diffusion rates; Stokes' law describes the sedimentation velocity of suspended particles; and the Noyes-Whitney equation describes the rate of solid dissolution. Thus, the correct framework is the Beer-Lambert Law.

Final Answer: Beer-Lambert's law

Answer: (A)

Go Back to Question 52

Q53.

Solution

Concept: Public health programs utilize multiple strategies to manage and limit the spread of infectious diseases across communities. These interventions can target the environment, disease vectors, or the host's immune system.

Solution: Step 1: Evaluate the definitions and primary mechanisms of the public health interventions listed in the options.
Step 2: Environmental sanitation and sewage treatment remove pathogens from the physical environment to prevent waterborne transmission, but they do not alter host immunity. Hence, options (A) and (D) are incorrect.
Step 3: Vector control focuses on eliminating disease-carrying organisms, such as mosquitoes or rodents, to interrupt the transmission cycle. Hence, option (C) is incorrect.
Step 4: Vaccination and immunization programs involve administering antigenic material (such as weakened or killed pathogens, or toxoids) to a healthy individual.
Step 5: This exposure triggers an active immune response, stimulating B-lymphocytes to produce specific antibodies and memory cells. This artificial active immunity protects the individual and helps establish herd immunity across the community, effectively breaking the chain of transmission.
Final Answer: Vaccination/Immunization programs

Answer: (B)

Go Back to Question 53

Q54.

Solution

Concept: Family welfare and reproductive health initiatives employ various contraceptive strategies to prevent unintended pregnancies. These methods are categorized into temporary (reversible) or permanent (irreversible) options, and further sub-classified by their mechanism of action into barrier, hormonal, chemical, or surgical approaches.

Solution: Step 1: Evaluate the contraceptive options listed based on their operational mechanism and reversibility.
Step 2: Tubectomy and vasectomy are surgical sterilization procedures for females and males, respectively. They involve cutting or blocking the reproductive ducts, making them permanent and irreversible surgical methods. Thus, options (A) and (B) are incorrect.
Step 3: Oral contraceptive pills are a systemic, temporary hormonal method that works by releasing synthetic hormones to suppress ovulation and alter cervical mucus. Hence, option (D) is incorrect.
Step 4: A condom is a temporary, non-systemic mechanical barrier method. It works by creating a physical barrier that prevents spermatozoa from entering the female reproductive tract during intercourse.
Step 5: This physical barrier mechanism also helps prevent the transmission of sexually transmitted infections (STIs), making it a key tool in public health.
Final Answer: Condom

Answer: (C)

Go Back to Question 54

Q55.

Solution

Concept: Compounding pharmaceutical ointments and suspensions requires incorporating solid medicaments into a semi-solid or liquid vehicle. To ensure uniformity, smooth texture, and optimal drug release, the solid particles must be reduced to a fine size and thoroughly wetted before final blending.

Solution: Step 1: Analyze the specific compounding techniques listed in the options.
Step 2: Trituration refers broadly to grinding a solid substance in a mortar to reduce its particle size, often without adding a liquid. Hence, option (A) is incorrect.
Step 3: Levigation is the process of reducing the particle size of a solid by grinding it in a mortar or on a slab with a small volume of a viscous liquid (the levigating agent) in which the solid is completely insoluble.
Step 4: Common levigating agents include mineral oil or glycerin. This process shears the solid aggregates into fine particles and displaces entrapped air, forming a smooth paste that easily incorporates into ointment bases.
Step 5: Pulverization by intervention uses a volatile solvent to dissolve a stubborn material before grinding, and elutriation is a separation method based on upward fluid flow. Therefore, levigation is the correct term.
Final Answer: Levigation

Answer: (B)

Go Back to Question 55

Q56.

Solution

Concept: Liquid dosage forms for oral administration are classified based on their physical state (monophasic or biphasic) and chemical composition. Monophasic formulations include syrups, elixirs, linctuses, and drops, each designed for specific stability and palatability requirements.

Solution: Step 1: Analyze the characteristic formulation properties of an Elixir.
Step 2: An elixir is a clear, pleasantly flavored, sweetened, monophasic liquid preparation formulated as a hydroalcoholic solution intended for oral use.
Step 3: The inclusion of ethanol (alcohol) in the vehicle is a key structural feature. It serves as a co-solvent to dissolve active ingredients that have poor water solubility, and helps preserve the formulation.
Step 4: Evaluate the other options. Option (B) describes an oral suspension, which is a biphasic system. Option (C) defines a syrup, which is a concentrated aqueous solution of sucrose or sugar substitutes. Option (D) describes a liniment, which is an external topical preparation.
Step 5: Therefore, a hydroalcoholic, sweet, and clear monophasic liquid preparation accurately defines an elixir.

Final Answer: Hydroalcoholic, sweet, pleasant-flavored clear liquid preparation intended for oral use

Answer: (A)

Go Back to Question 56

Q57.

Solution

Concept: Vitamins are essential organic micronutrients required for key metabolic processes. They are classified into water-soluble categories (B-complex and Vitamin C) and lipid-soluble categories (Vitamins A, D, E, and K) based on their chemical structure and solubility profiles.

Solution: Step 1: Analyze the chemical structures and solubility profiles of the vitamins listed in the options.
Step 2: Vitamin B12 (Cyanocobalamin) and Vitamin C (Ascorbic acid) are highly polar molecules that dissolve readily in water. They do not contain a steroid-like core. Hence, options (A) and (B) are incorrect.
Step 3: Vitamin K is a fat-soluble vitamin, but its structure is based on a naphthoquinone ring system involved in clotting factor carboxylation, not a sterol nucleus. Hence, option (D) is incorrect.
Step 4: Vitamin D (Calciferol) is a fat-soluble vitamin derived from secosteroids, which contain a modified cyclopentanoperhydrophenanthrene (sterol) core structure.
Step 5: Vitamin D acts as a hormone to maintain calcium homeostasis. It stimulates the expression of calcium-binding proteins in intestinal enterocytes, increasing calcium absorption to support bone mineralization.
Final Answer: Vitamin D

Answer: (C)

Go Back to Question 57

Q58.

Solution

Concept: Diuretics are therapeutic agents that increase urine output by inhibiting specific sodium and electrolyte reabsorption pathways along the nephron. Loop diuretics are highly potent (high-ceiling) agents that target transport mechanisms in the loop of Henle.

Solution: Step 1: Identify the primary site of action for the loop diuretic Furosemide. Furosemide acts on the thick ascending limb (TAL) of the loop of Henle.
Step 2: Analyze the molecular mechanism in the TAL. The luminal membrane of epithelial cells in this segment contains a specialized symporter: the $Na^+/K^+/2Cl^-$ cotransporter (NKCC2), which reabsorbs one sodium ion, one potassium ion, and two chloride ions from the tubular fluid.
Step 3: Furosemide binds directly to the chloride-binding site of the NKCC2 symporter, inhibiting its transport activity.
Step 4: This inhibition prevents the reabsorption of these electrolytes, keeping them inside the tubular lumen. This increases the osmotic pressure of the fluid, preventing water reabsorption and leading to a significant increase in the excretion of water, sodium, chloride, and potassium.
Step 5: Furosemide does not block aldosterone receptors (spironolactone), inhibit carbonic anhydrase (acetazolamide), or block the NCC symporter in the distal tubule (thiazides).

