JELET Pharmacy Sample Paper-7

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 parameters is evaluated using a modified USP Type II dissolution apparatus equipped with a copper mesh cylinder for transdermal patches?

(A) Drug release profile

(B) Adhesive peel strength

(C) Moisture content variation

(D) Thickness uniformity

Q2. A solution contains 0.2 M acetic acid ($K_a = 1.8 \times 10^{-5}$) and 0.1 M sodium acetate. What is the pH of this buffer system?

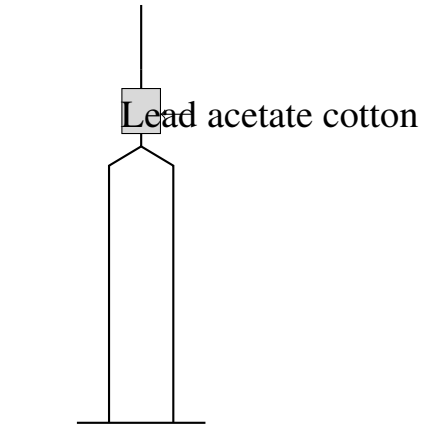
(A) 4.44

(B) 4.74

(C) 5.04

(D) 3.74

Q3. During the limit test for Arsenic, the purpose of adding lead acetate cotton wool in the mouth of the Gutzeit apparatus tube is to:



(A) Trap any escaping hydrogen gas

(B) Absorb hydrogen sulfide gas which may blacken the mercuric chloride paper

(C) Catalyze the reduction of arsenic arsenic acid to arsenious acid

(D) Prevent moisture from reaching the test paper

Q4. Which mechanism describes the movement of a drug across a cell membrane against its concentration gradient, requiring a specific carrier protein and the expenditure of cellular energy?

(A) Facilitated diffusion

(B) Simple passive diffusion

(C) Primary active transport

(D) Pinocytosis

Q5. Under the Drugs and Cosmetics Act 1940, Schedule M specifies the requirements for which of the following?

(A) Standards for surgical dressings and umbilical tapes

(B) Good Manufacturing Practices (GMP) and factory premises requirements

(C) List of prescription drugs that can only be sold on medical practitioner advice

(D) Standards for cosmetics and mechanical contraceptives

Q6. A crude drug sample of *Digitalis purpurea* leaves shows the presence of anomocytic stomata, unicellular uniseriate non-glandular trichomes with collapsed

cells, and absence of calcium oxalate crystals. Which of these features helps distinguish it directly from *Digitalis lanata*?

(A) Presence of anomocytic stomata

(B) Presence of non-glandular trichomes

(C) Absence of calcium oxalate crystals

(D) The specific morphology of its glandular trichome stalks

Q7. In an inventory control system, if the annual consumption of an item is ₹ 20,000, ordering cost is ₹ 50 per order, and holding cost is 20% of the item value per year, what is the Economic Order Quantity (EOQ) in terms of rupees per order?

(A) ₹ 1,000

(B) ₹ 2,000

(C) ₹ 3,162

(D) ₹ 500

Q8. Which specific diagnostic enzyme profile is typically elevated earliest (within 4–6 hours) in the serum of a patient following an acute myocardial infarction?

(A) Alanine aminotransferase (ALT)

(B) Creatine kinase-MB (CK-MB)

(C) Lactate dehydrogenase (LDH_1)

(D) Alkaline phosphatase (ALP)

Q9. In a community pharmacy setup, which barrier to patient counselling is classified as an "environmental barrier"?

(A) High counter design with no private acoustic space

(B) Patient's negative perception towards clinical advice

(C) Pharmacist's high anxiety and lack of confidence

(D) Patient's cognitive impairment or hearing loss

Q10. The biological half-life of a drug is 4 hours following first-order kinetics. How many hours will it take for approximately 93.75% of the drug to be eliminated from the systemic circulation?

(A) 12 hours

(B) 16 hours

(C) 20 hours

(D) 24 hours

Q11. A standard prescription contains the abbreviation "t.i.d. p.c.". What instruction should the pharmacist write on the dispensing label?

(A) Take three times a day before meals

(B) Take three times a day after meals

(C) Take twice a day before meals

(D) Take every three hours as required

Q12. What is the fundamental functional unit of the human kidney responsible for the processes of ultrafiltration, selective reabsorption, and active secretion?

(A) Glomerulus

(B) Nephron

(C) Collecting duct

(D) Bowman's capsule

Q13. Which thermodynamic phenomenon is primarily responsible for the chemical degradation of aspirin in aqueous solutions when exposed to elevated temperatures?

(A) Zero-order photolysis

(B) Hydrolytic ester cleavage

(C) Oxidative free radical propagation

(D) Intramolecular racemization

Q14. The therapeutic efficacy of which of the following general anesthetics is primarily driven by its positive allosteric modulation of $GABA_A$ receptors along with a rapid recovery profile due to extensive hepatic metabolism?

(A) Ketamine

(B) Nitrous oxide

(C) Propofol

(D) Diethyl ether

Q15. Under the Pharmacy Act 1948, the minimum age requirement for an individual to register as a registered pharmacist in a state registry is:

(A) 16 years

(B) 18 years

(C) 21 years

(D) 25 years

Q16. Which specific morphological type of bone is represented by the patella, developing within tendons subjected to considerable friction and physical stress?

(A) Flat bone

(B) Irregular bone

(C) Sesamoid bone

(D) Short bone

Q17. In the microbial assay of antibiotics like Erythromycin using the cylinder-plate method, the diameter of the zone of inhibition is inversely proportional to:

(A) The logarithm of the antibiotic concentration

(B) The thickness of the agar medium layer

(C) The diffusion coefficient of the drug in agar

(D) The incubation temperature of the media

Q18. Which structural modification in the basic penicillin nucleus imparts resistance to staphylococcal β-lactamase enzymes?

(A) Introduction of a hydrophilic amino group at the α-position of the side chain

(B) Incorporation of a bulky sterically hindered aromatic ring directly attached to the side-chain carbonyl group

(C) Substitution of the sulfur atom in the thiazolidine ring with oxygen

(D) Esterification of the carboxylic acid group at position 3

Q19. Calculate the amount of 95% v/v alcohol and water required to prepare 500 mL of a 70% v/v alcohol solution.

(A) 368.4 mL of 95% alcohol and volume made up to 500 mL with water

(B) 250.0 mL of 95% alcohol and 250.0 mL of water

(C) 333.3 mL of 95% alcohol and 166.7 mL of water

(D) 315.8 mL of 95% alcohol and volume made up to 500 mL with water

Q20. In hospital clinical practice, the term “teratogenicity” refers to a drug’s capacity to induce which adverse outcome?

(A) Severe hepatic necrosis in geriatric patients

(B) Irreversible bone marrow suppression

(C) Structural or functional defects in a developing fetus

(D) Anaphylactic shock during intravenous administration

Q21. Which anatomical region of the human brain plays the primary role in regulating autonomic homeostatic mechanisms such as body temperature, osmolarity, thirst, and satiety?

(A) Medulla oblongata

(B) Cerebellum

(C) Hypothalamus

(D) Thalamus

Q22. According to the structural features of carbohydrates, D-glucose and D-galactose are best described as:

(A) Anomers at C-1

(B) Epimers at C-4

(C) Epimers at C-2

(D) Functional isomers

Q23. Which legal provision under the Narcotic Drugs and Psychotropic Substances (NDPS) Act 1985 regulates the cultivation of the opium poppy (*Papaver somniferum*)?

(A) Central Government licensing and strict allocation of land tracts

(B) State Revenue Department open permit system

(C) Local Gram Panchayat authorization certificates

(D) National Narcotics Board post-harvest declaration scheme

Q24. What type of physical incompatibility occurs when camphor, menthol, and thymol are triturated together in a mortar?

(A) Liquefaction due to formation of a eutectic mixture

(B) Precipitation due to changes in solvent polarity

(C) Immiscibility due to high interfacial tension

(D) Chemical degradation via acid-base neutralization

Q25. The therapeutic intervention of choice for treating a patient with a confirmed overdose of organophosphate insecticides is the administration of:

(A) Physostigmine

(B) Atropine sulfate paired with Pralidoxime

(C) Neostigmine methylsulfate

(D) Pilocarpine nitrate

Q26. Which structural component of a bacterial cell wall is selectively targeted by glycopeptide antibiotics such as Vancomycin?

(A) Lipopolysaccharide outer membrane matrix

(B) D-Alanyl-D-Alanine terminus of the peptidoglycan precursor

(C) 30S ribosomal subunit binding domains

(D) Topoisomerase II enzyme complexes

Q27. During the collection and preparation of Ergot (*Claviceps purpurea*), the active medicinal component obtained is the:

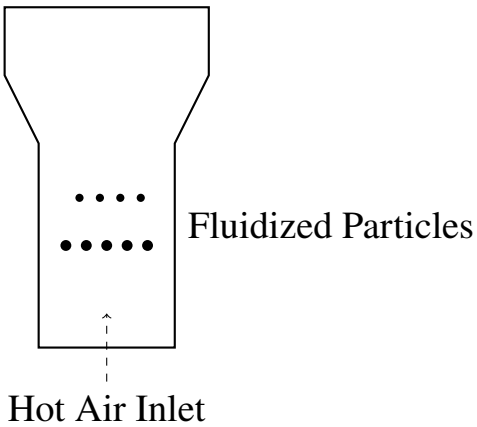
(A) Dried sclerotium developed in the ovary of rye plants

(B) Freshly collected ascospores from wild grasses

(C) Dried aerial hyphae grown in synthetic liquid medium

(D) Decorticated perithecium of infected plants

Q28. Which of the following parameters must be strictly controlled during the processing of materials in a fluid bed dryer (FBD) to prevent electrostatic charge buildup on particles?



(A) Air inlet temperature

(B) Humidity of the inlet air and proper grounding of the equipment

(C) Disk rotation frequency

(D) Feed spray nozzle pressure

Q29. In a clinical diagnostic laboratory, the detection of high levels of Bence-Jones proteins in a patient's urine sample is a primary diagnostic marker for:

(A) Acute glomerulonephritis

(B) Multiple myeloma

(C) Obstructive jaundice

(D) Diabetic ketoacidosis

Q30. What type of packaging material is categorized as Type I glass according to the hydrolytic resistance test described in the Pharmacopoeia?

(A) Soda-lime glass

(B) Borosilicate glass

(C) Treated soda-lime glass

(D) General purpose soda-lime glass

Q31. Which blood vessel directly carries deoxygenated blood from the upper systemic regions of the human body into the right atrium of the heart?

(A) Inferior vena cava

(B) Superior vena cava

(C) Pulmonary artery

(D) Coronary sinus

Q32. In the design of oral controlled-release tablets utilizing an asymmetric membrane coating, the primary mechanism of drug transport across the membrane is:

(A) Hydrostatic pressure-driven convective flow through macroscopic pores

(B) Zero-order passive partitioning through an uninterrupted lipid matrix

(C) Osmotic pumping through laser-drilled orifices

(D) Carrier-mediated active efflux kinetics

Q33. Which component of the human respiratory membrane provides the primary structural surface across which gas exchange occurs between the alveoli and pulmonary capillaries?

(A) Simple squamous epithelial cells of the alveolus

(B) Pseudostratified ciliated columnar epithelial cells

(C) Stratified squamous mucosal lining

(D) Dense irregular connective tissue layers

Q34. The presence of cluster crystals of calcium oxalate and lignified phloem fibers with a wavy outline are characteristic microscopic features of which crude drug?

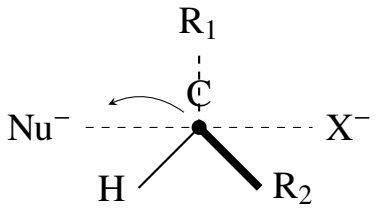
(A) Cinchona bark

(B) Senna leaves

(C) Cinnamon bark

(D) Cascara bark

Q35. A chemical reaction that follows an S_N2 mechanism typically features which of the following structural and stereochemical outcomes?



(A) Complete racemization via a stable carbocation intermediate

(B) Walden inversion of configuration through a pentacoordinate transition state

(C) Partial retention of configuration with a free radical pathway

(D) Allylic rearrangement via a cyclic transition intermediate

Q36. In the purchasing and procurement cycle of a hospital pharmacy, a "Tender System" is primarily used to ensure:

(A) Immediate acquisition of emergency medications regardless of cost

(B) Transparent, competitive, and cost-effective procurement of bulk items

(C) Over-the-counter retail distribution without tracking systems

(D) Bypassing state quality assurance inspections for imported medications

Q37. Which metabolic cycle represents the primary pathway for the breakdown of glucose to generate pyruvate and ATP under anaerobic conditions in human skeletal muscle cells?

(A) Citric Acid Cycle

(B) Glycolysis (Embden-Meyerhof pathway)

(C) Pentose Phosphate Pathway

(D) Glycogenolysis

Q38. In the evaluation of crude drugs, "chemotaxonomic classification" is based on arranging the drugs according to:

(A) The evolutionary development and phylogenetic relationships of plants

(B) The chemical nature of their active constituents

(C) The therapeutic application and pharmacological actions on systems

(D) The morphological characters of parts used

Q39. What is the mechanism of action of the cardiovascular drug Digitalis glycosides (e.g., Digoxin) at the cellular level?

(A) Inhibition of the Na^+/K^+-ATPase pump, leading to increased intracellular calcium

(B) Activation of M_2 muscarinic receptors in the myocardium

(C) Blockade of voltage-gated L-type calcium channels

(D) Antagonism of β_1 adrenergic receptors in the sinoatrial node

Q40. The National Health Program aimed at eliminating a specific infectious disease via the "DOTS" strategy is targeting which of the following illnesses?

(A) Malaria

(B) Pulmonary Tuberculosis

(C) Human Immunodeficiency Virus (HIV/AIDS)

(D) Filariasis

Q41. Which mechanical device is best suited for the continuous reduction of highly abrasive materials to a fine powder via both impact and attrition mechanisms?

(A) Hammer mill

(B) Cutter mill

(C) Ball mill

(D) Edge runner mill

Q42. Which structural feature characterizes the arrangement of cells in the human small intestinal mucosa that maximizes surface area for nutrient absorption?

(A) Haustra and tiae coli

(B) Villi and microvilli of the brush border

(C) Rugae and gastric pits

(D) Cilia and goblet cells

Q43. In the classification of lipids, sphingomyelin belongs to which specific group?

(A) Simple lipids

(B) Complex/Phospholipids

(C) Derived sterols

(D) Neutral glycerides

Q44. Under the state public health guidelines, which type of vaccine is formulated using attenuated live pathogens to provide long-lasting immunity against measles, mumps, and rubella?

(A) Subunit recombinant vaccine

(B) Toxoid vaccine

(C) MMR vaccine (Live attenuated)

(D) Inactivated killed vaccine

Q45. What is the mechanism of action of the competitive neuromuscular blocking drug d-Tubocurarine?

(A) Persistent depolarization of the motor endplate nicotinic receptors

(B) Antagonism of nicotinic (N_M) receptors at the skeletal neuromuscular junction

(C) Inhibition of acetylcholinesterase enzyme activity

(D) Blockade of calcium release from the sarcoplasmic reticulum

Q46. Which chemical test is specific for the identification of deoxysugars present in cardiac glycosides like Digitoxin?

(A) Borntrager's test

(B) Raymond's test

(C) Killer-Kiliani test

(D) Legal's test

Q47. If an ophthalmic solution needs to be made isotonic with lacrimal fluid, it must possess an osmotic pressure equivalent to what percentage concentration of sodium chloride solution?

(A) 0.45% w/v

(B) 0.9% w/v

(C) 2.0% w/v

(D) 5.0% w/v

Q48. Which enzyme catalyzes the irreversible committed step of glycolysis by converting fructose-6-phosphate to fructose-1,6-bisphosphate?

(A) Hexokinase

(B) Phosphofructokinase-1 (PFK-1)

(C) Pyruvate kinase

(D) Phosphoglucose isomerase

Q49. In the design of a hospital pharmacy layout, the "Clean Room" used for the preparation of sterile intravenous admixtures must conform to which minimum particulate cleanliness standard under ISO guidelines?

(A) ISO Class 5 (Class 100)

(B) ISO Class 8 (Class 100,000)

(C) ISO Class 9

(D) ISO Class 7 (Class 10,000)

Q50. The synthesis of an organic compound involves the conversion of an alcohol to an alkyl halide using thionyl chloride ($SOCl_2$). What is the typical stereochemical outcome of this reaction when performed in the absence of pyridine?

(A) Retention of configuration (S_Ni mechanism)

(B) Complete inversion of configuration (S_N2 mechanism)

(C) Complete racemization (S_N1 mechanism)

(D) Elimination to form an alkene (E2 mechanism)

Q51. Which hormone is synthesized by the parafollicular cells (C-cells) of the thyroid gland and acts to decrease blood calcium levels?

(A) Parathyroid hormone (PTH)

(B) Calcitonin

(C) Thyroxine (T_4)

(D) Triiodothyronine (T_3)

Q52. The deliberate addition of inferior, exhausted, or chemically altered materials to a pure crude drug sample to match its visual appearance for financial gain is termed as:

(A) Substitution

(B) Adulteration

(C) Sophiscation

(D) Deterioration

Q53. A patient presents with localized edema, redness, and high blood pressure. The clinical pharmacist notices that the patient was prescribed both an NSAID (Indomethacin) and an ACE inhibitor (Enalapril). This interaction reduces the antihypertensive effect due to:

(A) NSAID-induced inhibition of vasodilatory prostaglandins

(B) Competitive binding at the angiotensin converting enzyme site

(C) Alteration of hepatic microsomal oxidation pathways

(D) Decreased renal clearance of Enalapril by Indomethacin

Q54. Which parameter is used in store management to track the frequency with which the average inventory investment is sold and replaced over a defined accounting period?

(A) Material safety data sheet index

(B) Inventory turnover ratio

(C) Lead time variance index

(D) Safety stock coefficient

Q55. Which organ of the human female reproductive system serves as the primary site for the fertilization of an ovum by a spermatozoon?

(A) Uterus endometrium

(B) Fallopian tubes (Oviducts)

(C) Ovary cortex

(D) Cervical canal

Q56. What is the fundamental mechanism of action of the selective serotonin reuptake inhibitors (SSRIs) such as Fluoxetine in alleviating major depressive disorders?

