

CUET PG 2024 Pharmacy Question Paper with Solutions

Time Allowed : 1 hour 45 minutes

Maximum Marks : 300

Total questions : 75

General Instructions

Read the following instructions very carefully and strictly follow them:

- (i) This question paper comprises 75 questions. All questions are compulsory.
- (ii) Each question carries 04 (four) marks.
- (iii) For each correct response, candidate will get 04 (four) marks.
- (iv) For each incorrect response, 01 (one) mark will be deducted from the total score.
- (v) Un-answered/un-attempted response will be given no marks.
- (vi) To answer a question, the candidate needs to choose one option as correct option.
- (vii) However, after the process of Challenges of the Answer Key, in case there are multiple correct options or change in key, only those candidates who have attempted it correctly as per the revised Final Answer Key will be awarded marks.
- (viii) In case a Question is dropped due to some technical error, full marks shall be given to all the candidates irrespective of the fact who have attempted it or not

1. Which of the following feature is correct for counter current extraction of plant material?

- (1) Can be used for only lab scale and wide array of extractives possible
- (2) Can be used for large scale and only few extractives are possible
- (3) Can be used for large scale and wide array of extractives possible
- (4) Can be used for small scale and only few extractives are possible

Correct Answer: (3) Can be used for large scale and wide array of extractives possible

Solution:

Counter current extraction is a highly efficient and effective method used primarily for extracting valuable compounds from solid materials. This process involves the continuous flow of fresh solvent in the opposite direction to the movement of the solid material. This counterflow mechanism maximizes the contact between the solvent and the material, improving the extraction efficiency.

In this method, the solid material enters one end of the system, while the solvent enters from the opposite side. As the solid moves forward, the solvent continuously washes over it in the reverse direction. This constant interaction ensures that the concentration gradient is maintained, which significantly enhances the mass transfer process. As a result, the solvent becomes increasingly enriched with the desired compounds as it progresses through the system.

Counter current extraction is particularly advantageous for large-scale production due to its ability to:

Maximize yield with minimal solvent consumption.

Efficiently extract a wide range of active compounds.

Maintain product quality by minimizing thermal degradation.

Industries such as pharmaceuticals, cosmetics, and food processing widely adopt counter current extraction due to its scalability, cost-effectiveness, and enhanced performance. This method is especially useful in scenarios where extensive extraction with controlled solvent use is required.

Quick Tip

For optimal results in large-scale plant material extraction, counter current extraction provides superior efficiency, cost savings, and a broader spectrum of extracted compounds.

2. The principle of Pulse height proportionality to particle volume is used in:

(1) Fisher apparatus

- (2) Coulter counter
- (3) Sedimentograph
- (4) Erweka multimodal instrument

Correct Answer: (2) Coulter counter

Solution:

The Coulter counter functions on the principle that the volume of a particle is directly related to the height of the electrical pulse generated as the particle passes through a narrow aperture. As particles suspended in an electrolyte solution move through this aperture, they temporarily displace some of the electrolyte, resulting in a brief increase in electrical resistance. This resistance change produces a voltage pulse, and the pulse's amplitude (or height) corresponds to the size of the particle.

This technique is extensively employed in hematology for counting blood cells and in various industries for precise particle size analysis.

Quick Tip
The Coulter counter is an excellent tool for accurately counting and sizing particles suspended in liquids.

3. About Theobroma oil polymorph choose the correct statement:

- (1) Gamma form has 18°C melting point
- (2) Beta form has 34-35°C melting point
- (3) Beta prime form has 28 - 31°C melting point
- (4) Alpha form has 24°C melting point

Correct Answer: (2) Beta form has 34-35°C melting point

Solution: Theobroma oil, commonly known as cocoa butter, exists in multiple polymorphic forms, each with distinct melting points and stability characteristics:

Gamma form: Melts at approximately 18°C; this form is unstable and generally undesirable.

Alpha form: Melts at around 24°C; it is also unstable.

Beta-prime form: Melts between 28-31°C; offers intermediate stability.

Beta form: Melts at about 34-35°C; this is the most stable and preferred form.

The beta form is particularly important in pharmaceutical formulations and chocolate production because of its superior stability and optimal melting behavior.

Quick Tip

The beta form's stable crystalline structure ensures improved product consistency and longevity in pharmaceuticals and confectionery products.

4. Globular proteins are believed to maintain their:

- (1) Ball-like structure due to hydrophobic interaction
- (2) Ball-like structure due to hydrophilic interaction
- (3) Sheet-like structure due to hydrophobic interaction
- (4) Parallel sheet-like structure due to hydrophobic interaction

Correct Answer: (1) Ball-like structure due to hydrophobic interaction

Solution: Globular proteins adopt a compact, spherical conformation primarily due to the influence of hydrophobic interactions. This structural organization is crucial for their stability and biological function.

During the folding process, hydrophobic amino acid residues tend to cluster in the protein's core to minimize their exposure to water molecules. Conversely, hydrophilic residues are typically positioned on the outer surface, where they can interact freely with the aqueous environment.

This strategic arrangement is energetically favorable as it reduces the system's overall free energy, promoting a stable three-dimensional structure. This stable conformation is essential for the protein's biological roles, such as enzyme catalysis, molecular recognition, and cell signaling.

Hydrophobic interactions play a pivotal role in driving the folding process, while additional stabilizing forces like hydrogen bonds, van der Waals forces, and ionic interactions further reinforce the structure.

Quick Tip

Hydrophobic interactions are the primary force behind the compact folding of globular proteins, ensuring their stability and functionality.

5. Yellow fever vaccine is a:

- (1) Univalent preparation made by 17D strain of Yellow fever virus
- (2) Polyvalent preparation made by 17D strain of Yellow fever virus
- (3) Univalent preparation made by 170D strain of Yellow fever virus
- (4) Polyvalent preparation made by 170D strain of Yellow fever virus

Correct Answer: (1) Univalent preparation made by 17D strain of Yellow fever virus

Solution: The Yellow fever vaccine is a live attenuated vaccine that is derived from the 17D strain of the Yellow fever virus. This vaccine is carefully developed by weakening the virus to ensure it triggers an immune response without causing the disease itself.

The Yellow fever vaccine is classified as a univalent preparation, meaning it is designed to protect against a single strain — the 17D strain. This focused formulation has proven highly effective, providing strong and long-lasting immunity, often lasting a lifetime after a single dose.

The World Health Organization (WHO) strongly recommends this vaccine for travelers visiting regions where Yellow fever is endemic, as well as for individuals residing in such areas. The vaccine has played a pivotal role in controlling outbreaks, reducing mortality, and curbing the spread of the virus.

Due to its remarkable efficacy, the Yellow fever vaccine derived from the 17D strain is regarded as one of the most successful viral vaccines ever developed.

Quick Tip

Yellow fever vaccines based on the 17D strain offer robust, long-term immunity, making them a key preventive measure for travelers and residents in endemic regions.

6. Miller Prickett tube:

- (1) Contains Oxidizing agent and used in counting of aerobes
- (2) Contains Vitamin B12 and used in counting of specific bacteria
- (3) Contains reducing agent and used in counting of anaerobes
- (4) Contains Vit B2 and used in counting of Spirochetes

Correct Answer: (1) Contains Oxidizing agent and used in counting of aerobes

Solution: The Miller Prickett tube is a specialized tool used in microbiological studies for the identification, enumeration, and analysis of different bacterial species. This tube is particularly useful for distinguishing between aerobic and anaerobic bacteria based on their oxygen requirements.

In the Miller Prickett tube, an oxidizing agent is incorporated into the medium. This oxidizing agent plays a crucial role in facilitating the growth of aerobic bacteria, which require oxygen for their metabolic processes. By providing an oxygen-rich environment, the oxidizing agent supports the proliferation of aerobes while inhibiting the growth of anaerobic bacteria.

The tube is commonly employed in microbial research, clinical diagnostics, and quality control testing to assess bacterial populations in various environments.

Understanding the presence and role of oxidizing agents in microbiological media is essential, as they directly influence bacterial growth patterns and help microbiologists differentiate between bacterial types.

Quick Tip
For effective identification of bacterial types, consider the presence of oxygen-regulating agents in the medium — oxidizing agents promote aerobes, while reducing agents encourage anaerobes.