Final Answer: Inhibition of the $Na^+/K^+/2Cl^-$ cotransporter in the thick ascending limb of the loop of Henle

Answer: (A)

Go Back to Question 58

Q59.

Solution

Concept: Medicinal chemistry often utilizes structural modifications to optimize a drug's pharmacokinetic properties. A prodrug is an intentionally modified chemical derivative of an active drug molecule designed to overcome specific delivery barriers, such as poor water solubility, inadequate gastrointestinal absorption, or extensive pre-systemic metabolism.

Solution: Step 1: Understand the definition and behavior of a prodrug system.
Step 2: A prodrug is a pharmacologically inactive or significantly less active chemical entity when administered.
Step 3: Once inside the body, the prodrug must undergo predictable chemical or enzymatic biotransformation (such as hydrolysis by esterases or reduction by hepatic enzymes) to cleave the modifying group.
Step 4: This metabolic cleavage releases the active, therapeutically potent parent drug molecule at its target site of action.
Step 5: Prodrugs are not designed to be active in vitro or resistant to all metabolic degradation; rather, they rely on metabolic pathways to trigger their therapeutic activation inside the body.

Final Answer: Pharmacologically inactive until it undergoes metabolic biotransformation within the body

Answer: (B)

Go Back to Question 59

Q60.

Solution

Concept: Eukaryotic cells contain specialized, membrane-bound organelles that run specific metabolic pathways. Cellular respiration couples the breakdown of nutrients with the generation of chemical energy in the form of adenosine triphosphate (ATP).

Solution: Step 1: Analyze the metabolic roles of the cellular structures listed in the options.
Step 2: The cell nucleus houses genetic material (DNA) and manages transcription processes. Hence, option (A) is incorrect.
Step 3: Ribosomes are the primary cellular machinery responsible for translating mRNA into protein chains. Hence, option (B) is incorrect.
Step 4: Centrosomes organize the microtubule network during cell division. Hence, option (D) is incorrect.
Step 5: The mitochondrion contains an outer membrane, an inner membrane folded into cristae, and an internal matrix. This organelle houses the enzymes for the Krebs cycle and the protein complexes of the Electron Transport Chain (ETC).
Step 6: The ETC creates a proton gradient across the inner membrane that drives ATP synthase to generate ATP via oxidative phosphorylation. Because it produces the bulk of cellular chemical energy, the mitochondrion is known as the powerhouse of the cell.
Final Answer: Mitochondrion

Answer: (C)

Go Back to Question 60

Q61.

Solution

Concept: Pharmaceutical packaging materials must be chemically inert, mechanically stable, and impermeable to prevent contamination or degradation of the product over its shelf life. Liquid formulations containing volatile organic chemicals or organic solvents can interact with certain types of packaging materials.

Solution: Step 1: Evaluate how different packaging materials interact with volatile organic liquids.
Step 2: Glass and stainless steel are highly rigid, inert materials that provide excellent chemical resistance and are impermeable to organic molecules. Hence, options (A) and (C) are incorrect.
Step 3: Aluminium foil provides a strong barrier against gases and light when used in blister packaging, and does not leach into organic liquids. Hence, option (D) is incorrect.
Step 4: Low-Density Polyethylene (LDPE) is a flexible plastic polymer with relatively large spaces between its molecular chains.
Step 5: When storing liquid organic chemicals or volatile solvents, LDPE presents a risk because organic molecules can dissolve into or diffuse through the plastic matrix (permeation). This can lead to product loss, container deformation, or the leaching of plasticizers and unreacted monomers into the formulation, compromising product quality.
Final Answer: Low-Density Polyethylene (LDPE) plastic

Answer: (B)

Go Back to Question 61

Q62.

Solution

Concept: The Drugs and Cosmetics Act, 1940, and Rules, 1945, establish regulatory controls over the sale of medications in India. Schedule H contains a comprehensive list of prescription-only drugs that require professional medical supervision to manage risks such as toxicity, adverse reactions, or misuse.

Solution: Step 1: Review the statutory distribution requirements mandated for drugs listed under Schedule H.
Step 2: Schedule H medications cannot be dispensed arbitrarily over the counter or repeatedly without clear authorization from a physician. Thus, option (A) is incorrect.
Step 3: The legal mandate states that Schedule H drugs can only be sold by retail upon presenting a valid prescription written by a Registered Medical Practitioner (RMP).
Step 4: Additionally, the dispensing pharmacist must record details of the sale in a prescription register, and the container label must display the warning symbol "Rx" and a prominent notice stating that the drug is dangerous to take without medical advice.
Step 5: These drugs are not distributed free of charge unless part of specific public health initiatives, confirming that option (B) is the correct legal requirement.
Final Answer: It can only be sold by retail on the prescription of a Registered Medical Practitioner

Answer: (B)

Go Back to Question 62

Q63.

Solution

Concept: The human brain is divided into functional regions that manage voluntary actions, sensory processing, and involuntary visceral processes. Autonomic survival functions are regulated by specialized nuclei located in the lower brainstem.

Solution: Step 1: Match the specific physiological functions with the brain regions listed in the options.
Step 2: The cerebellum coordinates voluntary muscle movements, posture, balance, and motor learning. Hence, option (A) is incorrect.
Step 3: The cerebrum manages higher-level cognitive functions, including reasoning, sensory integration, memory, and voluntary motor control. Hence, option (B) is incorrect.
Step 4: The thalamus acts as a major relay station for sorting and transmitting sensory information to the cerebral cortex. Hence, option (D) is incorrect.
Step 5: The medulla oblongata is the inferior segment of the brainstem that connects to the spinal cord. It contains essential autonomic reflex centers, including the cardiovascular center (which regulates heart rate and blood pressure) and the respiratory center (which controls breathing rhythms). It also coordinates reflexes like swallowing, vomiting, and coughing, making it vital for survival.
Final Answer: Medulla oblongata

Answer: (C)

Go Back to Question 63

Q64.

Solution

Concept: Toxicology and preclinical drug evaluation utilize standardized metrics to quantify the acute toxicity profile of chemical compounds. These parameters measure responses across animal test populations to establish safety thresholds.

Solution: Step 1: Analyze the dose-response graph shown in the accompanying TikZ layout. The horizontal axis represents the administered dose of a toxicant, and the vertical axis tracks the percentage mortality within a test population.
Step 2: Find the point on the curve corresponding to a 50% mortality rate. Projecting this point down to the dose axis identifies the specific value designated as the LD_{50}.
Step 3: The acronym LD_{50} stands for Median Lethal Dose. It is defined as the statistically calculated single dose of a chemical substance that is expected to cause death in exactly 50% of an experimental animal population under controlled test conditions.
Step 4: This value helps compare the relative acute toxicities of chemicals; a lower LD_{50} value indicates a more potent toxin.
Step 5: It does not measure therapeutic cure rates, enzyme inhibition fractions, or pharmacokinetic clearance half-lives, confirming option (C) is correct.

Final Answer: The statistically derived single dose of a substance that can be expected to cause death in 50% of the tested animals

Answer: (C)

Go Back to Question 64

Q65.

Solution

Concept: Pharmacognosy classifies crude plant drugs based on their primary active chemical constituents, such as alkaloids, glycosides, tannins, or volatile oils. Alkaloids are nitrogen-containing basic organic compounds sub-classified by their core ring systems.