(A) Antagonism of presynaptic α_2-adrenergic autoreceptors

(B) Inhibition of the serotonin transporter (SERT) protein in the synaptic cleft

(C) Irreversible inhibition of monoamine oxidase-A enzymes

(D) Direct agonism at postsynaptic $5-HT_{1A}$ receptors

Q57. In public health programs, the primary vector targeted for control measures to interrupt the transmission cycle of Dengue fever is:

(A) *Anopheles stephensi*

(B) *Culex quinquefasciatus*

(C) *Aedes aegypti*

(D) *Mansonia uniformis*

Q58. What role does sodium carboxymethylcellulose (Na-CMC) play when formulated in a pharmaceutical suspension?

(A) Flocculating agent

(B) Hydrophilic suspending and viscosity-modifying agent

(C) Wetting agent with high HLB value

(D) Chemical buffer stabilizer

Q59. The biological evaluation technique used to estimate the potency of a digitalis preparation by observing its lethal effect on a specific animal model is an example of:

(A) Physicochemical assay

(B) Bioassay

(C) Microbiological assay

(D) Radioimmunoassay

Q60. Which component of the stomach's gastric mucosa is responsible for the secretion of intrinsic factor, which is required for the subsequent absorption of Vitamin B_{12} in the ileum?

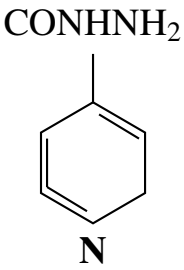
(A) Chief cells (Peptic cells)

(B) Parietal cells (Oxyntic cells)

(C) G-cells

(D) Mucous neck cells

Q61. What is the primary chemical structure configuration of the heterocyclic ring present in the structure of the antitubercular drug Isoniazid?



(A) Imidazole ring

(B) Pyridine ring

(C) Pyrimidine ring

(D) Thiazole ring

Q62. Under the Over-the-Counter (OTC) medication guidelines, which drug can be safely sold without a prescription for the symptomatic relief of mild tension headaches?

(A) Paracetamol

(B) Alprazolam

(C) Amoxicillin trihydrate

(D) Prednisolone

Q63. Which analytical instrument relies on the absorption of electromagnetic radiation in the wavelength region of 200 nm to 400 nm to determine the concentration of conjugated organic molecules in solution?

(A) Infrared Spectrophotometer

(B) UV-Visible Spectrophotometer

(C) Fluorimeter

(D) Flame Photometer

Q64. During the cultivation and collection of Solanaceous leaves like Belladonna, why is it recommended to dry the harvested leaves rapidly at temperatures between 50°C and 60°C?

(A) To maximize the volatile oil evaporation

(B) To deactivate hydrolytic enzymes that degrade tropane alkaloids

(C) To promote the conversion of hyoscyamine to atropine

(D) To fix the green chlorophyll color permanently

Q65. In the chemical structure of organic compounds, an aromatic system must satisfy Hückel's rule, which requires the presence of how many delocalized π-electrons within a planar cyclic system?

(A) $2n$ π-electrons

(B) $4n$ π-electrons

(C) $(4n + 2)$ π-electrons

(D) $(4n + 1)$ π-electrons

Q66. Which type of patient counselling strategy should a community pharmacist adopt when explaining the use of a metered-dose inhaler to an illiterate patient?

(A) Handing out a detailed English leaflet containing schematic charts

(B) Using verbal explanations paired with a physical demonstration using a placebo inhaler

(C) Advising the patient to read the inner manufacturer text on the outer carton box

(D) Delegating the clinical explanation entirely to the family members

Q67. What is the composition of Benedict's reagent used in clinical pathology tests for the detection of reducing sugars in urine?

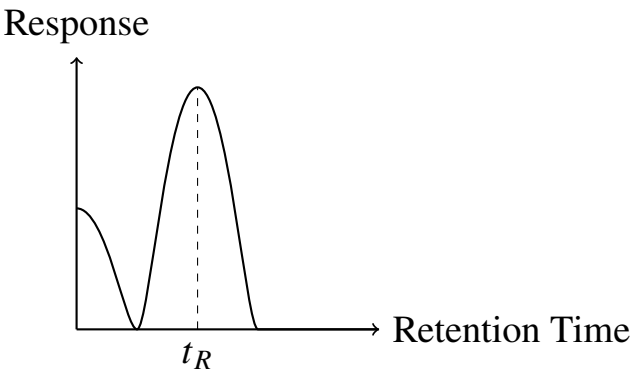
(A) Copper sulfate, sodium citrate, and sodium carbonate

(B) Mercuric chloride and potassium iodide

(C) Iodine dissolved in potassium iodide solution

(D) α-naphthol and concentrated surgical acid

Q68. Which analytical parameter determines the separation efficiency of a gas chromatography column during the analysis of volatile pharmaceutical components?



(A) The flow rate of the mobile liquid phase

(B) The partition coefficient of the analyte between the carrier gas and the stationary phase

(C) The surface tension of the injection sample droplets

(D) The mesh size of the pre-filter assembly

Q69. Under the global family welfare guidelines, the primary mechanism of action of copper-releasing intrauterine devices (IUDs) like Cu-T is to:

(A) Suppress ovulation by blocking the LH surge from the pituitary

(B) Exert a local spermicidal effect by altering endometrial inflammatory patterns

(C) Thickening the cervical mucus to form a physical plug to prevent sperm transport

(D) Induce luteolysis of the corpus luteum prematurely

Q70. Which class of antibiotics is associated with the risk of causing permanent tooth discoloration and enamel hypoplasia when administered to children under 8 years of age?

(A) Macrolides

(B) Aminoglycosides

(C) Tetracyclines

(D) Fluoroquinolones

Q71. What is the primary function of the lymphatic system within the context of human cardiovascular physiology?

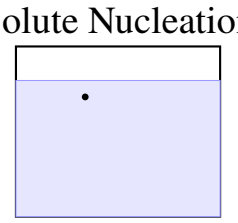
(A) Transporting high-pressure oxygenated blood to peripheral tissues

(B) Returning interstitial fluid and leaked plasma proteins back to the venous blood circulation

(C) Synthesizing major clotting proteins like fibrinogen

(D) Regulating the acid-base balance of the cerebrospinal fluid

Q72. In a pharmaceutical unit operation involving crystallization, the term "supersaturation" refers to a thermodynamic state where:



(A) The solvent contains less solute than it can normally dissolve at that temperature

(B) The solution contains more dissolved solute than is expected at equilibrium at that temperature

(C) The crystals begin to melt due to high agitation shear

(D) The solvent molecules undergo phase inversion to an amorphous form

Q73. Which organic chemical test is utilized to detect the presence of proteins by reacting with peptide bonds to produce a characteristic violet-purple colored complex in an alkaline medium?

(A) Ninhydrin test

(B) Biuret test

(C) Xanthoproteic test

(D) Millon's test

Q74. In hospital pharmacy practice, what type of drug distribution system minimizes medication errors, reduces waste, and packages drugs in individual doses labeled with generic names?

(A) Floor stock system

(B) Individual prescription order system

(C) Unit-dose distribution system

(D) Semi-controlled ward stock system

Q75. Which component of the human nervous system acts as the primary pathway for carrying sensory information from the peripheral receptors towards the central nervous system?

(A) Efferent somatic neurons

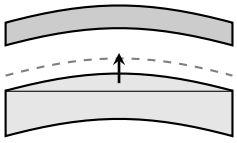
(B) Afferent somatic and visceral neurons

(C) Postganglionic sympathetic fibers

(D) Parasympathetic pelvic splanchnic nerves

Q76. A pharmaceutical tablet formulation develops a defect known as "capping" during compression. What is the mechanical cause of this defect?

Separation of Top Cap (Capping)



(A) High moisture content in the granules

(B) Entrapment of air within the granules during high-speed compression

(C) Excessive lubrication of the granular mass

(D) Use of deep concave punches with rough surfaces

Q77. What is the mechanism of action of the loop diuretic Furosemide in the human nephron?

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

(B) Competitive antagonism of aldosterone receptors in the collecting duct

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

(D) Reversible inhibition of carbonic anhydrase in the proximal tubule

Q78. In herbal drug evaluation, the parameter "bitterness value" is determined by comparing the threshold bitter concentration of an extract against a standard solution of:

(A) Quinine hydrochloride

(B) Strychnine sulfate

(C) Atropine methonitrate

(D) Morphine acetate

Q79. Which element is classified as an inorganic pharmaceutical agent used primarily as a systemic antacid by forming a gelatinous protective coating over gastric ulcers?

(A) Magnesium sulfate

(B) Aluminium hydroxide gel

(C) Sodium bicarbonate

(D) Calcium chloride

Q80. In the chemical structure of organic molecules, which functional group undergoes characteristic nucleophilic acyl substitution reactions most readily?

(A) Alkyl halides

(B) Acid chlorides (Acyl chlorides)

(C) Esters

(D) Amides

Q81. What is the primary clinical utility of performing a "Widal test" on a patient's serum sample?

(A) Detection of antibodies against *Salmonella typhi* to diagnose Typhoid fever

(B) Quantification of rheumatoid factor to confirm arthritis

(C) Screening for human chorionic gonadotropin (hCG)

(D) Identification of acid-fast bacilli for leprosy diagnosis

Q82. According to the Drugs and Cosmetics Act, an "Adulterated Drug" is defined as one that:

(A) Is sold under a name which belongs to another drug

(B) Consists in whole or in part of any filthy, putrid, or decomposed substance

(C) Has a label that bears statements which are false or misleading

(D) Is substituted completely by another active drug entity

Q83. Which anatomical component of the human eye contains the photoreceptor cells (rods and cones) that transduce light energy into electrical nerve impulses?

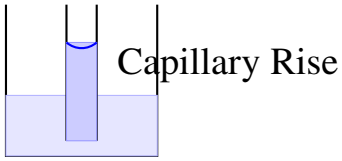
(A) Choroid

(B) Sclera

(C) Retina

(D) Cornea

Q84. What physical phenomenon describes the spontaneous up-curve migration of a liquid through a porous solid medium or capillary space due to surface tension forces?



(A) Sedimentation

(B) Flocculation

(C) Capillarity

(D) Coalescence

Q85. In biochemistry, an uncompetitive inhibitor of an enzyme-catalyzed reaction alters the kinetic parameters by:

(A) Increasing K_m without changing $V_{\max}$

(B) Decreasing both K_m and $V_{\max}$ proportionally

(C) Decreasing $V_{\max}$ while K_m remains completely unchanged

(D) Increasing both K_m and $V_{\max}$

Q86. Which public health disease prevention strategy is implemented by administering prophylactic Vitamin A solutions to infants at designated months of age?

(A) Primordial prevention

(B) Specific protection against nutritional blindness

(C) Tertiary rehabilitation

(D) Environmental sanitation

Q87. The structural modification of converting a phenolic hydroxyl group into an ester or ether prodrug form is generally carried out in medicinal chemistry to:

(A) Reduce the chemical stability of the drug molecule

(B) Increase lipid solubility and improve oral bioavailability

(C) Decrease the rate of renal active secretion

(D) Permanently deactivate the binding affinity to receptors

Q88. Which structure represents the primary site of synthesis and storage of oxytocin and vasopressin (ADH) before their release into the systemic circulation?

(A) Anterior pituitary gland (Adenohypophysis)

(B) Hypothalamus neurosecretory cells (released via Posterior pituitary)

(C) Adrenal cortex zona glomerulosa

(D) Pineal gland parenchymal blocks

Q89. What type of physical or chemical hazard is associated with storing light-sensitive formulations like Nitroprusside infusions in non-amber clear glass containers?

(A) Photo-oxidation and loss of potency, often indicated by color change

(B) Hydrolytic polymerization forming insoluble glass precipitates

(C) Microbial proliferation due to light activation

(D) Phase separation of the aqueous matrix

Q90. In the processing of crude drugs, the method of "maceration" involves:

(A) Boiling the drug with water for a specified period under pressure

(B) Allowing the comminuted drug to stand in contact with a solvent at room temperature for a prolonged period with occasional shaking

(C) Passing a continuous current of hot solvent through a column of packed drug

(D) Subjecting the drug to a stream of high-pressure water vapor

Q91. Which legal regulatory body is responsible for approving the opening of a new pharmacy institution and setting the minimum standard curriculum for pharmacy education in India?

(A) Central Drugs Standard Control Organization (CDSCO)

(B) Pharmacy Council of India (PCI)

(C) All India Council for Technical Education (AICTE)

(D) Indian Pharmacopoeia Commission (IPC)

Q92. What is the fundamental role of bile salts synthesized by the liver and stored in the gallbladder during the process of digestion?

(A) Hydrolytic cleavage of peptide bonds in proteins

(B) Emulsification of dietary lipids into small micelles to facilitate lipase action

(C) Activation of salivary amylase in the duodenum

(D) Lowering the pH of the chyme entering from the stomach

Q93. An organic compound displays a strong, sharp infrared absorption band in the region of 1715 cm^{-1}. This spectral feature confirms the presence of which functional group?

(A) Hydroxyl group (−OH)

(B) Carbonyl group (C = O)

(C) Alkyne triple bond (C ≡ C)

(D) Ether link (−O−)

Q94. In community pharmacy practice, what terminology describes the selection of a lower-cost, bioequivalent alternative drug product possessing the same active moiety, strength, and dosage form as the prescribed brand?

(A) Therapeutic duplication

(B) Generic substitution

(C) Off-label utilization

(D) Compassionate use allocation

Q95. Which type of primary packaging material is preferred for protecting moisture-sensitive solid oral tablets using a thermoforming process that creates individual pockets sealed with aluminum foil?

Blister Pack Unit

(A) Polyvinyl chloride (PVC) blister film with PVDC coating

(B) High-density polyethylene bulk carboys

(C) Low-density polystyrene open vials

(D) Glassine paper wraps

Q96. What is the mechanism of action of the cardiovascular agent Nitroglycerin in alleviating acute angina pectoris attacks?

(A) Blockade of voltage-sensitive sodium channels in myocardial conducting pathways

(B) Conversion to nitric oxide, which stimulates guanylyl cyclase to increase cGMP, causing systemic vasodilation

(C) Non-selective antagonism of β-adrenergic receptors in peripheral vasculature

(D) Inhibition of the renin-angiotensin-aldosterone cascade

Q97. In a clinical laboratory, a patient's fasting blood plasma sample yields a high concentration of ketone bodies (acetoacetate and β-hydroxybutyrate). This condition is a primary indicator of:

(A) High carbohydrate metabolic shift

(B) Diabetic ketoacidosis or prolonged starvation

(C) Hyperthyroidism

(D) Acute renal failure

Q98. Which structural parameter of granules determines their flow property and can be calculated by measuring the height and radius of a granular heap formed on a horizontal surface?

(A) Carr's compressibility index

(B) Angle of repose (θ)

(C) Hausner ratio

(D) Bulk density ratio

Q99. Which component of the human autonomic nervous system relies exclusively on acetylcholine as its postganglionic neurotransmitter to activate muscarinic receptors on effector organs?

(A) Sympathetic nervous system

(B) Parasympathetic nervous system

(C) Somatic motor system

(D) Central serotonergic pathway

Q100. Under the provisions of the Drugs and Magic Remedies (Objectionable Advertisements) Act 1954, advertisements for drugs claiming to cure which of the following conditions are strictly prohibited?

(A) Mild seasonal common cold

(B) Chronic conditions listed in the schedule, such as cancer or genetic blindness

(C) Minor cuts and superficial skin abrasions

(D) Nutritional iron-deficiency anemia

Detailed Solutions

Q1.

Solution

Concept:

Transdermal drug delivery systems (TDDS) require specialized quality control testing to ensure a reproducible drug release profile through the polymeric matrix. The United States Pharmacopeia (USP) outlines specific apparatuses for these dosage forms. For transdermal patches, a modified version of the USP Type II (Paddle) apparatus is frequently employed. This modification includes the addition of a specialized copper mesh cylinder or a watch glass/polyethylene screen assembly. The purpose of this modification is to hold the transdermal patch securely at the bottom of the dissolution vessel, ensuring that the adhesive surface remains flat and fully exposed to the dissolution medium without floating or warping during the agitation cycle.

Solution:

Step 1: Identify the standard dissolution apparatus classifications described in the pharmacopoeia. USP Type I is the basket apparatus, and USP Type II is the paddle apparatus.

Step 2: Recognize that transdermal patches cannot be evaluated using an unmodified paddle because they tend to float, stick to the paddle blades, or aggregate in a manner that alters the active surface area exposed to the medium.

Step 3: Analyze the role of the copper mesh cylinder. The patch is attached to or placed inside the cylinder assembly to keep it perfectly stationary at the base of the vessel.

Step 4: Determine the primary kinetic evaluation parameter measured. The dissolution test measures the rate and extent to which the active pharmaceutical ingredient (API) is released from the patch matrix over an extended time frame. Therefore, it establishes the complete drug release profile.

Final Answer: Drug release profile

Answer: (A)

Go Back to Question 1

Q2.

Solution

Concept:

A buffer solution containing a weak acid and its conjugate base can be evaluated using the Henderson-Hasselbalch equation. The mathematical model for calculating the pH of an acidic buffer system is defined as follows:

$$\text{pH} = \text{p}K_a + \log_{10}\left(\frac{[\text{Salt}]}{[\text{Acid}]}\right)$$

where $\text{p}K_a = -\log_{10}(K_a)$, [Salt] represents the molar concentration of the conjugate base (sodium acetate), and [Acid] represents the molar concentration of the weak acid (acetic acid).

Solution:

Step 1: Calculate the value of $\text{p}K_a$ from the given acid dissociation constant ($K_a = 1.8 \times 10^{-5}$):

$$\text{p}K_a = -\log_{10}(1.8 \times 10^{-5}) = 5 - \log_{10}(1.8) \approx 5 - 0.2553 = 4.7447$$

Step 2: Identify the molar concentrations provided in the problem statement. The concentration of the weak acid, [Acid], is 0.2 M, and the concentration of the sodium acetate salt, [Salt], is 0.1 M.

Step 3: Substitute these concentration values into the log term of the Henderson-Hasselbalch equation:

$$\frac{[\text{Salt}]}{[\text{Acid}]} = \frac{0.1}{0.2} = 0.5$$

Step 4: Compute the logarithm of the ratio calculated in Step 3:

$$\log_{10}(0.5) = -0.3010$$

Step 5: Combine the values to determine the final pH of the buffer system:

$$\text{pH} = 4.7447 + (-0.3010) = 4.4437 \approx 4.44$$

Final Answer: 4.44

Answer: (A)

Go Back to Question 2

Q3.

Solution

Concept:

The limit test for Arsenic is based on the classic Gutzeit test, where all arsenic present in the sample is chemically reduced to arsenious acid, and subsequently to volatile arsine gas (AsH_3). This gas reacts with mercuric chloride test paper to produce a yellow-to-brown stain. However, crude chemical reagents often contain sulfur impurities, which can be reduced during the reaction to produce hydrogen sulfide gas (H_2S). If H_2S escaping the generator column reaches the mercuric chloride paper, it reacts directly to form a dark lead or mercury sulfide black stain, severely interfering with the visual comparison of the arsenic spot.