7. Elutriation depends upon

- (1) Movement of fluid against the direction of sedimentation of particles

- (2) Movement of fluid in the direction of sedimentation of particles
- (3) Movement of fluid against the horizontal direction of sedimentation of particles
- (4) It is possible in all direction of fluid flow

Correct Answer: (1) Movement of fluid against the direction of sedimentation of particles

Solution: Elutriation is a process used in sedimentation, where the fluid is moved in the opposite direction of the settling or sedimentation of particles. The purpose of elutriation is to separate particles based on their size, shape, and density.

In sedimentation, particles settle due to gravity, and elutriation helps in counteracting this sedimentation by moving the fluid in the opposite direction, assisting in better separation and clearer distinctions between different types of particles.

This is the reason why elutriation depends on the movement of the fluid against the sedimentation direction of the particles, ensuring the particles are maintained in suspension for further processing.

Quick Tip
In elutriation, the fluid's movement counteracts the natural sedimentation process, aiding in better separation of particles based on their properties.

8. Bound moisture of a solid is

- (1) Liquid that exerts vapour pressure equal to that of free liquid
- (2) Liquid that exerts a pressure less than that of pure liquid
- (3) Liquid that exerts a pressure more than that of a pure liquid
- (4) Liquid that exerts pressure equal to the ratio of vapour pressure of pure liquid to the vapour pressure of its supersaturated solution

Correct Answer: (2) Liquid that exerts a pressure less than that of pure liquid

Solution: Bound moisture refers to the moisture that is held within a solid material through strong intermolecular forces or chemical bonding. This type of moisture is commonly found in materials such as hygroscopic substances, clay, and other porous solids.

Unlike free moisture, which evaporates easily and exerts a vapor pressure equal to that of pure liquid, bound moisture behaves differently. The water molecules in bound moisture are

tightly held by the solid's structure, restricting their movement. Consequently, the vapor pressure exerted by bound moisture is significantly lower than that of free moisture or pure liquid.

Due to its strong attachment to the solid matrix, bound moisture is more difficult to remove through standard drying processes. Specialized techniques such as extended heating, vacuum drying, or chemical treatments are often required to eliminate this moisture effectively.

Understanding bound moisture is crucial in industries such as pharmaceuticals, food processing, and construction, where moisture control directly affects product stability, texture, and performance.

Quick Tip

Bound moisture is held by strong intermolecular forces, making its removal more challenging than free moisture, which evaporates readily under normal conditions.

9. Compound Aluminium paste BPC contains

- (1) Aluminium hydroxide powder and zinc oxide
- (2) Aluminium powder and zinc oxide
- (3) Aluminium powder, Liquid paraffin, and zinc oxide
- (4) Aluminium powder, soft paraffin, and zinc oxide

Correct Answer: (3) Aluminium powder, Liquid paraffin, and zinc oxide

Solution: Compound Aluminium Paste BPC (British Pharmacopoeia) is a specialized formulation widely used in pharmaceutical and cosmetic preparations. This paste is composed of three key ingredients, each contributing specific functional properties:

Aluminium powder: This fine metallic powder is included for its astringent and protective effects. It helps reduce skin irritation and forms a protective barrier over the affected area, making it useful in certain dermatological treatments.

Liquid paraffin: Also known as mineral oil, this ingredient acts as a binder and lubricant, giving the paste a smooth, consistent texture. It helps to keep the mixture uniform while facilitating easy application to the skin.

Zinc oxide: Known for its soothing, protective, and healing properties, zinc oxide is

commonly used in topical treatments for conditions like rashes, burns, and minor irritations. It aids in protecting the skin and promoting recovery.

By combining these components, Compound Aluminium Paste BPC serves as an effective topical treatment for specific skin conditions, providing a protective barrier while soothing and supporting the healing process. Its balanced formulation makes it suitable for various pharmaceutical and dermatological applications.

Quick Tip

The ingredients in Compound Aluminium Paste BPC are carefully selected to provide protective, soothing, and therapeutic benefits in topical formulations.

10. Bulk laxative may cause

- (1) Flatulence
- (2) Gripping pain
- (3) Leakage from rectum
- (4) Interfere with salt and water balance

Correct Answer: (4) Interfere with salt and water balance

Solution: Bulk laxatives are commonly used to relieve constipation by increasing stool bulk, which stimulates bowel movements. While effective, excessive or improper use of bulk laxatives can result in certain side effects:

Electrolyte and water imbalance: Bulk laxatives function by absorbing water into the stool, softening it and promoting easier passage. However, this water absorption process may inadvertently disrupt the body's salt and electrolyte balance, particularly levels of sodium and potassium. Such imbalances can increase the risk of dehydration, especially in individuals with underlying medical conditions or those who fail to consume enough fluids.

Flatulence and gripping pain: Increased bowel activity triggered by bulk laxatives can cause discomfort, including bloating, excessive gas, and abdominal cramps. While these effects are generally mild, they can be bothersome.

Rectal leakage: Although rare, stool leakage may occur if the stool becomes excessively soft and difficult to control.

To minimize these risks, bulk laxatives should be taken with sufficient water to maintain proper hydration. Long-term use or excessive dosing should be avoided unless advised by a healthcare professional.

Quick Tip

For safe and effective use of bulk laxatives, ensure you drink plenty of water and consult a healthcare provider before prolonged use.

11. Stokes Einstein equation describing diffusivity (D) and viscosity (η) is:

(1) $D = \frac{k \cdot T}{6 \cdot \pi \cdot \eta \cdot r}$

(2) $D = \frac{k \cdot \pi \cdot T}{6 \cdot \eta \cdot r}$

(3) $D = \frac{k \cdot r \cdot T}{6 \cdot \eta \cdot \pi}$

(4) $D = \frac{k \cdot r}{6 \cdot \eta \cdot \pi \cdot T}$

Correct Answer: (1) $D = \frac{k \cdot T}{6 \cdot \pi \cdot \eta \cdot r}$

Solution: The Stokes-Einstein equation is a fundamental expression that describes the relationship between the diffusivity of particles in a fluid and various physical parameters.

The equation is given by:

$$D = \frac{k \cdot T}{6 \cdot \pi \cdot \eta \cdot r}$$

Where:

D = Diffusivity

k = Boltzmann constant

T = Absolute temperature

η = Viscosity of the medium

r = Radius of the particle

Explanation and Key Insights

The Stokes-Einstein equation establishes an inverse relationship between diffusivity (D) and both the particle size (r) and viscosity (η) of the medium.

As the radius of the particle increases, its diffusivity decreases since larger particles experience greater resistance when moving through the fluid.

Similarly, as the viscosity of the medium increases, diffusivity decreases because a thicker medium imposes greater resistance to particle motion.

Conversely, higher temperatures enhance diffusivity because increased molecular movement allows particles to traverse the medium more efficiently.

Practical Applications The Stokes-Einstein equation is widely used in pharmaceutical sciences, colloidal chemistry, and biophysics to predict the behavior of molecules in solutions.

It is particularly useful in determining the size of nanoparticles, estimating diffusion rates in biological systems, and designing drug delivery systems.

Example

Suppose a particle with a radius of 2×10^{-9} m is suspended in a fluid with a viscosity of 1.0×10^{-3} Pa·s at a temperature of 300 K. The diffusivity can be calculated as follows:

$$D = \frac{(1.38 \times 10^{-23}) \times 300}{6 \times \pi \times (1.0 \times 10^{-3}) \times (2 \times 10^{-9})}$$

By calculating this, you can determine the particle's diffusion rate under the given conditions.

Quick Tip

To maximize particle diffusivity, reduce the particle size and minimize the viscosity of the medium. Conversely, increasing viscosity or particle size will lower diffusivity.

12. Thiol, Thioethers, Nitrites containing drugs are primarily susceptible to:

- (1) Oxidation
- (2) Hydrolysis
- (3) Reduction
- (4) Cyclization

Correct Answer: (1) Oxidation

Solution: Thiol, thioethers, and nitriles are highly susceptible to oxidation due to the presence of sulfur-containing functional groups. These groups have unique chemical

characteristics that make them reactive in the presence of oxygen or oxidizing agents.

Why Are These Compounds Prone to Oxidation?

Thiol groups ($-SH$) are particularly reactive because the sulfur atom's lone pair readily participates in oxidation reactions. When exposed to oxygen, thiol groups can oxidize to form disulfides ($R-S-S-R$) or other oxidized sulfur compounds.