Solution: Step 1: Identify the biological source and chemical components of the plant species *Camellia sinensis*, commonly known as tea.
Step 2: Quinine is a quinoline alkaloid derived from the bark of *Cinchona officinalis*. Hence, option (A) is incorrect.
Step 3: Morphine is a phenanthrene isoquinoline alkaloid extracted from the latex of *Papaver somniferum*. Hence, option (C) is incorrect.
Step 4: Reserpine is an indole alkaloid derived from the roots of *Rauwolfia serpentina*. Hence, option (D) is incorrect.
Step 5: The leaves of *Camellia sinensis* contain purine derivatives, with caffeine (1,3,7-trimethylxanthine) as the primary active purine alkaloid. Caffeine acts as a central nervous system stimulant by antagonizing adenosine receptors, making it a key constituent of tea leaves.
Final Answer: Caffeine

Answer: (B)

Go Back to Question 65

Q66.

Solution

Concept: Hospital pharmacy administration and inventory procurement require systematic, transparent purchasing methods to secure quality pharmaceuticals at the most economical cost. Open or competitive bidding procedures help prevent financial mismanagement.

Solution: Step 1: Evaluate the purchasing methods used in institutional pharmacy procurement.
Step 2: Direct or spot purchasing involves buying items directly from a local supplier or vendor to meet urgent, short-term needs, without formal competitive bidding. Hence, options (B) and (C) are incorrect.
Step 3: Emergency procurement is an expedited process used to obtain critical supplies during an unexpected shortage, bypassing standard operational workflows. Hence, option (D) is incorrect.
Step 4: Open tendering is a formal procurement process where an institution publishes an open invitation for sealed competitive bids from pre-qualified manufacturers or suppliers.
Step 5: Vendors submit their pricing and terms in sealed envelopes, which are opened together at a scheduled time. The contract is typically awarded to the lowest eligible bidder who meets all quality requirements, ensuring a transparent and cost-effective procurement process for the hospital.

Final Answer: Open tendering

Answer: (A)

Go Back to Question 66

Q67.

Solution

Concept: Pharmacodynamics examines how combinations of drugs interact inside a biological system. When two medications are administered concurrently, their combined therapeutic outcome can be equal to, less than, or greater than the sum of their individual effects.

Solution: Step 1: Analyze the specific terms used to describe drug interactions in the options.
Step 2: Antagonism occurs when one drug decreases or abolishes the pharmacological effect of another drug, reducing the overall therapeutic outcome. Hence, option (A) is incorrect.
Step 3: An additive effect describes an interaction where the combined effect of two drugs is exactly equal to the mathematical sum of their individual effects (1 + 1 = 2). Hence, option (B) is incorrect.
Step 4: Synergism, or potentiation, describes a dynamic interaction where the combined effect of two drugs given together is significantly greater than the simple algebraic sum of their individual actions (1 + 1 > 2).
Step 5: A classic clinical example is combining sulfamethoxazole and trimethoprim (co-trimoxazole), which blocks sequential steps in bacterial folate synthesis to produce a highly potent antimicrobial effect.
Final Answer: Synergism (Potentiation)

Answer: (C)

Go Back to Question 67

Q68.

Solution

Concept: Organic chemistry and stereochemistry describe the three-dimensional arrangement of atoms in molecular structures. The spatial symmetry of a molecule dictates its optical activity and how it interacts with polarized light or biological receptors.

Solution: Step 1: Analyze the chemical structure shown in the accompanying TikZ diagram. The central carbon atom (C) is bonded to four distinct substituents: a fluorine atom (F), a hydrogen atom (H), a chlorine atom (Cl), and a methyl group (CH_3).
Step 2: When a tetrahedral carbon atom is bonded to four entirely different atoms or groups of substituents, it lacks an internal plane of symmetry. This structural feature is termed a chiral center, asymmetric center, or stereocenter.
Step 3: The presence of a chiral center allows the molecule to exist as a pair of non-superimposable mirror images called enantiomers. Enantiomers can rotate plane-polarized light in opposite directions and often show different binding affinities for asymmetric biological drug receptors.
Step 4: A carbocation or carbanion represents a charged, reactive intermediate, and a free radical contains an unpaired valence electron. Therefore, this specific carbon configuration is called a chiral center.
Final Answer: Chiral (Asymmetric) center

Answer: (C)

Go Back to Question 68

Q69.

Solution

Concept: Biochemical qualitative analysis utilizes colorimetric screening reactions to detect specific classes of macromolecules, such as carbohydrates, lipids, or proteins, in unknown samples.

Solution: Step 1: Review the chemical principles and color changes associated with the qualitative tests listed in the options.
Step 2: The Biuret and Ninhydrin tests are used to detect proteins and amino acids, respectively; Ninhydrin produces a purple-blue color with alpha-amino acids. Hence, options (A) and (B) are incorrect.
Step 3: Halphen's test is a specific colorimetric reaction used to detect the presence of cottonseed oil. Hence, option (D) is incorrect.
Step 4: Molisch's test is a general screening test for carbohydrates. The reagent consists of α-naphthol dissolved in ethanol.
Step 5: When concentrated sulfuric acid (H_2SO_4) is added to a test solution containing carbohydrates, the acid dehydrates the sugars into furfural or hydroxymethylfurfural derivatives. These derivatives then condense with α-naphthol to form a characteristic purple or violet-colored ring at the interface between the two liquid layers, confirming the presence of carbohydrates.
Final Answer: Molisch's test

Answer: (C)

Go Back to Question 69

Q70.

Solution

Concept: Endocrine physiology and the regulation of reproductive functions. The posterior pituitary gland (neurohypophysis) stores and releases two primary peptide hormones synthesized in the hypothalamus: antidiuretic hormone (vasopressin) and oxytocin.

Solution: Step 1: Analyze the physiological roles of the posterior pituitary hormones.
Step 2: Antidiuretic hormone (ADH) acts on the collecting ducts of the kidneys to increase water reabsorption, concentrating the urine. Hence, option (A) is incorrect.
Step 3: Oxytocin acts on smooth muscle tissues, particularly during and after childbirth. It binds to specific G-protein coupled receptors on uterine smooth muscle cells (myometrium), stimulating powerful rhythmic contractions to facilitate labor and delivery.
Step 4: Oxytocin also stimulates the contraction of myoepithelial cells surrounding the alveoli of the mammary glands, causing the ejection of milk in response to infant suckling.
Step 5: Oxytocin does not regulate liver glycogenolysis or testicular spermatogenesis. Thus, option (B) accurately describes its primary functions.
Final Answer: Uterine smooth muscle contractions during labor and milk ejection

Answer: (B)

Go Back to Question 70

Q71.

Solution

Concept: Pharmacognosy classifies crude natural drugs into organized or unorganized categories based on their macroscopic and microscopic structural characteristics. This division helps identify the drug's origin and detect potential adulteration.