Solution:

Step 1: Examine the chemical components of the Gutzeit apparatus. The reaction mixture contains zinc and hydrochloric acid to generate nascent hydrogen, which reduces arsenic to arsine gas.

Step 2: Identify potential secondary pathways. Any sulfur contamination leads to the formation of gaseous hydrogen sulfide (H_2S) along with arsine (AsH_3).

Step 3: Evaluate the role of the lead acetate cotton wool plug placed in the upper exit tube. Lead acetate possesses a high affinity for sulfide ions.

Step 4: Write the chemical trap reaction occurring within the cotton plug:

$$Pb(CH_3COO)_2 + H_2S \rightarrow PbS \downarrow +2CH_3COOH$$

The black precipitate of lead sulfide (PbS) remains bound to the cotton fibers, filtering out the unwanted gas and allowing only pure arsine gas to pass through.

Final Answer: Absorb hydrogen sulfide gas which may blacken the mercuric chloride paper

Answer: (B)

Go Back to Question 3

Q4.

Solution

Concept:

Biological membranes are selectively permeable barriers. The transport of xenobiotics and endogenous substances occurs via passive or specialized active pathways. When a drug molecule moves across a biological membrane against its concentration gradient (from a region of lower concentration to a region of higher concentration), the process cannot happen spontaneously. This upstream movement requires a specialized trans-membrane carrier protein that undergoes conformational changes, paired with the direct thermodynamic consumption of cellular energy derived from the hydrolysis of adenosine triphosphate (ATP). This specific energy-dependent, carrier-mediated transport mechanism is termed primary active transport.

Solution:

Step 1: Evaluate the direction of transport. The drug is moving against its thermodynamic concentration gradient, which immediately eliminates passive mechanisms such as simple diffusion and facilitated diffusion, both of which only operate down a concentration gradient.

Step 2: Differentiate between the remaining active processes. Facilitated diffusion utilizes a carrier protein but does not consume metabolic energy. Pinocytosis involves vesicular engulfment of fluid droplets rather than specific molecule transport via carrier proteins.

Step 3: Confirm the requirements of primary active transport. It explicitly requires a specific carrier protein complex embedded within the lipid bilayer alongside direct chemical energy expenditure. This perfectly matches the criteria outlined in the problem.

Final Answer: Primary active transport

Answer: (C)

Go Back to Question 4

Q5.

Solution

Concept:

The Drugs and Cosmetics Act of 1940 and its corresponding Rules of 1945 serve as the legal cornerstone regulating the manufacture, distribution, and import of pharmaceuticals in India. To streamline enforcement, various schedules are appended to the act, each defining specific statutory regulatory requirements. Schedule M explicitly prescribes the comprehensive standards, administrative workflows, and facility layouts mandatory for maintaining Good Manufacturing Practices (GMP) for public health protection. It details the exact engineering controls, space allocations, sanitation parameters, and equipment documentation needed for a pharmaceutical production facility.

Solution:

Step 1: Analyze the legal definition of Schedule M within the context of the Indian Drugs and Cosmetics Rules.

Step 2: Cross-examine each option against the statutory schedules. Standards for surgical dressings and umbilical tapes fall under Schedule F(II).

Step 3: Evaluate prescription drug guidelines. The list of prescription-only drugs falls under Schedule H and Schedule X, which dictate distribution regulations.

Step 4: Check standards for cosmetics and contraceptives. These are managed under Schedule S and Schedule R, respectively.

Step 5: Conclude that Schedule M is exclusively dedicated to Good Manufacturing Practices (GMP) guidelines and factory premises design criteria for pharmaceutical formulations.

Final Answer: Good Manufacturing Practices (GMP) and factory premises requirements

Answer: (B)

Go Back to Question 5

Q6.

Solution

Concept:

The microscopic evaluation of crude drugs provides anatomical data to distinguish closely related species or detect adulteration. *Digitalis purpurea* and *Digitalis lanata* belong to the family Plantaginaceae and share several morphological and histological characteristics. However, they exhibit key differences in their trichome morphology. While both species possess non-glandular covering trichomes, *Digitalis purpurea* is characterized by unicellular, uniseriate covering trichomes that frequently display collapsed or pinched cell walls. In contrast, the differentiating feature resides in their secretory anatomy: *Digitalis purpurea* possesses glandular trichomes with a unicellular stalk and a bicellular head, whereas *Digitalis lanata* features distinct glandular trichomes with a uniseriate multi-cellular stalk and a unicellular head.

Solution:

Step 1: Review the diagnostic histological profiles of Digitalis species. Both show anomocytic stomata and lack calcium oxalate crystals, meaning these traits cannot be used to differentiate the two.

Step 2: Analyze the trichomes. Both species possess non-glandular uniseriate trichomes, making general presence non-diagnostic.

Step 3: Evaluate the glandular trichome morphology. The structural distribution of cells in the stalk and the head serves as the key microscopic marker.

Step 4: Conclude that the specific morphology of its glandular trichome stalks provides the clear histological distinction required to separate *Digitalis purpurea* from *Digitalis lanata*.

Final Answer: The specific morphology of its glandular trichome stalks

Answer: (D)

Go Back to Question 6

Q7.

Solution

Concept:

The Economic Order Quantity (EOQ) is a mathematical inventory management model that determines the optimal order size that minimizes total inventory costs, which include ordering costs and holding costs. The foundational algebraic formula for EOQ is derived as follows:

$$\text{EOQ} = \sqrt{\frac{2 \cdot A \cdot O}{C}}$$

where A represents the annual consumption value or quantity, O represents the fixed cost per individual order placed, and C represents the annual holding/carrying cost expressed as a fractional percentage of the inventory item value.

Solution:

Step 1: Extract the numerical parameters given in the problem statement:

$$\text{Annual consumption value } (A) = ₹\,20{,}000$$

$$\text{Ordering cost per order } (O) = ₹\,50$$

$$\text{Holding cost percentage } (Ch) = 20\% = 0.20$$

Step 2: Substitute these parameters directly into the numerator of the EOQ formula:

$$\text{Numerator} = 2 \cdot 20000 \cdot 50 = 2,000,000$$

Step 3: Place the annual holding cost rate in the denominator ($C = 0.20$) and compute the fraction:

$$\frac{2,000,000}{0.20} = 10,000,000$$

Step 4: Take the square root of the resulting value to find the EOQ in terms of rupees:

$$\text{EOQ} = \sqrt{10,000,000} = 3162.277 \approx ₹\,3{,}162$$

Final Answer: ₹ 3,162

Answer: (C)

Go Back to Question 7

Q8.

Solution

Concept:

Following an acute myocardial infarction (AMI), necrotic cardiac muscle cells rupture, releasing their intracellular enzymatic contents into the systemic circulation. Tracking the temporal release of these proteins helps confirm a diagnosis. The primary diagnostic enzymes include Creatine Kinase (specifically the CK-MB isoenzyme), Lactate Dehydrogenase (LDH_1), and transaminases. Among these traditional markers, CK-MB is highly specific to myocardial tissue. It rises rapidly in serum within 4 to 6 hours after the onset of chest pain, reaches peak concentration at 18 to 24 hours, and returns to baseline within 48 to 72 hours.

Solution:

Step 1: Assess the baseline characteristics of Alanine aminotransferase (ALT). ALT is a marker primarily used to evaluate hepatic parenchymal damage, not cardiac necrosis.

Step 2: Examine the timeline for Lactate dehydrogenase (LDH_1). LDH_1 is a delayed marker that does not elevate significantly until 24 to 48 hours post-infarction, making it unsuitable for early detection.

Step 3: Evaluate Alkaline phosphatase (ALP). ALP is used to assess hepatobiliary obstruction or bone disorders and has no role in cardiac diagnostic profiles.

Step 4: Confirm the kinetics of CK-MB. Its elevation within the 4–6 hour window makes it the earliest standard serum enzyme marker for an acute myocardial infarction.

Final Answer: Creatine kinase-MB (CK-MB)

Answer: (B)

Go Back to Question 8

Q9.

Solution

Concept:

Patient counselling in community pharmacy practice is essential for improving therapeutic adherence and preventing medication errors. Communication barriers can be categorized into pharmacist-centered, patient-centered, or environmental barriers. Environmental barriers stem from the physical workspace design, structural layout, or background noise within the pharmacy setting. These physical elements can restrict patient-pharmacist interaction, compromise patient privacy, or prevent comfortable, confidential dialogue.

Solution:

Step 1: Categorize each provided option to isolate the environmental factor.

Step 2: Analyze Option B. A patient's negative perception towards clinical advice is classified as a psychological or attitudinal barrier.

Step 3: Analyze Option C. A pharmacist's high anxiety and lack of confidence represents an internal behavioral or professional barrier.

Step 4: Analyze Option D. A patient's cognitive impairment or hearing loss is classified as a physiological or biological barrier.

Step 5: Analyze Option A. A high counter design with no private acoustic space is a physical layout characteristic of the workplace environment. Therefore, it is classified as an environmental barrier.

Final Answer: High counter design with no private acoustic space

Answer: (A)

Go Back to Question 9

Q10.

Solution

Concept:

The elimination of a drug via first-order chemical kinetics follows an exponential decay model, meaning a constant fraction of the drug is eliminated per unit of time. The amount of drug remaining in the body after a given number of half-lives (n) can be calculated using the mathematical relationship:

$$\text{Remaining Percentage} = \left(\frac{1}{2}\right)^n \cdot 100\%$$

Consequently, the cumulative percentage of the drug eliminated from systemic circulation is expressed as:

$$\text{Eliminated Percentage} = 100\% - \text{Remaining Percentage}$$

Solution:

Step 1: Calculate the percentage of the drug remaining in the systemic circulation at the target elimination level:

$$\text{Remaining Percentage} = 100\% - 93.75\% = 6.25\%$$

Step 2: Express 6.25% as a fraction of the initial amount (100%):

$$\frac{6.25}{100} = \frac{1}{16}$$

Step 3: Determine the number of half-lives (n) required to reduce the concentration to this fraction:

$$\left(\frac{1}{2}\right)^n = \frac{1}{16} = \left(\frac{1}{2}\right)^4 \rightarrow n = 4 \text{ half-lives}$$

Step 4: Multiply the number of half-lives by the biological half-life period ($t_{1/2} = 4$ hours) to find the total time required:

$$\text{Total Time} = 4 \cdot 4 \text{ hours} = 16 \text{ hours}$$

Final Answer: 16 hours

Answer: (B)

Go Back to Question 10

Q11.

Solution

Concept:

Medical prescriptions regularly implement standardized Latin anatomical and administrative abbreviations to communicate dosing schedules across clinical teams. Accurate translation of these phrases during dispensing is essential for patient safety. The abbreviation "t.i.d." stands for *ter in die*, which translates directly to "three times a day". The phrase "p.c." represents *post cibum*, which translates to "after meals". Combining these two independent clinical instructions yields a clear, structured directive for patient medication adherence.

Solution:

Step 1: Deconstruct the phrase into its two separate components: "t.i.d." and "p.c.".

Step 2: Translate "t.i.d." (*ter in die*). This indicates a frequency of three times within a standard 24-hour cycle.

Step 3: Translate "p.c." (*post cibum*). This specifies that administration should occur after food intake to ensure proper absorption or minimize gastric irritation.

Step 4: Combine the terms into a single sentence: "Take three times a day after meals." This ensures the patient understands the correct schedule.

Final Answer: Take three times a day after meals

Answer: (B)

Go Back to Question 11

Q12.

Solution

Concept:

The human renal system maintains homeostatic plasma balance, fluid volumes, and waste excretion through structural units in the kidney. The nephron is the structural and functional unit of the kidney. Each kidney contains approximately one million nephrons. The nephron's vascular and tubular components work together to complete three physiological processes: non-selective ultrafiltration at the glomerular capillary barrier, selective active/passive tubular reabsorption along the convoluted tubules, and active tubular secretion into the lumen.

Solution:

Step 1: Evaluate the anatomical scale of the options provided.

Step 2: Examine the glomerulus and Bowman's capsule. These are sub-components of the renal corpuscle responsible only for ultrafiltration, not the entire process of reabsorption and secretion.

Step 3: Examine the collecting duct. This structure serves primarily as a shared conduit that concentrates urine under antidiuretic hormone influence, receiving output from multiple independent units.

Step 4: Identify the complete unit. The nephron comprises the renal corpuscle, proximal convoluted tubule, loop of Henle, and distal convoluted tubule. It carries out all renal physiological steps, making it the fundamental functional unit.

Final Answer: Nephron

Answer: (B)

Go Back to Question 12

Q13.

Solution

Concept:

Aspirin (acetylsalicylic acid) undergoes chemical degradation in the presence of water, a process accelerated by elevated temperatures. Structurally, aspirin is an ester formed by the acetylation of the phenolic hydroxyl group of salicylic acid. In an aqueous environment, the ester linkage is vulnerable to nucleophilic attack by water molecules or hydroxyl ions. This reaction cleaves the ester bond, breaking aspirin down into its degradation products: salicylic acid and acetic acid. This pathway is classified as a hydrolytic ester cleavage.

Solution:

Step 1: Analyze the chemical structure of acetylsalicylic acid to identify its main functional groups. It contains a carboxylic acid group and an ester linkage.

Step 2: Evaluate the degradation conditions described. The drug is placed in an aqueous solution and exposed to heat, which accelerates solution-phase reactions.

Step 3: Match the conditions to a degradation mechanism. The presence of water molecules driving the decomposition of an ester group indicates a hydrolysis reaction.

Step 4: Exclude alternative pathways. Photolysis requires light exposure, oxidation involves electron loss or free radical propagation, and racemization requires a chiral center, which aspirin lacks. This confirms the reaction is hydrolytic ester cleavage.

Final Answer: Hydrolytic ester cleavage

Answer: (B)

Go Back to Question 13

Q14.

Solution

Concept:

Intravenous general anesthetics are classified by their chemical structures, pharmacokinetic profiles, and mechanisms of action within the central nervous system. Propofol (2,6-diisopropylphenol) is an ultra-short-acting anesthetic agent commonly used for inducing and maintaining anesthesia. Its mechanism of action relies on binding to specific domains on the $GABA_A$ receptor complex. This binding acts as a positive allosteric modulator, prolonging the opening of the chloride ion channel. The resulting influx of chloride ions hyperpolarizes the postsynaptic membrane, suppressing neuronal excitability. Propofol also features a rapid recovery profile due to its high lipid solubility and rapid clearance via hepatic metabolism.

Solution:

Step 1: Review the pharmacological mechanisms of the listed general anesthetics.

Step 2: Evaluate Ketamine. It acts primarily as an NMDA receptor antagonist, causing dissociative anesthesia, which does not match the prompt.

Step 3: Evaluate Nitrous oxide. This is an NMDA antagonist and a gas administered via inhalation, not an ultra-short-acting intravenous agent.

Step 4: Evaluate Propofol. It acts via positive allosteric modulation of $GABA_A$ receptors and is cleared rapidly through hepatic metabolic pathways, matching all criteria.

Final Answer: Propofol

Answer: (C)

Go Back to Question 14

Q15.

Solution

Concept:

The Pharmacy Act of 1948 provides the statutory framework regulating the profession of pharmacy across India. It governs education, standardizes requirements for entering the profession, and manages State Pharmacy Councils. Section 32 of the Act outlines the legal prerequisites an applicant must satisfy to register their name in the official State Pharmacist Registry. Along with holding an approved diploma or degree in pharmacy from an accredited institution, the individual must meet statutory residency and age criteria. The Act establishes the minimum age requirement for professional registration at 18 years.

Solution:

Step 1: Consult the statutory text of the Pharmacy Act of 1948 regarding registration requirements.
Step 2: Differentiate between the legal age of majority and specific professional thresholds.
Step 3: Note that while some commercial licenses require an individual to be 21 years old, the minimum statutory age required to register as a pharmacist after completing an accredited program is 18 years.

Final Answer: 18 years

Answer: (B)

Go Back to Question 15

Q16.

Solution

Concept:

Bones within the human skeletal system are classified based on their structural morphology into flat, irregular, short, long, or sesamoid bones. Sesamoid bones are specialized, small, rounded osseous structures embedded within tendons where they pass over joints. They develop in response to considerable friction, physical stress, and mechanical tension. Their physiological role is to modify the angle of tendon pull, protect the tendon from excessive wear, and improve the mechanical advantage of the associated joint. The patella (kneecap) is the largest and most prominent sesamoid bone in the human body.

Solution:

Step 1: Evaluate the structural properties of flat bones. Flat bones, like the sternum or cranial bones, consist of parallel layers of compact bone enclosing spongy bone and serve a protective or muscle-attachment function.

Step 2: Examine irregular bones. Irregular bones, such as vertebrae, have complex shapes that do not fit other categories.

Step 3: Analyze the patella. It develops directly within the quadriceps femoris tendon, where it crosses the knee joint line to manage friction and mechanical stress. This matches the anatomical definition of a sesamoid bone.

Final Answer: Sesamoid bone

Answer: (C)

Go Back to Question 16

Q17.

Solution

Concept:

The microbiological assay of antibiotics using the cylinder-plate (cup-plate) method evaluates antimicrobial potency by measuring the zone of inhibition produced by the diffusion of the antibiotic through an agar gel layer seeded with a susceptible indicator microorganism. The mathematical relationship governing the diffusion of a solute from a concentrated cylindrical source through an agar gel matrix is based on Fick's laws of diffusion. The diameter of the resulting circular zone of inhibition is directly proportional to the logarithm of the antibiotic concentration and its diffusion coefficient. However, it is inversely proportional to the physical thickness of the agar medium layer within the Petri dish.

Solution:

Step 1: Analyze the physical variables affecting zone formation in an agar diffusion assay.

Step 2: Consider the concentration variable. A higher antibiotic concentration increases the amount of drug available to diffuse outward, which widens the zone. This represents a direct logarithmic relationship, not an inverse one.

Step 3: Consider the agar depth variable. If the volume of agar poured into the plate increases, the thickness of the gel layer increases. The drug must then diffuse through a larger vertical volume of agar, reducing its lateral concentration gradient. As a result, an increase in agar thickness leads to a decrease in the horizontal zone diameter, establishing an inverse relationship.

Final Answer: The thickness of the agar medium layer

Answer: (B)

Go Back to Question 17

Q18.

