JELET Pharmacy Sample Paper-2

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 primarily responsible for the absorption of ultra-fine particles from the gastrointestinal tract via M-cells of Peyer's patches?

(A) Passive diffusion

(B) Persorption or vesicular transport

(C) Active transport

(D) Pore filtration

Q2. A prescription contains the Latin abbreviation *t.i.d. ex aq.* What instruction should be transcribed onto the dispensing label for the patient?

(A) To be taken three times a day before meals

(B) To be taken three times a day in water

(C) To be taken twice a day with fruit juice

(D) To be taken every three hours with water

Q3. Which route of drug administration provides a rapid systemic effect while

bypassing both first-pass hepatic metabolism and avoiding the harsh gastric pH, without requiring aseptic technique for administration?

(A) Sublingual

(B) Intravenous

(C) Subcutaneous

(D) Oral ingestion

Q4. How many grams of a 20% w/w ointment must be mixed with 150 grams of a 5% w/w ointment to prepare a final mixture containing 10% w/w of the active medicament?

(A) 50 grams

(B) 75 grams

(C) 100 grams

(D) 120 grams

Q5. Plastic containers made from polyvinyl chloride (PVC) may present a significant risk during the storage of lipophilic intravenous infusions primarily due to:

(A) Permeation of atmospheric oxygen through the container wall

(B) Leaching of diethylhexyl phthalate (DEHP) plasticizers into the vehicle

(C) Sorption of water molecules from the formulation into the matrix

(D) Hydrolytic degradation of PVC leading to sudden acidification

Q6. In a size reduction operation, Rittinger's hypothesis states that the energy consumed in crushing a given quantity of material is directly proportional to:

(A) The logarithm of the ratio of initial to final particle sizes

(B) The volume reduction achieved during the process

(C) The new surface area created during size reduction

(D) The square root of the initial average diameter

Q7. When compounding an aqueous mixture containing caffeine citrate and sodium benzoate, a visible precipitate is formed. This is an example of which type of incompatibility?

(A) Physical incompatibility due to insolubility

(B) Chemical incompatibility resulting in a less soluble complex

(C) Therapeutic incompatibility due to synergistic antagonism

(D) Intentional physical modification via adjustment of co-solvents

Q8. In the limit test for Iron as per the Indian Pharmacopoeia, what is the specific role of citric acid added during the procedure?

(A) To prevent the precipitation of iron by ammonia by forming a soluble complex

(B) To act as a reducing agent converting ferric iron to ferrous iron

(C) To provide a buffered acidic medium necessary for color development

(D) To form a purple-colored coordination compound with thioglycolic acid

Q9. Which of the following reagents is specifically employed as a clearing agent and sulfur-precipitating inhibitor in the standard limit test for Heavy Metals?

(A) Hydrogen sulfide gas

(B) Sodium sulfide solution

(C) Thioacetamide reagent

(D) Potassium cyanide solution

Q10. According to the Henderson-Hasselbalch equation, when the pH of a buffer solution is exactly one unit higher than the pK_a of the weak acid component, the ratio of conjugate base to weak acid ([Base]/[Acid]) is:

(A) 1 : 1

(B) 10 : 1

(C) 1 : 10

(D) 100 : 1

Q11. Which of the following compounds is classified as an official systemic acidifier used to treat severe metabolic alkalosis?

(A) Sodium bicarbonate

(B) Ammonium chloride

(C) Potassium citrate

(D) Calcium carbonate

Q12. What is the correct IUPAC name for the structural molecule commonly known as salicylic acid?

(A) 2-Hydroxybenzoic acid

(B) 4-Aminobenzoic acid

(C) 2-Acetoxybenzoic acid

(D) 3-Hydroxybenzenesulfonic acid

Q13. The presence of an electron-withdrawing group (such as a nitro group, $-NO_2$) attached to the *para*-position of a benzene ring containing a carboxylic acid function will cause:

(A) A decrease in the acidity of the carboxylic acid due to positive inductive effect

(B) An increase in the acidity of the carboxylic acid due to resonance and inductive electron withdrawal

(C) No change in the ionization constant (K_a) of the molecule

(D) A steric hindrance that selectively prevents ion-pair formation

Q14. Which of the following structural elements is absolutely essential for the high-affinity binding of local anesthetics of the ester type (like procaine) to voltage-gated sodium channels?

(A) A lipophilic aromatic ring linked via an ester intermediate chain to a hydrophilic tertiary amine

(B) A long unsubstituted aliphatic chain terminating in a quaternary ammonium salt

(C) A central imidazole ring flanked by two symmetrical phenolic hydroxyl groups

(D) A rigid steroid nucleus substituted with a secondary thiol chain

Q15. Phenothiazine derivatives used as antipsychotic agents, such as chlorpromazine, are highly prone to which primary pathway of chemical degradation when exposed to light and atmospheric oxygen?

(A) Hydrolytic cleavage of the central ring system

(B) Photochemical oxidation yielding a colored sulfoxide derivative

(C) Decarboxylation of the alkyl side chain

(D) Racemization of the chiral center at position 10

Q16. The discipline of pharmacokinetics describes which specific aspect of drug action within a biological system?

(A) The biochemical and physiological mechanisms of action of drugs

(B) The quantitative study of drug absorption, distribution, metabolism, and excretion

(C) The genetic variation responsible for abnormal responses to therapeutic agents

(D) The adverse profiles and toxicity thresholds of chemicals in target organs

Q17. When a drug is a substrate for the efflux transporter P-glycoprotein (P-gp) in the intestinal mucosa, its systemic bioavailability after oral administration is typically:

(A) Significantly enhanced due to accelerated carrier-mediated uptake

(B) Markedly reduced because the drug is actively pumped back into the intestinal lumen

(C) Unaffected because P-glycoprotein operates exclusively within the blood-brain barrier

(D) Delayed in onset but increased in terms of total area under the curve (AUC)

Q18. Pilocarpine acts as an effective miotic agent in the treatment of open-angle glaucoma primarily through which mechanism?

(A) Selective blockade of beta-2 adrenergic receptors on the ciliary epithelium

(B) Direct stimulation of muscarinic M_3 receptors causing contraction of the sphincter pupillae muscle

(C) Non-competitive inhibition of the enzyme carbonic anhydrase

(D) Irreversible inhibition of acetylcholinesterase within the uveoscleral tract

Q19. Atropine overdosage is clinically characterized by which characteristic cluster of signs and symptoms?

(A) Miosis, profuse sweating, bradycardia, and hypermotility of the bowel

(B) Mydriasis, dry mouth, tachycardia, hot flushed skin, and urinary retention

(C) Tremors, excessive salivation, bronchoconstriction, and diarrhea

(D) Postural hypotension, generalized muscle fasciculations, and hypothermia

Q20. Which of the following anti-epileptic agents exerts its primary therapeutic effect by slowing the rate of recovery of voltage-activated sodium channels from the inactivated state?

(A) Diazepam

(B) Phenytoin

(C) Ethosuximide

(D) Vigabatrin

Q21. The therapeutic action of cardiac glycosides like digoxin in congestive heart failure is fundamentally mediated by the inhibition of:

(A) Voltage-gated L-type Ca^{2+} channels

(B) Membranous Na^{+}/K^{+}-ATPase pump

(C) Intracellular phosphodiesterase-3 enzyme

(D) Sarcoplasmic ryanodine receptors

Q22. Loop diuretics, such as furosemide, achieve high efficacy in inducing diuresis by selectively inhibiting which transport system in the renal parenchyma?

(A) The Na^+/Cl^- symporter in the distal convoluted tubule

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

(C) The Na^+/H^+ antiporter in the proximal convoluted tubule

(D) Aldosterone-receptors in the cortical collecting duct

Q23. The mechanism of action of penicillin-type antibiotics involves the structural mimicry of which physiological substrate, leading to the inhibition of bacterial cell wall transpeptidase?

(A) D-alanyl-D-alanine

(B) N-acetylglucosamine

(C) L-lysine-D-alanine

(D) N-acetylmuramic acid

Q24. Tetracycline antibiotics are selectively contraindicated in pregnant women and young children because they:

(A) Cause severe bone marrow suppression and aplastic anemia

(B) Chelate with calcium ions, depositing in developing teeth and bones causing discoloration and hypoplasia

(C) Induce acute hemolytic anemia via glucose-6-phosphate dehydrogenase deficiency

(D) Accelerate premature closure of the cranial sutures

Q25. Propylthiouracil acts as an effective agent in managing hyperthyroidism by which dual biochemical mechanisms?

(A) Inhibiting the thyroid peroxidase enzyme and blocking peripheral conversion of T_4 to T_3

(B) Destroying the follicular cells via emission of localized beta particles

(C) Stimulating proteolytic cleavage of thyroglobulin within the colloid matrix

(D) Competitive antagonism at the nuclear thyroid hormone receptor sites

Q26. What is the standard pharmacological antidote indicated for the management of an acute poisoning case involving an overdose of heparin?

(A) Acetylcysteine

(B) Protamine sulfate

(C) Deferoxamine

(D) Flumazenil

Q27. At the sub-cellular level, the smooth endoplasmic reticulum is highly specialized to carry out which major physiological function?

(A) Translation of mRNA into structural proteins

(B) Synthesis of lipids, phospholipids, and steroid hormones

(C) Intracellular digestion of worn-out organelles via acid hydrolases

(D) Generation of adenosine triphosphate (ATP) via electron transport chain

Q28. The specialized connective tissue cells responsible for the synthesis and deposition of the organic extracellular matrix of bone are known as:

(A) Osteoclasts

(B) Osteoblasts

(C) Chondrocytes

(D) Fibroblasts

Q29. The normal pacemaker of the human heart, located in the superior wall of the right atrium, is the:

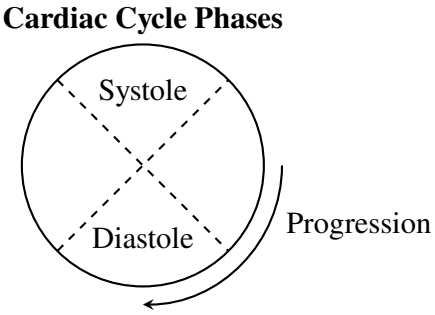
(A) Atrioventricular (AV) node

(B) Sinoatrial (SA) node

(C) Bundle of His

(D) Purkinje fibers

Q30. During which phase of the cardiac cycle do all four heart valves remain closed while the ventricles contract, leading to a sharp rise in intraventricular pressure without any change in volume?



(A) Isovolumetric relaxation phase

(B) Ventricular ejection phase

(C) Isovolumetric contraction phase

(D) Atrial systole phase

Q31. The primary chemical stimulus that regulates the rate and depth of respiration under resting physiological conditions is the concentration of:

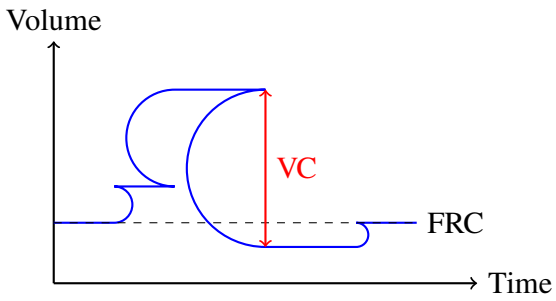
(A) Oxygen (O_2) in arterial blood

(B) Carbon dioxide (CO_2) and hydrogen ions (H^+) in arterial blood and cerebrospinal fluid

(C) Nitrogen (N_2) dissolved in blood plasma

(D) Bicarbonate ions (HCO_3^-) within the venous circulation

Q32. The vital capacity of the lungs is mathematically defined as the sum of which individual pulmonary volumes?



(A) Tidal Volume + Inspiratory Reserve Volume

(B) Tidal Volume + Expiratory Reserve Volume + Residual Volume

(C) Inspiratory Reserve Volume + Expiratory Reserve Volume + Tidal Volume

(D) Inspiratory Capacity + Functional Residual Capacity

Q33. Which specific specialized cells in the gastric mucosa are responsible for the secretion of intrinsic factor, which is required for Vitamin B_{12} absorption?

(A) Chief cells

(B) Parietal (oxyntic) cells

(C) Mucous neck cells

(D) G cells

Q34. The major site for the enzymatic digestion of dietary lipids and the subsequent absorption of fatty acids and monoglycerides in the human alimentary tract is the:

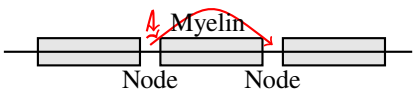
(A) Stomach

(B) Duodenum and jejunum of the small intestine

(C) Descending colon

(D) Cecum

Q35. Saltatory conduction is a rapid mechanism of nerve impulse transmission that occurs uniquely along:



(A) Non-myelinated nerve fibers via continuous depolarizing waves

(B) Myelinated nerve fibers, where the action potential leaps from one Node of Ranvier to the next

(C) Dendritic processes within gray matter columns

(D) Synaptic clefts via neurotransmitter exocytosis

Q36. The structural division of the nervous system that prepares the body for energy-expending, emergency, or stressful "fight-or-flight" situations is the:

(A) Parasympathetic division

(B) Sympathetic division

(C) Somatic motor system

(D) Central nervous system

Q37. Which hormone, synthesized by the hypothalamus and stored/released by the posterior pituitary gland, acts on the renal collecting ducts to increase water reabsorption?

(A) Oxytocin

(B) Antidiuretic Hormone (Vasopressin)

(C) Aldosterone

(D) Adrenocorticotropic Hormone

Q38. In the human male, the interstitial cells of Leydig, located in the connective tissue between the seminiferous tubules, are responsible for secreting:

(A) Follicle-Stimulating Hormone (FSH)

(B) Luteinizing Hormone (LH)

(C) Testosterone

(D) Inhibin

Q39. Which of the following structural parts of a crude plant drug represents organized tissue characterized by the presence of anomocytic stomata, unicellular covering trichomes, and calcium oxalate crystals, as seen in Digitalis?

(A) Senna leaf

(B) Digitalis leaf

(C) Clove flower bud

(D) Cinnamon bark

Q40. Ergot belongs to which morphological category of crude drugs used in pharmacognosy?

(A) An unorganized dried latex

(B) An organized dried sclerotium of a fungus

(C) An unorganized oleoresin exudate

(D) An organized dried rhizome

Q41. Under the pharmacological system of classification, crude drugs are grouped systematically according to:

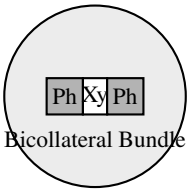
(A) Their botanical or zoological origin and families

(B) Their primary therapeutic use or administrative action on biological systems

(C) The chemical nature of their principal active constituents

(D) Alphabetical arrangement of their vernacular names

Q42. The anatomical arrangement characterized by the presence of bicollateral vascular bundles is an important diagnostic microscopic feature used to identify plants belonging to which family?



(A) Solanaceae

(B) Umbelliferae

(C) Solanaceae and Cucurbitaceae

(D) Leguminosae

Q43. The cultivation of Cinchona trees for the optimal production of antimalarial alkaloids requires which specific environmental conditions?

(A) Arid desert soils with negligible annual rainfall at sea level

(B) Tropical mountain slopes with high humidity and well-drained acidic soils

(C) Waterlogged marshy lands exposed to continuous sub-zero temperatures

(D) Alkaline clay soils under artificial greenhouse lighting

Q44. Which of the following standard post-harvest operations is essential for Digitalis leaves immediately after collection to preserve the cardioactive glycosides from enzymatic hydrolysis?

(A) Slow air drying in the shade over three weeks

(B) Immediate drying at a temperature below 60°C to inactivate hydrolytic enzymes

(C) Fermentation in closed heaps to develop the aroma

(D) Exposure to direct sulfur dioxide fumes for bleaching

Q45. The practice of substituting genuine Digitalis leaves with the leaves of *Verbascum thapsus* is classified as which specific type of adulteration?

(A) Adulteration with sub-standard commercial varieties

(B) Adulteration with superficially similar but completely inferior genuine leaves

(C) Substitution with exhausted drugs containing no active principles

(D) Presence of vegetative matter from the same plant

Q46. In the evaluation of crude drugs, the determination of 'Acid-Insoluble Ash' is highly specific for detecting the presence of:

(A) Adhering dirt, sand, and siliceous earth matter

(B) Water-soluble inorganic salts deposited in tissues

(C) Volatile organic compounds present in glandular trichomes

(D) Heavy metal residues like lead and arsenic from pesticides

Q47. Ashwagandha, a reputed Ayurvedic herbal drug derived from *Withania somnifera*, chemically contains which principal class of bioactive markers?

(A) Tropane alkaloids

(B) Steroidal lactones known as withanolides

(C) Anthraquinone glycosides

(D) Monoterpene volatile oils

Q48. Which of the following monosaccharides is structurally classified as a ketohexose sugar?

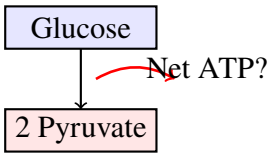
(A) D-Glucose

(B) D-Fructose

(C) D-Galactose

(D) D-Mannose

Q49. The quantitative pathway of glycolysis, which converts one molecule of glucose into two molecules of pyruvate under aerobic conditions, yields a net count of how many molecules of ATP directly via substrate-level phosphorylation?



(A) 2 ATP

(B) 4 ATP

(C) 6 ATP

(D) 32 ATP

Q50. The secondary structural conformation of proteins, such as the alpha-helix, is stabilized primarily by which type of chemical bond?

(A) Covalent disulfide bonds between cysteine residues

(B) Non-covalent hydrogen bonds between peptide amide (−NH−) and carbonyl (−CO−) groups

(C) Hydrophobic interactions between non-polar aliphatic side chains

(D) Ionic salt bridges between basic and acidic amino acids

Q51. Lecithin, a major structural component of cellular membranes and an important pharmaceutical emulsifier, belongs to which specific group of lipids?