Solution: Step 1: Understand the structural differences between organized and unorganized crude drugs.
Step 2: Organized drugs consist of defined cellular structures and represent intact or sliced anatomical organs of a plant or animal, such as leaves (Digitalis, Senna), roots (Rauwolfia), bark (Cinchona), or seeds (Nux Vomica).
Step 3: Microscopic evaluation of organized drugs reveals distinct cellular layers, including epidermis, vascular bundles, parenchyma, and trichomes.
Step 4: Unorganized drugs lack a defined cellular structure. They are prepared from natural sources via processing methods like incision, expression, distillation, or extraction, yielding substances such as juices, latex, dried exudates, gums, resins, or volatile oils.
Step 5: Therefore, crude drugs that retain their anatomical plant organs and cellular structures are classified as organized drugs.
Final Answer: Organized drugs

Answer: (A)

Go Back to Question 71

Q72.

Solution

Concept: Community pharmacy practice involves administrative, technical, and clinical responsibilities. Clinical duties focus on optimizing patient adherence, safety, and therapeutic outcomes through direct communication.

Solution: Step 1: Evaluate the scope of responsibilities listed in the options.
Step 2: Inventory management handles procurement and stock control, while material compounding involves preparing customized formulations. Hence, options (A) and (D) are incorrect.
Step 3: Pharmacovigilance involves monitoring, identifying, and reporting adverse drug reactions to regulatory databases. Hence, option (B) is incorrect.
Step 4: Patient counseling is the process where a pharmacist provides clear, professional guidance regarding a patient's medication regimen.
Step 5: For complex drug delivery systems like Metered-Dose Inhalers (MDIs), precise technique is essential for the drug to reach the lower respiratory tract. The pharmacist demonstrates the correct steps—such as shaking the canister, exhaling fully, coordinating inhalation with device actuation, and holding the breath—to ensure effective treatment.
Final Answer: Patient counselling

Answer: (C)

Go Back to Question 72

Q73.

Solution

Concept: Inorganic pharmaceutical chemistry utilizes mineral compounds for specific therapeutic purposes, including antacids, electrolytes, antimicrobial agents, and systemic acid-base modifiers. Systemic modifiers work by altering the bicarbonate-to-carbonic acid ratio in extracellular fluid.

Solution: Step 1: Analyze the chemical properties and therapeutic uses of the inorganic compounds listed in the options.
Step 2: Sodium bicarbonate is a systemic alkalizer used to treat metabolic acidosis or alkalinize urine to accelerate salicylate clearance. Hence, option (A) is incorrect.
Step 3: Magnesium hydroxide and calcium carbonate are insoluble, non-systemic antacids that neutralize gastric acid locally in the stomach. Hence, options (C) and (D) are incorrect.
Step 4: Ammonium chloride (NH_4Cl) is a soluble salt that acts as a systemic acidifier.
Step 5: When absorbed, ammonium ions (NH_4^+) are converted by the liver into urea, releasing hydrogen ions (H^+) and chloride ions (Cl^-) into the bloodstream. This excess of anions lowers blood plasma pH and helps correct systemic metabolic alkalosis.
Final Answer: Ammonium chloride

Answer: (B)

Go Back to Question 73

Q74.

Solution

Concept: Pharmaceutical engineering relies on specific mechanical unit operations to separate, purify, or dry materials during large-scale manufacturing. Choosing the correct separation technique depends on the physical state of the mixture and the properties of the components.

Solution: Step 1: Evaluate the mechanisms of the mechanical separation operations listed in the options.
Step 2: Sedimentation relies on gravitational forces to settle dense solid particles out of a stationary fluid over time. Hence, option (A) is incorrect.
Step 3: Centrifugation uses centrifugal force to accelerate the separation of phases based on density differences. Hence, option (B) is incorrect.
Step 4: Filtration is the mechanical unit operation used to separate solid particles from a fluid (either a liquid or a gas) by passing the mixture through a porous medium or membrane.
Step 5: The pore size of the filter medium allows the fluid phase to pass through as filtrate while retaining the solid particles on its surface as a filter cake. Drying involves removing volatile liquids via thermal evaporation, rather than mechanical separation. Therefore, filtration is the correct operation.
Final Answer: Filtration

Answer: (C)

Go Back to Question 74

Q75.

Solution

Concept: Physical pharmacy and physiology require maintaining osmotic compatibility between pharmaceutical formulations and biological fluids. Tonicity measures the effective osmotic pressure gradient between two solutions separated by a semi-permeable membrane, which determines the direction and extent of water diffusion.

Solution: Step 1: Analyze how solutions of varying tonicities affect cell volume.
Step 2: A hypertonic solution has a higher solute concentration than intracellular fluid, drawing water out of cells and causing them to shrink (crenation). Hence, option (A) is incorrect.
Step 3: A hypotonic solution has a lower solute concentration, causing water to diffuse into cells. In red blood cells, this can lead to swelling and bursting (hemolysis). Hence, option (B) is incorrect.
Step 4: An isotonic solution has an effective osmolality that matches blood plasma and intracellular fluid (equivalent to a 0.9% w/v sodium chloride solution).
Step 5: When red blood cells are suspended in an isotonic solution, the osmotic pressure is balanced across the cell membrane, resulting in no net movement of water. This preserves the cells' normal structural integrity, making isotonicity a critical requirement for parenteral and ophthalmic formulations to avoid tissue irritation or damage.

Final Answer: Isotonic solution

Answer: (C)

Go Back to Question 75

Q76.

Solution

Concept: The Cardiovascular system is intrinsically regulated by rhythmic alterations in electrical potentials across cardiac membranes, which dictate structural muscular contractions. The electrocardiogram (ECG) is a non-invasive diagnostic graphic recording of these surface electrical currents over time, depicting distinct waves that match specific physiological events.

Solution: Step 1: Analyze the standard baseline waves of a normal electrocardiogram cycle, which consist of the P wave, the QRS complex, and the T wave.
Step 2: The P wave represents the initial depolarization wave originating from the sinoatrial node as it spreads across the right and left atria. Hence, option (A) is incorrect.
Step 3: The QRS complex represents rapid ventricular depolarization. Because ventricular muscle mass is large, this complex exhibits the highest amplitude on the tracing.
Step 4: The T wave represents the subsequent electrical recovery or repolarization of the ventricular myocardium as the cells return to their resting potential.
Step 5: Atrial repolarization occurs simultaneously during the QRS complex but is visually hidden by the larger electrical signals of the ventricles. Therefore, the T wave specifically corresponds to ventricular repolarization.
Final Answer: Ventricular repolarization

Answer: (C)

Go Back to Question 76

Q77.

Solution

Concept: Pharmacognostic evaluation relies heavily on qualitative chemical screening assays to verify the identity of crude drugs and identify specific secondary metabolites. Plant-derived glycosides are classified into subgroups based on the chemical structure of their non-sugar moiety (aglycone).

Solution: Step 1: Identify the chemical nature of anthraquinone glycosides, which are found in laxative crude drugs like Senna, Aloe, Rhubarb, and Cascara.
Step 2: Review the specific protocols for the modified Borntrager's test, which is used to detect C-glycosides (where the sugar is bound directly to a carbon atom, as seen in Aloe).
Step 3: In this test, the crude drug sample is treated with ferric chloride ($FeCl_3$) and dilute hydrochloric acid (HCl). The ferric chloride acts as an oxidizing and hydrolyzing agent to break the stable carbon-carbon glycosidic linkage.
Step 4: The mixture is then extracted with an organic solvent like benzene or chloroform. When the separated organic layer is shaken with a dilute ammonia solution, the presence of anthraquinones causes the lower ammoniacal layer to turn a characteristic pink, red, or violet color.
Step 5: Raymond's and Legal's tests screen for cardiac glycosides, and the foam test detects saponins. Thus, the modified Borntrager's test is specific for anthraquinone C-glycosides.
Final Answer: Anthraquinone glycosides

Answer: (B)

Go Back to Question 77

Q78.