Solution

Concept:

The core chemical structure of penicillins consists of a fused β-lactam thiazolidine ring system linked to an acyl side chain. Many staphylococcal strains develop resistance to early penicillins by producing β-lactamase enzymes, which hydrolyze the amide bond in the β-lactam ring, deactivating the antibiotic. To overcome this resistance mechanism, medicinal chemists modify the structure by introducing a bulky, sterically hindered aromatic ring system directly attached to the side-chain carbonyl group. This bulky side chain creates steric hindrance around the β-lactam ring, preventing the active site of the β-lactamase enzyme from binding to and cleaving the ring while preserving its ability to bind to bacterial penicillin-binding proteins (PBPs).

Solution:

Step 1: Identify the mechanism of enzymatic inactivation of penicillins, which relies on the β-lactamase enzyme accessing the carbonyl carbon of the β-lactam ring.

Step 2: Evaluate chemical modifications designed to block this access. Introducing a hydrophilic group, like an amino group in ampicillin, broadens the spectrum of activity against Gram-negative bacteria but does not protect against β-lactamases.

Step 3: Analyze the effect of adding bulky, sterically hindered aromatic groups (as seen in methicillin or oxacillin). The large molecular size blocks enzymatic attack via steric hindrance, rendering the molecule resistant to β-lactamase cleavage.

Final Answer: Incorporation of a bulky sterically hindered aromatic ring directly attached to the side-chain carbonyl group

Answer: (B)

Go Back to Question 18

Q19.

Solution

Concept:

Pharmaceutical compounding relies on allegation or the dilution equation to calculate the specific volumes of concentrated stock solutions and vehicles required to prepare a target volume at a lower concentration. The core algebraic relationship is defined by the conservation of mass equation:

$$V_1 \cdot C_1 = V_2 \cdot C_2$$

where V_1 is the volume of the initial concentrated stock solution, C_1 is the concentration of that stock solution, V_2 is the final total volume of the desired solution, and C_2 is its target concentration.

Solution:

Step 1: Assign the known values from the problem description to their corresponding variables in the equation:

$$\text{Stock concentration } (C_1) = 95\% \text{ v/v}$$

$$\text{Target volume } (V_2) = 500 \text{ mL}$$

$$\text{Target concentration } (C_2) = 70\% \text{ v/v}$$

Step 2: Rearrange the algebraic equation to isolate the unknown variable, V_1:

$$V_1 = \frac{V_2 \cdot C_2}{C_1}$$

Step 3: Substitute the numerical values into the rearranged equation and solve for V_1:

$$V_1 = \frac{500 \cdot 70}{95} = \frac{35000}{95} = 368.421 \text{ mL}$$

Step 4: Determine the compounding workflow. Measure 368.4 mL of the 95% v/v stock alcohol solution, transfer it to a volumetric flask, and add sufficient purified water to bring the final total volume up to the 500 mL mark.

Final Answer: 368.4 mL of 95% alcohol and volume made up to 500 mL with water

Answer: (A)

Go Back to Question 19

Q20.

Solution

Concept:

In clinical pharmacology and toxicology, adverse drug reactions are categorized based on their clinical presentation, severity, and mechanism of induction. The term "teratogenicity" is derived from Greek roots meaning monster-producing. It defines a drug or exogenous agent's capacity to induce permanent structural, functional, or biochemical abnormalities in a developing embryo or fetus when administered to a pregnant woman. The severity of teratogenic outcomes depends on the specific developmental stage of the fetus during drug exposure.

Solution:

Step 1: Define the scope of teratogenicity, which applies to prenatal developmental toxicity rather than adult systemic organ toxicity.

Step 2: Evaluate Option A and Option B. Hepatic necrosis in geriatrics and bone marrow suppression are manifestations of systemic organ toxicity, not developmental toxicity.

Step 3: Evaluate Option D. Anaphylactic shock represents an immediate Type I hypersensitivity immune reaction, which is distinct from teratogenesis.

Step 4: Evaluate Option C. The induction of structural or functional defects in a developing fetus matches the definition of a teratogenic drug action.

Final Answer: Structural or functional defects in a developing fetus

Answer: (C)

Go Back to Question 20

Q21.

Solution

Concept:

The human central nervous system integrates physiological inputs to maintain homeostasis through specialized nuclei in the brain. The hypothalamus, located directly inferior to the thalamus and forming the lower walls of the third ventricle, serves as the primary integration center for the autonomic nervous system. It monitors blood composition, core temperatures, and hormonal signals, coordinating homeostatic adjustments through direct neural pathways or endocrine control via the pituitary gland. It regulates body temperature, blood osmolarity, thirst, hunger, satiety, and circadian rhythms.

Solution:

Step 1: Analyze the primary functions of the listed brain regions.

Step 2: Evaluate the medulla oblongata. It contains vital reflex centers controlling cardiovascular output and basic respiratory rhythms, but it does not serve as the primary integrator for complex homeostatic behaviors like thirst or satiety.

Step 3: Evaluate the cerebellum. Its role is focused on coordinating skeletal muscle contractions, maintaining posture, and balancing motor control.

Step 4: Evaluate the hypothalamus. This region integrates sensory and metabolic signals to regulate temperature, osmolarity, thirst, and satiety, fulfilling the primary homeostatic integration role described.

Final Answer: Hypothalamus

Answer: (C)

Go Back to Question 21

Q22.

Solution

Concept:

Carbohydrates exhibit multiple forms of stereoisomerism due to the presence of asymmetric chiral carbon centers within their structures. Isomers that differ in configuration around only a single asymmetric carbon atom are defined as epimers. D-glucose and D-galactose are aldohexose monosaccharides with identical molecular formulas ($C_6H_{12}O_6$) and identical functional backbone configurations. When comparing their stereochemical structures, their spatial configurations are identical at carbon positions C-2, C-3, and C-5. They differ only in the spatial orientation of the hydroxyl group ($-OH$) around the C-4 chiral center. Therefore, D-glucose and D-galactose are epimers at the C-4 position.

Solution:

Step 1: Recall the structural differences between D-glucose and D-galactose.

Step 2: Examine C-1 configuration changes. Structural variations at the C-1 carbonyl carbon of a cyclic sugar define anomers, not epimers.

Step 3: Examine C-2 differences. D-glucose and D-mannose differ at the C-2 position, making them C-2 epimers.

Step 4: Examine C-4 differences. The structural divergence between D-glucose and D-galactose occurs at the fourth carbon atom, which classifies them as epimers at C-4.

Final Answer: Epimers at C-4

Answer: (B)

Go Back to Question 22

Q23.

Solution

Concept:

The Narcotic Drugs and Psychotropic Substances (NDPS) Act of 1985 provides the legal framework for controlling and regulating operations relating to narcotic drugs and psychotropic substances across India. To prevent illicit production and diversion into illegal trade while ensuring an adequate supply for legitimate medical and scientific research, the Act centralizes control over highly addictive plant materials. Under these legal provisions, the cultivation of the opium poppy (*Papaver somniferum*) is strictly prohibited unless authorized under a specific license issued by the Central Government's Narcotics Commissioner, which restricts cultivation to designated land tracts.

Solution:

Step 1: Review the regulatory framework of the NDPS Act of 1985 regarding poppy cultivation.
Step 2: Evaluate the jurisdictional level. Cultivation control is maintained at the federal/central level rather than being delegated to state revenue offices or local gram panchayats to ensure compliance with international treaties.
Step 3: Identify the specific administrative process. The mechanism relies on a strict licensing program managed by the Central Government, which dictates land allocation and harvest quotas. This matches the legal provisions of the Act.

Final Answer: Central Government licensing and strict allocation of land tracts

Answer: (A)

Go Back to Question 23

Q24.

Solution

Concept:

Pharmaceutical incompatibilities occur when mixing two or more substances results in physical, chemical, or therapeutic changes that compromise the formulation. A physical incompatibility can occur when certain solid organic compounds are triturated together at room temperature. Camphor, menthol, and thymol are crystalline substances that, when brought into intimate physical contact, form intermolecular hydrogen bonds. This chemical interaction lowers the collective melting point of the mixture to a temperature below ambient room temperature (25°C). As a result, the solid crystalline powders liquefy without undergoing chemical degradation, a phenomenon known as eutectic mixture formation.

Solution:

Step 1: Observe the physical states of the starting materials. Camphor, menthol, and thymol are all solid crystalline powders at room temperature.

Step 2: Analyze the mechanical action. Triturating them together forces close molecular contact, leading to a depression of their mutual melting points.

Step 3: Identify the resulting phase change. The mixture transitions from a solid powder to a liquid phase.

Step 4: Classify the mechanism. This physical liquefaction due to a depressed melting point represents the formation of a eutectic mixture, distinguishing it from precipitation or chemical neutralization.

Final Answer: Liquefaction due to formation of a eutectic mixture

Answer: (A)

Go Back to Question 24

Q25.

Solution

Concept:

Organophosphate insecticides act as irreversible inhibitors of the acetylcholinesterase (AChE) enzyme. By phosphorylating the esteratic site of the enzyme, they prevent the breakdown of acetylcholine, leading to an accumulation of the neurotransmitter at muscarinic and nicotinic receptors. This accumulation causes a severe cholinergic crisis. Managing this toxicity requires a two-part pharmacological intervention: a competitive antagonist to block the excessive activation of muscarinic receptors, and an enzyme reactivator to restore acetylcholinesterase function before irreversible aging of the enzyme occurs.

Solution:

Step 1: Identify the primary agent needed to counter muscarinic symptoms (such as bradycardia, bronchorrhea, and miosis). Atropine sulfate serves as a competitive antagonist at muscarinic receptors and is titrated intravenously until signs of atropinization appear.

Step 2: Identify the agent needed to address nicotinic symptoms (such as muscle fasciculations and respiratory paralysis). Oximes, such as Pralidoxime (2-PAM), act as nucleophiles that cleave the phosphate bond from the acetylcholinesterase active site, reactivating the enzyme.

Step 3: Evaluate alternative options. Physostigmine and neostigmine are acetylcholinesterase inhibitors themselves, which would worsen the cholinergic crisis. Pilocarpine is a muscarinic agonist that would also exacerbate symptoms. This confirms that atropine sulfate paired with pralidoxime is the correct therapeutic choice.

Final Answer: Atropine sulfate paired with Pralidoxime

Answer: (B)

Go Back to Question 25

Q26.

Solution

Concept:

Glycopeptide antibiotics, such as Vancomycin, are large, hydrophilic molecules that exert their bactericidal effect by inhibiting bacterial cell wall synthesis. Unlike β-lactam antibiotics that bind directly to penicillin-binding proteins (PBPs), glycopeptides target the substrate of the cross-linking reaction. They bind with high affinity to the terminal amino acid residues of the uncross-linked peptidoglycan precursor chains within the cell wall matrix, preventing the proper assembly of the protective peptidoglycan layer.

Solution:

Step 1: Identify the molecular target of Vancomycin. It binds to the acyl-D-alanyl-D-alanine terminus of the growing peptidoglycan building blocks.

Step 2: Describe the immediate chemical consequence of this binding. The massive molecular bulk of the glycopeptide creates steric hindrance, blocking the access of transpeptidase (PBP) and transglycosylase enzymes to the substrate.

Step 3: Analyze the downstream cellular effect. Because cross-linking is prevented, the bacterial cell wall loses its mechanical integrity, leading to osmotic lysis.

Step 4: Exclude alternative options. Lipopolysaccharides are components of the outer membrane of Gram-negative bacteria, which are naturally resistant to Vancomycin due to size exclusion. Ribosomal subunits (30S) are targeted by aminoglycosides and tetracyclines, while topoisomerases are targeted by fluoroquinolones. This confirms the specific target is the D-Alanyl-D-Alanine terminus.

Final Answer: D-Alanyl-D-Alanine terminus of the peptidoglycan precursor

Answer: (B)

Go Back to Question 26

Q27.

Solution

Concept:

Ergot is a highly specialized crude drug obtained from the lifecycle of the fungus *Claviceps purpurea* (Family Clavicipitaceae), which parasitizes the ovaries of cereal crops, most notably rye (*Secale cereale*). From a pharmacognostical standpoint, the medicinal part used is not a standard plant tissue but a fungal survival structure known as a sclerotium. This structure forms during the sexual stage of the infection cycle, replacing the plant's grain with a dark purple, curved, elongated fungal mass containing ergot alkaloids such as ergotamine and ergometrine.

Solution:

Step 1: Analyze the biological source of Ergot. It is a product of fungal infection within the graminaceous host plant.

Step 2: Identify the specific developmental structure that accumulates the active alkaloids. The fungus transforms the host's ovary into a dense, compacted tissue mass.

Step 3: Define the terminology for this tissue. The correct mycological term for this resting or overwintering stage of the fungus is the dried sclerotium.

Step 4: Evaluate the remaining choices. Ascospores are reproductive units, hyphae are vegetative strands, and the perithecium is a fruiting body—none of these describe the complete commercial crude drug mass. Thus, it is defined as the dried sclerotium developed in the ovary of rye plants.

Final Answer: Dried sclerotium developed in the ovary of rye plants

Answer: (A)

Go Back to Question 27

Q28.

Solution

Concept:

A Fluid Bed Dryer (FBD) is highly efficient industrial equipment used in pharmaceutical manufacturing to dry wet granulations. It operates by passing hot air at high velocity through a perforated distribution plate, lifting and suspending the particles in a fluidized state. This intense, continuous physical contact and friction between rapidly moving dry particles, as well as between the particles and the metal walls of the chamber, leads to static electrification via the triboelectric effect. If this electrostatic charge is allowed to accumulate, it poses a severe risk of dust explosions and uneven material flow.

Solution:

Step 1: Understand the physics of fluidization inside an FBD. High-velocity friction creates static electrical charges across the high surface area of the suspended granules.

Step 2: Identify the environmental parameter that directly mitigates this charge. Atmospheric moisture or relative humidity in the fluidizing air acts as a natural conductor, helping dissipate static charges safely into the surroundings.

Step 3: Identify the primary mechanical safeguard required. The entire FBD assembly must be fitted with an integrated, verified earthing or grounding system to bleed off accumulated charges to the earth.

Step 4: Match these factors to the options. Controlling the humidity of the inlet air combined with the proper physical grounding of the equipment equipment directly addresses the electrostatic hazard, making Option B the correct choice.

Final Answer: Humidity of the inlet air and proper grounding of the equipment

Answer: (B)

Go Back to Question 28

Q29.

Solution

Concept:

Bence-Jones proteins are specialized monoclonal globulin proteins consisting of free immunoglobulin light chains (either kappa or lambda types) produced in excess by malignant plasma cells. Due to their relatively low molecular weight, these proteins are easily filtered across the renal glomerular basement membrane and enter the urine. A defining biochemical property of Bence-Jones proteins is their unique thermal behavior: they precipitate when heated to temperatures between 40°C and 60°C, but re-dissolve completely when boiling (100°C), a characteristic used as a diagnostic indicator for specific hematological malignancies.

Solution:

Step 1: Define the clinical and pathognomonic significance of Bence-Jones proteinuria.

Step 2: Evaluate the related diseases. Acute glomerulonephritis leads to a broad loss of serum proteins, primarily albumin, resulting in standard proteinuria. Obstructive jaundice presents with bilirubinuria, and diabetic ketoacidosis leads to glucosuria and ketonuria.

Step 3: Connect the marker to plasma cell dyscrasias. The uncontrolled clonal proliferation of plasma cells that produces these specific light chain proteins occurs almost exclusively in multiple myeloma. Therefore, detecting these proteins in urine is a key diagnostic marker for multiple myeloma.

Final Answer: Multiple myeloma

Answer: (B)

Go Back to Question 29

Q30.

Solution

Concept:

Glass containers used for packaging pharmaceutical products are classified into distinct types by international pharmacopoeias based on their chemical composition and hydrolytic resistance. This resistance determines the container's ability to resist leaching alkali oxides into aqueous preparations. Type I glass is highly resistant borosilicate glass, which contains substantial amounts of boric oxide, aluminum oxide, and alkaline earth oxides. This composition gives it exceptional chemical durability and a low thermal expansion coefficient, making it suitable for packaging highly sensitive parenteral formulations.

Solution:

Step 1: Recall the official pharmacopoeial classification scheme for glass packaging containers.

Step 2: Classify Type I glass. It is defined as borosilicate glass, which offers the highest chemical inertness.

Step 3: Classify the other types for comparison. Type II is treated soda-lime glass (modified via sulfur dealkalization), Type III is regular soda-lime glass, and Type IV (NP) is general-purpose, non-parenteral soda-lime glass.

Step 4: Match Type I directly to its material composition. It corresponds to borosilicate glass.

Final Answer: Borosilicate glass

Answer: (B)

Go Back to Question 30

Q31.

Solution

Concept:

The human systemic circulatory network relies on large venous conduits to return deoxygenated blood from peripheral organs back to the heart for re-oxygenation. The heart's right atrium serves as the central collection chamber for this returning systemic blood. Deoxygenated blood from regions located superior to the diaphragm (such as the head, neck, upper limbs, and thorax) is collected into a major venous channel known as the superior vena cava, which empties directly into the upper posterior portion of the right atrium.

Solution:

Step 1: Map the systemic venous drainage of the human body.

Step 2: Differentiate the roles of the primary vena cavae. The inferior vena cava collects deoxygenated blood from the lower half of the body (inferior to the diaphragm), such as the abdomen and lower extremities.

Step 3: Examine the pulmonary circuit. The pulmonary artery carries deoxygenated blood away from the right ventricle toward the lungs, which does not match the prompt's criteria.

Step 4: Examine the upper systemic drainage. The superior vena cava is the direct anatomical conduit draining the upper systemic regions into the right atrium.

Final Answer: Superior vena cava

Answer: (B)

Go Back to Question 31

Q32.

Solution

Concept:

Asymmetric membrane capsules or tablets represent a specialized category of controlled-release oral drug delivery systems. The coating membrane consists of a distinct, advanced polymeric structure characterized by a thin, dense, semi-permeable outer skin supported by a highly porous, thicker substructure. When this dosage form enters the gastrointestinal tract, water molecules diffuse across the semi-permeable membrane into the core, dissolving the drug and osmotic agents. This creates a high internal hydrostatic pressure. This pressure difference drives the dissolved drug out of the system through the macroscopic pores of the asymmetric membrane via convective flow.

Solution:

Step 1: Analyze the physical architecture of an asymmetric membrane coating. It is defined by its uneven pore density, featuring a dense outer skin and a porous sub-layer.

Step 2: Describe the internal mechanics. Water influx creates a hydrostatic pressure gradient between the tablet core and the external environment.

Step 3: Identify the transport mechanism. Instead of relying on simple molecular partitioning through a continuous polymer layer, the solution is forced through the porous pathways. This process is called hydrostatic pressure-driven convective flow through macroscopic pores.