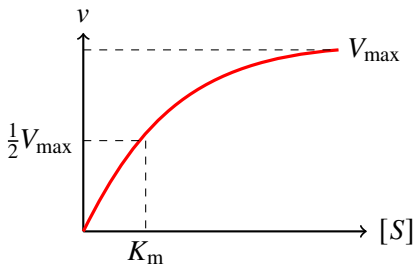
(A) Simple triglycerides

(B) Sphingolipids

(C) Phospholipids (Phosphatidylcholine)

(D) Derived sterols

Q52. According to the Michaelis-Menten kinetic model of enzymatic reactions, the Michaelis constant (K_m) is defined as:



(A) The maximum velocity (V_{max}) divided by two

(B) The specific substrate concentration at which the reaction velocity is exactly half of V_{max}

(C) The equilibrium constant for the dissociation of the enzyme-product complex

(D) The turnover number of the enzyme per unit time

Q53. A clinical biochemistry test reveals highly elevated levels of serum glutamate pyruvate transaminase (SGPT/ALT). This finding is strongly indicative of acute damage to which organ?

(A) Myocardium

(B) Liver parenchyma

(C) Skeletal muscle

(D) Pancreatic acinar tissue

Q54. The presence of ketone bodies (such as acetoacetate and beta-hydroxybutyrate) in a patient's urine sample can be detected using which qualitative laboratory test?

(A) Benedict's test

(B) Rothera's test

(C) Fouchet's test

(D) Hay's sulfur test

Q55. The presence of ketone bodies (such as acetoacetate and beta-hydroxybutyrate) in a patient's urine sample can be detected using which qualitative laboratory test?

(A) Widal test

(B) Dick test

(C) Schick test

(D) Mantoux test

Q56. Epidemiology is defined as the specialized branch of medical science that deals with:

(A) The synthesis and design of novel antimicrobial agents for endemic diseases

(B) The study of the distribution, determinants, and frequency of health-related states or events in specified populations

(C) The individual molecular response of a patient to environmental toxins

(D) The legislative control of infectious disease notification in municipal corporations

Q57. Which of the following water-soluble vitamins acts as an essential coenzyme component (as TPP) in the oxidative decarboxylation of alpha-keto acids, its deficiency leading to Beriberi?

(A) Riboflavin (Vitamin B_2)

(B) Thiamine (Vitamin B_1)

(C) Niacin (Vitamin B_3)

(D) Pyridoxine (Vitamin B_6)

Q58. A comprehensive family welfare program aims primarily at achieving which societal objective?

(A) Mandatory hospitalization of all geriatric citizens

(B) Stabilization of population growth through voluntary family planning and reproductive health education

(C) Free distribution of synthetic dietary supplements to urban school child populations

(D) Elimination of occupational hazards within primary heavy industries

Q59. The primary operational objective of the Revised National Tuberculosis Control Programme (RNTCP), utilizing the DOTS strategy, is to:

(A) Isolate all active tuberculosis patients in rural sanatoriums

(B) Achieve at least an 85% cure rate of infectious sputum-positive cases through supervised short-course chemotherapy

(C) Provide universal BCG vaccination to the geriatric population

(D) Eradicate the intermediate environmental vector of *Mycobacterium tuberculosis*

Q60. Which of the following infectious conditions is classified as a vaccine-preventable disease included within the routine schedule of the Universal Immunization Programme (UIP) in India?

(A) Dengue fever

(B) Pertussis (Whooping cough)

(C) Amoebic dysentery

(D) Filariasis

Q61. During a professional patient counselling session, the pharmacist should adopt which communication strategy to ensure maximum therapeutic compliance?

(A) Speak exclusively in advanced medical jargon to display clinical competence

(B) Ask open-ended questions, actively listen, and use simple, non-technical language reinforced with written labels

(C) Deliver a rapid, unidirectional verbal monologue to minimize dispensing time

(D) Avoid giving any information regarding potential side effects to prevent patient anxiety

Q62. When counselling a patient who has been freshly prescribed a sublingual nitroglycerin tablet for angina pectoris, what critical operational instruction must be given?

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

(B) Chew the tablet thoroughly before swallowing with food

(C) Place the tablet under the tongue and allow it to dissolve completely without swallowing it or drinking fluid

(D) Crush the tablet and mix it uniformly with an oil-based vehicle for application to the skin

Q63. Over-The-Counter (OTC) medications are legally defined as those drugs that:

(A) Can be sold to the consumer only upon presentation of a valid prescription from a Registered Medical Practitioner

(B) Are highly experimental and can only be dispensed within tertiary care research institutions

(C) Can be legally sold to consumers without a prescription, being safe and effective for self-directed use according to labeled instructions

(D) Are strictly banned from public distribution and reserved for military emergency use

Q64. According to the provisions of the Pharmacy Act, 1948, the primary statutory constitution of the Pharmacy Council of India (PCI) must be reconstituted by the central authorities every:

(A) 3 years

(B) 5 years

(C) 7 years

(D) 10 years

Q65. Under the Drugs and Cosmetics Act, 1940 and Rules, 1945, the legal requirements, standards, and operational guidelines for biological and special products (such as sera, vaccines, and insulin) are detailed under which specific Schedule?

(A) Schedule M

(B) Schedule C and C1

(C) Schedule G

(D) Schedule X

Q66. Which of the following drug classes is legally categorized under Schedule X of the Drugs and Cosmetics Rules, requiring special double-copy prescription storage and strict retail marketing controls?

(A) Antihypertensive agents like amlodipine

(B) Psychotropic substances and narcotics like ketamine or amphetamines

(C) Broad-spectrum fluoroquinolones like ciprofloxacin

(D) Systemic corticosteroids like dexamethasone

Q67. The Narcotic Drugs and Psychotropic Substances (NDPS) Act was enacted by the Indian Parliament in which year to consolidate and amend the law relating to narcotic drugs?

(A) 1940

(B) 1948

(C) 1985

(D) 1995

Q68. In selective inventory control management within a hospital pharmacy matrix, the “VED” analysis system classifies items based on which parameter?

V	E	D

Criticality Categories

(A) The monetary value and annual consumption cost of the inventory items

(B) The critical therapeutic urgency and necessity of the drug (Vital, Essential, Desirable)

(C) The physical storage space and volume constraints within the warehouse

(D) The shelf-life speed and turnover velocity of the packaged formulations

Q69. The systematic sequence of operational steps involved in the formal purchasing and procurement process of pharmaceuticals in a public healthcare institution starts with:

(A) Direct payment to international manufacturing firms

(B) Determination of requirements, preparation of tender specifications, and invitation of competitive bids

(C) Random collection of samples from open retail stores

(D) Immediate distribution of unchecked drug batches to emergency wards

Q70. For the optimal storage and preservation of thermolabile biological products like insulin and typhoid vaccines, the institutional drug store room refrigerator must maintain a strict temperature range of:

(A) Sub-zero temperatures between $-20^{\circ}C$ and $-10^{\circ}C$

(B) Cold temperatures between $2^{\circ}C$ and $8^{\circ}C$

(C) Controlled room temperature between $15^{\circ}C$ and $25^{\circ}C$

(D) Ambient tropical temperature of $30^{\circ}C$

Q71. Which of the following responsibilities represents a primary operational function of a clinical pharmacist operating within a modern hospital framework?

(A) Negotiating commercial real-estate leases for opening external franchise chemist outlets

(B) Participating in medical ward rounds, monitoring drug therapy for adverse events, and performing medication reconciliation

(C) Directly performing major surgical interventions in the operating theater

(D) Standardizing the mechanical assembly lines of tablet compression machinery

Q72. An organized institutional body within a hospital framework that is responsible for developing a customized formulary system, approving drug protocols, and ensuring safe medication practices is the:

(A) Institutional Ethics Committee

(B) Pharmacy and Therapeutics Committee (PTC)

(C) Medical Council Liaison Unit

(D) Executive Nursing Directorate

Q73. The primary administrative objective of maintaining a comprehensive 'Hospital Formulary' is to:

(A) Maximize the retail profit margins of private pharmaceutical distributors

(B) Provide a revised list of all available global chemical entities regardless of safety

(C) Promote rational, safe, and cost-effective drug therapy by restricting available medication choices to a selected list of approved drugs

(D) Enable patients to directly purchase prescription-only narcotics via online portals

Q74. Which of the following automated distribution systems is considered the safest and most efficient for inpatient drug delivery, minimizing dispensing errors and reducing nursing workloads?

(A) Complete Floor Stock System

(B) Individual Prescription Order System

(C) Unit Dose Dispensing System

(D) Open Ward Bulk Bin System

Q75. The term "Adverse Drug Reaction" (ADR), as per the World Health Organization definition, excludes which of the following scenarios?

(A) A noxious and unintended response occurring at normal therapeutic doses used for prophylaxis

(B) An accidental or intentional acute overdosage resulting from a suicide attempt

(C) A bizarre immunological hypersensitivity reaction to a properly manufactured drug batch

(D) An unexpected secondary effect that alters physiological function during standard clinical management

Q76. Health education programs designed to prevent the incidence of chronic non-communicable lifestyle diseases like Type 2 diabetes emphasize which level of prevention?

(A) Primordial and Primary prevention via lifestyle modifications and dietary control

(B) Secondary prevention via routine surgical excision

(C) Tertiary prevention via advanced palliative rehabilitation

(D) Quaternary prevention via over-medicalization management

Q77. The mechanical device commonly utilized in the pharmaceutical industry to achieve efficient wet granulation and rapid mixing of cohesive powders for tablet manufacture is the:

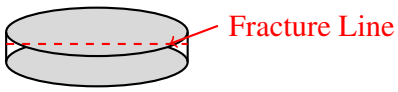
(A) Double cone blender

(B) Rapid Mixer Granulator (RMG)

(C) Fluidized bed dryer

(D) Planetary mixer

Q78. What specific visual defect occurs during tablet manufacturing when the upper or lower segment of a compressed tablet separates horizontally from the main body during ejection?



(A) Picking

(B) Mottling

(C) Capping

(D) Chipping

Q79. A prescription written by a physician demands: "Rx Ofloxacin Suspension, 125 mg po qid $\times$7 days". If the available stock formulation contains 50 mg/5 mL, what volume of suspension must be administered to the patient per individual dose?

(A) 5.0 mL

(B) 12.5 mL

(C) 25.0 mL

(D) 50.0 mL

Q80. According to the Indian Pharmacopoeia, a formulation stored in a "Well-Closed Container" must be protected specifically against the ingress of:

(A) Atmospheric moisture and gases under all climatic variables

(B) Extraneous solids and loss of contents during ordinary handling

(C) Microscopic viral pathogens and ionizing radiation

(D) Direct actinic solar rays via amber glass coloration

Q81. The primary structural advantage of utilizing a fluid energy mill for the ultra-fine size reduction of thermolabile antibiotic powders is that:

(A) It operates entirely via low-speed mechanical shearing using heavy iron rollers

(B) The rapid expansion of compressed air creates a cooling effect, preventing heat buildup during attrition and impact

(C) It utilizes organic solvents that chemically dissolve the large granules

(D) It acts via high-frequency electrical arcs that shatter crystalline structures

Q82. In the industrial filtration of highly concentrated slurries, the rate of filtration is inversely proportional to which variable according to the Darcy equation?

(A) The surface area of the filter medium

(B) The pressure drop across the filter cake

(C) The viscosity of the fluid and the thickness of the deposited filter cake

(D) The permeability coefficient of the porous bed

Q83. An physical incompatibility manifesting as "liquefaction" occurs when equal proportions of camphor and menthol are triturated together at room temperature due to:

(A) The formation of a low-melting eutectic mixture

(B) A rapid chemical neutralization reaction releasing water of crystallization

(C) Complete desolvation of the crystalline lattices by atmospheric moisture

(D) Polymerization into a highly volatile liquid macromolecule

Q84. Which of the following compounds is classified as an inorganic gastrointestinal protective and adsorbent agent utilized extensively in anti-diarrheal formulations?

(A) Magnesium sulfate

(B) Light Kaolin

(C) Sodium chloride

(D) Calcium hydroxide

Q85. What specific analytical reagent is universally employed as a precipitating agent in the limit test for Sulfates to create a uniform turbidity?

(A) Silver nitrate solution

(B) Barium chloride solution in the presence of dilute hydrochloric acid

(C) Ammonium oxalate reagent

(D) Potassium pyroantimonate solution

Q86. A standard pharmaceutical buffer solution containing a mixture of a weak base like ammonium hydroxide (NH_4OH) and its conjugate acid salt ammonium chloride (NH_4Cl) is highly effective at resisting pH alterations within which range?

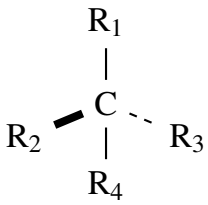
(A) Acidic range (pH 2.0 to 5.0)

(B) Alkaline range (pH 8.0 to 11.0)

(C) Strictly neutral point (pH 7.0)

(D) Extreme hyper-acidic range (pH 0.5 to 1.5)

Q87. The structural characteristic known as "chirality" arises in an organic drug molecule when it possesses:



(A) A highly rigid planar aromatic ring system with alternate double bonds

(B) An asymmetric carbon atom bonded to four different atoms or functional groups

(C) A center of inversion symmetry that neutralizes light rotation

(D) Multiple terminal conjugated double bonds linked to a carbonyl function

Q88. What is the principal mechanism of action of the non-steroidal anti-inflammatory drug (NSAID) aspirin at the molecular level?

(A) Reversible competitive blockade of histamine H_1 receptors

(B) Irreversible acetylation and inhibition of the cyclooxygenase (COX) enzymes

(C) Selective activation of the lipoxygenase pathway

(D) Antagonism of the nuclear peroxisome proliferator-activated receptors

Q89. Which of the following physicochemical parameters represents the relative distribution of a drug molecule between an organic lipophilic phase (like *n*-octanol) and an aqueous phase, directly controlling membrane permeability?

(A) Dissociation constant (pK_a)

(B) Partition Coefficient ($\log P$)

(C) Water solubility index

(D) Intrinsic dissolution rate

Q90. The biochemical pathway of phase I drug metabolism is predominantly characterized by which transformations aimed at increasing drug polarity?

(A) Glucuronidation and sulfate conjugation

(B) Oxidation, reduction, and hydrolysis

(C) Acetylation and amino acid conjugation

(D) Methylation of phenolic hydroxyl functions

Q91. The biological half-life ($t_{1/2}$) of a drug that follows first-order elimination kinetics is mathematically related to its elimination rate constant (K_e) by which equation?

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

(B) $t_{1/2} = 0.693 \times K_e$

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

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

Q92. The neuromuscular blocking agent succinylcholine acts as a muscle relaxant through which distinct physiological mechanism?

(A) Competitive antagonism at the nicotinic receptors of the motor endplate

(B) Persistent depolarization of the nicotinic neuromuscular junction receptors leading to desensitization

(C) Blockade of calcium release from the sarcoplasmic reticulum via ryanodine channels

(D) Direct activation of central GABA-B receptors in the spinal cord

Q93. The mechanism of action of the atypical sedative-hypnotic zolpidem involves selective binding to:

(A) The alpha-1 subunit modulation site of the $GABA_A$ receptor complex

(B) Central voltage-sensitive calcium channels

(C) Post-synaptic serotonin 5-HT_{1A} receptors

(D) Intracellular melatonin MT_1 receptors

Q94. Which of the following drugs is classified as a selective HMG-CoA reductase inhibitor used as a primary agent to lower plasma LDL cholesterol levels?

(A) Atorvastatin

(B) Gemfibrozil

(C) Cholestyramine

(D) Ezetimibe

Q95. The primary mechanism of action of the aminoglycoside antibiotic streptomycin involves:

(A) Inhibition of bacterial cell wall cross-linking

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

(C) Disruption of plasma membrane integrity via detergent-like action

(D) Direct inhibition of bacterial DNA gyrase and topoisomerase IV

Q96. The primary mechanism of action of the aminoglycoside antibiotic streptomycin involves:

(A) Direct stimulation of pancreatic beta cells to secrete stored insulin batches

(B) Activation of AMP-activated protein kinase (AMPK), leading to reduced hepatic gluconeogenesis and enhanced peripheral insulin sensitivity

(C) Competitive inhibition of alpha-glucosidase enzymes in the brush border intestinal mucosa

(D) Selective antagonism of the sodium-glucose cotransporter 2 (SGLT2) in the nephron

Q97. The distinct microscopic structure of an unorganized drug like Acacia can be distinguished from a pulverized organized leaf drug because Acacia lacks:

(A) Any trace of complex cellular elements like cell walls, vessels, trichomes, or stomata

(B) Crystalline forms of organic calcium salts

(C) Carbohydrate polymers within its exudate matrix

(D) Water-soluble gum fractions

Q98. Which of the following chemical screening tests is specifically used to identify the presence of anthraquinone glycosides in crude drugs like Senna or Aloe?

(A) Borntrager's test

(B) Legal's test

(C) Keller-Kiliani test

(D) Mayer's test

Q99. The specialized evaluation method that utilizes living biological systems, isolated animal organs, or whole microorganisms to standardize the potency of a digitalis preparation is termed a:

(A) Physico-chemical assay

(B) Organoleptic profile evaluation

(C) Bioassay

(D) Histochemical localization test

Q100. The primary therapeutic use of the natural herbal drug Artemisinin, isolated from *Artemisia annua*, is as a potent:

(A) Antihypertensive agent

(B) Antimalarial drug effective against multi-drug resistant *Plasmodium falciparum*

(C) Broad-spectrum anthelmintic agent

(D) Central nervous system stimulant

Detailed Solutions

Q1.