Solution

Concept: Pharmaceutical manufacturing regulations require verifying that sterilizing equipment operates effectively. Validation protocols use biological indicators containing standardized preparations of highly resistant bacterial spores to confirm that a sterilization cycle consistently achieves a sterility assurance level.

Solution: Step 1: Analyze the mechanisms and target biological indicators for different sterilization methods.
Step 2: Dry heat sterilization (hot air oven) relies on high temperatures to denature proteins and oxidize cellular components. Its performance is validated using spores of *Bacillus subtilis* (var. *niger*). Hence, option (A) is incorrect.
Step 3: Radiation sterilization using gamma rays or electron beams disrupts microbial DNA. Its effectiveness is monitored using spores of *Bacillus pumilus*. Hence, option (C) is incorrect.
Step 4: Steam sterilization under pressure (autoclaving) destroys microbes through moisture-induced protein coagulation.
Step 5: This process is validated using spores of *Geobacillus stearothermophilus* (formerly *Bacillus stearothermophilus*). These spores are highly resistant to moist heat, making them the standard biological indicator to confirm that an autoclave cycle has reached the required temperature and pressure parameters.
Final Answer: *Geobacillus stearothermophilus*

Answer: (B)

Go Back to Question 78

Q79.

Solution

Concept: The management of hospital and retail pharmacy operations requires implementing strict inventory control models. Reorder point calculations determine the specific stock level that should trigger a new procurement order to prevent shortages while minimizing holding costs.

Solution: Step 1: State the standard mathematical formula used to calculate the Reorder Point (ROP) under steady demand conditions:

$$\text{Reorder Point} = (\text{Average Daily Consumption Rate} \times \text{Lead Time in Days}) + \text{Safety Stock}$$

Step 2: Extract the operational values provided in the question:

$$\text{Average daily consumption} = 25 \text{ tablets}$$

$$\text{Lead time for delivery} = 6 \text{ days}$$

$$\text{Safety stock level} = 50 \text{ tablets}$$

Step 3: Substitute these values into the formula to calculate the reorder threshold:

$$\text{ROP} = (25 \times 6) + 50$$

Step 4: Solve the arithmetic steps sequentially:

$$\text{ROP} = 150 + 50 = 200 \text{ tablets}$$

Step 5: This calculation shows that when stock levels drop to 200 tablets, a new order must be placed. The 150 tablets consumed during the 6-day lead time will leave exactly 50 tablets of safety stock when the new shipment arrives, matching option (B).

Final Answer: 200 tablets

Answer: (B)

Go Back to Question 79

Q80.

Solution

Concept: Therapeutic drug monitoring and toxicology identify mechanisms of toxicity to guide the selection of specific chemical antidotes. Toxic levels of certain analgesic agents can deplete protective intracellular molecules, leading to hepatic necrosis.

Solution: Step 1: Review the metabolic pathway of paracetamol (acetaminophen). At therapeutic doses, it is metabolized primarily via glucuronidation and sulfation.
Step 2: A small fraction is metabolized by cytochrome P450 enzymes into a highly reactive, toxic intermediate called *N*-acetyl-*p*-benzoquinone imine (NAPQI).
Step 3: Under normal conditions, NAPQI is immediately detoxified by binding with intracellular glutathione. In an acute overdose, the excess NAPQI depletes glutathione stores and binds to vital proteins in hepatic cells, causing severe acute liver necrosis.
Step 4: Acetylcysteine (N-acetylcysteine or NAC) serves as a specific antidote for paracetamol poisoning. It acts by replenishing hepatic glutathione stores and binding directly to reactive NAPQI intermediates, protecting liver tissue from oxidative damage.
Step 5: Naloxone reverses opioid toxicity, protamine sulfate neutralizes heparin, and atropine treats organophosphate poisoning. Thus, acetylcysteine is the correct antidote.
Final Answer: Acetylcysteine

Answer: (A)

Go Back to Question 80

Q81.

Solution

Concept: The synthesis and structural optimization of organic pharmaceuticals rely on identifying core functional groups. Introducing specific substituents, such as halogens, can alter a molecule's lipophilicity, metabolic stability, and binding affinity for target receptors.

Solution: Step 1: Analyze the chemical structures of the systemic sedative-hypnotic and antianxiety drugs listed in the options.
Step 2: Diazepam is a classic benzodiazepine that features a chlorine atom attached to position 7 of its core benzene ring framework. Hence, option (A) is incorrect.
Step 3: Flurazepam is a derivative that contains both a chlorine atom on the benzodiazepine core and a fluorine atom on its attached phenyl ring. Hence, option (B) is incorrect.
Step 4: Alprazolam is a triazolobenzodiazepine containing a fused triazole ring and a chlorine substituent on the primary aromatic ring. Hence, option (D) is incorrect.
Step 5: Halothane ($CF_3CHBrCl$) is a halogenated hydrocarbon used as an inhalation anesthetic. It is not a benzodiazepine and does not contain a nitrogenous heterocyclic core, but its structure is heavily substituted with halogen atoms (three fluorine atoms, one bromine atom, and one chlorine atom) to minimize flammability and optimize anesthetic potency.
Final Answer: Halothane

Answer: (C)

Go Back to Question 81

Q82.

Solution

Concept: The human endocrine system utilizes negative feedback mechanisms to control hormone secretion and maintain physiological balance. The pituitary gland releases tropic hormones that stimulate peripheral endocrine glands, while elevated levels of peripheral hormones signal back to suppress further pituitary release.

Solution: Step 1: Analyze the regulatory feedback loop between the anterior pituitary gland and the thyroid gland.
Step 2: The anterior pituitary secretes Thyroid-Stimulating Hormone (TSH), which stimulates the thyroid gland to synthesize and release thyroid hormones, primarily thyroxine (T_4) and triiodothyronine (T_3).
Step 3: When circulating levels of free T_3 and T_4 rise above normal thresholds, they bind to specific receptors on cells in both the hypothalamus and the anterior pituitary.
Step 4: This binding initiates a negative feedback mechanism that inhibits the secretion of Thyrotropin-Releasing Hormone (TRH) from the hypothalamus and directly suppresses the release of TSH from the anterior pituitary.
Step 5: This feedback loop helps lower TSH production to prevent hyperthyroidism, maintaining hormone levels within a narrow physiological range.

Final Answer: Anterior pituitary gland to decrease the secretion of Thyroid-Stimulating Hormone (TSH)

Answer: (B)

Go Back to Question 82

Q83.

Solution

Concept: Powder technology and rheology are essential for designing solid dosage forms like tablets and capsules. A powder mass must have adequate flow properties to ensure uniform die filling during high-speed compression manufacturing, preventing variations in tablet weight.