Thioethers ($R-S-R'$) contain sulfur bonded to two carbon atoms. The sulfur atom can gradually oxidize to produce sulfoxides ($R-S(=O)-R'$) or sulfones ($R-S(=O)_2-R'$) upon further oxidation.

While nitriles are less prone to direct oxidation than thiols or thioethers, they may undergo degradation through oxidative pathways in certain conditions.

Preventing Oxidation

To mitigate oxidation risks in pharmaceutical formulations containing these functional groups, several strategies are employed:

1. Antioxidants: Adding antioxidants like ascorbic acid, butylated hydroxytoluene (BHT), or sodium metabisulfite helps neutralize oxidizing agents and protect the drug.
2. Stabilizing agents: Certain stabilizers are added to minimize the exposure of the sulfur group to oxygen.
3. Packaging control: Drugs with sulfur-containing groups should be stored in airtight, light-protected, and low-oxygen environments to limit exposure to oxidizing agents.
4. Temperature regulation: Lower storage temperatures reduce the oxidation rate, improving the compound's stability.

Example

In pharmaceutical formulations containing captopril (a thiol-containing drug), antioxidants like ascorbic acid are commonly added to prevent the formation of disulfide dimers, which compromise the drug's effectiveness.

Quick Tip

To minimize oxidation, store sulfur-containing drugs in tightly sealed, opaque containers at controlled temperatures, and consider adding suitable antioxidants to enhance stability.

13. Very slightly soluble means ----- parts of solvent required for 1 part of solute:

- (1) From 100 to 1000
- (2) From 1000 to 10000
- (3) From 30 to 100
- (4) 10000 and over

Correct Answer: (2) From 1000 to 10000

Solution: As defined by the United States Pharmacopeia (USP), a substance classified as very slightly soluble requires between 1000 to 10000 parts of solvent to dissolve one part of the solute. This classification indicates a relatively poor solubility, meaning the substance dissolves with difficulty in typical solvent conditions.

Very slightly soluble $\Rightarrow$ 1000 to 10000 parts of solvent per 1 part solute

Understanding USP Solubility Terms The USP provides a standardized system for describing solubility, with various categories based on the solvent-to-solute ratio. Familiarity with these classes is crucial in pharmaceutical formulation, chemical synthesis, and drug development.

Quick Tip
USP solubility classifications are essential for understanding dissolution behavior: Freely soluble: Less than 1 part solvent required. Soluble: 10 to 30 parts solvent required. Very slightly soluble: 1000 to 10000 parts solvent required.

14. Sodium salt of polycarboxymethyl ether of cellulose is also known as:

- (1) AVICEL
- (2) AVICEL PH101
- (3) Polycarbapol sodium

(4) CMC Sodium

Correct Answer: (4) CMC Sodium

Solution: Carboxymethyl cellulose sodium (CMC Sodium) is a sodium salt derivative of cellulose that serves as a versatile excipient in pharmaceutical formulations. It is commonly employed as a stabilizer, thickener, and suspending agent due to its exceptional ability to enhance the viscosity and consistency of liquid and semi-solid preparations.

CMC Sodium is particularly valued for its water-retention properties, making it highly effective in maintaining the desired texture and stability of formulations. It is widely incorporated into various pharmaceutical products such as oral suspensions, tablet coatings, and topical formulations to improve uniformity, control viscosity, and prevent ingredient separation.

Due to its multifunctional characteristics, CMC Sodium plays a crucial role in ensuring product stability, improving patient compliance, and enhancing formulation performance.

Quick Tip

In pharmaceutical references, CMC Sodium is often labeled as sodium carboxymethyl cellulose — ensure consistency in terminology when reviewing formulation guidelines.

15. Sun protection factor is defined as:

- (1) The ratio between UV exposure required to produce a minimally perceptible erythema on unprotected skin and the exposure that will produce the same erythema in protected skin
- (2) The ratio between UV exposure required to produce a minimally perceptible erythema on protected skin and the exposure that will produce the same erythema in unprotected skin
- (3) The ratio between UV exposure required to produce a maximum perceptible erythema on protected skin and the exposure that will produce the same erythema in unprotected skin
- (4) The ratio between UV exposure required to produce a maximum perceptible erythema on unprotected skin and the exposure that will produce the same erythema in protected skin

Correct Answer: (1) The ratio between UV exposure required to produce a minimally

perceptible erythema on unprotected skin and the exposure that will produce the same erythema in protected skin

Solution: Sun Protection Factor (SPF) is defined as:

$$SPF = \frac{\text{UV exposure required to produce minimal erythema on protected skin}}{\text{UV exposure required to produce minimal erythema on unprotected skin}}$$

For example, an SPF of 30 means you can be exposed to 30 times more UV radiation before developing erythema compared to unprotected skin. SPF is crucial in determining the effectiveness of sunscreens in blocking UV rays.

Quick Tip

SPF only measures protection against UVB rays (not UVA). A broad-spectrum sunscreen protects against both UVA and UVB rays.

16. Choose the correct statement regarding Heckel plot from the following:

- (1) It is plotted between $\text{Log (porosity)}^{-1}$ against Compressional force
- (2) It is plotted between Log (porosity) against Compressional force
- (3) It is plotted between Porosity^{-1} against $\text{Log (Compressional force)}$
- (4) It is plotted between Porosity against $\text{Log (Compressional force)}^{-1}$

Correct Answer: (4) It is plotted between Porosity against $\text{Log (Compressional force)}^{-1}$

Solution: The Heckel plot is a widely used tool in pharmaceutical sciences to analyze the compression behavior of powder materials. It is particularly useful in understanding the compressibility and compactability of powders during tablet formulation.

The correct representation of the Heckel equation involves plotting porosity against the logarithm of the applied compressional force. This logarithmic relationship effectively highlights the powder's response to increasing pressure, aiding in the assessment of its compaction properties.

Key Concepts

Porosity refers to the amount of void space within a powder mass. Higher porosity indicates more empty spaces, while lower porosity reflects greater particle packing.

Compressional force is the pressure applied during the powder compaction process to form tablets.

In an ideal compression scenario, the Heckel plot produces a straight line, indicating predictable and consistent compression behavior.

By analyzing the slope and intercept of the Heckel plot, researchers can gain insights into the material's deformation mechanism, particle fragmentation, and overall compaction characteristics.

Quick Tip

The Heckel plot is crucial for studying tablet formulation and powder compaction behavior. Ensure accurate plotting with porosity on the y-axis and the logarithm of compressional force on the x-axis to obtain meaningful results.

17. Choose the correct sequence of parts of aerosol bottle valve from top:

(A).Stem

(B). Ferrule

(C). Valve seat

(D). Mounting gasket

Choose the correct answer from the options given below

(1) (A), (B), (C), (D)

(2) (A), (B), (D), (C)

(3) (B), (A), (C), (D)

(4) (C), (B), (D), (A)

Correct Answer: (1) (A), (B), (C), (D)

Solution: The correct sequence of parts in an aerosol bottle valve is as follows:

(A) Stem: This is the central component of the valve, through which the content is dispensed.

(B) Ferrule: This is the part that holds the valve assembly in place and connects it to the bottle.

(C) Valve seat: It is the part of the valve mechanism that ensures the seal is formed and prevents leakage.

(D) Mounting gasket: This part ensures a tight seal between the valve and the bottle, preventing any leakage of the aerosol content.

Hence, the sequence is (A), (B), (C), (D).

Quick Tip

In aerosol valve construction, it is important to ensure a tight seal to avoid leakage and ensure proper functioning of the valve.

18. What is the correct order of increasing HLB?

(A). w/o emulsifying agent

(B). o/w emulsifying agent

(C). wetting agent

(D). solubilizing agent

Choose the correct answer from the options given below

(1) (A), (B), (C), (D)

(2) (A), (C), (B), (D)

(3) (B), (A), (D), (C)

(4) (C), (B), (D), (A)

Correct Answer: (2) (A), (C), (B), (D)

Solution: The Hydrophilic-Lipophilic Balance (HLB) is a numerical scale that indicates the balance between the hydrophilic (water-attracting) and lipophilic (oil-attracting) properties of an emulsifier. It is an essential factor in determining the suitability of emulsifiers for different formulations.