Solution

Concept: Absorption mechanisms in the gastrointestinal tract vary depending on particle size. While soluble molecules use passive or active transport, ultra-fine particulate matters or colloidal carriers are taken up via specialized epithelial cells named M-cells located in Peyer's patches through vesicular translocation processes.

Solution: Step 1: Analyze the specific cellular site mentioned in the question, which is the M-cells of Peyer's patches. These cells are histologically designed for sample collection of particulate antigens from the intestinal lumen.
Step 2: Understand the term "persorption". Persorption refers to the process where large molecules or ultra-fine intact particles pass through the single layer of epithelial cells into the lymph or bloodstream via vesicular structures or paracellular gaps.
Step 3: Differentiate from normal mechanisms. Passive diffusion handles small lipophilic molecules, active transport moves nutrients against concentration gradients using chemical energy, and pore filtration works only for small water-soluble ions.
Step 4: Confirm that ultra-fine drug delivery systems like nanoparticles and liposomes utilize this transcellular vesicular mechanism to cross the mucosal barrier intact.

Final Answer: Persorption or vesicular transport

Answer: (B)

Go Back to Question 1

Q2.

Solution

Concept: Prescription translation requires precise interpretation of Latin abbreviations into simple language instructions for patient safety. The term "t.i.d." stands for *ter in die* (three times a day) and "ex aq." stands for *ex aqua* (in or with water).

Solution: Step 1: Break down the abbreviation component by component to prevent transcription errors.
Step 2: Translate the frequency parameter: *ter in die* translates mathematically and clinically to three times within a twenty-four-hour cycle.
Step 3: Translate the vehicle parameter: *ex aqua* explicitly commands the use of water as the medium for dilution or ingestion of the medication.
Step 4: Combine the components into a cohesive instructional sentence suitable for a standard dispensing label. This yields "To be taken three times a day in water."

Final Answer: To be taken three times a day in water

Answer: (B)

Go Back to Question 2

Q3.

Solution

Concept: The selection of systemic routes of drug administration depends on speed, metabolic escape, physiological conditions, and technique complexity. The sublingual route involves placing the dosage form under the tongue where it dissolves in salivary secretions.

Solution: Step 1: Evaluate venous anatomy. The sublingual mucosa is highly vascularized; drugs absorbing here drain directly into the systemic veins, entirely bypassing portal circulation and liver first-pass metabolism.
Step 2: Evaluate chemical environment. The sublingual cavity maintains a near-neutral pH, preventing the acid-catalyzed degradation seen in the gastric lumen.
Step 3: Evaluate operational requirements. Unlike parenteral routes like intravenous or subcutaneous injections, sublingual administration is completely non-invasive and does not require sterile equipment or strict aseptic techniques.
Step 4: Match these combined characteristics with the available options to confirm that the sublingual route satisfies all parameters.

Final Answer: Sublingual

Answer: (A)

Go Back to Question 3

Q4.

Solution

Concept: Pharmaceutical alligation methods or material balance equations help calculate the required proportions of two component mixtures of different strengths to achieve a desired intermediate strength.

Solution: Step 1: Set up the algebraic mass balance equation for the active ingredient. Let the mass of the 20% ointment needed be x grams.
Step 2: Express total active drug content before mixing as the sum of individual components:

$$\text{Mass of drug} = (0.20 \times x) + (0.05 \times 150)$$

Step 3: Express total active drug content in the final mixture:

$$\text{Final mass of drug} = 0.10 \times (x + 150)$$

Step 4: Equate the initial and final quantities:

$$0.20x + 7.5 = 0.10x + 15$$

Step 5: Solve for x by isolating variables:

$$0.10x = 7.5 \implies x = 75 \text{ grams}$$

Final Answer: 75 grams

Answer: (B)

Go Back to Question 4

Q5.

Solution

Concept: Plastic packaging materials can interact with pharmaceutical formulations through leaching, sorption, or permeation. Polyvinyl chloride polymer matrices require plasticizers to maintain structural flexibility.

Solution: Step 1: Identify the additive component of PVC. Diethylhexyl phthalate is a lipophilic plasticizer added extensively to PVC to make it pliable for flexible infusion bags.
Step 2: Analyze the nature of the formulation. A lipophilic intravenous infusion acts as an organic solvent matrix.
Step 3: Deduce the chemical interaction. The lipophilic vehicle readily dissolves and extracts the loosely bound DEHP molecules out of the plastic wall into the solution, causing patient exposure to potential phthalate toxicities.
Step 4: Differentiate from other mechanisms like sorption or oxidation, which do not represent the primary toxicity hazard of flexible PVC with lipophilic fluids.

Final Answer: Leaching of diethylhexyl phthalate (DEHP) plasticizers into the vehicle

Answer: (B)

Go Back to Question 5

Q6.

Solution

Concept: Size reduction theories correlate the energy input required to fracture solid materials with the physical changes produced in particle dimensions. Rittinger's hypothesis focuses specifically on surface energy changes.

Solution: Step 1: Recall the mathematical basis of size reduction equations, generally written as:

$$dE = -K \cdot \frac{dx}{x^n}$$

Step 2: For Rittinger's theory, the exponent value is $n = 2$. Integrating this specific differential form reveals that the energy required is proportional to $(1/x_2 - 1/x_1)$.
Step 3: Interpret the physical meaning of this integrated value. Since the total surface area per unit volume of spherical or cubical particles is inversely proportional to their diameter, $(1/x_2 - 1/x_1)$ directly represents the net increase in total surface area.
Step 4: Conclude that Rittinger's hypothesis considers solid mechanical fracture to be an exclusive function of creating new interfaces and surface configurations.

Final Answer: The new surface area created during size reduction

Answer: (C)

Go Back to Question 6

Q7.

Solution

Concept: Pharmaceutical incompatibilities occur when components mixed together interact chemically, physically, or therapeutically to compromise the quality of the dosage form. Chemical incompatibilities often result in precipitation reactions due to double decomposition or complex formation.

Solution: Step 1: Identify the chemical structures of the ingredients. Caffeine citrate is an acidic salt complex, while sodium benzoate is a salt of a weak organic acid.
Step 2: Analyze the solution interaction. When combined in an aqueous medium, a chemical reaction occurs where the acidic components cause displacement, leading to the formation of a less soluble caffeine-benzoate complex compound.
Step 3: Observe the macroscopic change. This newly formed molecular complex cannot remain dissolved in the available volume of water, causing a visible precipitate to settle out.
Step 4: Classify this event based on its origin. Because a chemical reaction generates a new chemical species with lower solubility, it is categorized as a chemical incompatibility.

Final Answer: Chemical incompatibility resulting in a less soluble complex

Answer: (B)

Go Back to Question 7

Q8.

Solution

Concept: Limit tests are quantitative or semi-quantitative experiments designed to identify and control small traces of impurities within pharmaceutical substances. The limit test for iron relies on a purple color reaction under alkaline parameters.

Solution: Step 1: Examine the core reaction. Iron impurities react with thioglycolic acid in a medium buffered with ammonia to yield a purple ferrous thioglycolate complex.
Step 2: Identify potential chemical interference. When ammonia is added to raise the pH, iron ions can react with hydroxyl ions (OH^-) to form insoluble ferric and ferrous hydroxides, which precipitate out of solution.
Step 3: Analyze the role of citric acid. Citric acid is added to form a highly stable, water-soluble iron-citrate complex compound.
Step 4: Evaluate the protective mechanism. This ammonium citrate complex prevents ammonia from precipitating the iron as hydroxides, keeping the ions in solution to react fully with the thioglycolic acid reagent.

Final Answer: To prevent the precipitation of iron by ammonia by forming a soluble complex

Answer: (A)

Go Back to Question 8

Q9.

Solution

Concept: Modern pharmacopoeial limit tests for heavy metal contaminants utilize uniform, controlled sulfur donor reagents to generate a stable brown colloidal suspension for visual comparison.

Solution: Step 1: Review older pharmacopoeial methods that used hydrogen sulfide gas or sodium sulfide solutions, which frequently produced unstable colors, irregular precipitation, and variable colloidal states.
Step 2: Identify the updated reagent. Thioacetamide (CH_3CSNH_2) serves as an organic sulfur donor that undergoes controlled hydrolysis in hot, buffered settings.
Step 3: Analyze the hydrolysis pathway. Thioacetamide steadily releases a uniform concentration of sulfide ions in situ.
Step 4: Determine the advantages. This in situ generation prevents rapid local supersaturation, suppresses elemental sulfur precipitation, acts as an effective clearing agent, and produces a highly reproducible visual color match.

Final Answer: Thioacetamide reagent

Answer: (C)

Go Back to Question 9

Q10.

Solution

Concept: The Henderson-Hasselbalch equation relates the pH of a buffer system to the ionization constant (pK_a) of the weak acid component and the log ratio of its conjugate base and un-ionized acid forms.

Solution: Step 1: State the standard mathematical equation for an acidic buffer system:

$$\text{pH} = pK_a + \log_{10}\left(\frac{[\text{Base}]}{[\text{Acid}]}\right)$$

Step 2: Substitute the conditions given in the problem statement into the equation:

$$\text{pH} = pK_a + 1$$

Step 3: Set up the resulting algebraic equality:

$$pK_a + 1 = pK_a + \log_{10}\left(\frac{[\text{Base}]}{[\text{Acid}]}\right)$$

Step 4: Simplify by canceling out pK_a from both sides:

$$1 = \log_{10}\left(\frac{[\text{Base}]}{[\text{Acid}]}\right)$$

Step 5: Convert the logarithmic expression back to its exponential form:

$$\frac{[\text{Base}]}{[\text{Acid}]} = 10^1 = 10 \implies 10 : 1$$

Final Answer: 10 : 1

Answer: (B)

Go Back to Question 10

Q11.

Solution

Concept: Systemic electrolyte modifiers are therapeutic chemicals used to correct imbalances in blood pH and systemic ion levels. Systemic acidifiers lower blood pH to manage metabolic alkalosis.

Solution: Step 1: Define the therapeutic target. Metabolic alkalosis is characterized by high plasma bicarbonate and an elevated blood pH. Treatment requires a substance that yields acid metabolites.
Step 2: Evaluate the chemical properties of ammonium chloride (NH_4Cl). It is an inorganic salt compound.
Step 3: Trace the metabolic pathway. When absorbed, ammonium chloride travels to the liver where the ammonium ion (NH_4^+) is converted into urea:

$$2NH_4Cl + CO_2 \rightarrow CO(NH_2)_2 + 2HCl + H_2O$$

Step 4: Identify the active compound. The metabolic conversion releases free hydrochloric acid (HCl), which neutralizes excess bicarbonate ions and effectively lowers systemic pH.

Final Answer: Ammonium chloride

Answer: (B)

Go Back to Question 11

Q12.

Solution

Concept: The IUPAC nomenclature system assigns systematic names to organic chemical structures based on prioritized functional groups and specific substituent numbering along the principal carbon ring or chain.

Solution: Step 1: Identify the core chemical structure of salicylic acid, which consists of a single benzene ring substituted with both a carboxylic acid group ($-COOH$) and a hydroxyl group ($-OH$).
Step 2: Determine priority rules. According to IUPAC rules, the carboxylic acid group takes priority over the hydroxyl group, making the core molecule a benzoic acid derivative.
Step 3: Number the aromatic ring. Assign position 1 to the carbon linked to the prioritized $-COOH$ group.
Step 4: Locate the secondary substituent. Numbering towards the closest substituent puts the hydroxyl group on carbon position 2.
Step 5: Combine these structural elements into a single systematic name: 2-Hydroxybenzoic acid.

Final Answer: 2-Hydroxybenzoic acid

Answer: (A)

Go Back to Question 12

Q13.

Solution

Concept: The acidity of aromatic carboxylic acids depends heavily on electronic properties, which are modified by substituent inductive ($\pm I$) and resonance ($\pm M$) effects on the benzene ring.

Solution: Step 1: Define the mechanism of acidity. An acid's strength increases if the conjugate base anion formed after deprotonation is stabilized by dispersing its negative charge.
Step 2: Analyze the nitro group ($-NO_2$). It is a powerful electron-withdrawing group acting via both a negative inductive effect ($-I$) and a strong negative resonance effect ($-M$).
Step 3: Evaluate positional effects. When attached to the *para*-position, the nitro group effectively withdraws electron density away from the carboxylate group through the conjugated pi-system.
Step 4: Determine the outcome. This electron withdrawal stabilizes the negative charge on the carboxylate group, lowering the energy of the conjugate base and significantly increasing the overall acidity of the molecule.

Final Answer: An increase in the acidity of the carboxylic acid due to resonance and inductive electron withdrawal

Answer: (B)

Go Back to Question 13

Q14.

Solution

Concept: The structural activity relationship (SAR) of local anesthetics defines the structural domains required to fit into the binding pockets of voltage-gated sodium channel proteins within neuronal membranes.

Solution: Step 1: Identify the three essential pharmacophoric regions that comprise a classic ester-type local anesthetic molecule like procaine.
Step 2: Analyze the lipophilic domain. This domain consists of an aromatic ring system that helps the molecule penetrate biological lipid membranes and interact with hydrophobic amino acid residues.
Step 3: Analyze the hydrophilic domain. This domain features a substituted tertiary amine group that can alternate between uncharged and charged forms to block the open channel pore.
Step 4: Identify the bridge link. An intermediate hydrocarbon chain containing an ester linkage connects these two distinct ends.
Step 5: Conclude that this specific arrangement is essential for high-affinity channel binding and proper anesthetic action.

Final Answer: A lipophilic aromatic ring linked via an ester intermediate chain to a hydrophilic tertiary amine

Answer: (A)

Go Back to Question 14

Q15.

Solution

Concept: The chemical stability of pharmaceutical agents is governed by the vulnerability of their heterocyclic structures to environmental variables like light, ambient temperature, moisture, and molecular oxygen.

Solution: Step 1: Examine the chemical architecture of chlorpromazine, which features a tricyclic phenothiazine ring containing a central sulfur and nitrogen atom.
Step 2: Identify structural vulnerabilities. The sulfur atom in the central ring is highly susceptible to radical attacks when exposed to light photons and atmospheric oxygen.
Step 3: Trace the chemical pathway. Exposure to light initiates a photo-oxidation cascade that introduces oxygen directly onto the central sulfur atom.
Step 4: Characterize the degradation product. This photochemical reaction transforms the molecule into chlorpromazine sulfoxide, causing a visible pinkish-brown discoloration in liquid formulations.

Final Answer: Photochemical oxidation yielding a colored sulfoxide derivative

Answer: (B)

Go Back to Question 15

Q16.

Solution

Concept: Pharmacology is split into two major operational branches: pharmacodynamics, which studies a drug's effects on the body, and pharmacokinetics, which tracks how the body processes a drug.

Solution: Step 1: Define the scope of pharmacokinetics using the standard ADME acronym framework.
Step 2: Detail the individual components: Absorption (how the drug enters systemic circulation), Distribution (how it disperses through tissues), Metabolism (how enzymes chemically transform it), and Excretion (how organs eliminate it).
Step 3: Summarize the field as the quantitative study of drug concentration changes across different biological compartments over time.
Step 4: Contrast this with pharmacodynamics, which focuses on receptor bindings, biochemical pathways, and physiological mechanisms of action.

Final Answer: The quantitative study of drug absorption, distribution, metabolism, and excretion

Answer: (B)

Go Back to Question 16

Q17.

Solution

Concept: Intestinal drug absorption is regulated by passive permeability pathways and active transmembrane transporters that either facilitate uptake or actively pump molecules out of the cell.

Solution: Step 1: Identify the role of P-glycoprotein (P-gp), an ATP-dependent efflux pump located on the apical membrane of intestinal enterocytes.
Step 2: Trace the movement of a substrate drug. As the drug passes through the mucosal membrane, P-gp binds it and pumps it back out into the intestinal lumen against the concentration gradient.
Step 3: Evaluate the physiological impact. This continuous efflux reduces the total amount of active drug that can cross the enterocyte layer into the portal vein.
Step 4: Determine the pharmacokinetic outcome. The active efflux significantly reduces the drug's overall systemic bioavailability after oral dosing.

Final Answer: Markedly reduced because the drug is actively pumped back into the intestinal lumen

Answer: (B)

Go Back to Question 17

Q18.

Solution

Concept: Antiglaucoma drugs work by reducing intraocular pressure, either by decreasing aqueous humor production from the ciliary body or by increasing drainage through the trabecular meshwork or uveoscleral pathways.

Solution: Step 1: Identify the pharmacological class of pilocarpine. It is a direct-acting cholinomimetic alkaloid.
Step 2: Pinpoint the target receptors. Pilocarpine selectively stimulates muscarinic acetylcholine receptors, particularly the M_3 subtype, located on ocular smooth muscle tissues.
Step 3: Trace the structural response. Activating these receptors causes the sphincter pupillae muscle to contract, producing miosis. It also contracts the ciliary muscle.
Step 4: Relate this to fluid dynamics. This contraction pulls the scleral spur, widening the spaces within the trabecular meshwork to facilitate aqueous humor drainage and lower intraocular pressure.

Final Answer: Direct stimulation of muscarinic M_3 receptors causing contraction of the sphincter pupillae muscle

Answer: (B)

Go Back to Question 18

Q19.

Solution

Concept: Toxicological syndromes, or toxidromes, reflect extensive overactivation or blockade of specific subdivisions of the autonomic nervous system. Atropine poisoning presents as a classic anticholinergic syndrome.

Solution: Step 1: Identify atropine's mechanism of action. It is a competitive antagonist at muscarinic acetylcholine receptors, blocking normal parasympathetic signals.
Step 2: Match symptoms to affected organ systems. Blocking ocular M_3 receptors stops pupillary constriction, causing severe midriasis. Blocking sweat and salivary gland secretions leads to dry skin and severe dry mouth.
Step 3: Analyze cardiovascular and smooth muscle effects. Removing vagal parasympathetic tone causes rapid tachycardia. Relaxing intestinal smooth muscle can cause acute urinary retention.
Step 4: Combine these findings into the classic clinical description: "blind as a bat, dry as a bone, red as a beet, hot as a hare, mad as a hatter." This correlates with option B.