Solution: Step 1: Evaluate the methods used to assess the flowability of pharmaceutical powders, including Carr's Compressibility Index, Hausner's Ratio, and the Angle of Repose.
Step 2: The angle of repose (θ) is determined by pouring a powder sample through a funnel onto a flat horizontal surface to form a symmetrical cone.
Step 3: The relationship between the dimensions of the cone and the angle of repose is mathematically expressed as:

$$\tan(\theta) = \frac{h}{r} \implies \theta = \tan^{-1}\left(\frac{h}{r}\right)$$

where h is the height of the powder cone and r is the radius of its circular base.
Step 4: A lower angle of repose indicates that internal friction forces are minimal, allowing the powder to spread flat. An angle of repose less than 25° signifies excellent, highly fluid flow properties, whereas angles greater than 40° indicate poor or cohesive flow.
Final Answer: Angle of repose

Answer: (B)

Go Back to Question 83

Q84.

Solution

Concept: Qualitative analysis of organic drugs utilizes standardized chemical screening protocols to identify specific heterocyclic ring systems or functional groups. These colorimetric tests rely on predictable chemical shifts or precipitation reactions.

Solution: Step 1: Analyze the chemical structural properties of the purine derivative caffeine (1,3,7-trimethylxanthine). Purines consist of a fused imidazole and pyrimidine ring system.
Step 2: Review the specific test protocols used to identify xanthine alkaloids. The sample is treated with an oxidizing agent like potassium chlorate ($KClO_3$) and hydrochloric acid (HCl), and then evaporated to dryness.
Step 3: The resulting weather-resistant reddish-yellow residue contains ammelide derivatives. When this residue is exposed to dilute ammonia solution (NH_4OH), it forms a deep purple-violet substance known as murexide (purpurate of ammonia).
Step 4: This specific color change is called the Murexide test. It is a standard method used to identify purine bases like caffeine, theobromine, and theophylline.
Step 5: Vitali-Morin's test identifies tropane alkaloids, the Thalleioquin test identifies cinchona alkaloids, and the Ninhydrin test detects amino acids.
Final Answer: Murexide test

Answer: (C)

Go Back to Question 84

Q85.

Solution

Concept: The Pharmacy Act, 1948, establishes a legal and administrative framework to regulate the profession of pharmacy across India. This framework requires creating and maintaining updated official registers of qualified pharmacists in every state to ensure public safety.

Solution: Step 1: Review the statutory duties assigned to State Pharmacy Councils under Chapter IV of the Pharmacy Act, 1948.
Step 2: The executive committee and the president manage the council's administrative schedules. Hence, options (A) and (C) are incorrect.
Step 3: Section 26 of the Act mandates that the State Pharmacy Council appoint a qualified individual to serve as the official Registrar.
Step 4: The Registrar is legally responsible for maintaining the State Register of Pharmacists. This duty includes entering the names, addresses, and qualifications of approved applicants, removing the names of deceased or disqualified persons, and publishing updated copies of the register.
Step 5: The government analyst evaluates drug samples in state laboratories, which is a different regulatory role. Therefore, maintaining the state register is the statutory duty of the Registrar.
Final Answer: Registrar

Answer: (B)

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Q86.

Solution

Concept: Biochemical assessment of human carbohydrate metabolism. Glygogenesis and glycogenolysis are balanced metabolic pathways that regulate blood glucose levels. Glycogen serves as the primary macromolecular storage form of glucose in animal tissues.

Solution: Step 1: Identify the main physiological sites of glycogen storage in the human body.
Step 2: Although minor glycogen reserves exist in kidneys and glial cells, the primary storage sites are skeletal muscle tissue and liver tissue.
Step 3: Muscle glycogen provides an immediate source of glucose-6-phosphate for glycolysis within muscle cells during active physical exertion.
Step 4: Liver glycogen accounts for approximately 6% to 8% of the tissue's wet weight. Hepatic tissue contains the enzyme glucose-6-phosphatase, which allows it to break down glycogen and release free glucose into the bloodstream to maintain normal systemic blood glucose levels during fasting periods.
Step 5: Adipose tissue stores lipids as triglycerides, and the pancreas secretes regulatory hormones. Thus, the liver and skeletal muscle are the primary storage sites.
Final Answer: Liver and skeletal muscle

Answer: (C)

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Q87.

Solution

Concept: Pharmaceutical compounding calculations use proportion analysis to adjust the concentration of liquid formulations. Dilution problems apply the conservation of mass principle, which states that the total mass of solute remains constant when a solvent is added to a solution.

Solution: Step 1: State the fundamental dilution equation linking initial and final concentrations and volumes:

$$C_1 \times V_1 = C_2 \times V_2$$

Step 2: Identify the known parameters from the problem statement:

$$\text{Initial concentration } (C_1) = 90\% \text{ v/v}$$

$$\text{Target concentration } (C_2) = 60\% \text{ v/v}$$

$$\text{Target final volume } (V_2) = 300 \text{ mL}$$

Step 3: Substitute these values into the equation to find the required volume of the concentrated alcohol stock (V_1):

$$90 \times V_1 = 60 \times 300$$

Step 4: Solve the arithmetic expression step-by-step to prevent calculation errors:

$$90 \times V_1 = 18000 \implies V_1 = \frac{18000}{90} = 200 \text{ mL}$$

Step 5: The calculation shows that to prepare the solution, measure exactly 200 mL of 90% alcohol and add enough purified water to bring the final volume to 300 mL, matching option (C).

Final Answer: 200 mL

Answer: (C)

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Q88.

Solution

Concept: The evaluation of solid dosage forms includes standardized testing protocols to confirm that tablets possess adequate mechanical strength and physical stability. Tablets must resist breaking, chipping, or crumbling during downstream packaging, transport, and handling operations.

Solution: Step 1: Analyze the specific operational purposes of the quality control tests listed in the options.
Step 2: Dissolution testing evaluates the rate at which the active drug substance dissolves into an aqueous medium, which correlates with in vivo absorption. Hence, option (A) is incorrect.
Step 3: Disintegration testing measures the time required for a compressed tablet to break down into smaller particles within a liquid medium under specified conditions. Hence, option (B) is incorrect.
Step 4: Friability testing evaluates the surface mechanical resistance of a tablet to abrasive and rotational forces.
Step 5: This test is performed using a Roche Friabilator. A sample of pre-weighed tablets is placed in a plastic chamber that rotates at 25 rpm for 4 minutes (100 total revolutions), dropping the tablets from a height of 6 inches during each turn.
Step 6: The tablets are then dedusted and reweighed. The weight loss is calculated as a percentage; a maximum weight loss of no more than 1% is typically acceptable for standard compressed tablets.
Final Answer: Friability test

Answer: (C)

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Q89.

Solution

Concept: The functional anatomy of the human skeletal system. The skeleton is divided into the axial skeleton, which forms the central axis of the body, and the appendicular skeleton, which includes the bones of the limbs and their supporting girdles.

Solution: Step 1: Review the anatomical locations of the bones listed in the options to determine which belongs to the appendicular skeleton.
Step 2: The cranium consists of fused cranial bones that protect the brain within the head. It is a key component of the axial skeleton. Hence, option (A) is incorrect.
Step 3: The sternum (breastbone) is a flat bone located along the anterior midline of the thorax, anchoring the rib cage within the axial skeleton. Hence, option (B) is incorrect.
Step 4: The vertebral column forms the primary structural support axis of the trunk and is part of the axial skeleton. Hence, option (D) is incorrect.
Step 5: The clavicle (collarbone) is a slender, s-shaped bone that, along with the scapula, forms the pectoral (shoulder) girdle.
Step 6: The pectoral girdle anchors the upper limbs to the axial skeleton, making the clavicle a component of the appendicular skeleton.
Final Answer: Clavicle

Answer: (C)

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Q90.