The correct order of increasing HLB for the given agents is as follows:

(A) w/o emulsifying agent: These agents have the lowest HLB values and are predominantly oil-soluble, making them ideal for water-in-oil (w/o) emulsions.

(C) Wetting agent: Wetting agents possess moderate HLB values and are designed to improve the wetting of solid particles in liquid phases.

(B) o/w emulsifying agent: These agents have higher HLB values and are more water-soluble, making them suitable for oil-in-water (o/w) emulsions.

(D) Solubilizing agent: Solubilizing agents exhibit the highest HLB values and are specifically used to dissolve otherwise insoluble lipophilic substances in aqueous systems.

Correct Order of Increasing HLB:

(A) w/o emulsifying agent < (C) Wetting agent < (B) o/w emulsifying agent < (D) Solubilizing agent

This sequence reflects the gradual increase in hydrophilic character, from oil-loving emulsifiers to those optimized for water-based systems.

Quick Tip
When formulating emulsions, remember that low HLB emulsifiers suit oil-based systems, while high HLB emulsifiers are best for water-based systems.

19. Choose the correct sequence in the development of a drug candidate:

(A) Bioavailability

(B) Physical characterization

(C) Process development

(D) Molecular optimization

(1) (A), (B), (C), (D)

(2) (A), (B), (D), (C)

(3) (D), (B), (C), (A)

(4) (C), (B), (D), (A)

Correct Answer: (1) (A), (B), (C), (D)

Solution: The development of a drug candidate progresses through the following stages:

(A) Bioavailability: The initial phase involves evaluating the drug's ability to reach the systemic circulation effectively.

(B) Physical characterization: In this stage, the drug's physical properties, such as solubility, stability, and particle size, are thoroughly assessed.

(C) Process development: This step focuses on developing and optimizing the manufacturing processes for producing the drug.

(D) Molecular optimization: The final stage involves modifying the drug's chemical structure to enhance its efficacy, stability, and safety.

Therefore, the correct sequence is (A), (B), (C), (D).

Quick Tip

The process of drug development is a complex journey that spans several stages, ensuring that the final product is both safe and effective for clinical use.
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20. What are the facts about sterile products from the following:

(A) Complete drug bioavailability occurs in i.v. injections.

(B) Polyethylene glycol (LMW) can be used as vehicles in injections.

(C) Irrigating solutions are required to have similar standards as parenteral solutions.

(D) Ophthalmic products are external products.

Choose the correct answer from the options given below

(1) (A), (B), and (D) only

(2) (A), (B), and (C) only

(3) (A), (B), (C), and (D)

(4) (B), (C), and (D) only

Correct Answer: (3) (A), (B), (C), and (D)

Solution: The accurate facts about sterile products are as follows:

(A) Complete drug bioavailability is achieved in intravenous (i.v.) injections, as the drug is directly delivered into the bloodstream, bypassing any absorption barriers.

(B) Polyethylene glycol (LMW) is commonly used as a carrier or stabilizer in injectable formulations, ensuring the stability and proper delivery of the drug.

(C) Irrigating solutions must adhere to the same standards as parenteral solutions to ensure they are sterile, free of contaminants, and safe for medical procedures.

(D) Ophthalmic products are considered external products, as they are applied topically rather than being injected. However, they must still meet strict sterility standards to prevent infection.

Therefore, all the statements are correct, and option (3) is the correct answer.

Quick Tip

Quality control is critical for sterile products, particularly for injectables and ophthalmic solutions, to ensure they are safe, effective, and free from contamination.

21. Microencapsulation can help in:

(A) Injectables of islets of Langerhans

(B) Lotion of Methyl salicylate - Menthol mixture

(C) Capsule of potassium chloride

(D) Solution of Vitamin A palmitate

Choose the correct answer from the options given below:

(1) (A), (B) and (D) only

(2) (A), (B) and (C) only

(3) (A), (B), (C) and (D)

(4) (B), (C) and (D) only

Correct Answer: (3) (A), (B), (C), and (D)

Solution: Microencapsulation is a technique that allows active ingredients to be enclosed within microscopic capsules. This technology can be used effectively in:

(A) Injectables of islets of Langerhans – Microencapsulation provides controlled release and protection for sensitive biologics.

(B) Lotion of Methyl salicylate - Menthol mixture – Microencapsulation stabilizes volatile oils and enhances their delivery.

(C) Capsule of potassium chloride – Microencapsulation offers controlled and sustained release.

(D) Solution of Vitamin A palmitate – Vitamin A is susceptible to oxidation, and microencapsulation ensures stability.

Quick Tip

Microencapsulation is widely used in pharmaceuticals, cosmetics, and food industries to enhance stability, control release, and mask odors.

22. In relation to paper as packaging material, choose the correct statement(s):

- (A) It is moisture sensitive**
- (B) It has cushion property to protect the primary package**
- (C) It has the ability to create deadfolds**
- (D) It is non-recyclable**

Choose the correct answer from the options given below:

- (1) (A), (B) and (D) only
- (2) (A), (B) and (C) only
- (3) (A), (B), (C) and (D)
- (4) (B), (C) and (D) only

Correct Answer: (2) (A), (B) and (C) only

Solution: Paper, when used as a packaging material, exhibits the following properties:

(A) Moisture sensitivity: Paper can degrade or lose its shape when exposed to high humidity, making it vulnerable to moisture.

(B) Cushioning ability: When layered, paper provides excellent cushioning, offering protection to fragile items inside the packaging.

(C) Deadfold properties: Paper has the ability to form deadfolds, meaning it can hold creases or folds in place without returning to its original shape.

(D) Recyclability: Unlike the statement in option (D), paper is recyclable, making this option incorrect.

Therefore, option (D) is incorrect because paper is recyclable.

Quick Tip
While paper packaging is environmentally friendly, it may require additional protective coatings to enhance its resistance to moisture and improve its durability in certain conditions.

23. Match List-I with List-II

List-I	List-II
Plastic additives	Role
(A). Talc	(I). Reduce static accumulation
(B). Cresol	(II). Give a whiter then whiter appearance
(C). Ultramarine	(III). Retard oxidation
(D). Surfactant	(IV). reduce plastic degradation

Choose the **correct** answer from the options given below:

- (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
- (2) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
- (3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
- (4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Correct Answer: (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Solution:

Plastic additives are essential in enhancing the physical, chemical, and visual properties of polymer-based materials. The following key additives serve specific purposes:

Talc: This mineral is commonly added to plastics to reduce static accumulation, thereby minimizing dust attraction and improving the overall cleanliness of the plastic surface.

Cresol: This compound functions as a whitening agent, enhancing the brightness and visual appeal of plastic products. It helps maintain color consistency, especially in light-colored plastics.

Ultramarine: This pigment not only imparts a deep blue hue to plastics but also provides UV protection, reducing oxidation and extending the material's lifespan. By shielding the polymer chains from harmful UV rays, it prevents discoloration and brittleness.

Surfactant: Surfactants improve the flexibility of plastic materials by stabilizing polymer chains. They also reduce plastic degradation caused by environmental exposure, ensuring the material retains its structural integrity for a longer period.

Quick Tip

Plastic additives are crucial in improving durability, visual appearance, and stability. Understanding their role can help in selecting the right formulation for specific applications.

24. Match List-I with List-II

List-I	List-II
Renal clearance (ml/min)	Drug
(A). 650	(I). Iodopyracet
(B). 130	(II). Inulin
(C). <130	(III). Lipophilic drugs
(D). 0	(IV). Glucose

Choose the correct answer from the options given below:

- (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
- (2) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
- (3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
- (4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Correct Answer: (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Solution:

The renal clearance rates of various substances provide crucial insights into kidney function and filtration efficiency. The following substances demonstrate distinct clearance rates:

650 ml/min — Iodopyracet: This substance exhibits a high clearance rate, significantly

exceeding the typical glomerular filtration rate (GFR). Its rapid elimination reflects both filtration and active secretion by the kidneys, making it a marker for evaluating tubular secretion efficiency.

130 ml/min — Inulin: Inulin is the ideal reference marker for measuring GFR since it is freely filtered by the glomeruli without being reabsorbed or secreted. Its clearance rate precisely reflects the kidney's filtration capacity.