Final Answer: Mydriasis, dry mouth, tachycardia, hot flushed skin, and urinary retention

Answer: (B)

Go Back to Question 19

Q20.

Solution

Concept: Anticonvulsant medications stabilize hyperexcitable neuronal membranes by modulating ion channels, enhancing GABAergic inhibition, or blocking excitatory glutamatergic pathways.

Solution: Step 1: Analyze the functional states of voltage-gated sodium channels: resting, activated, and inactivated states during action potential propagation.
Step 2: Examine phenytoin's mechanism. It selectively binds to sodium channels while they are in their closed, inactivated state.
Step 3: Evaluate the cellular effect. Binding slows the channel's rate of recovery back to the active state, extending the refractory period and preventing high-frequency repetitive firing without disrupting normal, low-frequency cell signaling.
Step 4: Contrast this with ethosuximide, which targets T-type calcium channels, or diazepam, which modulates $GABA_A$ receptors.

Final Answer: Phenytoin

Answer: (B)

Go Back to Question 20

Q21.

Solution

Concept: Inotropic agents alter myocardial contractility by modifying intracellular calcium levels during excitation-contraction coupling. Cardiac glycosides work by inhibiting active ion transport pumps.

Solution: Step 1: Identify digoxin's biochemical target. It binds selectively to the extracellular face of the alpha subunit of the membrane-bound Na^+/K^+-ATPase pump.
Step 2: Trace the resulting ion changes. Inhibiting this active transport pump halts the outward movement of sodium, increasing intracellular sodium levels.
Step 3: Analyze the secondary effect on transporters. This sodium buildup slows down the Na^+/Ca^{2+} exchanger, which normally uses the sodium gradient to pump calcium out of the cell.
Step 4: Connect to muscle contractility. Calcium ions accumulate within the sarcoplasmic reticulum, leaving more calcium available to bind to troponin C during action potentials, which strengthens myocardial contraction.

Final Answer: Membranous Na^+/K^+-ATPase pump

Answer: (B)

Go Back to Question 21

Q22.

Solution

Concept: Diuretics are grouped by the specific segments of the nephron they target and the individual ion transport proteins they inhibit along the renal tubule.

Solution: Step 1: Locate where loop diuretics act. Furosemide operates in the thick ascending limb of the loop of Henle, a segment responsible for reabsorbing about 25% of filtered sodium.
Step 2: Identify the specific target protein. It binds to the chloride-binding site of the $Na^+/K^+/2Cl^-$ cotransporter (NKCC2) on the luminal membrane.
Step 3: Analyze the transport block. This binding stops the symporter from moving sodium, potassium, and chloride from the tubular fluid into the cell.
Step 4: Determine the physiological effect. Retaining these ions within the lumen retains water, leading to a significant increase in urine volume and rapid diuresis.

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

Answer: (B)

Go Back to Question 22

Q23.

Solution

Concept: Beta-lactam antibiotics act as cell wall synthesis inhibitors by disrupting final transpeptidation reactions, utilizing structural mimicry of endogenous bacterial peptide targets.

Solution: Step 1: Examine the structure of the bacterial peptidoglycan layer. It requires cross-linking via transpeptidase enzymes to maintain cell wall stability.
Step 2: Identify the enzyme's natural substrate. The enzyme binds to a terminal D-alanyl-D-alanine peptide sequence on glycan chains.
Step 3: Analyze the structure of penicillin. The core three-dimensional arrangement of the beta-lactam ring closely mimics the conformation of this D-alanyl-D-alanine group.
Step 4: Trace the molecular inhibition. The transpeptidase enzyme mistakenly binds the penicillin molecule instead, causing irreversible covalent acetylation of its active site. This halts cell wall cross-linking, leaving the bacteria vulnerable to osmotic lysis.

Final Answer: D-alanyl-D-alanine

Answer: (A)

Go Back to Question 23

Q24.

Solution

Concept: The safety profiles of antimicrobial drugs can vary across different age groups or physiological states due to direct chemical interactions with developing tissues.

Solution: Step 1: Review the chemical structure of tetracyclines. They contain a core four-ring hydronaphthacene nucleus with multiple hydroxyl groups that readily chelate divalent metal ions like calcium (Ca^{2+}).
Step 2: Analyze tissue deposition. During periods of active bone and tooth formation, tetracyclines bind to calcium orthophosphate complexes in these tissues.
Step 3: Evaluate the physiological impact. This chelation forms a stable complex that deposits directly into teeth and growing bones, causing permanent yellow-brown tooth discoloration and enamel hypoplasia.
Step 4: Identify clinical restrictions. Because of these risks, tetracyclines are contraindicated during pregnancy and in children under eight years old.

Final Answer: Chelate with calcium ions, depositing in developing teeth and bones causing discoloration and hypoplasia

Answer: (B)

Go Back to Question 24

Q25.

Solution

Concept: Antithyroid medications manage hyperthyroidism by disrupting biochemical steps in hormone synthesis within thyroid follicles or by modulating peripheral hormone conversion pathways.

Solution: Step 1: Identify the main mechanism of action of thioureylene drugs like propylthiouracil (PTU) within the thyroid gland. They inhibit the membrane-bound thyroid peroxidase enzyme.
Step 2: Trace the thyroid effect. This enzyme inhibition stops both the oxidation of iodide ions and the subsequent iodination of tyrosine residues on thyroglobulin, blocking hormone synthesis.
Step 3: Analyze peripheral metabolic effects. PTU also has a distinct secondary mechanism: it inhibits the type 1 5'-deiodinase enzyme in peripheral tissues.
Step 4: Connect to systemic activity. This secondary block stops the peripheral conversion of thyroxine (T_4) into the more potent triiodothyronine (T_3), making PTU highly effective for treating acute thyroid storms.

Final Answer: Inhibiting the thyroid peroxidase enzyme and blocking peripheral conversion of T_4 to T_3

Answer: (A)

Go Back to Question 25

Q26.

Solution

Concept: Antidote therapy in toxicology utilizes chemical neutralization, competitive receptor antagonism, or physiological bypass to reverse toxic drug effects. Heparin is a highly negatively charged acidic mucopolysaccharide anticoagulant, which can be neutralized by a highly basic macromolecule via an electrostatic ion-pairing reaction.

Solution: Step 1: Analyze the chemical nature of heparin. Heparin molecules possess a high density of sulfate and carboxylic acid functional groups, making it the most strongly organic acidic substance found in the human body. This strong negative charge is essential for its binding interaction with antithrombin III.
Step 2: Evaluate the properties of protamine sulfate. Protamine is a low-molecular-weight, arginine-rich nuclear protein isolated from fish sperm that carries a strong positive charge due to its basic guanidino groups.
Step 3: Trace the chemical interaction. When protamine sulfate is injected intravenously into a patient experiencing heparin-induced hemorrhaging, it immediately binds to the circulating heparin molecules through a rapid, highly stable ion-pairing reaction.
Step 4: Determine the clinical outcome. This electrostatic binding forms an inactive, stable salt complex that lacks anticoagulant activity, effectively neutralizing the heparin and clearing it from circulation.

Final Answer: Protamine sulfate

Answer: (B)

Go Back to Question 26

Q27.

Solution

Concept: Cellular organelles are highly specialized to partition biochemical reactions. The endoplasmic reticulum is split into two distinct structural and functional zones: the rough endoplasmic reticulum, which is studded with ribosomes, and the smooth endoplasmic reticulum, which lacks these ribonuclear complexes.

Solution: Step 1: Analyze the structural anatomy of the smooth endoplasmic reticulum (SER). It consists of a connected network of fine tubules without attached ribosomes on its outer membrane, meaning it does not participate in protein translation.
Step 2: Detail its biosynthetic roles. The membrane of the SER contains specialized enzyme complexes that synthesize lipids, phospholipids, glycolipids, and all steroid-based hormones, such as cortisol, testosterone, and estrogen, from cholesterol precursors.
Step 3: Detail its physiological roles. The SER also serves as the primary site for intracellular calcium storage (Ca^{2+} sequestration) within muscle cells (where it is called the sarcoplasmic reticulum) and contains cytochrome P450 enzyme complexes responsible for drug detoxification in liver cells.
Step 4: Contrast with other organelles: the rough ER translates proteins, lysosomes digest macromolecules, and mitochondria generate ATP via oxidative phosphorylation.

Final Answer: Synthesis of lipids, phospholipids, and steroid hormones

Answer: (B)

Go Back to Question 27

Q28.

Solution

Concept: Bone tissue dynamics are regulated by a balanced cycle of bone formation and bone resorption, which is controlled by specialized, lineage-specific skeletal cells operating within the extracellular mineralized bone matrix.

Solution: Step 1: Identify the primary cellular components of osseous tissue: osteoblasts, osteocytes, osteoclasts, and osteoprogenitor cells.
Step 2: Analyze the role of osteoblasts. Derived from mesenchymal stem cells, osteoblasts are active bone-forming cells located along bone surfaces. They synthesize and secrete the organic components of the extracellular matrix, known as osteoid, which consists mostly of type I collagen and non-collagenous proteins.
Step 3: Trace the mineralization process. After depositing this organic framework, osteoblasts manage its mineralization by releasing alkaline phosphatase and calcium-binding vesicles, eventually becoming trapped inside their own matrix to mature into osteocytes.
Step 4: Contrast with osteoclasts, which are large, multinucleated cells derived from hematopoietic stem cells that break down and resorb bone matrix by secreting hydrochloric acid and lysosomal enzymes.

Final Answer: Osteoblasts

Answer: (B)

Go Back to Question 28

Q29.

Solution

Concept: The heart's intrinsic conduction system coordinates the cardiac cycle through a network of specialized cardiac muscle cells that generate and propagate electrical impulses rhythmically throughout the myocardium.

Solution: Step 1: Locate the sinoatrial (SA) node anatomically. It is a small crescent of specialized muscle tissue located in the superior wall of the right atrium, just below the opening of the superior vena cava.
Step 2: Explain its physiological properties. The cells of the SA node exhibit automaticity, meaning they lack a stable resting membrane potential. Instead, they display a slow, spontaneous phase 4 depolarization (the pacemaker potential) driven by hyperpolarization-activated cyclic nucleotide-gated "funny" (I_f) sodium channels.
Step 3: Determine impulse frequency. Because the SA node depolarizes faster ($70 - 80$ times per minute) than any other part of the conduction system, it sets the baseline rhythm for the entire heart, acting as its natural pacemaker.
Step 4: Trace the signal pathway. The action potential spreads from the SA node across the atrial walls to the atrioventricular (AV) node, then travels through the Bundle of His and Purkinje fibers to trigger ventricular contraction.

Final Answer: Sinoatrial (SA) node

Answer: (B)

Go Back to Question 29

Q30.

Solution

Concept: The mechanical events of the cardiac cycle are split into distinct phases defined by pressure changes within the cardiac chambers and the opening or closing of the atrioventricular and semilunar valves.

Solution: Step 1: Analyze the beginning of ventricular systole. Following atrial contraction, the ventricles fill with blood, and the action potential arrives via the Purkinje network, triggering ventricular depolarization (the QRS complex on an ECG).
Step 2: Trace valve movements. As ventricular myocardium begins to contract, pressure within the chambers rises sharply above atrial pressure, forcing the atrioventricular valves (mitral and tricuspid) to snap shut. This closure generates the first heart sound (S_1, "lub").
Step 3: Analyze the volume parameters. At this moment, intraventricular pressure is still lower than the backpressure in the aorta and pulmonary artery, keeping the semilunar valves closed. Because all four valves are closed, blood cannot flow out of or into the ventricles.
Step 4: Define the phase. The ventricles continue to contract against this closed volume, causing ventricular pressure to spike rapidly while the blood volume remains completely constant. This phase is termed isovolumetric contraction.

Final Answer: Isovolumetric contraction phase

Answer: (C)

Go Back to Question 30

Q31.

Solution

Concept: The homeostatic control of respiration relies on feedback loops involving peripheral chemoreceptors in the carotid and aortic bodies and central chemoreceptors located in the medulla oblongata of the brainstem.

Solution: Step 1: Understand the sensitivity limits of respiratory control. Under normal resting conditions, the brain is highly sensitive to changes in blood carbon dioxide (CO_2) levels and pH, rather than small decreases in oxygen (O_2) levels.
Step 2: Trace the central mechanism. Carbon dioxide gas readily diffuses across the blood-brain barrier into the cerebrospinal fluid (CSF). Once inside the CSF, it reacts with water via carbonic anhydrase to form carbonic acid, which dissociates into bicarbonate and hydrogen ions:

$$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$

Step 3: Analyze chemoreceptor activation. The central chemoreceptors in the medulla are directly stimulated by this rise in hydrogen ion (H^+) concentration within the CSF, which reflects hypercapnia in arterial blood.
Step 4: Determine the respiratory response. Activating these chemoreceptors triggers the medullary respiratory centers to increase the rate and depth of ventilation, expelling excess CO_2 at the lungs to restore blood pH to normal.

Final Answer: Carbon dioxide (CO_2) and hydrogen ions (H^+) in arterial blood and cerebrospinal fluid

Answer: (B)

Go Back to Question 31

Q32.

Solution

Concept: Spirometry measures static lung volumes and capacities to assess pulmonary function and distinguish between obstructive and restrictive respiratory conditions. Lung capacities are calculated as the mathematical sum of two or more individual lung volumes.

Solution: Step 1: Define the individual lung volumes measured by spirometry: Tidal Volume (TV), Inspiratory Reserve Volume (IRV), Expiratory Reserve Volume (ERV), and Residual Volume (RV).
Step 2: Understand Vital Capacity (VC). Vital Capacity represents the maximum volume of air a person can forcefully exhale from the lungs after a maximum, deep inhalation.
Step 3: Set up the mathematical formula. To find this total air volume, sum the individual components: the normal air exchanged during regular breathing (TV), the extra air that can be inhaled forcefully (IRV), and the extra air that can be exhaled forcefully (ERV):

$$VC = IRV + ERV + TV$$

Step 4: Note that Residual Volume (RV) is the air that remains trapped in the lungs after a full exhalation and cannot be voluntarily expelled, meaning it is excluded from vital capacity measurements.

Final Answer: Inspiratory Reserve Volume + Expiratory Reserve Volume + Tidal Volume

Answer: (C)

Go Back to Question 32

Q33.

Solution

Concept: The gastric mucosa contains specialized secretory glands lined with distinct epithelial cell lineages. Each cell type is responsible for producing specific components of gastric juice that assist in chemical digestion or nutrient absorption.

Solution: Step 1: Analyze the cell types within a gastric pit. These include parietal cells, chief cells, mucous neck cells, and enteroendocrine G cells.
Step 2: Examine the function of parietal (oxyntic) cells. Located primarily in the fundus and body of the stomach, these large cells feature extensive intracellular canaliculi. They use a H^+/K^+-ATPase proton pump to actively secrete hydrochloric acid (HCl) into the stomach lumen.
Step 3: Identify the second essential secretion of parietal cells: intrinsic factor. Intrinsic factor is a glycoprotein that binds to dietary vitamin B_{12} (cyanocobalamin) in the acidic environment of the stomach, protecting it from degradation.
Step 4: Trace downstream absorption. This intrinsic factor-vitamin B_{12} complex travels intact to the terminal ileum of the small intestine, where it binds to specific mucosal receptors to facilitate vitamin absorption into the bloodstream.

Final Answer: Parietal (oxyntic) cells

Answer: (B)

Go Back to Question 33

Q34.

Solution

Concept: The gastrointestinal tract uses a coordinated sequence of mechanical actions and enzymatic secretions to break down complex dietary macromolecules into small, absorbable monomer units within the small intestine.

Solution: Step 1: Analyze the stages of lipid digestion. While lingual and gastric lipases initiate minor fat digestion, large dietary triglycerides remain mostly un-emulsified when they enter the duodenum.
Step 2: Examine the role of the small intestine. As acidic chyme enters the duodenum, it triggers the release of bile salts from the gallbladder and pancreatic lipase from the pancreas. Bile salts emulsify large fat globules into tiny droplets, vastly increasing the surface area available for enzymes.
Step 3: Trace enzymatic cleavage. Pancreatic lipase hydrolyzes triglycerides into free fatty acids and 2-monoglycerides. These products associate with bile salts to form water-soluble mixed micelles.
Step 4: Identify the site of absorption. These micelles transport lipids to the brush border membrane of the enterocytes in the duodenum and jejunum, where the lipophilic fatty acids and monoglycerides diffuse passively across the cell membrane.

Final Answer: Duodenum and jejunum of the small intestine

Answer: (B)

Go Back to Question 34

Q35.

Solution

Concept: The velocity of action potential propagation along neuronal axons depends on axon diameter and the presence of an insulating myelin sheath, which is formed by Schwann cells in the peripheral nervous system and oligodendrocytes in the central nervous system.

Solution: Step 1: Analyze the structure of a myelinated axon. The lipid-rich myelin sheath acts as an electrical insulator, wrapping tightly around the axon membrane to prevent transmembrane ion leakage.
Step 2: Identify structural gaps in the sheath. This insulation is interrupted at regular intervals by unmyelinated gaps called the Nodes of Ranvier, which contain a high concentration of voltage-gated sodium (Na^+) channels.
Step 3: Trace current flow. Because myelin blocks regular ion movement across the membrane, the local circuit currents generated by an action potential travel through the axoplasm to the next node without losing energy.
Step 4: Define saltatory conduction. The membrane depolarizes exclusively at these uninsulated nodes, causing the action potential to "jump" rapidly from one Node of Ranvier to the next. This saltatory conduction is significantly faster and uses less metabolic energy than the continuous wave propagation seen in unmyelinated fibers.