Solution

Concept: The analysis of inorganic pharmaceutical chemicals utilizes specific quantitative limit tests to detect and restrict trace contaminants. The limit test for arsenic uses specialized glassware to capture gaseous arsenic derivatives on indicator papers, producing a colored stain.

Solution: Step 1: Identify the standard laboratory glassware apparatus configuration mandated for executing the limit test for arsenic.

Step 2: Nessler cylinders are long, uniform glass tubes used for colorimetric comparisons in limit tests for chloride and sulfate, not arsenic. Hence, option (A) is incorrect.

Step 3: The Kipp's apparatus is used to generate large volumes of gases like hydrogen sulfide in general chemistry laboratories, and the Soxhlet apparatus is used for continuous hot extraction of crude drugs. Hence, options (C) and (D) are incorrect.

Step 4: The limit test for arsenic is performed using the Gutzeit Apparatus. In this setup, any arsenic present in the sample is reduced to volatile arsine gas (AsH_3) by a mixture of zinc and hydrochloric acid.

Step 5: The generated arsine gas passes upward through a glass tube containing lead acetate-soaked cotton wood (which traps hydrogen sulfide gas) and reacts with mercuric chloride ($HgCl_2$) test paper at the top. This reaction produces a yellow-to-brown stain, and the intensity of the stain is compared against a standard to limit arsenic contamination.

Final Answer: Gutzeit apparatus

Answer: (B)

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Q91.

Solution

Concept: Cardiovascular pharmacology and the management of chronic ischemic heart disease. Nitrates are effective anti-anginal drugs that act primarily as pro-drugs, releasing active signaling molecules that cause direct relaxation of vascular smooth muscle.

Solution: Step 1: Analyze the molecular mechanism of organic nitrates like nitroglycerin and isosorbide dinitrate.
Step 2: Once inside vascular smooth muscle cells, organic nitrates undergo enzymatic metabolism to release free nitric oxide (NO).
Step 3: The released nitric oxide binds to and activates the cytosolic enzyme soluble guanylyl cyclase (sGC).
Step 4: Activated guanylyl cyclase catalyzes the conversion of guanosine triphosphate (GTP) into cyclic guanosine monophosphate (cGMP). Elevated intracellular cGMP levels activate protein kinase G, leading to dephosphorylation of myosin light chains and a reduction in intracellular calcium, which causes smooth muscle relaxation.
Step 5: This relaxation dilates systemic veins, reducing venous return (preload) and lower myocardial oxygen demand. Nitrates do not act by blocking beta-adrenergic receptors or inhibiting calcium entry channels.

Final Answer: Release of nitric oxide to activate guanylyl cyclase and increase cyclic GMP levels

Answer: (A)

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Q92.

Solution

Concept: The analysis and identification of crude drugs in pharmacognosy rely on evaluating distinct microscopic structures. Stomata are specialized epidermal pore structures that regulate gas exchange and transpiration, and their morphological features vary across plant families.

Solution: Step 1: Review the micro-morphological classifications of plant stomata.
Step 2: Anomocytic (irregular-celled) stomata are surrounded by a variable number of cells that look identical to standard epidermal cells, common in Digitalis. Hence, option (A) is incorrect.
Step 3: Diacytic (cross-celled) stomata are enclosed by two subsidiary cells whose shared wall is perpendicular to the guard cells, typical in Peppermint. Hence, option (C) is incorrect.
Step 4: Paracytic (parallel-celled) stomata feature one or more subsidiary cells arranged parallel to the long axis of the guard cells, characteristic of Senna leaves.
Step 5: Senna leaves, derived from *Cassia angustifolia*, consistently show these paracytic stomatal patterns under microscopic examination. Anisocytic stomata have three subsidiary cells of unequal size, as seen in Belladonna. Therefore, Senna leaves are characterized by paracytic stomata.
Final Answer: Paracytic stomata

Answer: (B)

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Q93.

Solution

Concept: Biochemical assessment of human protein and nitrogen metabolism. Amino acid catabolism generates toxic ammonium ions, which must be converted into a non-toxic water-soluble compound to be safely excreted by the kidneys.

Solution: Step 1: Identify the primary metabolic end-product of protein nitrogen catabolism in humans.
Step 2: While purine catabolism produces uric acid, general amino acid breakdown releases free ammonia (NH_3). Ammonia is highly cytotoxic, particularly to central nervous system tissues.
Step 3: To prevent toxicity, free ammonia is transported to the liver, where it enters the urea cycle (ornithine cycle).
Step 4: This multi-step enzymatic pathway couples ammonia with carbon dioxide to synthesize urea (NH_2CONH_2).
Step 5: Urea is a stable, non-toxic compound that enters the bloodstream and is subsequently filtered and excreted by the kidneys. Creatinine is a waste product of muscle creatine breakdown. Therefore, urea is the primary nitrogenous waste product of protein metabolism.
Final Answer: Urea

Answer: (B)

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Q94.

Solution

Concept: The Drugs and Cosmetics Act, 1940, and Rules, 1945, regulate the standards, licensing, and administration of pharmaceutical products in India. The schedules annexed to the rules define specific criteria for conducting technical studies and clinical operations.

Solution: Step 1: Analyze the regulatory scope of the schedules listed in the options.
Step 2: Schedule G lists medications that must be taken under medical supervision, requiring a specific warning on the label. Hence, option (A) is incorrect.
Step 3: Schedule H and Schedule X govern prescription-only and restricted narcotic/psychotropic drugs, respectively. Hence, options (B) and (C) are incorrect.
Step 4: Schedule Y details the official requirements, guidelines, and protocols for permission to import or manufacture a new drug, as well as for conducting clinical trials.
Step 5: Schedule Y defines the phase-wise clinical trial structures (Phases I, II, III, and IV), ethical responsibilities, animal data expectations, and documentation needed to establish human safety and efficacy before marketing approval is granted.

Final Answer: Guidelines and requirements for permission to import or manufacture new drugs and conduct clinical trials

Answer: (D)

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Q95.

Solution

Concept: Pharmaceutical manufacturing of solid dosage forms utilizes specific functional excipients to optimize processability and ensure that the final product meets standard quality criteria. Lubricants are key additives included in tablet and capsule formulations.

Solution: Step 1: Analyze the functional roles of different excipient classes during tablet compression.
Step 2: Diluents or fillers (like lactose) add necessary bulk to the powder mass to make a tablet a manageable size. Hence, option (A) is incorrect.
Step 3: Binders or adhesives provide cohesive forces that hold the powder particles together during granulation and compression. Hence, option (B) is incorrect.
Step 4: Disintegrants (like starch) facilitate the rapid breakup of the tablet matrix when exposed to moisture in the gastrointestinal tract. Hence, option (C) is incorrect.
Step 5: Lubricants, such as magnesium stearate or talc, are hydrophobic excipients added to final blending steps.
Step 6: They act by reducing friction at the interface between the tablet mass and the metal walls of the die and punches during compaction and ejection. This prevents the tablet from sticking to the punches, minimizes machinery wear, and ensures smooth operation.