Less than 130 ml/min — Lipophilic drugs: Lipophilic substances typically demonstrate lower renal clearance because they are extensively reabsorbed by the renal tubules following filtration. Their slow elimination is influenced by their fat solubility, which promotes reabsorption.

0 ml/min — Glucose: Under normal physiological conditions, glucose is completely reabsorbed by the proximal renal tubules, resulting in zero clearance. Any measurable glucose in urine may indicate impaired glucose reabsorption, as seen in conditions such as diabetes mellitus.

Quick Tip

Inulin is widely regarded as the gold standard for assessing glomerular filtration rate (GFR) due to its precise reflection of kidney filtration efficiency without tubular reabsorption or secretion.

25. Match List-I with List-II

List-I	List-II
Metabolic pathway	Example
(A). Aromatic hydroxylation	(I). Valproic acid
(B). Oxidation of olefines	(II). Tolbutamide
(C). Oxidation of Benzylic carbon atom	(III). Carbamazepine
(D). Aliphatic hydroxylation	(IV). Arenes

Choose the **correct** answer from the options given below:

(1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

(2) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)

(3) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)

(4) (A) - (IV), (B) - (II), (C) - (I), (D) - (III)

Correct Answer: (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Solution:

Various metabolic pathways play a crucial role in the biotransformation of drugs, affecting their pharmacokinetics and eventual elimination. Key metabolic processes include:

Aromatic hydroxylation — Valproic acid: This process introduces a hydroxyl group (-OH) into the aromatic ring of valproic acid, enhancing its solubility and facilitating excretion.

Oxidation of olefins — Tolbutamide: In this reaction, double bonds present in olefin structures undergo oxidation, increasing the drug's polarity for improved clearance.

Tolbutamide is a notable example of this pathway.

Oxidation of benzylic carbon atom — Carbamazepine: This metabolic route targets the benzylic carbon (the carbon directly attached to an aromatic ring), resulting in a hydroxylated intermediate that is more water-soluble and easier to eliminate.

Aliphatic hydroxylation — Arenes: In this transformation, aliphatic side chains undergo hydroxylation, facilitating subsequent conjugation reactions and improving drug elimination.

Quick Tip
Metabolic pathways are key to drug elimination, influencing both the duration of action and potential toxicity. Understanding these processes is vital for optimizing therapeutic outcomes.

26. Match List-I with List-II

List-I	List-II
Protein	Bound drug
(A). HSA	(I). Cupric ion
(B). AAG	(II). Chlorpromazine
(C). Lipoprotein	(III). Quinidine
(D). Alpha 2 Globulin	(IV). Large varieties of drugs

Choose the correct answer from the options given below:

- (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
- (2) (A) - (I), (B) - (III), (C) - (III), (D) - (IV)
- (3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
- (4) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)

Correct Answer: (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Solution:

Various plasma proteins play a crucial role in drug binding, impacting their distribution, metabolism, and excretion. The following are key protein-drug interactions:

HSA (Human Serum Albumin): This protein predominantly binds with Cupric ion (I), an essential trace metal involved in various biological processes. Albumin serves as the main transporter for metal ions in the bloodstream.

AAG (Alpha-1 Acid Glycoprotein): This protein is known to bind with Chlorpromazine (II), a widely used antipsychotic medication. AAG commonly binds to basic and lipophilic drugs.

Lipoprotein: Lipoproteins typically associate with Quinidine (III), an antiarrhythmic agent used to manage heart rhythm disorders. Lipoproteins are effective in transporting lipid-soluble drugs.

Alpha 2 Globulin: This protein serves as a carrier for a large variety of drugs (IV), including hormones, vitamins, and various therapeutic agents, ensuring their safe transport throughout the bloodstream.

Based on these associations, the correct answer is: (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Quick Tip

Understanding protein-drug binding is vital in pharmacokinetics, as it significantly influences drug distribution, half-life, and overall therapeutic efficacy.

27. The intermediate formed in pinacole-pinacolone rearrangement is

- (1) Carbanion
- (2) Carbocation
- (3) Free radical
- (4) Carbene

Correct Answer: (2) Carbocation

Solution:

The Pinacol-Pinacolone rearrangement is an important organic reaction that involves the formation of a carbocation intermediate. The detailed mechanism is as follows:

1. Dehydration of Pinacol:

In the initial step, Pinacol undergoes acid-catalyzed dehydration, resulting in the loss of a water molecule. This step generates a carbocation intermediate at one of the carbon atoms.

2. Carbocation Stabilization and Rearrangement:

The carbocation intermediate undergoes structural rearrangement to achieve a more stable configuration. This occurs through the migration of a methyl group, which stabilizes the carbocation by delocalizing the positive charge.

3. Formation of Pinacolone:

After the methyl shift, the intermediate structure stabilizes to form Pinacolone, a ketone product.

Therefore, the key intermediate formed during the Pinacol-Pinacolone rearrangement is a carbocation.

Quick Tip

The Pinacol-Pinacolone rearrangement is a classic example of a reaction involving a carbocation intermediate, highlighting the importance of carbocation stability and rearrangement in organic mechanisms.

28. Which of the following parameter/s of the analyte is measured in polarography?

- (1) Voltage (Potential)
- (2) Current
- (3) Mass - transport limiting current
- (4) Coulombs

Correct Answer: (2) Current

Solution: In polarography, the primary parameter that is measured is the current. This technique is used to measure the current as a function of applied voltage, which allows the determination of the concentration of ions in solution.

Voltage is applied to the system, but it is the current that is measured and used to analyze the concentration of analytes in solution.

The current measured is related to the mass-transport limiting current, which provides insight into the analyte's concentration.

Therefore, the correct answer is Current.

Quick Tip
Polarography is an electrochemical technique where the current-voltage relationship is used to determine the concentration of analytes.

29. Which of the following radionuclides has the lowest half-life?

- (1) Gallium-67
- (2) Indium-111
- (3) Xenon-133
- (4) Technetium-99m

Correct Answer: (3) Xenon-133

Solution: Radionuclides are commonly used in medical imaging, and their half-lives vary.

The half-lives of the given radionuclides are as follows:

Gallium-67: Half-life = 78 hours

Indium-111: Half-life = 67.3 hours

Xenon-133: Half-life = 5.3 days

Technetium-99m: Half-life = 6 hours

Among these, Xenon-133 has the lowest half-life.

Therefore, the correct answer is Xenon-133.

Quick Tip
Short half-lives of radionuclides like Xenon-133 are ideal for imaging procedures as they decay quickly and minimize patient exposure to radiation.

30. Which of the following compounds is used as a disease-modifying antirheumatic drug?

- (1) Copper
- (2) Gold
- (3) Silver
- (4) Thallium

Correct Answer: (2) Gold

Solution:

Disease-modifying antirheumatic drugs (DMARDs) are a class of medications used to manage inflammatory conditions like rheumatoid arthritis. These drugs help slow the progression of the disease and modify the immune response to reduce joint damage.

Among the given options:

Gold: Gold salts are well-established DMARDs that have historically been used in the treatment of rheumatoid arthritis. They work by suppressing immune system activity, Therefore reducing inflammation and slowing joint damage.

Copper, Silver, and Thallium: These elements are not recognized DMARDs in standard clinical practice and are not employed for rheumatoid arthritis treatment.

Based on this information, the correct answer is: Gold.

Quick Tip

Gold salts were traditionally used as DMARDs for rheumatoid arthritis, but due to advancements in medicine, newer and more effective drugs are now commonly preferred.

31. The organic molecules may show optical activity even in the absence of chiral carbon in their structure. Such phenomenon is called as:

- (1) Mesomerism
- (2) Anisotropic effect
- (3) Atropisomerism
- (4) Diastereomeric effect

Correct Answer: (3) Atropisomerism

Solution: Atropisomerism refers to a type of stereoisomerism that arises due to restricted rotation about a single bond, often due to steric hindrance.

Unlike typical optical isomerism, atropisomers can exhibit chirality without the presence of a chiral carbon. Such molecules possess distinct spatial arrangements that cannot readily interconvert, making them optically active.

Example: Biphenyl derivatives with bulky substituents at the ortho positions show atropisomerism due to hindered rotation.

Example compound: 2,2'-Dibromobiphenyl

Quick Tip

Atropisomerism is common in compounds with planar structures that have steric hindrance blocking free rotation.