Final Answer: Myelinated nerve fibers, where the action potential leaps from one Node of Ranvier to the next

Answer: (B)

Go Back to Question 35

Q36.

Solution

Concept: The efferent visceral motor system, or autonomic nervous system, regulates involuntary homeostatic actions through two anatomically and functionally distinct divisions: the sympathetic and parasympathetic nervous systems.

Solution: Step 1: Evaluate the role of the sympathetic nervous system. It originates from the thoracolumbar regions of the spinal cord ($T_1 - L_2$) and is activated during physical exertion, emotional stress, or perceived emergencies.
Step 2: Trace its physiological effects. Activating the sympathetic system triggers a coordinated "fight-or-flight" response: it increases heart rate and myocardial contractility, dilates bronchioles to improve oxygenation, dilates pupils (mydriasis), and diverts blood flow away from the skin and digestive tract toward skeletal muscles.
Step 3: Evaluate the role of the parasympathetic nervous system. In contrast, the craniosacral parasympathetic division controls "rest-and-digest" activities, working to conserve metabolic energy, slow the heart rate, and stimulate digestion during periods of safety.

Final Answer: Sympathetic division

Answer: (B)

Go Back to Question 36

Q37.

Solution

Concept: The endocrine system coordinates long-term physiological changes using chemical messengers that travel through systemic circulation to bind target tissue receptors. Fluid balance is maintained by specific hypothalamic neurohypophyseal hormones.

Solution: Step 1: Trace the synthesis and storage of antidiuretic hormone (ADH), also known as arginine vasopressin. ADH is synthesized by neurosecretory cells located within the supraoptic and paraventricular nuclei of the hypothalamus. It travels down the hypothalamo-hypophyseal tract to be stored in the axon terminals of the posterior pituitary gland.
Step 2: Identify triggers for release. When osmoreceptors detect a rise in plasma osmolality or baroreceptors detect a drop in blood volume, ADH is released into systemic capillaries.
Step 3: Analyze the mechanism of action. ADH travels to the kidneys and binds to basolateral V_2 receptors on the principal cells of the late distal tubules and collecting ducts. This triggers an intracellular cAMP cascade that inserts aquaporin-2 water channels into the apical membranes.
Step 4: Determine the water retention outcome. These channels allow water to be reabsorbed passively along the medullary concentration gradient, concentrating the urine and expanding blood volume to restore homeostatic fluid balances.

Final Answer: Antidiuretic Hormone (Vasopressin)

Answer: (B)

Go Back to Question 37

Q38.

Solution

Concept: The endocrine and gametogenic functions of the male reproductive system are regulated by feedback loops within the hypothalamic-pituitary-gonadal axis, operating inside specific tissue compartments of the testes.

Solution: Step 1: Analyze the tissue compartments of the testes. The testes are divided into the seminiferous tubules, where spermatogenesis occurs, and the vascularized connective interstitial spaces between these tubules.
Step 2: Identify the interstitial cells of Leydig. These endocrine cells are situated within the interstitial spaces. They contain extensive smooth endoplasmic reticulum and lipid droplets rich in cholesterol esters.
Step 3: Trace hormone activation. Luteinizing Hormone (LH) released from the anterior pituitary binds to specific G-protein coupled receptors on Leydig cells, stimulating them to synthesize and secrete testosterone, the primary male androgen.
Step 4: Contrast with Sertoli cells. Sertoli cells line the interior walls of the seminiferous tubules; they are stimulated by Follicle-Stimulating Hormone (FSH) to support developing sperm cells and secrete regulatory proteins like inhibin.

Final Answer: Testosterone

Answer: (C)

Go Back to Question 38

Q39.

Solution

Concept: The microscopic evaluation of organized crude plant drugs relies on identifying specific diagnostic anatomical features, such as trichome structures, stomatal arrangements, and crystal types, within leaf tissue layers.

Solution: Step 1: Analyze the microscopic features of *Digitalis purpurea* (Foxglove) leaves. Digitalis leaf tissue is characterized by anomocytic (irregular-celled) stomata, where the guard cells are surrounded by a variable number of cells indistinguishable from regular epidermal cells.
Step 2: Identify its trichome structures. The epidermal layer features prominent, uniseriate covering trichomes composed of $3-5$ elongated, thick-walled cells with collapsed, collapsed-looking joint segments, alongside small glandular trichomes with unicellular heads.
Step 3: Contrast with Senna leaves. Senna leaves are characterized by paracytic stomata, where the guard cells are flanked by two specialized subsidiary cells arranged parallel to the stomatal pore, along with distinctive warty, curved unicellular trichomes and calcium oxalate prisms.

Final Answer: Digitalis leaf

Answer: (B)

Go Back to Question 39

Q40.

Solution

Concept: Crude plant and fungal drugs are morphologically categorized as either organized drugs, which feature defined cellular tissue structures, or unorganized drugs, which consist of non-cellular secretions, exudates, juices, or latex extracts.

Solution: Step 1: Examine the biological origin of Ergot. Ergot is derived from the dried sclerotium of the parasitic fungus *Claviceps purpurea*, which infects the ovaries of rye plants (*Secale cereale*).
Step 2: Define a sclerotium. A sclerotium is a compact, hardened mass of fungal mycelium that contains stored nutrients and serves as a dormant survival structure during winter conditions.
Step 3: Evaluate its morphological structure. Because it consists of an organized network of pseudoparenchymatous fungal cells and hyphae, Ergot is classified as an organized crude drug rather than a non-cellular plant exudate, sap, or resin secretion.

Final Answer: An organized dried sclerotium of a fungus

Answer: (B)

Go Back to Question 40

Q41.

Solution

Concept: Crude natural drugs can be organized using different classification systems, including alphabetical, taxonomic, morphological, chemical, pharmacological, or chemotaxonomic methods, depending on the focus of study.

Solution: Step 1: Analyze the pharmacological (therapeutic) classification system. This method groups crude drugs according to their primary therapeutic applications or their physiological actions on specific biological systems.
Step 2: Provide examples. Under this system, drugs like Digitalis, Strophanthus, and Arjuna are grouped together as cardiotonics; Senna, Castor oil, and Cascara are grouped as purgatives; and Cinchona, Artemisia, and Quinine are grouped as antimalarials.
Step 3: Contrast with other systems. The taxonomic system organizes drugs by botanical family lineages; the morphological system separates them into organized tissues (roots, leaves, bark) or unorganized secretions; and the chemical system groups them by active functional traits (alkaloids, glycosides, volatile oils).

Final Answer: Their primary therapeutic use or administrative action on biological systems

Answer: (B)

Go Back to Question 41

Q42.

Solution

Concept: Plant anatomy features diverse arrangements of vascular tissue within stems, roots, and petioles. These arrangements serve as reliable diagnostic criteria for identifying specific botanical families under microscopic evaluation.

Solution: Step 1: Define a bicollateral vascular bundle. A standard collateral vascular bundle contains a single strand of phloem located external to a single strand of xylem. In contrast, a bicollateral vascular bundle features a central xylem strand flanked by both an outer phloem strand and an inner phloem strand, separated by layers of cambium tissue.
Step 2: Identify plant families with this trait. The presence of bicollateral vascular bundles in stem cross-sections is a key diagnostic anatomical feature found across all members of the families Solanaceae (e.g., Datura, Atropa) and Cucurbitaceae (e.g., gourds, pumpkins).
Step 3: Evaluate the options. Option C properly identifies both Solanaceae and Cucurbitaceae as families that share this distinctive vascular bundle configuration.

Final Answer: Solanaceae and Cucurbitaceae

Answer: (C)

Go Back to Question 42

Q43.

Solution

Concept: The cultivation of medicinal plants requires specific environmental conditions, such as altitude, temperature ranges, rainfall distributions, soil types, and fertilization schedules, to ensure proper plant growth and optimal yield of active secondary metabolites.

Solution: Step 1: Analyze the cultivation needs of Cinchona species (e.g., *Cinchona succirubra*). Cinchona is a tropical mountain tree native to the high-altitude cloud forests of the Andes.
Step 2: Identify optimal soil and climate parameters. It grows best on steep, well-drained mountain slopes at altitudes between $1000 - 3000$ meters above sea level, where it receives high annual rainfall ($2000 - 4000$ mm) and experiences constant high humidity with moderate, stable temperatures ($15 - 25^{\circ}C$).
Step 3: Evaluate soil properties. The tree requires rich, porous, volcanic or loamy soils that are slightly acidic and free from stagnant water logging, which can cause root rot and suppress alkaloid production in the bark.
Step 4: Select the corresponding option. This environment matches the tropical mountain slopes described in option B.

Final Answer: Tropical mountain slopes with high humidity and well-drained acidic soils

Answer: (B)

Go Back to Question 43

Q44.

Solution

Concept: Post-harvest handling of crude drugs requires careful management of drying speed and temperature to prevent the chemical degradation of active constituents by endogenous plant enzymes that remain active after harvesting.

Solution: Step 1: Analyze the active constituents of Digitalis leaves. Fresh leaves contain primary cardioactive glycosides, such as purpurea glycosides A and B, which are highly vulnerable to enzymatic hydrolysis by co-existing hydrolytic enzymes (digipurpidase) present within the plant cell sap.
Step 2: Trace the degradation pathway if left untreated. If fresh leaves are dried too slowly or left in humid storage conditions, these enzymes remain active and rapidly cleave terminal glucose molecules from the primary glycosides, converting them into less potent secondary glycosides like digitoxin and gitoxin.
Step 3: Define the protective drying protocol. To prevent this enzymatic breakdown, fresh leaves must be transferred immediately after collection to drying ovens maintained at a controlled temperature below 60°C. This rapid heat drying quickly deactivates the hydrolytic enzymes while preserving the primary cardiac glycosides intact.

Final Answer: Immediate drying at a temperature below 60°C to inactivate hydrolytic enzymes

Answer: (B)

Go Back to Question 44

Q45.

Solution

Concept: Adulteration of crude drugs involves the intentional or accidental substitution of genuine plant matter with inferior, exhausted, or completely fake materials, compromising therapeutic safety and efficacy.

Solution: Step 1: Analyze the specific case of substitution described. The leaves of *Verbascum thapsus* (Mullein) are occasionally mixed with or substituted for the genuine leaves of *Digitalis purpurea*.
Step 2: Compare morphological characteristics. Mullein leaves closely resemble genuine Digitalis leaves in terms of general shape, size, and green color, making it easy to mistake them on superficial visual inspection.
Step 3: Identify microscopic differences. Under a microscope, Mullein leaves reveal distinctive, large branched candelabra trichomes that are completely different from the uniseriate covering trichomes of genuine Digitalis leaves. Mullein leaves also lack cardioactive glycosides, making them therapeutically useless.
Step 4: Classify the adulteration type. Because a completely different plant species with zero therapeutic value is selected based on its superficial physical resemblance, this practice is categorized as substitution with superficially similar but completely inferior genuine leaves.

Final Answer: Adulteration with superficially similar but completely inferior genuine leaves

Answer: (B)

Go Back to Question 45

Q46.

Solution

Concept: Ash values serve as an important analytical parameter in pharmacognostic evaluation, helping to detect inorganic impurities, earthy contaminants, or mineral matter present within a crude drug sample.

Solution: Step 1: Define total ash value. Total ash measures both physiological ash derived from natural mineral components within plant tissues (such as calcium oxalate or potassium salts) and non-physiological ash derived from external soil or dirt contaminants adhering to the drug surface.
Step 2: Define acid-insoluble ash value. To determine this value, the total ash residue is boiled with dilute hydrochloric acid (HCl), and the insoluble matter is filtered, washed, ignited, and weighed.
Step 3: Analyze chemical resistance. Natural physiological plant ash compounds dissolve readily in dilute mineral acids. In contrast, mineral contaminants like silica (SiO_2), sand, quartz fragments, and heavy soil particles are highly resistant to acid dissolution and remain as insoluble residue.
Step 4: Conclude its specific analytical utility. Measuring acid-insoluble ash is an effective method for determining the presence of adhering sand, dirt, and siliceous matter on crude drug samples.

Final Answer: Adhering dirt, sand, and siliceous earth matter

Answer: (A)

Go Back to Question 46

Q47.

Solution

Concept: Herbal drugs contain diverse secondary metabolites that drive their primary therapeutic properties. These chemical compounds serve as quantitative analytical markers during quality control evaluation.

Solution: Step 1: Identify the botanical source of Ashwagandha. It is derived from the dried roots of *Withania somnifera*, a prominent medicinal plant belonging to the family Solanaceae.
Step 2: Analyze its primary chemical constituents. Ashwagandha contains a unique class of secondary metabolites called withanolides.
Step 3: Define withanolides structurally. Withanolides are a group of naturally occurring ergostane-type steroidal lactones, where a modified steroidal ring system is linked to a six-membered lactone ring. Key examples include withaferin A and withanolide D.
Step 4: Relate chemical composition to therapeutic applications. These steroidal lactones drive Ashwagandha's adaptogenic, immunomodulatory, anti-inflammatory, and anti-stress properties.

Final Answer: Steroidal lactones known as withanolides

Answer: (B)

Go Back to Question 47

Q48.

Solution

Concept: Carbohydrates are classified structurally based on their total number of carbon atoms and the chemical nature of their primary carbonyl functional group, which can be either an aldehyde group or a ketone group.

Solution: Step 1: Define a hexose sugar. A hexose is a monosaccharide containing exactly six carbon atoms in its molecular framework ($C_6H_{12}O_6$).
Step 2: Differentiate between aldohexoses and ketohexoses. An aldohexose contains an aldehyde function ($-CHO$) at the terminal carbon-1 position, whereas a ketohexose contains a ketone function ($-C = O$) at the internal carbon-2 position.
Step 3: Evaluate the options. Glucose, galactose, and mannose are structural stereoisomers that all feature a terminal aldehyde group, classifying them as aldohexoses.
Step 4: Analyze fructose. Fructose possesses a ketone functional group at the carbon-2 position while maintaining a six-carbon backbone, classifying it as a ketohexose sugar.

Final Answer: D-Fructose

Answer: (B)

Go Back to Question 48

Q49.

Solution

Concept: Glycolysis, or the Embden-Meyerhof pathway, is an anaerobic metabolic pathway in the cell cytoplasm that breaks down one molecule of glucose into two molecules of pyruvate, generating ATP and reducing equivalents.

Solution: Step 1: Trace ATP consumption during the investment phase of glycolysis. One ATP molecule is consumed by hexokinase to phosphorylate glucose to glucose-6-phosphate, and a second ATP is consumed by phosphofructokinase-1 to form fructose-1,6-bisphosphate (Total investment = 2 ATP).
Step 2: Trace ATP generation during the payoff phase. For each three-carbon unit that passes through the pathway, two ATP molecules are generated directly via substrate-level phosphorylation: one from phosphoglycerate kinase and another from pyruvate kinase. Since one glucose molecule yields two three-carbon units, a total of four ATP molecules are generated (Total generation = 4 ATP).
Step 3: Calculate the net ATP yield via substrate-level phosphorylation:

$$\text{Net ATP Yield} = \text{Generated ATP} - \text{Invested ATP} = 4 \text{ ATP} - 2 \text{ ATP} = 2 \text{ ATP}$$

Step 4: Note that while additional ATP can be generated downstream via the malate-aspartate or glycerol-3-phosphate shuttles using NADH, the net yield from substrate-level phosphorylation alone is exactly 2 ATP.

Final Answer: 2 ATP

Answer: (A)

Go Back to Question 49

Q50.

Solution

Concept: The structural configuration of a protein is organized into four hierarchical levels: primary, secondary, tertiary, and quaternary structures. Each level is stabilized by specific chemical bonding interactions along the polypeptide chain.

Solution: Step 1: Define primary structure. The primary structure is the linear sequence of amino acids linked together by covalent peptide bonds.
Step 2: Define secondary structure. The secondary structure refers to localized spatial arrangements of the polypeptide backbone, such as the right-handed alpha-helix or beta-pleated sheets.
Step 3: Identify the stabilizing forces. These secondary structures are stabilized by non-covalent hydrogen bonds that form between the carbonyl oxygen atom ($-C = O$) of one peptide bond and the amide hydrogen atom ($-N - H$) of another peptide bond located four amino acid residues further along the chain.
Step 4: Contrast with higher-order structures. Tertiary and quaternary structures are stabilized by a mix of hydrophobic interactions, ionic salt bridges, van der Waals forces, and covalent disulfide bonds between amino acid side chains (R-groups).

Final Answer: Non-covalent hydrogen bonds between peptide amide ($-NH-$) and carbonyl ($-CO-$) groups

Answer: (B)

Go Back to Question 50

Q51.

Solution

Concept: The question requires the identification of the specific chemical group of lipids to which lecithin belongs, based on its biological structure and industrial application as an emulsifier.

Solution: Step 1: Analyze the chemical nature of lecithin. Lecithin is a generic term used to designate any group of yellow-brownish fatty substances occurring in animal and plant tissues.
Step 2: Identify the primary component of lecithin. It is largely composed of phosphatidylcholine, which consists of a glycerol backbone esterified with two fatty acids and one phosphoric acid group linked to a choline residue.
Step 3: Categorize the lipid based on its structural moieties. Because it contains both a hydrophobic lipid portion (fatty acids) and a hydrophilic polar head group (phosphate and choline), it falls under the structural class of compound lipids known as phospholipids.
Step 4: Evaluate the options provided. Simple triglycerides contain only glycerol and fatty acids without a phosphate group. Sphingolipids possess a sphingosine backbone rather than glycerol. Derived sterols encompass multi-ring structures like cholesterol. Therefore, lecithin specifically belongs to phospholipids.
Final Answer: Phospholipids (Phosphatidylcholine)

Answer: (C)

Go Back to Question 51

Q52.