Final Answer: To reduce friction between the tablet punch/die walls and the formulation during compression

Answer: (D)

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Q96.

Solution

Concept: The endocrine pancreas regulates energy metabolism through hormones secreted by the islets of Langerhans. These cell populations release hormones that work antagonistically to maintain stable plasma glucose levels.

Solution: Step 1: Identify the cell types within the islets of Langerhans and match them with their respective hormones.
Step 2: Beta (β) cells make up the majority of islet tissue and secrete insulin in response to elevated blood glucose levels. Insulin acts as an anabolic hormone to lower blood glucose. Hence, option (A) is incorrect.
Step 3: Alpha (α) cells secrete the peptide hormone glucagon.
Step 4: Glucagon is released in response to hypoglycemia (low blood glucose levels). It acts primarily on hepatocytes to stimulate glycogenolysis (the breakdown of stored glycogen into glucose) and gluconeogenesis (the synthesis of glucose from non-carbohydrate precursors).
Step 5: These hepatic actions release free glucose into the blood, raising blood sugar back to a normal range. Delta cells secrete somatostatin, and F-cells release pancreatic polypeptide. Thus, glucagon is secreted by alpha cells.
Final Answer: Alpha cells

Answer: (B)

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Q97.

Solution

Concept: Microbiology and diagnostic staining techniques help differentiate and classify bacterial species based on differences in their cell wall architectures. The Gram stain is a fundamental differential staining method used in clinical pathology.

Solution: Step 1: Review the steps of the Gram-staining technique. The procedure involves primary staining with crystal violet, complexation with Gram's iodine mordant, decolorization with alcohol or acetone, and counterstaining with safranin.
Step 2: Analyze the structural differences between Gram-positive and Gram-negative cell walls when treated with the decolorizing agent.
Step 3: Gram-negative bacteria have a thin peptidoglycan layer and an outer lipopolysaccharide membrane. The alcohol decolorizer dissolves this outer lipid layer, washing out the crystal violet-iodine complex and leaving the cells colorless.
Step 4: Gram-positive bacteria possess a thick, highly cross-linked peptidoglycan layer containing teichoic acids. Treatment with alcohol dehydrates this thick layer, causing it to shrink and trap the large crystal violet-iodine complexes inside the cell.
Step 5: As a result, Gram-positive cells resist decolorization and retain the primary deep purple or violet stain, while Gram-negative cells pick up the safranin counterstain and appear pink or red.

Final Answer: A thick, cross-linked peptidoglycan layer that traps the crystal violet-iodine complex during decolorization

Answer: (A)

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Q98.

Solution

Concept: Clinical toxicology and emergency medical management. Poisoning from specific toxic elements or industrial compounds requires the use of specialized chelating agents that bind to the toxins and facilitate their excretion.

Solution: Step 1: Analyze the mechanisms and indications for the chelating agents listed in the options.
Step 2: Deferoxamine is a specific iron-chelating agent used to treat acute iron toxicity or chronic iron overload from repeated blood transfusions. Hence, option (A) is incorrect.
Step 3: Penicillamine is used primarily to chelate copper in patients with Wilson's disease, and Edetate calcium disodium (CaEDTA) is commonly used for lead poisoning. Hence, options (B) and (C) are incorrect.
Step 4: Dimercaprol, also known as British Anti-Lewisite (BAL), is a dithiol compound containing two active sulfhydryl (−SH) groups.
Step 5: Dimercaprol acts by binding heavy metal ions like arsenic, mercury, and gold through its sulfhydryl groups, forming stable, non-toxic, water-soluble heterocyclic chelate rings.
Step 6: This chelation prevents the heavy metals from binding to and inhibiting vital sulfhydryl-containing enzymes inside cells, and the resulting complexes are excreted in the urine.

Final Answer: Dimercaprol (British Anti-Lewisite)

Answer: (D)

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Q99.

Solution

Concept: Physical pharmacy and the rheological characterization of fluid systems. Viscosity measures a fluid's resistance to flow or gradual deformation by shear stress. Fluid systems are classified into Newtonian or non-Newtonian categories based on their behavioral response to applied mechanical stress.

Solution: Step 1: Understand the core distinction between Newtonian and non-Newtonian rheological profiles.
Step 2: A Newtonian fluid exhibits a constant viscosity at a given temperature, regardless of the shear rate applied to it. The relationship between shear stress (σ) and shear rate (γ) is linear and passes through the origin, mathematically expressed as:

$$\sigma = \eta \cdot \gamma$$

where η is the dynamic viscosity coefficient.
Step 3: Common Newtonian fluids include water, simple syrups, ethanol, and dilute mineral solutions.
Step 4: Non-Newtonian systems change their viscosity based on the applied shear force. These systems include plastic fluids (which require a yield value to begin flow), pseudoplastic fluids (shear-thinning materials like polymer mucilages), and dilatant fluids (shear-thickening suspensions).
Step 5: Therefore, a fluid system whose viscosity remains constant irrespective of the applied shear stress is explicitly defined as a Newtonian fluid.
Final Answer: Newtonian fluid

Answer: (A)

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Q100.

Solution

Concept: The Drugs and Magic Remedies (Objectionable Advertisements) Act, 1954, regulates the advertisement of drugs in India. The statute aims to protect consumers from misleading, false, or exaggerated therapeutic claims that encourage self-medication for severe, chronic, or incurable medical conditions.

Solution: Step 1: Identify the primary legislative intent behind the Narcotic Drugs Act and the Drugs and Magic Remedies Act.
Step 2: Controlling the manufacturing parameters of generic medications is governed by the Drugs and Cosmetics Act, 1940. Hence, option (A) is incorrect.
Step 3: Regulating the academic curriculum of pharmacy institutions is the statutory responsibility of the Pharmacy Council of India under the Pharmacy Act, 1948. Hence, option (C) is incorrect.
Step 4: The specific purpose of the Drugs and Magic Remedies Act is to prohibit the public advertisement of drugs and remedies that claim to possess magical properties for curing, preventing, or mitigating certain severe conditions.
Step 5: The scheduled conditions under this Act include disorders like cancer, diabetes, epilepsy, kidney stones, and hypertension. By banning these advertisements, the law prevents misleading claims from delaying proper medical diagnosis and treatment, supporting public health safety.

Final Answer: To prohibit misleading advertisements of drugs and magic remedies making false claims of curing certain diseases

Answer: (B)

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	B	3	B	4	C	5	C
6	B	7	B	8	B	9	B	10	B
11	B	12	B	13	B	14	B	15	C
16	C	17	C	18	C	19	C	20	C
21	B	22	C	23	C	24	B	25	A
26	B	27	B	28	A	29	B	30	B
31	B	32	B	33	C	34	B	35	B
36	B	37	A	38	B	39	A	40	C
41	C	42	B	43	C	44	B	45	B
46	C	47	C	48	B	49	A	50	C
51	B	52	A	53	B	54	C	55	B
56	A	57	C	58	A	59	B	60	C
61	B	62	B	63	C	64	C	65	B
66	A	67	C	68	C	69	C	70	B
71	A	72	C	73	B	74	C	75	C
76	C	77	B	78	B	79	B	80	A
81	C	82	B	83	B	84	C	85	B
86	C	87	C	88	C	89	C	90	B
91	A	92	B	93	B	94	D	95	D
96	B	97	A	98	D	99	A	100	B