Final Answer: Hydrostatic pressure-driven convective flow through macroscopic pores

Answer: (A)

Go Back to Question 32

Q33.

Solution

Concept:

The exchange of respiratory gases (O_2 and CO_2) between the external environment and the blood occurs across the ultra-thin respiratory membrane within the pulmonary alveoli. To optimize gas exchange via passive diffusion, the diffusion barrier must be as thin as possible. The alveolar wall is primarily composed of a single layer of delicate epithelial cells known as Type I alveolar cells or pneumocytes. Structurally, these are simple squamous epithelial cells that provide a minimal physical thickness, allowing gases to diffuse rapidly between the alveolar air spaces and the adjacent capillary network.

Solution:

Step 1: Evaluate the relationship between tissue structure and function in the respiratory tract.
Step 2: Analyze alternative epithelial structures. Pseudostratified ciliated columnar epithelium lines the upper airways (such as the trachea and bronchi) to trap and clear particulates, but it is too thick for gas diffusion. Stratified squamous epithelium protects high-friction zones (like the esophagus) and is also unsuitable.
Step 3: Identify the optimal diffusion tissue. Simple squamous epithelium provides the ultra-thin, flat surface required for efficient gas exchange across the blood-air barrier.

Final Answer: Simple squamous epithelial cells of the alveolus

Answer: (A)

Go Back to Question 33

Q34.

Solution

Concept:

The microscopic identification of crude organized drugs involves locating specific diagnostic cellular structures within tissue layers. Cinnamon bark (obtained from *Cinnamomum zeylanicum*, Family Lauraceae) displays distinct anatomical features under a microscope. A key diagnostic marker for this authentic bark is the presence of isolated, large cluster crystals of calcium oxalate distributed within the parenchymal cells of the phloem, combined with characteristic lignified phloem fibers that feature a distinctly wavy outline and thick, pitted walls.

Solution:

Step 1: Match the microscopic markers to the anatomical profiles of the listed barks.

Step 2: Evaluate Cinchona bark. It is characterized by large, isolated, bright yellow, structurally distinct phloem fibers with conspicuous longitudinal pits, but it does not feature wavy phloem fibers or predominant cluster crystals.

Step 3: Evaluate Cascara bark. It contains a characteristic horse-shoe shaped sclerenchyma band and crystal sheaths, which differs from the prompt's description.

Step 4: Confirm the features of Cinnamon bark. The combination of cluster crystals of calcium oxalate and lignified phloem fibers with a wavy outline is a diagnostic profile for Cinnamon bark.

Final Answer: Cinnamon bark

Answer: (C)

Go Back to Question 34

Q35.

Solution

Concept:

An S_N2 mechanism (Substitution Nucleophilic Bimolecular) is a single-step, concerted organic reaction where bond-breaking and bond-formation happen simultaneously. The incoming nucleophile attacks the electrophilic carbon center from the side directly opposite to the leaving group (backside attack). This requires the molecule to pass through a high-energy pentacoordinate transition state. This backside attack forces the three remaining substituents to flip to the opposite side, resulting in a complete inversion of stereochemical configuration at the reaction site, a process known as Walden inversion.

Solution:

Step 1: Analyze the reaction kinetics of the S_N2 pathway. It is a bimolecular, single-step reaction without any ionic intermediates.

Step 2: Contrast this with the S_N1 pathway. S_N1 reactions involve a planar carbocation intermediate that allows nucleophilic attack from either side, resulting in racemization. This does not apply to S_N2 reactions.

Step 3: Describe the transition state of an S_N2 reaction. The carbon center is transiently bonded to both the nucleophile and the leaving group in a pentacoordinate arrangement.

Step 4: Determine the stereochemical outcome. The concerted backside attack causes a complete inversion of configuration. This is described as a Walden inversion of configuration through a pentacoordinate transition state.

Final Answer: Walden inversion of configuration through a pentacoordinate transition state

Answer: (B)

Go Back to Question 35

Q36.

Solution

Concept:

In hospital pharmacy management, procurement involves acquiring high-quality pharmaceuticals and medical supplies at the most economical costs. A formalized "Tender System" is a competitive procurement method used by institutional and government hospitals. The institution publishes an open or restricted invitation detailing the technical specifications and estimated quantities of required items. Manufacturers and approved suppliers submit sealed financial and technical bids, allowing the hospital to select suppliers through a transparent evaluation process.

Solution:

Step 1: Identify the primary administrative goal of using a tender system in an institutional setting.
Step 2: Evaluate the operational mechanics. By inviting multiple verified manufacturers to submit bids simultaneously, the market drives down pricing through competition.
Step 3: Analyze quality assurance integration. The system mandates that all bids meet pre-defined pharmacopoeial standards, ensuring high quality alongside cost efficiency.
Step 4: Conclude that a tender system is primarily implemented to ensure transparent, competitive, and cost-effective procurement of bulk items.

Final Answer: Transparent, competitive, and cost-effective procurement of bulk items

Answer: (B)

Go Back to Question 36

Q37.

Solution

Concept:

Glycolysis, also known as the Embden-Meyerhof-Parnas pathway, is a foundational metabolic sequence that takes place in the cytosol of all human cells. It functions independently of molecular oxygen to break down one molecule of six-carbon glucose into two molecules of three-carbon pyruvate. During this anaerobic catabolic process, a net yield of two molecules of ATP and two molecules of NADH is generated via substrate-level phosphorylation, providing a vital source of cellular energy during periods of limited oxygen supply or intensive muscular exertion.

Solution:

Step 1: Analyze the oxygen requirements of the listed metabolic pathways.

Step 2: Evaluate the Citric Acid Cycle (Krebs cycle). This pathway takes place in the mitochondria and is strictly aerobic, requiring oxygen to act as the final electron acceptor via the electron transport chain.

Step 3: Evaluate the Pentose Phosphate Pathway. This pathway is an anabolic shunt focused on producing NADPH and ribose-5-phosphate rather than generating ATP energy.

Step 4: Identify the anaerobic ATP-generating pathway. Glycolysis breaks down glucose into pyruvate under anaerobic conditions, matching the criteria.

Final Answer: Glycolysis (Embden-Meyerhof pathway)

Answer: (B)

Go Back to Question 37

Q38.

Solution

Concept:

Crude drugs can be systematically organized using various classification schemes, including morphological, taxonomic, pharmacological, and chemical methods. Chemotaxonomic classification is an advanced approach that bridges taxonomy and phytochemistry. It is based on the regular distribution of specific chemical constituents across related plant families. This method leverages the understanding that plants with close evolutionary and phylogenetic relationships often share similar secondary metabolic pathways, leading them to synthesize similar classes of active pharmaceutical compounds.

Solution:

Step 1: Define the operational principle of chemotaxonomic classification. It combines chemical profiling with taxonomic grouping.

Step 2: Contrast this method with alternative classification schemes. Grouping by therapeutic action defines pharmacological classification. Grouping by plant parts used defines morphological classification.

Step 3: Isolate the core criteria of chemotaxonomy. It categorizes drugs based on the chemical nature of their active constituents within a taxonomic framework. This aligns with Option B.

Final Answer: The chemical nature of their active constituents

Answer: (B)

Go Back to Question 38

Q39.

Solution

Concept:

Digitalis cardiac glycosides, such as Digoxin, are positive inotropic agents used to manage heart failure and certain cardiac arrhythmias. Their mechanism of action relies on binding to and inhibiting the extracellular domain of the Na^+/K^+-ATPase pump embedded within the sarcolemma of myocardial cells. This inhibition stops the active transport of three sodium ions out of the cell and two potassium ions into the cell, altering the intracellular ion concentrations.

Solution:

Step 1: Detail the cellular ion exchange changes caused by inhibiting the pump. Inhibiting Na^+/K^+-ATPase leads to an accumulation of intracellular sodium ions.

Step 2: Analyze the secondary effect on the Na^+/Ca^{2+} exchanger (NCX). The reduced sodium gradient across the sarcolemma slows down the activity of the Na^+/Ca^{2+} exchanger, which normally pumps calcium out of the cell in exchange for sodium entry.

Step 3: Determine the final ion concentration change. This reduction in calcium efflux leads to an accumulation of intracellular calcium ions within the sarcoplasmic reticulum. This increased calcium availability enhances myofibril cross-bridge formation, increasing the force of myocardial contraction (positive inotropy). This matches Option A.

Final Answer: Inhibition of the Na^+/K^+-ATPase pump, leading to increased intracellular calcium

Answer: (A)

Go Back to Question 39

Q40.

Solution

Concept:

The World Health Organization (WHO) and national public health bodies implement structured strategies to manage endemic infectious diseases. The DOTS strategy, which stands for Directly Observed Treatment, Short-course, is a comprehensive public health initiative designed to control the transmission and spread of pulmonary tuberculosis caused by *Mycobacterium tuberculosis*. The core component of the DOTS framework requires a trained health worker or community volunteer to directly observe the patient swallowing each dose of anti-tubercular medication, ensuring strict patient adherence and preventing the development of multi-drug resistant strains.

Solution:

Step 1: Decode the medical acronym DOTS: Directly Observed Treatment, Short-course.

Step 2: Match this therapeutic strategy to its target disease. This multi-drug, highly structured regimen was developed specifically to manage the long treatment durations required for mycobacterial infections.

Step 3: Identify the corresponding target disease. The DOTS framework is the globally recognized strategy for managing pulmonary tuberculosis.

Final Answer: Pulmonary Tuberculosis

Answer: (B)

Go Back to Question 40

Q41.

Solution

Concept:

Size reduction is an essential unit operation in pharmaceutics used to increase the surface area of materials, improve dissolution rates, and ensure content uniformity. Different milling equipment implements distinct mechanical actions, such as impact, attrition, compression, or cutting. A ball mill consists of a hollow, rotating cylindrical vessel containing metallic or porcelain spheres (balls). As the cylinder rotates, the balls are lifted and cascade down onto the material. This action combines high-energy impact from the falling balls with continuous attrition from the spheres sliding against one another, making it highly effective for grinding abrasive materials into a fine powder.

Solution:

Step 1: Analyze the mechanical mechanisms of the listed mills. A hammer mill relies almost entirely on impact, which can cause excessive wear when processing highly abrasive materials. A cutter mill operates via a shearing action, which is suited for fibrous materials.

Step 2: Evaluate the action of a ball mill. The combination of balls cascading and rolling inside a rotating drum generates both impact and attrition forces simultaneously.

Step 3: Assess its suitability for abrasive materials. The enclosed, heavy-duty design of a ball mill can withstand abrasive materials without excessive mechanical wear, effectively reducing them to a fine powder. This aligns with Option C.

Final Answer: Ball mill

Answer: (C)

Go Back to Question 41

Q42.

Solution

Concept:

The mucosal lining of the human small intestine is anatomically specialized to maximize the surface area available for digesting and absorbing nutrients. This surface area extension is achieved through structural adaptations across multiple anatomical scales. The mucosa is folded into finger-like macroscopic projections known as villi. Furthermore, the plasma membrane of the individual simple columnar epithelial enterocytes is folded into microscopic projections termed microvilli, which form the brush border. Together with the circular folds (plicae circulares), these structures increase the absorptive surface area of the small intestine more than 600-fold.

Solution:

Step 1: Evaluate the structural adaptations of the gastrointestinal tract.

Step 2: Analyze alternative choices. Haustra and taeniae coli are structural features of the large intestine involved in pouching and segmenting fecal matter, not nutrient absorption. Rugae are temporary folds found in the stomach that allow for expansion.

Step 3: Connect the structures to small intestinal absorption. Villi and microvilli form the specialized brush border interface designed to maximize nutrient transport into the circulatory and lymphatic systems.

Final Answer: Villi and microvilli of the brush border

Answer: (B)

Go Back to Question 42

Q43.

Solution

Concept:

Lipids are heterogeneous organic molecules classified into simple, complex (compound), or derived lipids based on their chemical composition. Simple lipids are fatty acid esters of alcohols, such as triglycerides. Complex lipids contain additional chemical groups beyond fatty acids and an alcohol, such as phosphoric acid, carbohydrate moieties, or specific nitrogenous bases. Sphingomyelin is a prominent complex lipid found in high concentrations within the myelin sheath of nerve cells. Structurally, it contains an amino alcohol core (sphingosine) attached to a fatty acid, a phosphate group, and a choline residue, classifying it as a phospholipid.

Solution:

Step 1: Analyze the chemical structural components of sphingomyelin. It consists of sphingosine, a long-chain fatty acid, a phosphate group, and a nitrogenous base (choline).

Step 2: Apply the lipid classification framework. The presence of the functional phosphate group removes it from the simple lipid category.

Step 3: Classify based on functional groups. Because it contains a structural phosphate backbone group, it is classified within the compound or complex lipid group, specifically as a phospholipid. This corresponds to Option B.

Final Answer: Complex/Phospholipids

Answer: (B)

Go Back to Question 43

Q44.

Solution

Concept:

Immunobiological formulations are classified based on the nature of the antigen used to stimulate host immunity. Live attenuated vaccines are prepared by modifying wild-type pathogens in a laboratory setting to eliminate their virulence while preserving their viability. When administered, these attenuated organisms replicate within the host, stimulating a comprehensive, long-lasting immune response that involves both humoral (antibody-mediated) and cell-mediated pathways. This replication typically provides durable immunity without causing the full clinical symptoms of the disease.

Solution:

Step 1: Review the formulation characteristics of the MMR vaccine. The MMR vaccine provides protection against Measles, Mumps, and Rubella.

Step 2: Identify the vaccine type. All three viral components in the standard MMR formulation are live, attenuated viral strains.

Step 3: Contrast with other vaccine types. Toxoid vaccines use inactivated bacterial toxins (such as tetanus toxoid). Inactivated vaccines contain killed pathogens that cannot replicate, often requiring booster doses. Subunit vaccines use isolated antigen fragments.

Step 4: Match the description to the correct option. The MMR vaccine is a live attenuated formulation that provides long-lasting protection.

Final Answer: MMR vaccine (Live attenuated)

Answer: (C)

Go Back to Question 44

Q45.

Solution

Concept:

Neuromuscular blocking agents are drugs that interrupt the transmission of nerve impulses at the skeletal neuromuscular junction, causing muscle relaxation. These agents are classified as depolarizing or non-depolarizing blocks. d-Tubocurarine is a classic non-depolarizing neuromuscular blocker. It acts as a competitive antagonist by binding directly to nicotinic cholinergic (N_M) receptors located on the post-junctional motor endplate. This binding competitively blocks acetylcholine from interacting with the receptors, preventing endplate depolarization and muscle contraction.

Solution:

Step 1: Identify the site of action for d-Tubocurarine, which is the somatic neuromuscular junction.

Step 2: Define its interaction with the receptor. It binds competitively to the N_M nicotinic receptor without stimulating it, acting as a competitive antagonist.

Step 3: Contrast with depolarizing agents. Succinylcholine is a depolarizing blocker that causes persistent activation and depolarization of the endplate, which is a different mechanism.

Step 4: Exclude enzymatic pathways. It does not inhibit acetylcholinesterase or affect calcium release from the sarcoplasmic reticulum. This confirms it acts as an antagonist at the N_M receptors.

Final Answer: Antagonism of nicotinic (N_M) receptors at the skeletal neuromuscular junction

Answer: (B)

Go Back to Question 45

Q46.

Solution

Concept:

Cardiac glycosides, such as those found in *Digitalis* species, consist of an aglycone genin core linked to a sugar moiety. The sugar portion often includes specialized 2,6-deoxysugars like digitoxose. In pharmacognosy, specific colorimetric chemical tests are used to identify these structural components. The Keller-Kiliani test is a diagnostic color test used to detect 2,6-deoxysugars. The test is performed by dissolving the extract in glacial acetic acid containing a trace amount of ferric chloride, followed by the cautious addition of concentrated sulfuric acid to form a lower layer.

Solution:

Step 1: Analyze the chemical reagents and outcomes of the listed tests.

Step 2: Evaluate Borntrager's test. This test is used to detect anthraquinone glycosides, producing a pink-to-red color in an alkaline layer.

Step 3: Evaluate Legal's and Raymond's tests. These tests are used to detect the unsaturated lactone ring of the cardenolide aglycone core, not the sugar component.

Step 4: Evaluate the Keller-Kiliani test. A positive test produces a reddish-brown ring at the junction of the liquid layers, and the upper acetic acid layer gradually turns a characteristic bluish-green color. This reaction confirms the presence of deoxysugars.

Final Answer: Keller-Kiliani test

Answer: (C)

Go Back to Question 46

Q47.

Solution

Concept:

Ophthalmic formulations must be formulated to match the physiological properties of lacrimal fluid to prevent pain, tissue irritation, and cellular damage upon administration. Isotonicity signifies that the formulation possesses the same osmotic pressure and solute concentration as the biological fluids across a semi-permeable cell membrane. Human blood plasma and lacrimal fluid exert an osmotic pressure equivalent to a 0.9% w/v aqueous solution of sodium chloride (NaCl). Therefore, a 0.9% w/v sodium chloride solution is used as the standard reference for adjusting pharmaceutical tonicity.

Solution:

Step 1: Identify the standard physiological baseline for tonicity adjustments in ophthalmic and parenteral solutions.

Step 2: Recall the percentage concentration of sodium chloride that is isotonic with human lacrimal secretions and blood plasma.

Step 3: Note that a concentration of 0.45% w/v is hypotonic, whereas concentrations like 2.0% w/v or 5.0% w/v are hypertonic and can cause cellular crenation.

Step 4: Select the exact value that represents physiological isotonicity, which is 0.9% w/v.

Final Answer: 0.9% w/v

Answer: (B)

Go Back to Question 47

Q48.

Solution

Concept:

Glycolysis is regulated through specific enzymes that catalyze highly exergonic, irreversible reactions. The primary committed, rate-limiting step of the glycolytic pathway is the phosphorylation of fructose-6-phosphate to form fructose-1,6-bisphosphate. This reaction consumes one molecule of ATP and is catalyzed by the allosteric enzyme Phosphofructokinase-1 (PFK-1). Once fructose-1,6-bisphosphate is synthesized, the molecule is committed to cleavage and subsequent steps within the glycolytic pathway, making PFK-1 a key site for metabolic control.

Solution:

Step 1: Identify the three irreversible steps of glycolysis: hexokinase, phosphofructokinase-1, and pyruvate kinase.

Step 2: Differentiate the roles of these enzymes. Hexokinase converts glucose to glucose-6-phosphate, but this product can enter alternative pathways like the pentose phosphate pathway or glycogen synthesis, so it is not the committed step for glycolysis.