Solution

Concept: The question asks for the definition of the Michaelis constant (K_m) derived from the standard Michaelis-Menten kinetic model of single-substrate enzyme-catalyzed reactions.

Solution: Step 1: Examine the Michaelis-Menten mathematical equation that relates the initial reaction velocity (v) to the substrate concentration ($[S]$):

$$v = \frac{V_{max}[S]}{K_m + [S]}$$

where V_{max} is the maximum reaction velocity and K_m is the Michaelis constant.
Step 2: Substitute the condition where the initial reaction velocity is exactly equal to half of the maximum velocity, which means setting $v = \frac{1}{2}V_{max}$ into the kinetic equation:

$$\frac{1}{2}V_{max} = \frac{V_{max}[S]}{K_m + [S]}$$

Step 3: Simplify the algebraic expression by canceling out the common V_{max} term from both sides of the equation:

$$\frac{1}{2} = \frac{[S]}{K_m + [S]}$$

Step 4: Solve the simplified linear relationship for the Michaelis constant parameter K_m by cross-multiplying the denominators:

$$K_m + [S] = 2[S]$$

$$K_m = [S]$$

Step 5: Conclude the physical interpretation from the derived relationship. This proves that K_m is numerically equivalent to the specific substrate concentration at which the rate of the enzymatic reaction reaches exactly half of its maximal velocity.

Final Answer: The specific substrate concentration at which the reaction velocity is exactly half of V_{max}

Answer: (B)

Go Back to Question 52

Q53.

Solution

Concept: The question asks to identify the specific organ whose acute damage is signaled by significantly elevated clinical serum levels of the enzyme glutamate pyruvate transaminase.

Solution: Step 1: Understand the biochemical nature of the enzyme. Serum glutamate pyruvate transaminase (SGPT), which is now universally referred to as alanine aminotransferase (ALT), is an enzyme found primarily inside cellular structures.
Step 2: Determine the tissue distribution of this clinical marker. While trace amounts are found in cardiac and skeletal muscles, the highest concentration of ALT is localized within the parenchymal cells of the liver.
Step 3: Analyze the mechanism of enzyme release into the bloodstream. When hepatocytes experience acute injury, necrosis, or structural membrane inflammation, their cellular integrity is compromised, leading to leakage of the intracellular ALT directly into systemic circulation.
Step 4: Correlate the laboratory findings with organ pathology. Consequently, an acute spike in serum SGPT/ALT parameters serves as a highly sensitive and specific clinical indicator for damage localized within the liver parenchyma.
Final Answer: Liver parenchyma

Answer: (B)

Go Back to Question 53

Q54.

Solution

Concept: The objective is to identify the correct qualitative chemical laboratory test designed to identify the abnormal excretion of ketone bodies within a clinical urine sample.

Solution: Step 1: Define the target compounds being evaluated. Ketone bodies, which include chemical structures like acetoacetate, acetone, and beta-hydroxybutyrate, appear in the urine during states of altered metabolic carbohydrate starvation or diabetic ketoacidosis.
Step 2: Review the chemical principles of the choices provided. Benedict's test relies on reducing copper ions to detect reducing sugars like glucose. Fouchet's test utilizes ferric chloride to precipitate and detect bile pigments like bilirubin. Hay's sulfur test utilizes surface tension properties to identify bile salts.
Step 3: Analyze the chemical mechanism of Rothera's test. Rothera's diagnostic method utilizes a reagent mixture containing sodium nitroprusside and ammonium sulfate. In an alkaline environment, acetoacetate and acetone react with nitroprusside molecules to form a distinctive, characteristic permanganate or purple-colored ring interface.
Step 4: Correlate the specific test with the clinical marker. Therefore, Rothera's qualitative test is uniquely designed for confirming the presence of ketone bodies in clinical urinalysis.
Final Answer: Rothera's test

Answer: (B)

Go Back to Question 54

Q55.

Solution

Concept: The goal is to determine the diagnostic identity and clinical application of the specific screening tests provided within the multiple-choice options.

Solution: Step 1: Analyze the question options to evaluate their corresponding diagnostic clinical parameters. The Widal test is a serological agglutination test designed to diagnose typhoid fever caused by Salmonella species.
Step 2: Examine the childhood susceptibility tests. The Dick test is an intradermal screening method used to evaluate a patient's vulnerability or immunity status to scarlet fever toxins. The Schick test is an established clinical skin assay used to assess immunity against the diphtheria toxin produced by Corynebacterium diphtheriae.
Step 3: Analyze the Mantoux test profile. The Mantoux tuberculin skin test involves the precise intradermal injection of purified protein derivative (PPD) into the forearm skin layers. It is universally used as a diagnostic tool to detect hypersensitivity exposure and latent or active infection by Mycobacterium tuberculosis.
Step 4: Identify the valid option based on standard clinical microbiology questions. Evaluating these diagnostic options demonstrates that the Mantoux test is the correct biological screening tool among the listed options.
Final Answer: Mantoux test

Answer: (D)

Go Back to Question 55

Q56.

Solution

Concept: The question requires selecting the core medical and scientific definition of epidemiology within public health frameworks.

Solution: Step 1: Break down the root scientific terminology of epidemiology. The word originates from Greek roots meaning the study of what is upon or among the population.
Step 2: Define the modern scope of the discipline. It does not look at isolated molecular changes or the synthetic development of medications, nor is it restricted solely to the legal notification of infections.
Step 3: Identify the core objectives of epidemiological studies. The primary purpose of this medical branch is to examine the specific patterns of disease distribution across populations, identify the causative risk factors and determinants, and measure the overall frequency of health conditions to guide public health policy.
Step 4: Match with the provided options. This matches the definition stating it evaluates distribution, determinants, and frequency within specified populations.

Final Answer: The study of the distribution, determinants, and frequency of health-related states or events in specified populations

Answer: (B)

Go Back to Question 56

Q57.

Solution

Concept: The question asks to identify the specific water-soluble B-complex vitamin that transforms into the coenzyme thiamine pyrophosphate (TPP) to prevent the deficiency disease known as Beriberi.

Solution: Step 1: Review the metabolic function described. The oxidative decarboxylation of alpha-keto acids, such as the conversion of pyruvate to acetyl-CoA, requires a cofactor named thiamine pyrophosphate (TPP).
Step 2: Trace the nutritional origin of the TPP cofactor. TPP is the biologically active derivative of Thiamine, which is classified chemically as Vitamin B_1.
Step 3: Correlate the specific deficiency pathologies. A lack of thiamine severely impairs cellular energy production, primarily affecting the nervous and cardiovascular systems, which clinically manifests as wet or dry Beriberi.
Step 4: Differentiate from other vitamins listed. Riboflavin forms FAD/FMN coenzymes, Niacin forms NAD/NADP, and Pyridoxine forms PLP. Therefore, Thiamine is the unique vitamin described.

Final Answer: Thiamine (Vitamin B_1)

Answer: (B)

Go Back to Question 57

Q58.

Solution

Concept: The question requires the selection of the primary objective underlying public family welfare and planning initiatives implemented within community pharmacy and social medicine frameworks.

Solution: Step 1: Analyze the scope of family welfare programs. These social healthcare programs are designed to enhance maternal health, child survival, and overall family well-being.
Step 2: Evaluate the population dynamics objective. A central demographic goal of such welfare frameworks is managing unsustainable demographic expansion through structural education.
Step 3: Assess the mechanisms utilized. This objective is achieved by promoting voluntary family planning methods, raising reproductive health awareness, and providing widespread access to contraceptive measures, rather than imposing coercive restrictions or industry-specific updates.
Step 4: Select the corresponding option. This aligns with the stabilization of population growth through voluntary family planning and reproductive education.

Final Answer: Stabilization of population growth through voluntary family planning and reproductive health education

Answer: (B)

Go Back to Question 58

Q59.

Solution

Concept: The question asks for the primary operational milestone and strategy of the Revised National Tuberculosis Control Programme utilizing the Directly Observed Treatment Short-course framework.

Solution: Step 1: Understand the objective of the DOTS intervention. The DOTS strategy focus is on breaking the chain of transmission of tuberculosis within the wider community.
Step 2: Identify the primary source of transmission. Infectious sputum-positive pulmonary tuberculosis cases pose the highest risk of spreading Mycobacterium tuberculosis to healthy populations.
Step 3: Analyze the target metrics of the RNTCP framework. To successfully control the disease burden, the operational guidelines prioritize achieving a high therapeutic success rate rather than institutional isolation. Specifically, the mandate sets a minimum threshold of curing at least 85% of these infectious sputum-positive cases using directly observed short-course multi-drug regimens.
Step 4: Match with the correct definition. This aligns with the target of an 85% cure rate through supervised chemotherapy.

Final Answer: Achieve at least an 85% cure rate of infectious sputum-positive cases through supervised short-course chemotherapy

Answer: (B)

Go Back to Question 59

Q60.

Solution

Concept: The question requires identifying the infectious disease that is included in the routine national schedule of the Universal Immunization Programme (UIP) in India.

Solution: Step 1: Review the diseases targeted by the Universal Immunization Programme. The UIP provides free vaccination against several life-threatening childhood conditions.
Step 2: Evaluate the options provided against the official immunization list. Dengue fever, amoebic dysentery, and filariasis do not currently have routine vaccine prophylactic distributions included within the mandatory infant UIP schedule.
Step 3: Analyze the components of standard combination vaccines. Pertussis, commonly known as whooping cough, is an acute, highly contagious respiratory tract infection caused by Bordetella pertussis. Prophylaxis against it is systematically administered via the DPT (Diphtheria, Pertussis, Tetanus) or pentavalent combination vaccine.
Step 4: Conclude the correct vaccine-preventable disease. This makes Pertussis the correct historical and operational disease target under the routine immunization schedule.
Final Answer: Pertussis (Whooping cough)

Answer: (B)

Go Back to Question 60

Q61.

Solution

Concept: The question focuses on identifying the most effective professional communication strategy a pharmacist must utilize during a patient counseling session to maximize compliance.

Solution: Step 1: Define the primary goal of patient counseling. The ultimate objective is to ensure that the patient understands their medication regimen, which enhances therapeutic adherence and minimizes errors.
Step 2: Criticize ineffective communication styles. Using advanced medical jargon alienates the patient, a rapid monologue prevents interaction, and hiding potential side effects compromises safety.
Step 3: Identify patient-centered communication techniques. Effective counseling relies on interactive dialogue. The pharmacist should ask open-ended questions to assess understanding, listen actively, use simple non-technical language, and reinforce instructions with written labels.
Step 4: Choose the option that embodies professional best practices. This matches the collaborative strategy prioritizing open questions, active listening, and simple language.
Final Answer: Ask open-ended questions, actively listen, and use simple, non-technical language reinforced with written labels

Answer: (B)

Go Back to Question 61

Q62.

Solution

Concept: The objective is to select the critical instruction a clinical pharmacist must provide to a patient prescribed sublingual nitroglycerin tablets for acute angina pectoris management.

Solution: Step 1: Analyze the route of administration specified. Sublingual means placement beneath the tongue structure.
Step 2: Understand the physiological rationale of this route. The sublingual mucosa is highly vascularized, allowing the medication to be absorbed directly into systemic circulation. This skips the gastrointestinal tract and avoids first-pass hepatic metabolism, ensuring rapid onset of therapeutic effect.
Step 3: Evaluate patient instructions based on this mechanism. If the tablet is swallowed, chewed, or taken with fluids, the drug enters the stomach where it undergoes extensive hepatic degradation, rendering it ineffective for acute angina relief.
Step 4: Formulate the explicit administration instruction. The patient must place the tablet under the tongue and allow it to dissolve completely without swallowing it or consuming liquids.

Final Answer: Place the tablet under the tongue and allow it to dissolve completely without swallowing it or drinking fluid

Answer: (C)

Go Back to Question 62

Q63.

Solution

Concept: The objective is to identify the accurate legal and operational definition of Over-The-Counter (OTC) pharmaceutical products.

Solution: Step 1: Define the baseline category of OTC drugs. These are medications that are safe and effective for use by the general public without a prescription.
Step 2: Analyze the legal differences from prescription-only drugs. Unlike prescription products, which legally require a written order from a registered medical practitioner, OTC medications are selected by consumers for self-directed management of minor ailments.
Step 3: Identify safety parameters for OTC labeling. These medications must have clear directions for use so that a consumer can safely follow the packaged instructions without professional medical supervision.
Step 4: Evaluate the choices provided. The option specifying that they can be legally sold without a prescription and are safe for self-directed use reflects this legal definition.

Final Answer: Can be legally sold to consumers without a prescription, being safe and effective for self-directed use according to labeled instructions

Answer: (C)

Go Back to Question 63

Q64.

Solution

Concept: The question requires knowing the statutory timeframe mandated by the Pharmacy Act of 1948 for the periodic reconstitution of the Pharmacy Council of India.

Solution: Step 1: Identify the relevant legislation. The Pharmacy Act of 1948 regulates the profession and practice of pharmacy across India.
Step 2: Locate the provisions governing the Central Council (PCI). The Act details the composition, functions, and term limits of elected, nominated, and ex-officio members of the council.
Step 3: Extract the specific statutory duration. According to the legislative clauses of this Act, the Pharmacy Council of India must be reconstituted by the central authorities at regular intervals.
Step 4: Determine the correct duration. The statutory term fixed by the law for the continuous existence of a single council block before mandatory reconstitution is exactly 5 years.
Final Answer: 5 years

Answer: (B)
Go Back to Question 64

Q65.

Solution

Concept: The goal is to identify the correct regulatory Schedule within the Drugs and Cosmetics Rules of 1945 that defines the standards for biological and special pharmaceutical products.

Solution: Step 1: Review the statutory classifications within the Drugs and Cosmetics Rules. Different alphabetical schedules govern distinct domains of manufacturing, quality control, and retail sales.
Step 2: Differentiate between the schedules listed in the options. Schedule M specifies the requirements for Good Manufacturing Practices (GMP) for premises and materials. Schedule G governs drugs that must be taken only under medical supervision. Schedule X contains narcotic and psychotropic substances requiring specialized prescription storage.
Step 3: Evaluate the parameters for Schedule C and C1. Schedule C details biological products like sera and vaccines, while Schedule C1 lists special non-biological products like digitalis and insulin preparations.
Step 4: Synthesize the findings. Therefore, Schedule C and C1 is the correct regulatory designation governing biological and special products.
Final Answer: Schedule C and C1

Answer: (B)
Go Back to Question 65

Q66.

Solution

Concept: The question requires identifying which specific therapeutic class of medications falls under the strict legal purview of Schedule X within Indian pharmaceutical jurisprudence.

Solution: Step 1: Define the operational scope of Schedule X. This specialized schedule includes substances that have a high potential for abuse, habit formation, addiction, and illicit diversion.
Step 2: Analyze the administrative controls required for Schedule X drugs. Retailers must maintain separate double-copy prescription carbon files and preserve sales records for a minimum of two years.
Step 3: Evaluate the options against these criteria. Antihypertensives, fluoroquinolone antibiotics, and systemic corticosteroids carry minimal risks of habitual psychological addiction or illicit recreational abuse.
Step 4: Identify the habit-forming chemical class. Psychotropic substances and narcotics, including molecules like ketamine, amphetamines, and phenobarbitone, pose clear addiction risks and are legally categorized under Schedule X.
Final Answer: Psychotropic substances and narcotics like ketamine or amphetamines

Answer: (B)

Go Back to Question 66

Q67.

Solution

Concept: The objective is to identify the exact calendar year in which the Narcotic Drugs and Psychotropic Substances (NDPS) Act was enacted by the Indian Parliament.

Solution: Step 1: Understand the objective of the NDPS legislation. The Act was introduced to consolidate and amend existing laws relating to narcotic drugs, make stringent provisions for the control of operations relating to psychotropic substances, and implement international treaty obligations.
Step 2: Differentiate this timeline from other major Indian pharmaceutical legislations. The Drugs and Cosmetics Act was enacted in 1940, and the Pharmacy Act was passed in 1948.
Step 3: Determine the exact date of enactment. The Narcotic Drugs and Psychotropic Substances Bill was debated and passed by both houses of the Indian Parliament, receiving presidential assent in the year 1985.
Step 4: Match with the provided multiple-choice option. This corresponds to the year 1985.
Final Answer: 1985

Answer: (C)

Go Back to Question 67

Q68.

Solution

Concept: The question requires identifying the primary parameter used to categorize inventory items within a hospital pharmacy using the VED selective inventory control system.

Solution: Step 1: Unpack the acronym VED. The letters represent three distinct qualitative categories: Vital (V), Essential (E), and Desirable (D).
Step 2: Define the criteria for each category based on therapeutic necessity. Vital items are absolutely critical for patient survival, and their absence can stop hospital operations. Essential items are necessary for effective therapy but have a short-term buffer allowance. Desirable items are for minor ailments, and their absence does not disrupt emergency care.
Step 3: Contrast with other selective control systems. ABC analysis classifies inventory based on annual monetary value and consumption cost, while FSN analysis focuses on turnover speed.
Step 4: Synthesize the primary classification parameter for VED. The system categorizes stocks based on the critical therapeutic urgency and clinical necessity of the drug items.
Final Answer: The critical therapeutic urgency and necessity of the drug (Vital, Essential, Desirable)

Answer: (B)

Go Back to Question 68

Q69.

Solution

Concept: The goal is to determine the correct initial step in the systematic sequence of the formal public purchasing and procurement process for pharmaceuticals.