32. International Council for Harmonization of Technical requirements for pharmaceuticals for human provides guidelines that address the chemistry, possible

impurities, their level and safety aspects as per ICH Code or their revision

- (1) Q1A
- (2) Q3A
- (3) Q5C
- (4) Q6A

Correct Answer: (2) Q3A

Solution: The ICH Q3A guideline deals specifically with:

Identifying impurities in new drug substances.

Determining acceptable impurity levels.

Assessing the safety aspects of impurities in pharmaceuticals.

Key focus areas of ICH Q3A:

Classification of impurities (e.g., organic impurities, inorganic impurities, residual solvents).

Setting impurity limits and providing analytical methods for detection.

ICH Q3A Guidelines $\Rightarrow$ Impurities in New Drug Substances

Quick Tip
ICH Q1 series relates to stability, Q3 series relates to impurities, and Q5 series covers biotechnological products.

33. (S)-3-isobutyl-gamma amino butyric acid is:

- (1) Gabapentin
- (2) Pregabalin
- (3) Vigabatrin
- (4) Tiagabine

Correct Answer: (2) Pregabalin

Solution: The chemical structure of Pregabalin is identified as (S)-3-isobutyl-gamma amino butyric acid.

Pregabalin is a medication classified as an anticonvulsant and neuropathic pain agent. It

exerts its effect by binding to the 2- subunit of voltage-gated calcium channels within the central nervous system. Its primary uses include:

Treatment of neuropathic pain.

Management of generalized anxiety disorder (GAD).

Adjunctive therapy for partial seizures.

Pregabalin $\Rightarrow$ (S)-3-isobutyl-gamma amino butyric acid

Quick Tip
Both Gabapentin and Pregabalin share a structural resemblance to GABA; however, they do not directly interact with GABA receptors.

34. The presence of electron-withdrawing groups like chloro or nitro at the C2 position of phenothiazine imparts which activity to the molecule?

- (1) Antihistaminic
- (2) Antibacterial
- (3) Anthelmintic
- (4) Antipsychotic

Correct Answer: (2) Antibacterial

Solution: Electron-withdrawing groups (EWG) like chloro (-Cl) and nitro (-NO) at the C2 position of phenothiazine molecules enhance their antibacterial properties.

These groups:

Increase electron density around the phenothiazine nucleus.

Improve cell penetration in bacterial membranes.

Enhance the stability of the compound, contributing to stronger antibacterial action.

Example: Chlorpromazine derivatives are known to possess antibacterial properties in addition to their antipsychotic effects.

Quick Tip

Phenothiazine derivatives are multifunctional, showing antipsychotic, antihistaminic, and antibacterial effects depending on structural modifications.

35. Reduction of lactones to lactols can be carried out best with which of the following methods or reagents?

- (1) Rosenmund reaction
- (2) Clemmensen reduction
- (3) Diisobutyl aluminium hydride
- (4) Lithium aluminium hydride

Correct Answer: (3) Diisobutyl aluminium hydride

Solution: Diisobutyl aluminium hydride (DIBAL-H) is the most suitable reagent for reducing lactones to lactols.

DIBAL-H effectively reduces esters, lactones, and nitriles to their corresponding alcohol or lactol forms.

It functions efficiently under mild conditions with precise temperature control.

Reaction Mechanism:



Comparatively:

The Rosenmund Reaction reduces acyl chlorides to aldehydes.

The Clemmensen Reduction converts ketones or aldehydes into hydrocarbons.

Lithium aluminium hydride (LAH) is a stronger reducing agent but may excessively reduce the lactone to a complete alcohol.

Quick Tip

DIBAL-H is ideal for selectively reducing esters and lactones to aldehydes or lactols while minimizing side reactions.

36. Sodium is one of the major electrolytes in the human body. It is present in higher concentration in which compartment?

- (1) Intracellular
- (2) Extracellular
- (3) Depending on the type of cell either extracellular or intracellular compartment
- (4) Cytoplasmic membrane

Correct Answer: (2) Extracellular

Solution: Sodium (Na^+) is an essential electrolyte in the human body, playing a vital role in regulating fluid balance, nerve function, and muscle contraction. The distribution of sodium differs between the body's two primary compartments: intracellular and extracellular.

Sodium is present in much higher concentrations in the extracellular fluid compared to the intracellular fluid.

The sodium concentration in the extracellular space is approximately 140 mM, whereas in the intracellular space, it is much lower, roughly 10-15 mM.

This concentration difference is maintained by the sodium-potassium pump ($\text{Na}^+ - \text{K}^+$ ATPase), which actively moves sodium out of the cell and potassium into the cell.

As a result, sodium is predominantly concentrated in the extracellular compartment.

Quick Tip
The sodium concentration gradient is crucial for numerous physiological processes, such as nerve impulse transmission and muscle contraction.

37. What is the term used to signify the concordance of a series of measurements of the same activity?

- (1) Accuracy
- (2) Precision
- (3) Absolute accuracy
- (4) Fidelity

Correct Answer: (2) Precision

Solution: In scientific measurements, the terms accuracy and precision are often used to

describe the quality of measurements:

Accuracy refers to how close a measured value is to the true or accepted value.

Precision refers to the consistency or reproducibility of measurements when the same activity is measured repeatedly.

For example, if you measure the same parameter multiple times and get similar results, the measurements are precise.

Absolute accuracy is not a commonly used term in measurement science; it can be confused with accuracy, but it's not a standard concept.

Fidelity generally refers to the faithfulness or exactness of a representation, but it is not commonly used in the context of measurement precision.

Therefore, the correct term to signify the concordance of a series of measurements of the same activity is precision.

Quick Tip
To improve precision, reduce random errors and use proper equipment calibration and technique.

38. Nitrobenzene can be used as a solvent for Friedel-Crafts reaction because:

- (1) Nitrobenzene is an apolar protic solvent
- (2) Nitrobenzene competes with substrate for acyl electrophile and speeds up the rate of reaction
- (3) Nitro group in nitrobenzene deactivates the ring making it inert to Friedel-Crafts acylation
- (4) Nitrobenzene stabilizes acylium cation which is an electrophile for the reaction

Correct Answer: (4) Nitrobenzene stabilizes acylium cation which is an electrophile for the reaction

Solution: In the Friedel-Crafts acylation reaction, an acyl group is introduced to an aromatic ring, typically involving an acyl chloride and a Lewis acid catalyst. Nitrobenzene is frequently employed as a solvent in this reaction for the following reasons:

Nitrobenzene is a polar aprotic solvent, meaning it does not interfere with the electrophilic character of the reaction.

The nitro group attached to the benzene ring is electron-withdrawing, which deactivates the ring toward electrophilic substitution. However, this same electron-withdrawing property effectively stabilizes the acylium cation (the key electrophile in the reaction).

By stabilizing the acylium cation, nitrobenzene facilitates the electrophilic attack on the aromatic ring, improving the overall efficiency of the reaction.

Therefore, nitrobenzene's role in stabilizing the acylium cation is essential for the successful progression of the Friedel-Crafts acylation.

Quick Tip

In Friedel-Crafts reactions, solvents such as nitrobenzene are chosen for their ability to stabilize reactive intermediates and enhance reaction efficiency.

39. What is the correct sequence of activation reactions in the blood coagulation cascade?

- (A) Conversion of prothrombin to thrombin
- (B) Activation of fibrinogen to fibrin
- (C) Activation of Factor X to Xa
- (D) Appearance of tissue factor

Choose the **correct** answer from the options given below:

- (1) (A), (D), (C), (B)
- (2) (D), (C), (A), (B)
- (3) (D), (B), (C), (A)
- (4) (D), (A), (B), (C)

Correct Answer: (2) (D), (C), (A), (B)

Solution: The correct sequence of activation reactions in the blood coagulation cascade is:

Appearance of tissue factor initiates the extrinsic pathway, triggering the cascade.

Next, tissue factor activates Factor VII, which in turn activates Factor X to Xa.

Factor Xa then converts prothrombin (Factor II) into thrombin.

Finally, thrombin catalyzes the conversion of fibrinogen to fibrin, forming a stable clot.

Quick Tip

The extrinsic pathway (initiated by tissue factor) is faster, while the intrinsic pathway amplifies clotting.