Step 3: Analyze the reaction catalyzed by Phosphofructokinase-1 (PFK-1). The conversion of fructose-6-phosphate to fructose-1,6-bisphosphate commits the carbohydrate to glycolytic degradation. This establishes PFK-1 as the enzyme that catalyzes the primary committed step.

Final Answer: Phosphofructokinase-1 (PFK-1)

Answer: (B)

Go Back to Question 48

Q49.

Solution

Concept:

The preparation of sterile pharmaceutical formulations, such as intravenous admixtures, total parenteral nutrition (TPN), and ophthalmic solutions, must be conducted within a controlled clean room environment to prevent microbial and particulate contamination. Clean rooms are classified under ISO 14644-1 standards based on the maximum allowable concentration of airborne particulates per cubic meter of air. The critical zone where sterile products are exposed to the environment during aseptic compounding must meet strict air quality requirements, equivalent to ISO Class 5 standards.

Solution:

Step 1: Review the environmental classification guidelines for sterile compounding areas.

Step 2: Define the baseline clean room zones. A typical compounding clean room includes a background area (often meeting ISO Class 7 or Class 8 standards) and a localized critical working zone.

Step 3: Identify the requirement for the immediate compounding area (such as a laminar airflow workbench). The air quality in this zone must not exceed 3,520 particles of size 0.5 μm or larger per cubic meter, which defines ISO Class 5 (historically referred to as Federal Standard 209E Class 100). This aligns with Option A.

Final Answer: ISO Class 5 (Class 100)

Answer: (A)

Go Back to Question 49

Q50.

Solution

Concept:

The chlorination of chiral secondary alcohols using thionyl chloride ($SOCl_2$) can proceed through different stereochemical pathways depending on the solvent conditions. In the absence of a nucleophilic solvent or a base like pyridine, the reaction proceeds via an S_Ni (Substitution Nucleophilic Internal) mechanism. The reaction begins with the alcohol reacting with $SOCl_2$ to form an intermediate alkyl chlorosulfite, releasing HCl. This intermediate then decomposes into an intimate ion pair within a solvent cage. The chloride ion then attacks the carbon center from the same side from which the sulfur dioxide leaving group departs, preserving the original spatial arrangement.

Solution:

Step 1: Identify the mechanism for the reaction between an alcohol and thionyl chloride without added pyridine. It follows an internal nucleophilic substitution (S_Ni) pathway.

Step 2: Describe the configuration changes during an S_Ni reaction. The nucleophilic chloride ion is delivered from the front side of the molecule via the decomposition of the chlorosulfite intermediate.

Step 3: Determine the stereochemical outcome. This front-side delivery prevents inversion, leading to retention of stereochemical configuration.

Step 4: Contrast with alternative conditions. If pyridine were present, it would react with the intermediate to generate a free chloride ion, which would execute a backside attack via an S_N2 mechanism, resulting in an inversion of configuration. In this configuration without pyridine, retention occurs.

Final Answer: Retention of configuration (S_Ni mechanism)

Answer: (A)

Go Back to Question 50

Q51.

Solution

Concept:

The thyroid gland consists of two distinct endocrine cell populations. The follicular cells synthesize iodinated thyroid hormones (thyroxine, T_4 and triiodothyronine, T_3) to regulate systemic basal metabolic rates. Interspersed among these follicles are the parafollicular cells, also known as C-cells. These neuroendocrine cells synthesize and secrete calcitonin, a 32-amino-acid peptide hormone that plays a critical role in mineral homeostasis by opposing the actions of parathyroid hormone (PTH) to decrease calcium concentrations in blood plasma.

Solution:

Step 1: Identify the hormone secreted by the thyroid gland's C-cells. This is calcitonin.

Step 2: Analyze its physiological mechanisms. Calcitonin decreases blood calcium levels (Ca^{2+}) through two main targeted activities: it directly inhibits the bone-resorbing activity of osteoclasts (suppressing calcium release into circulation) and increases renal calcium excretion by decreasing tubular reabsorption.

Step 3: Contrast with alternatives. Parathyroid hormone (PTH) increases blood calcium levels. T_4 and T_3 regulate cellular metabolism rather than short-term calcium fluxes. This confirms Option B as the correct answer.

Final Answer: Calcitonin

Answer: (B)

Go Back to Question 51

Q52.

Solution

Concept:

In pharmacognosy, evaluating crude drugs involves detecting fraudulent practices used to manipulate market values. Adulteration is the intentional or accidental substitution of a genuine crude drug with inferior, exhausted, or chemically altered substances. A highly sophisticated type of intentional adulteration is known as sophistication, where modifiers add materials resembling the genuine article to pass quality testing based purely on visual look. However, pharmacopoeias often use the broader term "adulteration" to describe any debasement of a drug sample with inferior elements for commercial gain.

Solution:

Step 1: Evaluate the technical terms for crude drug degradation.

Step 2: Differentiate the categories. Substitution involves swapping the drug entirely for a different botanical species. Deterioration is a natural reduction in quality due to poor storage or aging.

Step 3: Analyze the scenario where inferior, exhausted, or altered elements are added to mimic the pure drug's appearance. This is a deliberate act of debasement for economic gain, which falls under the legal and scientific classification of adulteration. This matches Option B.

Final Answer: Adulteration

Answer: (B)

Go Back to Question 52

Q53.

Solution

Concept:

The homeostatic control of blood pressure relies partly on renal prostaglandin production. Vasodilatory prostaglandins, such as PGI_2 (prostacyclin) and PGE_2, are produced in the kidneys to maintain baseline renal blood flow, counteract vasoconstrictor systems, and promote sodium excretion (natriuresis). When a patient receives concurrent therapy with a non-steroidal anti-inflammatory drug (NSAID) and an angiotensin-converting enzyme (ACE) inhibitor, a significant pharmacodynamic drug interaction occurs.

Solution:

Step 1: Analyze the therapeutic pathway of the ACE inhibitor (Enalapril). Enalapril blocks angiotensin II production to promote systemic vasodilation and lower blood pressure.

Step 2: Examine the mechanism of the NSAID (Indomethacin). Indomethacin inhibits cyclooxygenase (COX) enzymes, which suppresses the synthesis of prostaglandins PGI_2 and PGE_2.

Step 3: Determine the consequence of this co-administration. Inhibiting these renal prostaglandins blocks their vasodilatory effect and impairs sodium excretion, leading to fluid retention and an increase in systemic vascular resistance. This counters the antihypertensive action of the ACE inhibitor, matching Option A.

Final Answer: NSAID-induced inhibition of vasodilatory prostaglandins

Answer: (A)

Go Back to Question 53

Q54.

Solution

Concept:

Pharmaceutical store management and inventory control use mathematical metrics to maintain supply chain efficiency and avoid capital lock-up. The Inventory Turnover Ratio (ITR) is an operational ratio that measures how efficiently a business manages its stock assets over an accounting period. It evaluates how many times a pharmacy's average inventory investment is sold and replaced during a year, calculated using the formula:

$$\text{Inventory Turnover Ratio} = \frac{\text{Cost of Goods Sold (COGS)}}{\text{Average Inventory Value}}$$

Solution:

Step 1: Analyze the parameter that links inventory replacement velocity with capital deployment.

Step 2: Evaluate the alternatives. Lead time measures the delay between placing an order and receiving stock. Safety stock represents the buffer quantity kept to prevent stockouts.

Step 3: Define the metric tracking sales frequency relative to asset investment. The Inventory Turnover Ratio quantifies how often the average stock investment moves through the retail cycle, making it the primary metric for tracking inventory velocity. This matches Option B.

Final Answer: Inventory turnover ratio

Answer: (B)

Go Back to Question 54

Q55.

Solution

Concept:

The human female reproductive tract consists of specialized structures designed for gamete transport, fertilization, and embryonic development. The ovaries release a mature oocyte during ovulation, which enters the fallopian tubes (also known as oviducts or uterine tubes). The fallopian tubes are lined with ciliated epithelial cells that generate directional fluid currents to move the ovum toward the uterus.

Solution:

Step 1: Track the path of gametes during reproduction. Sperm cells deposited in the vagina migrate upward through the cervical canal and uterine cavity to reach the fallopian tubes.

Step 2: Locate the site of fertilization. Fertilization typically occurs within the expanded lateral third of the fallopian tube, a region known as the ampulla.

Step 3: Exclude alternative structures. The uterine endometrium is the site of blastocyst implantation and gestation, not fertilization. The ovary cortex houses developing follicles, and the cervical canal serves as a entry gateway. This confirms that the fallopian tubes are the primary site of fertilization, matching Option B.

Final Answer: Fallopian tubes (Oviducts)

Answer: (B)

Go Back to Question 55

Q56.

Solution

Concept:

The monoamine hypothesis of depression links mood disorders to a deficiency in neurotransmitters like serotonin (5-HT) and norepinephrine within key synaptic regions of the brain. Selective Serotonin Reuptake Inhibitors (SSRIs), including Fluoxetine, are first-line antidepressants designed to address this deficit by modulating synaptic transmission.

Solution:

Step 1: Identify the primary molecular target of SSRIs. These drugs target the Serotonin Transporter (SERT) protein located on the presynaptic neuronal membrane.

Step 2: Describe the physiological mechanism. Under normal conditions, SERT actively reuptakes serotonin from the synaptic cleft back into the presynaptic terminal to terminate signaling.

Step 3: Determine the drug's effect. By binding to and inhibiting SERT, Fluoxetine blocks this reuptake pathway. This prolongs the residence time of serotonin within the synaptic cleft, increasing activation of postsynaptic 5-HT receptors and stimulating downstream signaling pathways that help alleviate depressive symptoms. This matches Option B.

Final Answer: Inhibition of the serotonin transporter (SERT) protein in the synaptic cleft

Answer: (B)

Go Back to Question 56

Q57.

Solution

Concept:

Public health epidemiology classifies communicable diseases based on their causative pathogens and transmission vectors. Dengue fever is an acute febrile viral disease caused by the Dengue virus (DENV, serotypes 1–4), a member of the Flaviviridae family. Because there are limited antiviral therapies available for Dengue, public health prevention programs focus heavily on vector control measures to disrupt transmission.

Solution:

Step 1: Identify the primary biological vector responsible for transmitting the Dengue virus to human hosts. This is the female *Aedes aegypti* mosquito.

Step 2: Examine vector characteristics. This mosquito species is a day-biting vector that breeds in clean, stagnant water collections around urban households.

Step 3: Contrast with other species. *Anopheles* mosquitoes transmit malaria, while *Culex* species serve as vectors for lymphatic filariasis and West Nile virus. This confirms that vector control programs targeting *Aedes aegypti* are essential for interrupting Dengue transmission, matching Option C.

Final Answer: *Aedes aegypti*

Answer: (C)

Go Back to Question 57

Q58.

Solution

Concept:

The physical stability of pharmaceutical suspensions relies on balancing sedimentation rates and particle redispersibility. According to Stokes' Law, the sedimentation velocity (v) of a suspended particle is inversely proportional to the viscosity (η) of the continuous external medium:

$$v = \frac{2r^2(\rho_s - \rho_0)g}{9\eta}$$

To reduce the settling rate of dispersed solid particles, formulations incorporate high-molecular-weight hydrophilic polymers known as suspending agents.

Solution:

Step 1: Identify the chemical nature of sodium carboxymethylcellulose (Na-CMC). It is a semi-synthetic, water-soluble cellulose derivative.

Step 2: Determine its role in an aqueous suspension. When dissolved, Na-CMC forms a hydrated polymeric network that increases the viscosity of the external phase, reducing the sedimentation velocity of the suspended particles.

Step 3: Evaluate its properties. It also acts as a hydrophilic colloid, coating the hydrophobic surface of dispersed drug particles to prevent close compaction and help maintain structural homogeneity. This matches Option B.

Final Answer: Hydrophilic suspending and viscosity-modifying agent

Answer: (B)

Go Back to Question 58

Q59.

Solution

Concept:

When the chemical structure of a drug is complex or variable, standard physicochemical analysis (like titration or spectrophotometry) may not accurately measure therapeutic activity. In such cases, pharmacology uses biological standardization. A bioassay is an experimental technique used to estimate the potency, concentration, or activity of a drug, hormone, or toxin by measuring its biological response on a living system, such as isolated tissues, cell cultures, or intact animal models.

Solution:

Step 1: Analyze the specified evaluation technique for digitalis. The preparation is administered to an animal model (such as a guinea pig or pigeon) to determine the minimum lethal dose required to induce cardiac arrest.

Step 2: Define this analytical approach. Because it quantifies potency by measuring a functional biological endpoint in a living organism, it is classified as a bioassay.

Step 3: Contrast with alternatives. Microbiological assays measure zone inhibition or growth in microorganisms, while radioimmunoassays use radiolabeled antibodies to measure antigen concentrations. This confirms Option B as the correct answer.

Final Answer: Bioassay

Answer: (B)

Go Back to Question 59

Q60.

Solution

Concept:

The gastric mucosa contains specialized secretory structures called gastric glands, which house distinct cell types that facilitate digestion. Intrinsic factor is a glycoprotein that binds dietary Vitamin B_{12} (cyanocobalamin) in the acidic environment of the stomach, protecting it from enzymatic breakdown until it can be absorbed via receptor-mediated endocytosis in the terminal ileum.

Solution:

Step 1: Review the secretory roles of gastric mucosal cells.

Step 2: Analyze each cell type. Chief cells synthesize and secrete pepsinogen, an inactive proteolytic proenzyme. G-cells are endocrine cells that secrete the hormone gastrin into the bloodstream. Mucous neck cells produce protective alkaline mucus.

Step 3: Identify the cell responsible for intrinsic factor. The parietal cells (also called oxyntic cells), which use proton pumps to secrete hydrochloric acid (HCl), are also responsible for synthesizing and secreting intrinsic factor. This makes them essential for Vitamin B_{12} absorption, matching Option B.

Final Answer: Parietal cells (Oxyntic cells)

Answer: (B)

Go Back to Question 60

Q61.

Solution

Concept:

The structural classification of heterocycles identifies organic ring systems based on the number of ring atoms and the identity of their heteroatoms. Isoniazid (isonicotinic acid hydrazide) is a key first-line synthetic antitubercular agent. Chemically, it consists of a hydrazide functional group attached to a central six-membered aromatic ring containing a single nitrogen heteroatom.

Solution:

Step 1: Analyze the chemical structure of Isoniazid shown in the diagram. The structure features a six-membered unsaturated aromatic ring with a single nitrogen atom located at position 4 relative to the hydrazide substituent ($-CONHNH_2$).

Step 2: Match this structure to its heterocyclic name. A six-membered aromatic ring containing one nitrogen atom is called a pyridine ring.

Step 3: Differentiate from alternatives. Imidazole and thiazole are five-membered rings, while pyrimidine is a six-membered ring containing two nitrogen atoms. Therefore, the core heterocyclic structure of Isoniazid is a pyridine ring, matching Option B.

Final Answer: Pyridine ring

Answer: (B)

Go Back to Question 61

Q62.

Solution

Concept:

Pharmaceutical laws organize medications into distinct legal schedules based on their safety margins, potential for abuse, and the need for medical supervision. Over-the-Counter (OTC) drugs are medications that have been determined safe and effective for consumer use without a prescription from a healthcare provider, provided they carry clear labeling for self-diagnosis and self-treatment of mild, temporary conditions.

Solution:

Step 1: Evaluate the prescription requirements for the listed medications.

Step 2: Classify the restricted options. Alprazolam is a benzodiazepine classified as a controlled substance due to its risk of dependence. Amoxicillin is a systemic antibiotic that requires professional oversight to prevent antimicrobial resistance. Prednisolone is a potent corticosteroid that can cause systemic side effects if used unmonitored.

Step 3: Identify the OTC medication. Paracetamol (acetaminophen) is an established antipyretic and analgesic with a wide safety margin when used at recommended doses, allowing it to be sold over the counter for mild pain relief. This matches Option A.

Final Answer: Paracetamol

Answer: (A)

Go Back to Question 62

Q63.

Solution

Concept:

The quantitative analysis of pharmaceutical compounds using absorption spectroscopy relies on electronic transitions within molecules exposed to electromagnetic radiation. The ultraviolet (UV) region of the electromagnetic spectrum is sub-divided into the far-UV (100 nm to 200 nm) and near-UV (200 nm to 400 nm) regions, followed by the visible light region (400 nm to 800 nm). Organic molecules containing conjugated π-electron systems absorb radiation within these ranges, promoting valency electrons from ground-state bonding orbitals to higher-energy anti-bonding molecular orbitals ($\pi \rightarrow \pi^*$ transitions).

Solution:

Step 1: Match the specified wavelength range (200 nm to 400 nm) to its region of the electromagnetic spectrum. This range corresponds to the ultraviolet region.

Step 2: Identify the corresponding analytical instrument. An instrument configured to measure light transmittance and absorbance across both the ultraviolet and visible spectrums is a UV-Visible Spectrophotometer.

Step 3: Differentiate from alternatives. Infrared instruments operate at longer wavelengths (2.5 μm to 15 μm), and flame photometers measure atomic emission rather than molecular absorption. This confirms Option B as the correct answer.

Final Answer: UV-Visible Spectrophotometer

Answer: (B)

Go Back to Question 63

Q64.

Solution

Concept:

Post-harvest preservation in pharmacognosy aims to protect active secondary metabolites within plant tissues from biological degradation. Freshly harvested medicinal leaves contain cellular moisture and active endogenous enzymes (such as esterases and hydrolases). If plant material is allowed to dry slowly at room temperature, these enzymes remain active and can hydrolyze secondary metabolites, reducing the drug's therapeutic value.

Solution:

Step 1: Analyze the cellular environment of freshly harvested Belladonna leaves, which contain tropane alkaloids like L-hyoscyamine.

Step 2: Determine the effect of slow drying. High moisture levels allow endogenous hydrolytic enzymes to break down these alkaloids into less active components.

Step 3: Analyze the effect of rapid thermal drying (50°C to 60°C). This temperature range denatures the protein structure of these hydrolytic enzymes, halting their catalytic activity and preserving the alkaloid content within the leaf matrix. This matches Option B.

Final Answer: To deactivate hydrolytic enzymes that degrade tropane alkaloids

Answer: (B)

Go Back to Question 64

Q65.

Solution

Concept:

In organic chemistry, aromaticity describes cyclic, planar, fully conjugated structures that exhibit enhanced thermodynamic stability due to electron delocalization. To be classified as aromatic, a molecular system must fulfill Hückel's Rule. This rule provides a mathematical condition for the number of continuously overlapping, unhybridized p-orbital parallel electrons required to form a stable closed shell of de-localized π-electrons.