Solution: Step 1: Analyze the workflow of public institutional procurement. Procurement in public healthcare frameworks must be transparent, cost-effective, and structured to prevent waste or corruption.
Step 2: Evaluate the logical sequence of operations. Before any payments are authorized, contracts signed, or samples evaluated, the institution must determine its actual needs.
Step 3: Identify the phase where documentation begins. The initial stage involves assessing inventory requirements, drafting exact technical tender specifications for the drugs, and inviting competitive bids from authorized manufacturers.
Step 4: Correlate with the provided options. The choice that starts with the determination of requirements and invitation of competitive bids represents the correct initial step.
Final Answer: Determination of requirements, preparation of tender specifications, and invitation of competitive bids

Answer: (B)

Go Back to Question 69

Q70.

Solution

Concept: The question requires identifying the standard regulated temperature range for storing thermolabile biological products, such as insulin and vaccines, in a medical refrigerator.

Solution: Step 1: Define the storage requirements for thermolabile biologicals. Products like insulin and typhoid vaccines contain active proteins and antigenic structures that degrade if exposed to freezing or ambient tropical temperatures.
Step 2: Review official pharmacopoeial temperature definitions. Sub-zero temperatures (-20°C to -10°C) are reserved for deep-freeze items and can ruin liquid vaccine formulations via crystallization. Controlled room temperature spans 15°C to 25°C.
Step 3: Identify the standard definition of a cold place. The Indian and international pharmacopoeias define a cold temperature storage condition as a range maintained strictly between 2°C and 8°C.
Step 4: Match with the refrigerator settings. This temperature range prevents bacterial growth and maintains the structural integrity of biological products.
Final Answer: Cold temperatures between 2°C and 8°C

Answer: (B)

Go Back to Question 70

Q71.

Solution

Concept: The question requires identifying the primary operational function of a clinical pharmacist within a modern hospital framework.

Solution: Step 1: Differentiate between the branches of pharmacy. Industrial pharmacy focuses on tablet compression machinery lines. Commercial pharmacy deals with real-estate leases and franchises. Clinical pharmacy centers entirely on patient care and the rational use of medications.
Step 2: Analyze the scope of clinical pharmacy practice. Clinical pharmacists work directly with physicians, nurses, and patients in clinical settings to optimize drug therapy.
Step 3: Identify specific clinical duties. Their core responsibilities include participating in medical ward rounds, monitoring patient drug charts for adverse reactions, checking for drug-drug interactions, and performing medication reconciliation.
Step 4: Evaluate the options. The option that highlights participation in medical ward rounds and drug therapy monitoring reflects the definition of clinical pharmacy.
Final Answer: Participating in medical ward rounds, monitoring drug therapy for adverse events, and performing medication reconciliation

Answer: (B)

Go Back to Question 71

Q72.

Solution

Concept: The objective is to identify the institutional hospital committee responsible for developing the formulary system, approving drug protocols, and ensuring safe medication practices.

Solution: Step 1: Analyze the administrative bodies within a hospital. The Institutional Ethics Committee primarily reviews human clinical trial protocols. The Nursing Directorate manages nursing staffing and standards.
Step 2: Define the committee that links medical staff and pharmacy services. A dedicated advisory group is needed to oversee the selection, procurement, distribution, and clinical utilization of medications within the hospital.
Step 3: Identify the Pharmacy and Therapeutics Committee (PTC). The PTC is an institutional body composed of physicians, pharmacists, and other healthcare professionals. Its primary mandate is to manage the hospital formulary system and ensure safe, rational drug use.
Step 4: Conclude the correct committee name. This matches the definition and function of the Pharmacy and Therapeutics Committee.
Final Answer: Pharmacy and Therapeutics Committee (PTC)

Answer: (B)

Go Back to Question 72

Q73.

Solution

Concept: The question requires selecting the primary administrative and clinical objective of maintaining a comprehensive, customized Hospital Formulary system.

Solution: Step 1: Define a Hospital Formulary. It is a continually revised compilation of pharmaceuticals, medicaments, and associated clinical guidelines that reflects the current clinical judgment of the hospital medical staff.
Step 2: Evaluate the purpose of limiting the medication list. A hospital cannot stock every global chemical entity due to financial and logistical constraints.
Step 3: Identify the advantages of a selective formulary system. Restricting available medications to a curated list of approved drugs helps the institution optimize purchasing, reduce inventory costs, and minimize medication errors. This approach ensures that therapies are rational, safe, and cost-effective.
Step 4: Select the option that aligns with rational drug therapy. This matches the goal of promoting rational, safe, and cost-effective drug therapy by restricting available medication choices.
Final Answer: Promote rational, safe, and cost-effective drug therapy by restricting available medication choices to a selected list of approved drugs

Answer: (C)

Go Back to Question 73

Q74.

Solution

Concept: The question asks to identify the safest and most efficient inpatient drug distribution system for minimizing dispensing errors and reducing nursing workloads.

Solution: Step 1: Analyze standard hospital drug distribution systems. The Complete Floor Stock System stores bulk medications on nursing units, which increases the risk of errors and nursing workloads. The Individual Prescription Order System requires preparing multi-day supplies, which increases waste.
Step 2: Examine the Unit Dose Dispensing System. In this system, the pharmacy prepares and dispenses medications in single, individual, pre-packaged doses, with each packet labeled for a specific patient and a specific administration time.
Step 3: Evaluate the clinical benefits of unit-dose dispensing. This system reduces medication errors because the pharmacist reviews the order before packaging. It also saves nursing time by eliminating the need to measure or prepare doses on the ward.
Step 4: Select the optimal distribution method. The Unit Dose Dispensing System is recognized as the safest and most efficient option.
Final Answer: Unit Dose Dispensing System

Answer: (C)
Go Back to Question 74

Q75.

Solution

Concept: The question requires identifying which scenario is excluded from the official World Health Organization definition of an Adverse Drug Reaction (ADR).

Solution: Step 1: Review the standard WHO definition of an Adverse Drug Reaction. The WHO defines an ADR as a response to a drug that is noxious and unintended, and which occurs at doses normally used in humans for prophylaxis, diagnosis, or therapy.
Step 2: Evaluate the key elements of the definition. The phrase "doses normally used" is a critical component of this definition. It covers unexpected toxicities, immunological hypersensitivity reactions, and secondary physiological alterations that occur during standard clinical use.
Step 3: Analyze the exclusion criteria. Any response caused by an accidental or intentional acute overdosage, such as a suicide attempt or a dosing error, involves a dose far higher than normal therapeutic limits. These situations are classified as acute poisonings or toxic exposures rather than standard ADRs.
Step 4: Identify the excluded scenario. An acute overdosage resulting from a suicide attempt is excluded from the standard ADR definition.
Final Answer: An accidental or intentional acute overdosage resulting from a suicide attempt

Answer: (B)
Go Back to Question 75

Q76.

Solution

Concept: The question requires identifying the level of prevention targeted by health education programs that focus on preventing the incidence of chronic non-communicable lifestyle diseases like Type 2 diabetes.

Solution: Step 1: Understand the levels of prevention in public health frameworks. Primordial prevention aims to avoid the emergence and establishment of social, economic, and cultural patterns of living that are known to contribute to an elevated risk of disease.
Step 2: Define primary prevention parameters. Primary prevention focuses on modifying risk factors to prevent the actual onset of a disease. This is achieved through lifestyle changes, dietary control, and regular physical activity before any pathological changes occur.
Step 3: Analyze secondary, tertiary, and quaternary preventions. Secondary prevention involves early diagnosis and prompt treatment to stop disease progression. Tertiary prevention focuses on rehabilitation to reduce disabilities. Quaternary prevention protects patients from unnecessary or excessive medical interventions.
Step 4: Evaluate the specific intervention described. Health education programs that promote lifestyle modifications and dietary control to stop chronic diseases from developing fall under primordial and primary prevention.
Final Answer: Primordial and Primary prevention via lifestyle modifications and dietary control

Answer: (A)

Go Back to Question 76

Q77.

Solution

Concept: The objective is to identify the mechanical device commonly used in the pharmaceutical industry to achieve efficient wet granulation and rapid mixing of cohesive powders for tablet manufacturing.

Solution: Step 1: Analyze the requirements of wet granulation in manufacturing. The process requires dry blending of powders, addition of a liquid binder, and the breakdown of large aggregates into uniform granules within a single, controlled environment.
Step 2: Evaluate the blending mechanisms of the options. A double-cone blender is primarily used for gentle dry blending of free-flowing granules. A planetary mixer handles highly viscous masses but lacks high-shear capabilities. A fluidized bed dryer is used mainly for drying wet masses, though it can be adapted for fluid-bed granulation.
Step 3: Analyze the operation of a Rapid Mixer Granulator (RMG). An RMG utilizes a high-speed impeller at the bottom of the mixing bowl for rapid dry mixing and binder distribution, along with a high-speed chopper on the side to break up large lumps and ensure uniform granule size distribution.
Step 4: Match the device with the mechanical description. The Rapid Mixer Granulator is explicitly designed for high-efficiency wet granulation and rapid mixing.
Final Answer: Rapid Mixer Granulator (RMG)

Answer: (B)

Go Back to Question 77

Q78.

Solution

Concept: The question requires identifying the specific tablet manufacturing defect where the upper or lower segment of a compressed tablet separates horizontally from the main body during ejection.

Solution: Step 1: Define the specific visual and structural tablet defects listed. Picking occurs when a small amount of tablet material adheres to the punch face, creating a localized pit. Mottling describes an unequal or uneven distribution of color across the tablet surface.
Step 2: Analyze the mechanical definitions of capping and chipping. Chipping is the breaking or fracturing of small fragments around the edges of the tablet structure.
Step 3: Distinguish the mechanism of capping. Capping is characterized by the complete or partial horizontal separation of the top or bottom crown of the tablet from its main body. This defect is typically caused by air entrapment within the die cavity or excessive elastic recovery during the compression cycle.
Step 4: Match the description with the correct term. The horizontal fracture and separation of a segment from the main body is the precise definition of capping.
Final Answer: Capping

Answer: (C)

Go Back to Question 78

Q79.

Solution

Concept: The question requires a pharmaceutical calculation to determine the exact volume of Ofloxacin suspension to be administered per individual dose based on a physician's prescription.

Solution: Step 1: Extract the given parameters from the prescription text. The required individual dose strength is 125 mg. The dosage frequency is "qid" (four times a day) for a total duration of 7 days.

Step 2: Identify the concentration of the available stock formulation. The stock suspension contains a drug concentration of 50 mg of Ofloxacin per 5 mL of liquid volume.

Step 3: Set up the unitary proportion equation to solve for the target volume (X):

$$\frac{50 \text{ mg}}{5 \text{ mL}} = \frac{125 \text{ mg}}{X \text{ mL}}$$

Step 4: Rearrange the algebraic equation to solve for X:

$$X = \frac{125 \text{ mg} \times 5 \text{ mL}}{50 \text{ mg}}$$

Step 5: Compute the numerical value:

$$X = \frac{625}{50} = 12.5 \text{ mL}$$

Thus, each individual dose requires the administration of exactly 12.5 mL of the suspension.

Final Answer: 12.5 mL

Answer: (B)

Go Back to Question 79

Q80.

Solution

Concept: The objective is to identify what a formulation stored in a "Well-Closed Container" must be protected against according to the specifications of the Indian Pharmacopoeia.

Solution: Step 1: Review pharmacopoeial definitions for primary packaging containers. Containers are categorized based on their ability to protect contents from external environmental hazards during normal handling and storage.
Step 2: Differentiate between container types. A tightly-closed container protects contents from contamination by extraneous solids, liquids, and atmospheric moisture or gases under normal conditions. An amber-colored container is designed to protect light-sensitive formulations from actinic solar rays.
Step 3: Analyze the minimum requirements for a well-closed container. According to official pharmacopoeial guidelines, a well-closed container must protect its contents from the ingress of extraneous solids and prevent any loss of the pharmaceutical product during ordinary handling, transport, and storage.
Step 4: Select the corresponding definition. This matches the option specifying protection against extraneous solids and loss of contents.
Final Answer: Extraneous solids and loss of contents during ordinary handling

Answer: (B)

Go Back to Question 80

Q81.

Solution

Concept: The question focuses on identifying the primary structural advantage of utilizing a fluid energy mill for the ultra-fine size reduction of thermolabile antibiotic powders.

Solution: Step 1: Analyze the operational mechanism of a fluid energy mill. This size reduction equipment has no moving mechanical parts. Instead, it relies on high-velocity streams of compressed air or inert gas injected into a milling chamber.
Step 2: Examine how particle size reduction occurs. High-velocity gas streams cause suspended solid drug particles to collide violently with each other (interparticulate attrition) and with the chamber walls (impact), breaking them into ultra-fine powders.
Step 3: Analyze the thermal dynamics of the process. As the highly compressed air expands rapidly within the milling chamber, it undergoes an endothermic expansion that creates a cooling effect.
Step 4: Correlate this thermal property with product stability. This cooling effect prevents heat buildup during the milling process, making the fluid energy mill ideal for micronizing heat-sensitive (thermolabile) materials like antibiotics without causing thermal degradation.

Final Answer: The rapid expansion of compressed air creates a cooling effect, preventing heat buildup during attrition and impact

Answer: (B)

Go Back to Question 81

Q82.

Solution

Concept: The question requires identifying the variable that is inversely proportional to the rate of industrial filtration according to the Darcy equation.

Solution: Step 1: Write out the mathematical expression of the Darcy equation for filtration:

$$\frac{dV}{dt} = \frac{A \cdot \Delta P}{\mu \cdot R}$$

where $\frac{dV}{dt}$ represents the filtration rate, A is the surface area of the filter medium, ΔP is the pressure drop across the filter bed, μ is the dynamic viscosity of the filtrate, and R is the total resistance of the cake and filter medium.

Step 2: Define total resistance (R) as a function of cake thickness (L). Resistance increases proportionally with the thickness of the deposited filter cake.

Step 3: Analyze the proportional relationships in the equation. Variables in the numerator (A and ΔP) are directly proportional to the filtration rate.

Step 4: Identify the inversely proportional variables. Variables in the denominator (μ and R or L) are inversely proportional to the filtration rate. Therefore, the filtration rate decreases as the viscosity of the fluid (μ) or the thickness of the deposited filter cake (L) increases.

Final Answer: The viscosity of the fluid and the thickness of the deposited filter cake

Answer: (C)

Go Back to Question 82

Q83.

Solution

Concept: The question requires identifying the physical mechanism responsible for the liquefaction that occurs when equal proportions of solid camphor and menthol are triturated together at room temperature.

Solution: Step 1: Analyze the initial state of the components. Both camphor and crystalline menthol are solid organic compounds at normal room temperature.
Step 2: Understand the physical phenomenon during mixing. When these two specific chemical structures are brought into direct contact and triturated together, their intermolecular forces are altered, leading to a depression of their melting points.
Step 3: Define the resulting mixture. The combination forms a eutectic mixture whose collective melting point is significantly lower than room temperature (approximately 15°C to 18°C).
Step 4: Conclude the cause of the phase transition. Because the melting point of this specific ratio falls below ambient room temperature, the solid crystals spontaneously liquefy. This is a classic example of a physical incompatibility due to the formation of a low-melting eutectic mixture.
Final Answer: The formation of a low-melting eutectic mixture

Answer: (A)

Go Back to Question 83

Q84.

Solution

Concept: The goal is to identify the inorganic chemical compound that acts as a gastrointestinal protective and adsorbent agent in anti-diarrheal formulations.

Solution: Step 1: Evaluate the clinical indications of the compounds listed. Magnesium sulfate is a highly soluble inorganic salt that acts as an osmotic laxative to treat constipation. Sodium chloride and calcium hydroxide serve primarily as electrolyte replenishers or pH adjusters.
Step 2: Define the therapeutic mechanism of adsorbents. Gastrointestinal adsorbents are insoluble, chemically inert powders that bind to bacterial toxins, gas bubbles, and irritating substances throughout the intestinal lumen, preventing their systemic absorption.
Step 3: Analyze the properties of Kaolin. Light Kaolin is a naturally occurring hydrated aluminum silicate. It is completely insoluble in water and forms a protective coating over inflamed intestinal mucosa while adsorbing pathogenic toxins.
Step 4: Conclude the correct compound class. Light Kaolin is used as an inorganic gastrointestinal protective and adsorbent agent in anti-diarrheal suspensions.
Final Answer: Light Kaolin

Answer: (B)

Go Back to Question 84

Q85.

Solution

Concept: The question requires identifying the specific analytical reagent used as a precipitating agent to generate uniform turbidity in the official limit test for sulfates.

Solution: Step 1: Review the chemical principles of pharmacopoeial limit tests. The limit test for sulfates is a semi-quantitative assay designed to detect and control trace sulfate impurities within pharmaceutical chemicals.
Step 2: Identify the primary chemical reaction involved. The test relies on the precipitation of soluble sulfate ions (SO_4^{2-}) into an insoluble salt form using a specific barium reagent.
Step 3: Formulate the ionic precipitation equation:

$$SO_4^{2-} + BaCl_2 \xrightarrow{\text{dil. HCl}} BaSO_4 \downarrow + 2Cl^-$$

Step 4: Analyze the role of the reaction environment. The reaction is carried out in the presence of dilute hydrochloric acid to prevent the precipitation of other acid-soluble anions, such as carbonates or phosphates. Barium chloride solution acts as the primary precipitating agent, reacting with sulfate ions to form a uniform opalescence or turbidity of barium sulfate ($BaSO_4$).
Final Answer: Barium chloride solution in the presence of dilute hydrochloric acid

Answer: (B)

Go Back to Question 85

Q86.

Solution

Concept: The question asks to identify the operational pH range where a buffer solution containing ammonium hydroxide (NH_4OH) and ammonium chloride (NH_4Cl) is effective at resisting pH alterations.