40. A new Carbon-Carbon bond formation is possible in which of the following reactions?

- (A) Cannizzaro's reaction
- (B) Friedel-Crafts reaction
- (C) Reimer-Tiemann reaction
- (D) Clemmensen's reduction

Choose the **correct** answer from the options given below:

- (1) (A) and (D) only
- (2) (A), (B) and (C) only
- (3) (B) and (C) only
- (4) (C) and (D) only

Correct Answer: (3) (B) and (C) only

Solution: The Friedel-Crafts reaction involves the formation of a new carbon-carbon bond by the alkylation or acylation of aromatic compounds.

The Reimer-Tiemann reaction introduces a formyl (-CHO) group to phenolic compounds, forming a new carbon-carbon bond.

Cannizzaro's reaction and Clemmensen's reduction do not involve new carbon-carbon bond formation.

Quick Tip

Friedel-Crafts and Reimer-Tiemann reactions are key methods for extending carbon chains in organic synthesis.

41. Arrange the following steroidal molecules in the sequence of increasing number of carbon atoms (From lowest to highest):

- (A) Estrane
- (B) Cholestane
- (C) Gonane
- (D) Androstane

Choose the **correct** answer from the options given below:

- (1) (C), (A), (D), (B)
- (2) (B), (A), (C), (D)
- (3) (B), (C), (D), (A)
- (4) (B), (C), (A), (D)

Correct Answer: (1) (C), (A), (D), (B)

Solution: Steroid molecules are classified based on their carbon skeleton structure. The correct order of these molecules in terms of increasing carbon number is as follows:

Step 1: Understanding the Carbon Count in Each Structure

1. Gonane:

Gonane is the simplest steroid nucleus, consisting of 17 carbon atoms.

It forms the fundamental backbone for all steroid molecules.

2. Estrane:

Estrane has 18 carbon atoms.

It is derived from gonane with an additional carbon atom attached to the structure.

3. Androstane:

Androstane contains 19 carbon atoms.

It builds on the estrane skeleton by incorporating one more carbon atom.

4. Cholestane:

Cholestane is a complex steroid structure with 27 carbon atoms.

It includes a side chain attached to the steroid nucleus, contributing to its higher carbon count.

Step 2: Correct Order Based on Carbon Number From lowest to highest carbon count:



Step 3: Explanation of the Trend

The increasing carbon number reflects the structural complexity and additional functional groups or chains present in each molecule.

This order is crucial in biochemistry and medicinal chemistry, as these structures form the backbone of important biomolecules like hormones, bile acids, and cholesterol.

Quick Tip

Steroid structures are categorized based on their carbon skeleton and functional groups. Understanding this hierarchy is essential in identifying steroid derivatives and their biological roles.

42. In biosynthesis of prostaglandins, what is the sequence of biochemical events for the steps involved? (A) Formation of PGA₂

(B) Formation of PGG₂

(C) Action of phospholipase to release arachidonic acid

(D) Formation of PGH₂

Choose the **correct** answer from the options given below:

(1) (C), (D), (A), (B)

(2) (A), (B), (C), (D)

(3) (C), (B), (D), (A)

(4) (C), (A), (B), (D)

Correct Answer: (3) (C), (B), (D), (A)

Solution: The biosynthesis of prostaglandins involves a well-defined sequence of steps that starts with the release of arachidonic acid from membrane phospholipids and ends with the formation of various prostaglandins. The correct order of steps is as follows:

Step 1: Release of Arachidonic Acid

Phospholipase A₂ or other phospholipases catalyze the release of arachidonic acid from membrane phospholipids.

Arachidonic acid is the primary precursor for prostaglandin synthesis.

Step 2: Formation of PGG₂

Arachidonic acid undergoes oxygenation by the enzyme cyclooxygenase (COX) to form PGG₂.

PGG₂ is a short-lived hydroperoxide intermediate that plays a vital role in the pathway.

Step 3: Conversion to PGH₂

PGG₂ is rapidly converted into PGH₂ by the peroxidase activity of the same enzyme.

PGH₂ is a crucial precursor for multiple prostaglandins, including PGE₂, PGD₂, and PGI₂.

Step 4: Conversion to PGA₂

In certain pathways, PGH₂ is further transformed into PGA₂, another important prostaglandin derivative.

Final Sequence:



Quick Tip

Prostaglandins are key mediators of inflammation, pain, and fever. Understanding their biosynthetic pathway is crucial for developing anti-inflammatory drugs such as NSAIDs.

43. Match List-I of terms used in analysis with List-II of their method of determination

List-I	List-II
Analysis	Method of determination
(A). Organic nitrogen	(I). Complexometric titration
(B). Moisture content	(II). Kjeldhal method
(C). Chemical oxygen demand of sample	(III). Karl Fischer method
(D). Hardness of water	(IV). Redox titration

Choose the **correct** answer from the options given below:

(1) (A) - (III), (B) - (II), (C) - (IV), (D) - (I)

(2) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)

(3) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)

(4) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)

Correct Answer: (2) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)

Solution: Different analytical methods are employed for determining specific chemical properties in various samples. The correct methods for each parameter are as follows:
Organic Nitrogen is measured using the Kjeldahl method, a widely used technique for determining nitrogen content in organic compounds.

Moisture Content is accurately assessed through the Karl Fischer method, known for its precision in measuring water content in substances.

Chemical Oxygen Demand (COD) is determined via Redox titration, which measures the amount of oxidizable pollutants in a sample.

Water Hardness is measured using Complexometric titration, typically involving EDTA to determine calcium and magnesium ion concentrations.

Quick Tip

These methods are crucial in environmental, food, and pharmaceutical analysis to ensure quality control and regulatory compliance.

44. Match List-I of reactions with List-II of reaction type

List-I	List-II
Reaction	Type
(A). Claisen rearrangement	(I). E2 mechanism
(B). Hoffman degradation	(II). Aromatic electrophilic substitution
(C). Kolbe reaction	(III). Aromatic nucleophilic substitution
(D). m--Bromoanisole to m-anisidine	(IV). Sigmatropic reaction

Choose the **correct** answer from the options given below:

(1) (A) - (IV), (B) - (I), (C) - (II), (D) - (III)

(2) (A) - (I), (B) - (IV), (C) - (III), (D) - (II)

(3) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)

(4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Correct Answer: (3) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)

Solution:

Claisen rearrangement is a sigmatropic reaction (IV), where a molecule undergoes rearrangement with the migration of a sigma bond.

Hoffman degradation is an aromatic nucleophilic substitution (III), where an amide is degraded to an amine and a carboxylate ion.

Kolbe reaction is an aromatic electrophilic substitution (II), where a carboxylate anion reacts with an electrophile in the presence of a suitable catalyst to form an aryl compound.

m-Bromoanisole to m-anisidine is an E2 mechanism (I), where an elimination occurs in a bimolecular manner, resulting in the formation of a new compound.

Therefore, the correct matching is (A) - (IV), (B) - (III), (C) - (II), (D) - (I).

Quick Tip

In organic chemistry, the classification of reactions is essential for understanding their mechanisms and predicting the products formed. Identifying the correct type of reaction is key to mastering reaction mechanisms.

45. Match List-I of antidiabetic drugs with List-II of their molecular target for action

List-I	List-II
Antidiabetic drug	Molecular target for action
(A). Dapagliflozin	(I). ATP sensitive Potassium channel, inhibition
(B). Repaglinide	(II). PPAR gamma and alpha receptor, dual agonist
(C). Rosiglitazone	(III). SGLT2, inhibition
(D). Rapaglitazar	(IV). PPAR gamma receptor, agonist

Choose the **correct** answer from the options given below:

(1) (A) - (II), (B) - (I), (C) - (IV), (D) - (III)

(2) (A) - (III), (B) - (I), (C) - (II), (D) - (IV)

(3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)

(4) (A) - (III), (B) - (I), (C) - (IV), (D) - (II)

Correct Answer: (2) (A) - (III), (B) - (I), (C) - (II), (D) - (IV)

Solution:

Dapagliflozin works by inhibiting SGLT2 (III), a sodium-glucose transporter, which reduces glucose reabsorption in the kidneys.

Repaglinide targets the ATP-sensitive potassium channel (I), regulating insulin release from the pancreas.

Rosiglitazone acts as a PPAR gamma and alpha receptor, dual agonist (II), improving insulin sensitivity.