Solution:

Step 1: Define the criteria of Hückel's Rule. For a planar cyclic system with uninterrupted conjugation to exhibit aromatic stability, its total count of delocalized π-electrons must fit the formula:

$$\text{Number of } \pi\text{-electrons} = 4n + 2$$

where n is a non-negative integer ($n = 0, 1, 2, 3, \ldots$).

Step 2: Apply the integer values. Systems with $2, 6, 10,$ or 14 delocalized π-electrons satisfy this rule, as seen in molecules like benzene ($n = 1$, 6 π-electrons).

Step 3: Select the matching mathematical option. This corresponds to $(4n + 2)$ π-electrons, matching Option C.

Final Answer: $(4n + 2)$ π-electrons

Answer: (C)

Go Back to Question 65

Q66.

Solution

Concept:

Patient counseling in community pharmacy involves adapting communication techniques to meet a patient's individual literacy level, cognitive background, and physical capabilities. Metered-Dose Inhalers (MDIs) are complex device-driven formulations that require coordinated physical steps (such as simultaneous exhalation, actuation, inhalation, and breath-holding) to ensure the drug reaches the lower airways. If an inhaler is used incorrectly, the drug may deposit in the oropharynx, reducing its therapeutic effect.

Solution:

Step 1: Analyze the patient profile. An illiterate patient may struggle with written text or complex technical diagrams.

Step 2: Evaluate the counseling options. Written leaflets or instructions printed on the packaging are ineffective communication tools for this demographic.

Step 3: Identify the most effective approach. The pharmacist should use simple, verbal instructions combined with a physical demonstration using a placebo inhaler. This allows the patient to observe, practice, and receive immediate feedback on their technique, ensuring they can use the device safely and correctly. This matches Option B.

Final Answer: Using verbal explanations paired with a physical demonstration using a placebo inhaler

Answer: (B)

Go Back to Question 66

Q67.

Solution

Concept:

Clinical pathology uses colorimetric assays to screen urine samples for abnormal metabolic products, such as glucose, which can indicate conditions like diabetes mellitus. Benedict's reagent is a stable chemical mixture used to detect reducing sugars. Reducing sugars contain free, reactive aldehyde or ketone groups that can act as reducing agents in alkaline environments.

Solution:

Step 1: Analyze the chemical components of Benedict's reagent. The reagent contains copper sulfate ($CuSO_4$), sodium citrate, and sodium carbonate (Na_2CO_3).

Step 2: Understand the role of each component. Copper sulfate provides the cupric ions (Cu^{2+}) that serve as the oxidizing agent. Sodium carbonate creates the necessary alkaline environment. Sodium citrate acts as a chelating agent, binding the cupric ions to prevent them from precipitating as insoluble copper hydroxide during storage.

Step 3: Describe the positive reaction. When heated with a reducing sugar, the blue Cu^{2+} ions are reduced to an insoluble red cuprous oxide (Cu_2O) precipitate. This matches Option A.

Final Answer: Copper sulfate, sodium citrate, and sodium carbonate

Answer: (A)

Go Back to Question 67

Q68.

Solution

Concept:

Gas Chromatography (GC) separates volatile organic compounds based on their varying distribution behaviors between a moving gas stream (mobile phase) and a stationary material fixed inside a column. As an analyte moves through the column, it partitions dynamically between these two phases. The time an analyte spends retained within the stationary phase relative to the mobile phase determines its overall separation profile.

Solution:

Step 1: Analyze the thermodynamic parameter that controls chemical separation in GC. This is the partition coefficient (K), defined as:

$$K = \frac{\text{Concentration of solute in stationary phase}}{\text{Concentration of solute in mobile phase}}$$

Step 2: Relate this coefficient to column migration. A compound with a high partition coefficient interacts more strongly with the stationary phase, slowing its migration and increasing its retention time (t_R). A compound with a low partition coefficient moves more rapidly with the carrier gas.
Step 3: Connect to separation efficiency. These differences in partitioning behavior allow the column to resolve complex mixtures into distinct chromatographic peaks, matching Option B.

Final Answer: The partition coefficient of the analyte between the carrier gas and the stationary phase

Answer: (B)

Go Back to Question 68

Q69.

Solution

Concept:

Family planning programs use long-acting reversible contraceptives (LARCs), such as Intrauterine Devices (IUDs), to prevent unwanted pregnancies. Copper-releasing IUDs (e.g., Cu-T) are non-hormonal devices placed within the uterine cavity. Their contraceptive effect relies on continuous local biochemical interactions within the endometrial environment rather than suppressing ovulation.

Solution:

Step 1: Identify the primary mechanism of action of copper IUDs. The device continuously releases copper ions (Cu^{2+}) into the uterine cavity and fallopian tubes.

Step 2: Describe the tissue response. These ions act as a local foreign body, triggering a sterile, localized inflammatory reaction within the endometrium.

Step 3: Analyze the effect on gametes. This cellular infiltration and altered enzyme profile create an environment that is highly toxic to spermatozoa, impairing their motility, viability, and ability to fertilize an ovum. This local spermicidal effect prevents fertilization, matching Option B.

Final Answer: Exert a local spermicidal effect by altering endometrial inflammatory patterns

Answer: (B)

Go Back to Question 69

Q70.

Solution

Concept:

Selecting pediatric antibiotics requires evaluating both antimicrobial efficacy and potential long-term tissue toxicities. Tetracyclines are broad-spectrum bacteriostatic antibiotics that inhibit bacterial protein synthesis by binding to the 30S ribosomal subunit. However, they possess a strong chemical affinity for calcified tissues, forming stable complexes with calcium phosphate.

Solution:

Step 1: Analyze the side-effect profile of tetracyclines in developing tissues. Tetracyclines cross tissue boundaries and deposit in areas of active calcification, such as growing bone matrices and developing tooth structures.

Step 2: Describe the clinical consequences. If administered during dental development (from the second half of pregnancy up to 8 years of age), the drug deposits in the hydroxyapatite crystal lattice.

Step 3: Observe the permanent manifestation. This deposition causes permanent yellow, brown, or gray discoloration of the teeth and can lead to enamel hypoplasia. Therefore, tetracyclines are generally contraindicated in children under 8 years of age, matching Option C.

Final Answer: Tetracyclines

Answer: (C)

Go Back to Question 70

Q71.

Solution

Concept:

At the arterial end of capillaries, high hydrostatic pressure forces water and small solutes out of the plasma into the surrounding interstitial spaces. While much of this fluid is reabsorbed at the venous end via oncotic pressure, a fraction remains behind in the tissues. The lymphatic system serves as an accessory pathway to return this fluid and filtered proteins to the blood vascular system.

Solution:

Step 1: Identify the fluid imbalance that occurs in peripheral microvessels. Approximately 2 to 3 liters of interstitial fluid remain in the tissue spaces daily, along with leaked plasma proteins that cannot re-enter the blood capillaries directly due to concentration gradients.

Step 2: Analyze the role of the lymphatic network. Blind-ended lymphatic capillaries absorb this fluid (now called lymph) and return it through a network of vessels and nodes to the subclavian veins, reintroducing it into the venous circulation.

Step 3: Connect to cardiovascular homeostasis. This pathway is essential for maintaining blood volume and preventing severe tissue edema. This matches Option B.

Final Answer: Returning interstitial fluid and leaked plasma proteins back to the venous blood circulation

Answer: (B)

Go Back to Question 71

Q72.

Solution

Concept:

Crystallization is a separation technique used to purify active pharmaceutical ingredients (APIs) by shifting a solute from a liquid solution into a solid crystal lattice. The driving force for crystallization is governed by the system's thermodynamic saturation state, which varies with temperature. At a given temperature, a solution at equilibrium that contains the maximum concentration of dissolved solute is considered saturated.

Solution:

Step 1: Define the term supersaturation. Supersaturation is a metastable thermodynamic state where a solution contains a higher concentration of dissolved solute than it would normally hold at equilibrium under those specific temperature conditions.

Step 2: Describe how this state is achieved and resolved. It can be induced by cooling a hot saturated solution or evaporating a solvent. Because this state is unstable, the system resolves its excess free energy through nucleation, causing the excess solute to precipitate out of solution as organized crystals. This matches Option B.

Final Answer: The solution contains more dissolved solute than is expected at equilibrium at that temperature

Answer: (B)

Go Back to Question 72

Q73.

Solution

Concept:

Clinical biochemistry uses targeted colorimetric assays to verify the presence of proteins in biological fluids. The Biuret test is an established chemical reaction used to detect compounds containing two or more peptide bonds (−CONH−). The reagent consists of an alkaline solution of copper sulfate ($CuSO_4$).

Solution:

Step 1: Analyze the chemical mechanism of the Biuret test. When proteins are mixed with the reagent under strongly alkaline conditions, the copper ions (Cu^{2+}) coordinate with the unshared electron pairs of the nitrogen atoms in adjacent peptide bonds.

Step 2: Observe the coordination complex. This interaction forms a coordination complex that produces a characteristic change from blue to a deep violet-purple color.

Step 3: Evaluate alternatives. The Ninhydrin test reacts with free α-amino groups to form a purple adduct (Ruhemann's purple). The Xanthoproteic test identifies aromatic amino acid side chains through nitration, turning yellow. This confirms that the Biuret test is specific for identifying peptide bonds in proteins, matching Option B.

Final Answer: Biuret test

Answer: (B)

Go Back to Question 73

Q74.

Solution

Concept:

Hospital pharmacy operations use specific institutional distribution networks to supply medications to inpatient wards while maintaining patient safety, tracking inventory, and controlling costs. Traditional distribution methods, such as the complete floor stock or individual prescription systems, can carry higher risks of medication errors, product diversion, or drug waste due to bulk storage in patient care areas.

Solution:

Step 1: Identify the core features of a unit-dose distribution system. Medications are dispensed from the pharmacy in individual, pre-packaged, single-dose containers that are labeled with the generic name, strength, lot number, and expiration date, providing enough medication for a single 24-hour treatment cycle.

Step 2: Evaluate the benefits of this configuration. Preparing individual doses minimizes the need for nursing staff to calculate or measure doses at the bedside, which helps reduce medication administration errors. It also reduces drug waste because unused doses can be returned to the central pharmacy inventory, matching Option C.

Final Answer: Unit-dose distribution system

Answer: (C)

Go Back to Question 74

Q75.

Solution

Concept:

The peripheral nervous system organizes its nerve pathways based on the direction of signal transmission relative to the central nervous system (CNS). Neurons are classified into afferent or efferent groups. Afferent (sensory) neurons possess specialized sensory receptors that detect physical or chemical changes in the internal or external environment. Efferent (motor) neurons transmit regulatory signals outward from the CNS to peripheral effector organs like muscles or glands.

Solution:

Step 1: Analyze the directional flow of neural information described in the problem. The pathway carries sensory inputs from peripheral receptors inward toward the spinal cord and brain.

Step 2: Classify this pathway using neurological terminology. Nerve fibers that conduct signals toward the central nervous system are called afferent pathways. This includes both somatic sensory fibers (from skin, muscles, and joints) and visceral sensory fibers (from internal organs).

Step 3: Contrast with alternatives. Efferent neurons carry signals away from the CNS. This confirms that afferent somatic and visceral neurons form the primary entry pathway for sensory input, matching Option B.

Final Answer: Afferent somatic and visceral neurons

Answer: (B)

Go Back to Question 75

Q76.

Solution

Concept:

Tablet manufacturing can face physical compression defects due to mechanical issues or suboptimal formulation parameters. Capping is defined as the partial or complete separation of the top or bottom crown of a tablet from its main body. This defect is fundamentally caused by the entrapment of air within the formulation mass during high-speed compression.

Solution:

Step 1: Analyze the mechanical sequence shown in the diagram. As the punches move together rapidly to compress the loose powder bed into a compact matrix, air present between the granules must be expelled.

Step 2: Identify the cause of failure. During high-speed operations, the compression force is applied within milliseconds, which may not leave enough time for air to escape through the clearance gaps around the punch. This traps highly pressurized air pockets within the tablet.

Step 3: Observe the post-compression effect. When the upper punch retracts and the mechanical pressure is released, this trapped air expands rapidly, shearing the tablet along its weakest horizontal plane and causing the top cap to detach. This confirms Option B as the correct answer.

Final Answer: Entrapment of air within the granules during high-speed compression

Answer: (B)

Go Back to Question 76

Q77.

Solution

Concept:

The nephron uses specific transmembrane transporter proteins along its segments to regulate electrolyte and water balance. Loop diuretics, such as Furosemide, are potent diuretic agents used to treat fluid overload and edema. Their primary site of action is the thick ascending limb (TAL) of the loop of Henle, a segment that reabsorbs solutes but is impermeable to water.

Solution:

Step 1: Identify the molecular target of Furosemide. It targets the lumen-facing $Na^+/K^+/2Cl^-$ cotransporter (NKCC2) protein in the thick ascending limb.
Step 2: Describe the effect of inhibition. By binding to the chloride-binding site of this symporter, Furosemide blocks the reabsorption of sodium, potassium, and chloride ions from the tubular fluid.
Step 3: Determine the downstream physiological outcome. This inhibition increases solute concentration within the tubular lumen, washing out the medullary osmotic gradient and preventing water reabsorption in the collecting ducts. This leads to a significant increase in urine output, matching Option C.

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

Answer: (C)

Go Back to Question 77

Q78.

Solution

Concept:

The quality control of herbal drugs uses standardized organoleptic evaluations to assess crude plant materials containing bitter principles, such as glycosides or alkaloids. The "bitterness value" is a pharmacopoeial metric defined as the reciprocal of the minimum concentration of a drug or extract that can be detected as bitter by human gustatory testing. To standardize individual variations in human taste perception, this value is calibrated against a highly stable reference standard.

Solution:

Step 1: Identify the international reference compound used for bitterness calibration. This is quinine hydrochloride.

Step 2: Describe the standard method. A dilution series of the reference compound is compared against a dilution series of the herbal extract using a panel of human testers to determine the absolute taste threshold.

Step 3: Confirm the baseline value. Quinine hydrochloride is assigned a standard bitterness value of $200,000$ units. This reference material allows for reproducible testing across different laboratories, matching Option A.

Final Answer: Quinine hydrochloride

Answer: (A)

Go Back to Question 78

Q79.

Solution

Concept:

Antacids are inorganic pharmaceutical compounds used to neutralize excess gastric hydrochloric acid and alleviate symptoms of peptic ulcer disease or gastroesophageal reflux. These compounds are classified into systemic antacids, which can be absorbed into the bloodstream and risk altering systemic acid-base balances, and non-systemic antacids, which remain largely unabsorbed in the gastrointestinal tract.

Solution:

Step 1: Analyze the properties of the listed antacid formulations. Sodium bicarbonate is a highly soluble, systemic antacid that neutralizes acid rapidly but can cause systemic alkalosis.

Step 2: Examine the mechanism of aluminium hydroxide gel. It is a non-systemic antacid that reacts with gastric hydrochloric acid to form aluminium chloride and water.

Step 3: Identify its protective action. In the stomach, this compound forms a viscous, gelatinous gel matrix. This gel adheres to the gastric mucosa and coats ulcerated areas, creating a physical barrier that protects the tissue from pepsin and gastric acid. This matches the mechanism described in Option B.

Final Answer: Aluminium hydroxide gel

Answer: (B)

Go Back to Question 79

Q80.

Solution

Concept:

Carboxylic acid derivatives possess a carbonyl carbon bonded to an electronegative atom or leaving group ($-X$). These compounds undergo nucleophilic acyl substitution reactions, where an incoming nucleophile attacks the electrophilic carbonyl carbon to form a tetrahedral intermediate, which then collapses to expel the leaving group. The reactivity of these derivatives depends on the electron-withdrawing capacity and leaving-group ability of the substituent attached to the acyl group.

Solution:

Step 1: Arrange carboxylic acid derivatives by their typical reactivity toward nucleophilic attack:

$$\text{Acid Chlorides} > \text{Acid Anhydrides} \gg \text{Esters} > \text{Amides}$$

Step 2: Evaluate the properties of acid chlorides. The chlorine atom is highly electronegative, withdrawing electron density via inductive effects to make the carbonyl carbon highly electrophilic.
Step 3: Assess the leaving group. The chloride ion (Cl^-) is a weak base and an excellent leaving group. This combination allows acid chlorides to undergo rapid nucleophilic acyl substitution without requiring an acid catalyst, making them more reactive than esters or amides. This matches Option B.

Final Answer: Acid chlorides (Acyl chlorides)

Answer: (B)

Go Back to Question 80

Q81.

Solution

Concept:

Clinical pathology uses serological agglutination tests to identify exposure to bacterial pathogens. The Widal test is a diagnostic tool used in public health to screen patients presenting with persistent febrile symptoms. The underlying mechanism relies on an antigen-antibody agglutination reaction.

Solution:

Step 1: Identify the pathogen targeted by the Widal test. This test detects serum antibodies produced against the causative agent of typhoid fever, *Salmonella typhi*.

Step 2: Describe the testing parameters. The assay tests the patient's serum against prepared suspensions of specific *Salmonella* antigens: the somatic "O" antigen and the flagellar "H" antigen.

Step 3: Interpret the results. Visible clumping (agglutination) indicates the presence of corresponding antibodies, helping to diagnose typhoid (enteric) fever. This matches Option A.

Final Answer: Detection of antibodies against *Salmonella typhi* to diagnose Typhoid fever

Answer: (A)

Go Back to Question 81

Q82.

Solution

Concept:

The Indian Drugs and Cosmetics Act of 1940 establishes legal definitions to regulate the quality, safety, and labeling of pharmaceuticals. Under Section 17 of the Act, substandard medications are categorized into three distinct statutory classes: misbranded, spurious, or adulterated drugs.

Solution:

Step 1: Review the statutory definitions under the Act.

Step 2: Differentiate the categories. A drug is misbranded if its label bears false or misleading statements. It is spurious if it is an imitation or substitute for another drug.

Step 3: Define an adulterated drug. Under the Act, a drug is classified as adulterated if it consists in whole or in part of any filthy, putrid, or decomposed substance, or if it has been prepared, packed, or stored under unsanitary conditions where it may have been contaminated. This matches the legal criteria in Option B.

Final Answer: Consists in whole or in part of any filthy, putrid, or decomposed substance

Answer: (B)

Go Back to Question 82

Q83.

Solution

Concept:

The human eye consists of three concentric tissue layers: the outer fibrous sclera and cornea, the middle vascular uvea (choroid, ciliary body, and iris), and the inner neural layer. Transducing light energy into electrical signals requires specialized sensory cells called photoreceptors.