Solution: Step 1: Classify the chemical components of the buffer system. Ammonium hydroxide (NH_4OH) is a weak base, and ammonium chloride (NH_4Cl) is its conjugate acid salt. This combination forms a standard basic or alkaline buffer system.

Step 2: Apply the Henderson-Hasselbalch equation for basic buffer mixtures to estimate the operational area:

$$\text{pOH} = \text{p}K_\text{b} + \log\left(\frac{[\text{Salt}]}{[\text{Base}]}\right)$$

$$\text{pH} = 14 - \text{pOH}$$

Step 3: Determine the constant values. The dissociation constant value ($\text{p}K_\text{b}$) for ammonium hydroxide is approximately 4.75 at room temperature.

Step 4: Calculate the peak buffer efficiency range. The maximum buffering capacity occurs around $\text{pOH} = \text{p}K_\text{b} \pm 1$, which equates to a pOH range of 3.75 to 5.75. Converting this to the standard pH scale ($\text{pH} = 14 - \text{pOH}$) yields an effective buffering range situated within the alkaline region, specifically between pH 8.0 to 11.0.

Final Answer: Alkaline range (pH 8.0 to 11.0)

Answer: (B)

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Q87.

Solution

Concept: The question requires identifying the structural molecular criteria that give rise to the property of "chirality" within an organic drug molecule.

Solution: Step 1: Define chirality in organic chemistry. Chirality refers to the geometric property of a molecule that makes it non-superimposable on its mirror image, similar to left and right hands.
Step 2: Identify the primary structural source of molecular asymmetry. A common cause of chirality in organic drug molecules is the presence of a stereocenter, typically a carbon atom with sp^3 hybridization.
Step 3: Analyze the bonding requirements for an asymmetric carbon. For a carbon atom to be asymmetric or chiral, it must be covalently bonded to four entirely different atoms or distinct functional groups ($R_1 \neq R_2 \neq R_3 \neq R_4$).
Step 4: Evaluate the options. Planar aromatic systems or lines of symmetry eliminate optical activity. Therefore, chirality arises when a molecule contains an asymmetric carbon atom bonded to four different groups.

Final Answer: An asymmetric carbon atom bonded to four different atoms or functional groups

Answer: (B)

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Q88.

Solution

Concept: The objective is to identify the precise molecular mechanism of action by which the non-steroidal anti-inflammatory drug (NSAID) aspirin exerts its therapeutic effects.

Solution: Step 1: Classify aspirin chemically. Aspirin is acetylsalicylic acid, a well-established non-steroidal anti-inflammatory drug used for its analgesic, antipyretic, and anti-inflammatory properties.
Step 2: Identify the target enzyme system. NSAIDs interact with cyclooxygenase (COX) enzymes, which catalyze the conversion of arachidonic acid into pro-inflammatory prostaglandins and thromboxanes.
Step 3: Analyze aspirin's unique interaction with COX. Unlike most other NSAIDs that act as reversible competitive inhibitors, aspirin covalently modifies the enzyme. It transfers its acetyl group to a specific serine residue (Ser-530 in COX-1 and Ser-516 in COX-2) near the active site.
Step 4: Determine the functional outcome of this modification. This chemical acetylation permanently blocks the active site, resulting in the irreversible inhibition of cyclooxygenase enzymes. This mechanism distinguishes aspirin from other standard NSAIDs.

Final Answer: Irreversible acetylation and inhibition of the cyclooxygenase (COX) enzymes

Answer: (B)

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Q89.

Solution

Concept: The question requires identifying the physicochemical parameter that measures the relative distribution of a drug molecule between an organic lipophilic phase and an aqueous phase to control membrane permeability.

Solution: Step 1: Define the phases involved in drug absorption. For a drug molecule to be absorbed, it must pass through biological membranes, which are lipophilic bilayers, and dissolve in aqueous physiological fluids.
Step 2: Analyze the parameter that quantifies this balance. The dissociation constant (pK_a) measures the ionization state of a molecule at a given pH. Water solubility indexes measure absolute saturation thresholds.
Step 3: Define the partition coefficient ($\log P$). The partition coefficient is the ratio of a drug's concentration in a non-polar, lipophilic solvent (typically *n*-octanol) to its concentration in a polar, aqueous solvent (water) at equilibrium:

$$P = \frac{[\text{Drug}]_{\text{organic}}}{[\text{Drug}]_{\text{aqueous}}}$$

Step 4: Correlate this ratio with biological absorption. The logarithm of this ratio ($\log P$) serves as a standard metric for lipophilicity, directly predicting how effectively a drug molecule can partition into and diffuse across lipid membranes.
Final Answer: Partition Coefficient ($\log P$)

Answer: (B)

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Q90.

Solution

Concept: The question requires identifying the primary chemical transformations that characterize Phase I drug metabolism pathways aimed at increasing molecular polarity.

Solution: Step 1: Divide drug metabolism into its primary functional phases. Hepatic biotransformation is divided into Phase I (functionalization) reactions and Phase II (conjugation) reactions.

Step 2: Analyze the purpose of Phase I reactions. Phase I reactions introduce or expose functional polar groups ($-OH$, $-NH_2$, $-SH$, or $-COOH$) on the drug molecule to increase its water solubility and prepare it for subsequent conjugation.

Step 3: Identify the primary chemical mechanisms used in Phase I. These transformations are carried out primarily by the cytochrome P450 enzyme superfamily and involve oxidation, reduction, and hydrolysis reactions.

Step 4: Differentiate Phase I from Phase II reactions. Glucuronidation, sulfate conjugation, acetylation, and methylation reactions require attaching an endogenous molecule to the drug, which is the defining characteristic of Phase II pathways. Therefore, oxidation, reduction, and hydrolysis are Phase I transformations.

Final Answer: Oxidation, reduction, and hydrolysis

Answer: (B)

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Q91.

Solution

Concept: The question requires identifying the mathematical equation that relates the biological half-life ($t_{1/2}$) of a drug following first-order elimination kinetics to its elimination rate constant (K_e).

Solution: Step 1: Write out the integrated rate equation for a first-order chemical elimination process:

$$C_t = C_0 \cdot e^{-K_e \cdot t}$$

where C_t is the concentration at time t, C_0 is the initial plasma concentration, and K_e is the first-order elimination rate constant.

Step 2: Define the biological half-life condition. The half-life ($t_{1/2}$) is the time required for the plasma concentration to decrease by exactly 50%. This means setting $C_t = \frac{1}{2}C_0$ at $t = t_{1/2}$:

$$\frac{1}{2}C_0 = C_0 \cdot e^{-K_e \cdot t_{1/2}}$$

Step 3: Simplify the equation by dividing both sides by C_0:

$$\frac{1}{2} = e^{-K_e \cdot t_{1/2}}$$

Step 4: Take the natural logarithm (ln) of both sides to isolate the exponent variables:

$$\ln\left(\frac{1}{2}\right) = -K_e \cdot t_{1/2}$$

$$-\ln(2) = -K_e \cdot t_{1/2}$$

Step 5: Substitute the numerical value for $\ln(2)$, which is approximately 0.693, and rearrange the equation to solve for $t_{1/2}$:

$$0.693 = K_e \cdot t_{1/2}$$

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

Final Answer: $\boxed{t_{1/2} = \frac{0.693}{K_e}}$

Answer: (A)

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Q92.

Solution

Concept: The question asks for the physiological mechanism of action by which the neuromuscular blocking agent succinylcholine causes skeletal muscle relaxation.

Solution: Step 1: Classify neuromuscular blockers into their primary functional categories. These agents are divided into non-depolarizing (competitive) blockers and depolarizing blockers.
Step 2: Analyze the mechanism of non-depolarizing agents. Drugs like d-tubocurarine or vecuronium act as competitive antagonists at nicotinic acetylcholine receptors, preventing channel opening.
Step 3: Analyze succinylcholine's unique interaction with receptors. Succinylcholine is a depolarizing neuromuscular blocker. It structurally mimics acetylcholine and binds to nicotinic receptors at the motor endplate, opening the channels and causing initial muscle fasciculations.
Step 4: Determine the cause of the subsequent muscle relaxation. Unlike acetylcholine, succinylcholine is not rapidly degraded by acetylcholinesterase, leading to persistent depolarization of the post-junctional membrane. This continuous depolarization inactivates voltage-gated sodium channels, preventing the generation of new action potentials and causing flaccid muscle paralysis due to receptor desensitization.

Final Answer: Persistent depolarization of the nicotinic neuromuscular junction receptors leading to desensitization

Answer: (B)

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Q93.

Solution

Concept: The objective is to identify the specific molecular binding site targeted by the atypical, non-benzodiazepine sedative-hypnotic agent zolpidem.

Solution: Step 1: Classify zolpidem within neuropharmacology. Zolpidem is an imidazopyridine derivative categorized as a "Z-drug" sedative-hypnotic, used to treat insomnia.
Step 2: Identify the target receptor complex. Like traditional benzodiazepines, zolpidem modulates the $GABA_A$ receptor, an ionotropic receptor linked to a chloride ion channel that mediates inhibitory neurotransmission in the central nervous system.
Step 3: Analyze zolpidem's subunit selectivity. Standard benzodiazepines bind non-selectively to various subunits of the $GABA_A$ receptor complex. In contrast, zolpidem displays high selectivity for receptors containing the α_1 subunit (BZ_1 receptor subtype).
Step 4: Correlate subunit selectivity with clinical effects. The α_1 subunit mediates the sedative and amnestic properties of GABAergic drugs, while α_2 and α_3 subunits are associated with anxiolytic and muscle-relaxant effects. Therefore, zolpidem's selective binding to the α_1 subunit modulation site accounts for its targeted sedative action with minimal muscle relaxation.
Final Answer: The alpha-1 subunit modulation site of the $GABA_A$ receptor complex

Answer: (A)

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Q94.

Solution

Concept: The question requires identifying the drug that acts as a selective inhibitor of the enzyme HMG-CoA reductase to lower plasma LDL cholesterol levels.

Solution: Step 1: Identify the therapeutic goal and target enzyme. Lowering plasma low-density lipoprotein (LDL) cholesterol can be achieved by inhibiting 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, the rate-limiting enzyme in hepatic cholesterol biosynthesis.
Step 2: Evaluate the mechanisms of the options provided. Gemfibrozil is a fibric acid derivative that activates PPAR-α to reduce triglyceride levels. Cholestyramine is a bile acid sequestrant that prevents cholesterol reabsorption in the gut. Ezetimibe selectively inhibits cholesterol absorption via the NPC1L1 transporter.
Step 3: Identify the statin class. Atorvastatin belongs to the statin class of lipid-lowering medications, which act as structural analogs of HMG-CoA and competitively inhibit HMG-CoA reductase.
Step 4: Conclude the correct medication. This competitive inhibition reduces intracellular cholesterol synthesis, upregulating hepatic LDL receptors and increasing the clearance of LDL cholesterol from the bloodstream. Therefore, Atorvastatin is the HMG-CoA reductase inhibitor.
Final Answer: Atorvastatin

Answer: (A)

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Q95.

Solution

Concept: The question asks for the primary mechanism of action by which the aminoglycoside antibiotic streptomycin exerts its bactericidal effects.

Solution: Step 1: Classify streptomycin within antimicrobial therapy. Streptomycin is an aminoglycoside antibiotic derived from Streptomyces griseus, used primarily to treat bacterial infections such as tuberculosis.
Step 2: Identify the cellular target of aminoglycosides. These agents cross the bacterial cell wall and membrane to interact directly with the protein synthesis machinery.
Step 3: Analyze the specific ribosomal interaction. Streptomycin binds selectively to the 16S rRNA component of the small 30S ribosomal subunit in susceptible bacteria.
Step 4: Determine the functional consequences of this binding. This interaction interferes with the initiation complex and induces a conformational change in the A-site of the ribosome, causing misreading of the genetic code on mRNA. This leads to the synthesis of nonfunctional or toxic proteins and the inhibition of protein synthesis, ultimately disrupting bacterial cell membrane integrity and causing cell death.

Final Answer: Binding to the 30S ribosomal subunit, causing misreading of the genetic code and inhibition of protein synthesis

Answer: (B)

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Q96.

Solution

Concept: The question requires identifying the primary molecular mechanism of action of the biguanide oral antihyperglycemic drug metformin based on the provided options.

Solution: Step 1: Analyze the clinical role of metformin. Metformin is the first-line oral medication used for the management of Type 2 diabetes mellitus, functioning primarily to lower blood glucose levels without causing hypoglycemia or stimulating insulin secretion directly.
Step 2: Evaluate the mechanisms listed in the choices. Direct stimulation of pancreatic beta cells describes sulfonylureas. Inhibition of alpha-glucosidase describes acarbose. SGLT2 inhibition describes gliflozins.
Step 3: Analyze the intracellular pathways of biguanides. Metformin enters cells and transiently inhibits Complex I of the mitochondrial respiratory chain. This leads to a decrease in cellular ATP levels and a corresponding increase in AMP levels, which activates AMP-activated protein kinase (AMPK).
Step 4: Determine the metabolic consequences of AMPK activation. Activated AMPK suppresses the expression of lipogenic and gluconeogenic genes, reducing hepatic gluconeogenesis (glucose production). Additionally, it enhances peripheral insulin sensitivity and increases glucose uptake in skeletal muscle, improving overall glycemic control.

Final Answer: Activation of AMP-activated protein kinase (AMPK), leading to reduced hepatic gluconeogenesis and enhanced peripheral insulin sensitivity

Answer: (B)

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Q97.

Solution

Concept: The objective is to understand the microscopic and structural distinctions between organized and unorganized crude drugs, using Acacia as a representative example.

Solution: Step 1: Define organized and unorganized crude drugs in pharmacognosy. Organized drugs consist of direct, cellular parts of plants or animals (such as leaves, roots, barks, or flowers) and possess a defined cellular structure.
Step 2: Define unorganized drugs. Unorganized drugs are products derived from plants or animals through processes like incision, expression, distillation, or extraction (such as gums, mucilages, resins, and dried juices). They do not retain a cellular structure.
Step 3: Analyze the properties of Acacia. Acacia is a dried gummy exudate obtained from the stems and branches of Acacia senegal. Chemically, it consists of carbohydrate polymers and water-soluble gum fractions.
Step 4: Identify the diagnostic microscopic differences. Because it is an unorganized exudate, a pulverized sample of Acacia completely lacks complex cellular elements, such as cell walls, xylem vessels, trichomes, or stomata, which are characteristic of organized leaf powders.

Final Answer: Any trace of complex cellular elements like cell walls, vessels, trichomes, or stomata

Answer: (A)

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Q98.

Solution

Concept: The question asks to identify the specific chemical screening test used to confirm the presence of anthraquinone glycosides in crude drugs like Senna or Aloe.

Solution: Step 1: Review the chemical screening tests used in pharmacognosy. Different colorimetric reactions are designed to identify distinct classes of secondary plant metabolites.
Step 2: Analyze the specific tests listed. Legal's test and the Keller-Kiliani test are used to identify cardiac glycosides; Keller-Kiliani specifically detects deoxy sugars like digitoxose. Mayer's test is a standard precipitation test used to detect alkaloids.
Step 3: Analyze the chemical mechanism of Borntrager's test. Borntrager's test is designed to identify anthraquinone glycosides. The crude drug is boiled with dilute hydrochloric acid and ferric chloride to hydrolyze the glycosides into free anthraquinone aglycones. The mixture is then extracted with an organic solvent like chloroform.
Step 4: Determine the positive reaction indicator. When an alkaline solution like dilute ammonia is added to the organic layer, the ammoniacal layer turns a characteristic rose-pink or red color. This color change confirms the presence of anthraquinone derivatives.
Final Answer: Borntrager's test

Answer: (A)

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Q99.

Solution

Concept: The question requires identifying the evaluation method that utilizes living biological systems, isolated organs, or microorganisms to standardize the potency of a digitalis preparation.

Solution: Step 1: Analyze the types of drug evaluation methods. Evaluation methods are used to determine the identity, purity, quality, and potency of crude drugs, and are categorized as organoleptic, microscopic, physical, chemical, or biological.
Step 2: Understand the limitations of chemical assays for complex drugs. For certain complex drugs like digitalis or insulin, chemical or physical assays may not accurately reflect the actual therapeutic or biological activity in a living system.
Step 3: Define a bioassay (biological standardization). A bioassay involves measuring the relative potency of a drug by comparing its physiological effect on living biological systems—such as whole animals, isolated animal tissues, or specific microorganisms—against a standard reference preparation.
Step 4: Match the definition with the question description. Utilizing living tissues or systems to standardize digitalis potency is the precise definition of a bioassay.
Final Answer: Bioassay

Answer: (C)

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Q100.

Solution

Concept: The objective is to identify the primary therapeutic classification and clinical utility of the natural herbal drug Artemisinin, isolated from Artemisia annua.

Solution: Step 1: Identify the source and nature of the compound. Artemisinin is a sesquiterpene lactone containing an unusual peroxide bridge, isolated from the sweet wormwood herb, Artemisia annua, which has a history of use in traditional medicine.
Step 2: Understand its molecular mechanism of action. The internal endoperoxide bridge interacts with free iron or heme inside target cells, generating highly reactive free radicals that damage and destroy cellular membranes.
Step 3: Identify the clinical target of these free radicals. This radical generation occurs within the intraerythrocytic stages of the malaria parasite, leading to rapid clearance of the infection.
Step 4: Determine the primary therapeutic application. Artemisinin and its derivatives (such as artesunate and artemether) serve as the cornerstone of Artemisinin-based Combination Therapy (ACT). This is the global first-line protocol used to treat multi-drug resistant strains of Plasmodium falciparum malaria.

Final Answer: Antimalarial drug effective against multi-drug resistant *Plasmodium falciparum*

Answer: (B)

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Answer Key

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