Solution:

Step 1: Identify the tissue layer that houses photoreceptor cells. This is the retina, the innermost layer of the eye.

Step 2: Describe the cellular components. The retina contains rods (specialized for low-light vision) and cones (specialized for color vision and high acuity).

Step 3: Trace the sensory pathway. These cells absorb incoming photons, triggering a biochemical cascade that converts light energy into nerve impulses. These signals are then transmitted via the optic nerve to the visual cortex of the brain. This confirms Option C as the correct answer.

Final Answer: Retina

Answer: (C)

Go Back to Question 83

Q84.

Solution

Concept:

The behavior of liquids inside small channels or porous media is governed by cohesive forces (attraction between like liquid molecules) and adhesive forces (attraction between liquid molecules and a solid surface). Capillarity, or capillary action, is the physical phenomenon where a liquid spontaneously rises or falls within a narrow tube or porous matrix, driven by surface tension and adhesive forces.

Solution:

Step 1: Analyze the physical system shown in the diagram. A narrow tube is placed into a liquid, causing the liquid to rise upward against gravity.

Step 2: Identify the mechanism. Because the adhesive forces between the liquid molecules and the glass wall are stronger than the cohesive forces within the liquid, the fluid spreads along the inner surface.

Step 3: Connect to surface tension. Surface tension pulls the liquid column upward to minimize surface area, a process known as capillary rise or capillarity. This matches Option C.

Final Answer: Capillarity

Answer: (C)

Go Back to Question 84

Q85.

Solution

Concept:

Enzyme inhibitors can alter kinetic parameters based on how and where they bind to an enzyme system. In the Michaelis-Menten model, competitive inhibitors bind exclusively to the free enzyme, while noncompetitive inhibitors bind to both free enzyme and the enzyme-substrate complex. Uncompetitive inhibition represents a distinct mechanism where the inhibitor binds *only* to the pre-formed enzyme-substrate ([ES]) complex, rather than the free enzyme active site.

Solution:

Step 1: Analyze the effect of an uncompetitive inhibitor on the maximum velocity (V_{max}). Because it binds to the [ES] complex and prevents it from completing the reaction, it reduces the amount of active enzyme complex available, lowering the effective V_{max}.

Step 2: Analyze the effect on the Michaelis constant (K_m). Binding to the [ES] complex shifts the chemical equilibrium toward the bound state, artificially increasing the enzyme's apparent substrate affinity. This results in a lower measured K_m value.

Step 3: Determine the relationship between these shifts. In uncompetitive inhibition, both K_m and V_{max} decrease by the exact same proportion, maintaining a constant V_{max}/K_m ratio. This matches Option B.

Final Answer: Decreasing both K_m and V_{max} proportionally

Answer: (B)

Go Back to Question 85

Q86.

Solution

Concept:

Public health strategies organize disease prevention into primary, secondary, and tertiary levels. Primary prevention aims to prevent a disease or condition before it occurs. This category includes primordial prevention (altering societal environments) and specific protection (targeted interventions against a specific disease entity).

Solution:

Step 1: Analyze the public health goal of administering prophylactic Vitamin A solutions to infants. Severe Vitamin A deficiency can lead to xerophthalmia, keratomalacia, and permanent childhood blindness.

Step 2: Classify the intervention strategy. Providing a specific nutrient to a high-risk group to prevent a specific pathological condition is an example of specific protection.

Step 3: Exclude alternatives. It is not tertiary rehabilitation (which focuses on managing established disabilities) or general environmental sanitation. This confirms Option B as the correct answer.

Final Answer: Specific protection against nutritional blindness

Answer: (B)

Go Back to Question 86

Q87.

Solution

Concept:

Medicinal chemistry uses prodrug design to optimize the pharmacokinetic profiles of active drug molecules. A prodrug is a pharmacologically inactive compound that undergoes chemical or enzymatic transformation within the body to release the active parent drug. Phenolic hydroxyl groups ($-OH$) on molecules can present chemical vulnerabilities, as they are polar and subject to rapid first-pass metabolism via glucuronidation or sulfation in the liver.

Solution:

Step 1: Analyze the structural effect of converting a phenolic hydroxyl group into an ester or ether linkage. This modification masks the polar, ionizable hydroxyl group.

Step 2: Determine the pharmacokinetic consequences. Masking this group increases the lipophilicity of the molecule, allowing it to pass more easily through the lipid bilayer of epithelial cells in the gastrointestinal tract.

Step 3: Relate to bioavailability. This increased membrane permeability improves oral absorption and protects the molecule from premature metabolism, enhancing overall bioavailability. This matches Option B.

Final Answer: Increase lipid solubility and improve oral bioavailability

Answer: (B)

Go Back to Question 87

Q88.

Solution

Concept:

The hypothalamic-neurohypophyseal system forms a direct functional link between the central nervous system and the endocrine system. The peptide hormones oxytocin and vasopressin (antidiuretic hormone, ADH) regulate functions like uterine contraction, milk ejection, and renal water retention. While these hormones are released into the bloodstream from the posterior pituitary gland (neurohypophysis), their site of synthesis is located further up in the brain.

Solution:

Step 1: Locate the site of hormone synthesis. Oxytocin and vasopressin are synthesized within the cell bodies of magnocellular neurosecretory cells located in the paraventricular and supraoptic nuclei of the hypothalamus.

Step 2: Trace the transport pathway. Once synthesized, these hormones are packaged into secretory vesicles and transported down the axons of the hypothalamo-hypophyseal tract.

Step 3: Identify the site of storage and release. The terminal endings of these axons store the hormones in the posterior pituitary gland until an action potential triggers their release into the systemic circulation. This matches Option B.

Final Answer: Hypothalamus neurosecretory cells (released via Posterior pituitary)

Answer: (B)

Go Back to Question 88

Q89.

Solution

Concept:

Pharmaceutical packaging must shield chemically unstable drug formulations from environmental hazards like moisture, oxygen, and ambient light. Light radiation, particularly in the ultraviolet and blue visible spectrums, can provide the activation energy required to trigger degradation pathways in light-sensitive molecules.

Solution:

Step 1: Analyze the chemical nature of sodium nitroprusside. Nitroprusside is a complex coordination compound that is highly sensitive to light.

Step 2: Determine the consequence of exposing it to light in clear containers. Photons strike the coordination complex, triggering a photo-oxidation reaction that causes photochemical decomposition and a loss of therapeutic potency.

Step 3: Identify visible signs of degradation. This reaction changes the color of the solution (often turning it orange, dark brown, or blue), indicating the production of degradation products like toxic cyanide ions. Storing the formulation in amber glass containers prevents this degradation by filtering out actinic light wavelengths. This matches Option A.

Final Answer: Photo-oxidation and loss of potency, often indicated by color change

Answer: (A)

Go Back to Question 89

Q90.

Solution

Concept:

Pharmacognosy uses extraction techniques to isolate active secondary metabolites from crude plant materials. These solid-liquid extraction methods are selected based on the stability of the active components, the type of solvent (menstruum), and processing temperatures. Common techniques include maceration, percolation, infusion, and decoction.

Solution:

Step 1: Define the operational protocol for maceration.

Step 2: Describe the steps. The crude drug is crushed or comminuted to break its outer boundaries and increase its surface area. It is then placed in a closed container with the specified solvent and allowed to stand at room temperature for an extended period (typically 2 to 7 days) with occasional shaking.

Step 3: Complete the extraction. This static soaking allows the solvent to penetrate the cellular matrix and dissolve soluble constituents. The mixture is then filtered to separate the liquid extract (menstruum) from the solid residue (marcm), matching Option B.

Final Answer: Allowing the comminuted drug to stand in contact with a solvent at room temperature for a prolonged period with occasional shaking

Answer: (B)

Go Back to Question 90

Q91.

Solution

Concept:

The statutory governance of the pharmacy profession in India is established under the Pharmacy Act of 1948. This legislation created regulatory bodies to maintain standards of professional conduct and uniform educational requirements across the country.

Solution:

Step 1: Identify the central statutory authority created under the Pharmacy Act of 1948. This is the Pharmacy Council of India (PCI).

Step 2: Review its regulatory responsibilities. The PCI is responsible for setting the minimum standard curriculum (the Education Regulations) for pharmacy diplomas, degrees, and postgraduate courses. It also inspects and approves pharmacy institutions seeking to operate or admit students.

Step 3: Contrast with alternatives. The CDSCO regulates clinical trials and drug approvals, while the IPC maintains pharmacopoeial drug standards. This confirms that the PCI is the body responsible for regulating pharmacy education, matching Option B.

Final Answer: Pharmacy Council of India (PCI)

Answer: (B)

Go Back to Question 91

Q92.

Solution

Concept:

Dietary lipids are hydrophobic molecules that do not dissolve easily in the aqueous environment of the small intestine. Because digestive lipases are water-soluble enzymes that can only act at the surface interface of oil droplets, efficient lipid digestion requires breaking down large fat globules into smaller particles to increase the available surface area.

Solution:

Step 1: Analyze the chemical nature of bile salts. Synthesized from cholesterol in the liver, bile salts are amphipathic molecules containing both hydrophobic and hydrophilic regions.

Step 2: Describe their function in the small intestine. Bile salts act as biological detergents, associating with large dietary fat globules and breaking them down into microscopic droplets through a process called emulsification.

Step 3: Explain the role of micelles. They stabilize these small droplets into polymolecular aggregates called micelles. This configuration significantly increases the surface area available for pancreatic lipase to hydrolyze triglycerides into free fatty acids and monoglycerides, matching Option B.

Final Answer: Emulsification of dietary lipids into small micelles to facilitate lipase action

Answer: (B)

Go Back to Question 92

Q93.

Solution

Concept:

Infrared (IR) Spectroscopy identifies organic functional groups by measuring the absorption of infrared radiation, which causes characteristic molecular vibrations. Covalent bonds absorb light at specific frequencies corresponding to their unique stretching or bending modes, creating diagnostic absorption bands in the IR spectrum.

Solution:

Step 1: Analyze the specified infrared absorption band (1715 cm^{-1}). This region of the spectrum (1680 cm^{-1} to 1750 cm^{-1}) is characterized by strong, sharp absorption peaks driven by the stretching vibrations of a carbon-oxygen double bond.

Step 2: Identify the corresponding functional group. A carbon-oxygen double bond defines the carbonyl group (C = O), which is found in aldehydes, ketones, carboxylic acids, and esters.

Step 3: Differentiate from alternatives. Hydroxyl groups (−OH) produce broad bands at higher frequencies (3200 cm^{-1} to 3600 cm^{-1}), while alkyne triple bonds absorb near 2100 cm^{-1}. This confirms that a peak at 1715 cm^{-1} indicates a carbonyl group, matching Option B.

Final Answer: Carbonyl group (C = O)

Answer: (B)

Go Back to Question 93

Q94.

Solution

Concept:

Pharmacy practice uses specific terminology to describe standard dispensing adjustments aimed at improving cost-effectiveness and patient access to care. Generic substitution is the practice of dispensing a bioequivalent, non-branded generic product in place of a prescribed brand-name drug.

Solution:

Step 1: Define the operational requirements for a generic substitution. The substituted product must be a pharmaceutical alternative that contains the exact same active chemical moiety, in the same strength, quantity, and dosage form, and must demonstrate bioequivalence to ensure the same therapeutic effect.

Step 2: Identify the primary benefit. Generic products are typically less expensive to manufacture and distribute, allowing the pharmacy to provide a lower-cost alternative to the patient.

Step 3: Distinguish from therapeutic substitution, which involves changing to a different chemical drug within the same therapeutic class. This confirms Option B as the correct answer.

Final Answer: Generic substitution

Answer: (B)

Go Back to Question 94

Q95.

Solution

Concept:

Pharmaceutical packaging uses distinct configurations to protect solid oral dosage forms from physical damage and environmental factors like moisture and gas permeation. A blister pack is a unit-dose packaging system created via a thermoforming process, where a flexible plastic sheet is heated to form individual cavities that hold the tablets, which are then sealed with an outer aluminum foil backing.

Solution:

Step 1: Analyze the material requirements for blister packaging shown in the diagram. The base film must be easily thermoformed into distinct pockets while providing a barrier against moisture.
Step 2: Evaluate the properties of polyvinyl chloride (PVC). PVC is a widely used transparent thermoplastic polymer that offers excellent structural rigidity and ease of processing.
Step 3: Analyze the role of coatings. On its own, raw PVC has a relatively high moisture vapor transmission rate. Coating the PVC film with polyvinylidene chloride (PVDC) significantly improves its barrier properties against moisture and oxygen, making it ideal for protecting moisture-sensitive solid oral tablets, matching Option A.

Final Answer: Polyvinyl chloride (PVC) blister film with PVDC coating

Answer: (A)

Go Back to Question 95

Q96.

Solution

Concept:

Angina pectoris is characterized by transient myocardial ischemia, which occurs when coronary blood flow cannot meet the heart's metabolic oxygen demands. Nitroglycerin is an organic nitrate vasodilator used to treat acute anginal attacks. Its mechanism of action relies on cellular biotransformation to supplement endogenous vascular signaling pathways.

Solution:

Step 1: Trace the intracellular pathway of Nitroglycerin. Upon entering vascular smooth muscle cells, Nitroglycerin undergoes enzymatic conversion to release active nitric oxide (NO).

Step 2: Identify the downstream molecular target. Nitric oxide stimulates the soluble guanylyl cyclase enzyme, which catalyzes the conversion of GTP to cyclic guanosine monophosphate (cGMP).

Step 3: Describe the cellular response. Accumulated cGMP activates protein kinase G, leading to dephosphorylation of myosin light chains, a reduction in intracellular calcium, and smooth muscle relaxation.

Step 4: Connect to clinical efficacy. This relaxation causes widespread vasodilation, particularly in the venous system. Venodilation pools blood in peripheral tissues, reducing venous return (preload) and lowering the heart's workload and oxygen demand to alleviate anginal pain, matching Option B.

Final Answer: Conversion to nitric oxide, which stimulates guanylyl cyclase to increase cGMP, causing systemic vasodilation

Answer: (B)

Go Back to Question 96

Q97.

Solution

Concept:

Under normal physiological conditions, the body metabolizes glucose to meet its cellular energy needs. However, if glucose availability drops significantly or if cells cannot absorb it due to an absolute lack of insulin, the metabolic system shifts to prioritize lipolysis. This process breaks down adipose tissue into free fatty acids, which undergo β-oxidation in the liver to produce acetyl-CoA.

Solution:

Step 1: Track the accumulation of excess acetyl-CoA. When the production of acetyl-CoA exceeds the capacity of the citric acid cycle, the liver channels the excess into ketogenesis, producing ketone bodies like acetoacetate, β-hydroxybutyrate, and acetone.

Step 2: Identify clinical conditions that trigger this pathway. In type 1 diabetes mellitus, an absolute lack of insulin prevents glucose utilization, causing severe hyperglycemia alongside rapid ketogenesis. This can lead to a dangerous drop in blood pH known as diabetic ketoacidosis (DKA). Prolonged starvation triggers a similar metabolic shift due to a lack of dietary carbohydrates.

Step 3: Select the matching diagnostic indicator. High plasma concentrations of ketone bodies are a primary indicator of diabetic ketoacidosis or prolonged starvation, matching Option B.

Final Answer: Diabetic ketoacidosis or prolonged starvation

Answer: (B)

Go Back to Question 97

Q98.

Solution

Concept:

The physical characterization of granular pharmaceutical materials involves assessing their flow properties, which influence manufacturing operations like tablet compression and capsule filling. The Angle of Repose (θ) is a simple metric used to evaluate powder flowability. It is determined by pouring a powder sample through a funnel onto a horizontal surface to form a symmetrical, conical heap. The angle of repose is the angle formed between the inclined side of the cone and the horizontal base, calculated using the trigonometric relationship:

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

where h is the height of the powder cone and r is the radius of its circular base. Smaller angles of repose indicate weaker internal friction between particles, which correlates with better powder flow properties.

Solution:

Step 1: Identify the structural parameter described in the problem statement, which involves measuring the height (h) and radius (r) of a granular heap.

Step 2: Match this to its geometric definition. This procedure is used to calculate the angle of repose (θ).

Step 3: Contrast with alternatives. Carr's index and the Hausner ratio are calculated using differences between a powder's bulk density and tapped density rather than measuring a physical heap. This confirms that the specified procedure measures the angle of repose, matching Option B.

Final Answer: Angle of repose (θ)

Answer: (B)

Go Back to Question 98

Q99.

Solution

Concept:

The human peripheral efferent nervous system uses specific neurotransmitters to mediate synaptic transmission across its divisions. The autonomic nervous system is divided into the sympathetic and parasympathetic branches, which use a two-neuron chain (preganglionic and postganglionic) to reach their target organs.

Solution:

Step 1: Analyze the neurotransmitter profiles of the autonomic pathways. Both sympathetic and parasympathetic preganglionic neurons release acetylcholine to activate nicotinic receptors in autonomic ganglia.

Step 2: Examine postganglionic sympathetic terminals. Most postganglionic sympathetic neurons release norepinephrine to stimulate adrenergic receptors on effector tissues.

Step 3: Examine postganglionic parasympathetic terminals. All postganglionic parasympathetic neurons release acetylcholine as their primary neurotransmitter. This acetylcholine travels across the synaptic cleft to activate muscarinic receptors (M_1 through M_5) on target visceral organs, mediating classic parasympathetic responses. This confirms that the parasympathetic nervous system relies exclusively on this pathway, matching Option B.

Final Answer: Parasympathetic nervous system

Answer: (B)

Go Back to Question 99

Q100.

Solution

Concept:

The Drugs and Magic Remedies (Objectionable Advertisements) Act of 1954 is an Indian consumer protection law designed to prevent the dissemination of false, misleading, or unscientific claims regarding treatments and cures. The legislation features a statutory schedule that lists serious, chronic, or incurable medical conditions. Under the provisions of the Act, publishing any advertisement that claims a drug, device, or magical remedy can prevent, diagnose, or cure any condition listed in this schedule is strictly prohibited.

Solution:

Step 1: Analyze the scope of the Act's prohibitions. The law targets advertisements that exploit vulnerable patients by making unverified claims about severe or chronic health conditions.

Step 2: Evaluate the listed medical conditions. Minor issues like a seasonal common cold or superficial skin abrasions do not fall under these strict promotional bans.

Step 3: Identify scheduled conditions. Severe, long-term diseases listed in the schedule—such as cancer, diabetes, epilepsy, and genetic blindness—are subject to strict advertising bans. This prevents predatory marketing and protects public safety, matching Option B.

Final Answer: Chronic conditions listed in the schedule, such as cancer or genetic blindness

Answer: (B)

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Answer Key

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