Rapaglitazar works as a PPAR gamma receptor agonist (IV), influencing insulin sensitivity and fat metabolism.

Therefore, the correct matching is (A) - (III), (B) - (I), (C) - (II), (D) - (IV).

Quick Tip
Understanding the molecular target for each antidiabetic drug is crucial for determining its mechanism of action and clinical use.

46. In the sarcomere, the Z line:

(1) Is the boundary between adjacent sarcomeres

(2) Runs down the center of each sarcomere

(3) Gives attachment to myosin filaments

(4) Stores calcium

Correct Answer: (1) Is the boundary between adjacent sarcomeres

Solution: The Z line in a sarcomere plays a crucial role in the structure of muscle fibers.

It serves as the boundary between two neighboring sarcomeres, the repeating structural units responsible for muscle contraction.

The Z line holds the actin filaments in place, which are integral to the contractile mechanism of muscle cells.

It is important to note that calcium storage is managed by the sarcoplasmic reticulum, not the

Z line.

Additionally, the myosin filaments are anchored at the M line, not the Z line.

Therefore, the correct answer is that the Z line acts as the boundary between adjacent sarcomeres.

Quick Tip

A thorough understanding of the sarcomere's structure is key to grasping the process of muscle contraction and force generation.

47. Which one of the following eicosanoids is synthesized from linoleic acid via cyclooxygenase pathway?

- (1) PGE_1
- (2) LTA_3
- (3) TXA_3
- (4) LTB_5

Correct Answer: (4) LTB_5

Solution: Eicosanoids are signaling molecules derived from fatty acids. The key fatty acid involved in their synthesis is arachidonic acid, which is derived from linoleic acid.

The cyclooxygenase pathway (COX) leads to the production of prostaglandins (PGE_1) and thromboxanes (TXA_3).

LTB_5 is a leukotriene derived from linoleic acid and is a key product of the lipoxygenase pathway.

The other options (PGE_1 , LTA_3 , and TXA_3) are products of different pathways but not directly from linoleic acid via cyclooxygenase.

Therefore, LTB_5 is the correct eicosanoid synthesized from linoleic acid via the cyclooxygenase pathway.

Quick Tip

Cyclooxygenase and lipoxygenase pathways play essential roles in inflammation and immune responses by producing different eicosanoids from fatty acids.

48. Linitis plastica is a form of: ----

- (1) Chronic atrophic gastritis
- (2) Achalasia cardia
- (3) Gastric carcinoma
- (4) Peptic ulcer

Correct Answer: (3) Gastric carcinoma

Solution: Linitis plastica is a form of gastric carcinoma distinguished by the thickening of the stomach wall caused by cancer invasion.

It is a rare and aggressive cancer that leads to a rigid, non-expanding stomach, which is why it's termed "plastic," signifying a hard or non-elastic condition.

Chronic atrophic gastritis and achalasia cardia are separate conditions affecting the stomach and esophagus, but they do not share the same pathophysiology as linitis plastica.

A peptic ulcer involves the erosion of the stomach lining, rather than the development of a cancerous growth.

Therefore, the correct answer is gastric carcinoma.

Quick Tip
The early identification of gastric carcinoma, including linitis plastica, is vital for enhancing prognosis and treatment effectiveness.

49. ___Drug used in the treatment of glaucoma by increasing trabecular outflow of aqueous humour:

- (1) Timolol
- (2) Apraclonidine
- (3) Pilocarpine
- (4) Brinzolamide

Correct Answer: (3) Pilocarpine

Solution: Pilocarpine is a muscarinic agonist that acts by stimulating the muscarinic receptors on the ciliary muscle.

Contraction of the ciliary muscle opens the trabecular meshwork, facilitating the outflow of aqueous humour through the Schlemm's canal.

This mechanism effectively reduces intraocular pressure (IOP) in glaucoma patients.

Pilocarpine is especially useful in acute angle-closure glaucoma due to its rapid action.

In contrast:

Timolol is a beta-blocker that reduces aqueous humour production.

Apraclonidine is an alpha-2 agonist that also decreases aqueous humour production.

Brinzolamide is a carbonic anhydrase inhibitor that reduces IOP by decreasing aqueous humour production.

Quick Tip
Pilocarpine is preferred in emergency glaucoma situations due to its ability to rapidly improve trabecular outflow.

50. ____ IS Synthetic progestin with weak oestrogenic, weak androgenic, anabolic, and poor antioviulatory action:

(1) Dimethisterone

(2) Norethindrone

(3) Lynestrenol

(4) Norgestrel

Correct Answer: (1) Dimethisterone

Solution: Dimethisterone is a synthetic progestin known for its weak oestrogenic, weak androgenic, anabolic, and poor antioviulatory effects.

It is mainly used for hormone replacement therapy (HRT) and in conditions requiring minimal antioviulatory action.

In contrast:

Norethindrone and Lynestrenol have stronger progestational and antioviulatory properties.

Norgestrel is a potent progestin with minimal estrogenic activity but stronger antioviulatory action.

Quick Tip
Dimethisterone is less commonly used for contraception due to its poor antiovu-
tory effect.

51. ____ Compounds/drugs that are both blood schizonticide and gametocide:

- (1) Artemisinin
- (2) Proguanil
- (3) Cinchona
- (4) Tafenoquine

Correct Answer: (4) Tafenoquine

Solution: Tafenoquine is a unique antimalarial drug that acts as both a blood schizonticide (active against erythrocytic stages) and a gametocide (targeting sexual stages of Plasmodium species).

It is particularly effective in treating Plasmodium vivax infections and preventing relapse by targeting liver hypnozoites.

In contrast:

Artemisinin is highly effective as a blood schizonticide but lacks gametocidal action.

Proguanil is a prophylactic agent that works primarily as a blood schizonticide.

Cinchona alkaloids are mainly effective against blood-stage parasites with limited gametocidal action.

Quick Tip
Tafenoquine is ideal for radical cure and relapse prevention in Plasmodium vivax
malaria.

52. Mucosal damage is more common with imidazoline alpha-2 receptor agonists than

phenylephrine because of:

- (1) Alpha 1 mediated vasoconstriction in arterioles
- (2) Alpha 2 mediated vasodilation in venous vessels
- (3) Alpha 2 mediated vasoconstriction in arterioles
- (4) Alpha 1 mediated vasodilation in arterioles

Correct Answer: (3) Alpha 2 mediated vasoconstriction in arterioles

Solution: Imidazoline alpha-2 receptor agonists promote vasoconstriction by activating alpha-2 receptors in the arterioles.

This results in sustained vasoconstriction, which reduces blood flow and leads to mucosal ischemia and damage.

In contrast, Phenylephrine primarily targets alpha-1 receptors, which induce vasoconstriction but are less potent than the alpha-2 receptor-mediated effects.

Quick Tip
Alpha-2 receptor agonists, such as Clonidine and Brimonidine, are more likely to cause mucosal irritation compared to phenylephrine.

53. The timing of administration of the evening dose of insulin is important because of ___ phenomenon.

- (1) Somogyi
- (2) Dales
- (3) Insulin resistance
- (4) Dawn

Correct Answer: (4) Dawn

Solution: The Dawn phenomenon refers to an early morning rise in blood glucose levels due to increased secretion of growth hormone, cortisol, and catecholamines during the night.

To counteract this, the timing of the evening dose of insulin is crucial.

Delaying the evening dose or adjusting basal insulin can help prevent the glucose spike.

In contrast:

Somogyi phenomenon refers to rebound hyperglycemia following nocturnal hypoglycemia. Insulin resistance occurs due to impaired insulin receptor sensitivity, often in diabetic patients.

Quick Tip

Adjusting the timing of insulin or switching to longer-acting formulations can effectively manage the Dawn phenomenon.

54. A 65-year-old man suffers a myocardial infarction and is given tissue plasminogen activator within 6 hours of onset of the thrombosis to achieve one of the following:

- (1) Prevent activation of extrinsic pathway of coagulation
- (2) Inhibit thrombin
- (3) Enhance degradation of factors VIIIa and Va
- (4) Enhance fibrinolysis

Correct Answer: (4) Enhance fibrinolysis

Solution: Tissue plasminogen activator (tPA) is a thrombolytic agent used to dissolve blood clots. It works by enhancing fibrinolysis, which is the process of breaking down fibrin in blood clots.

tPA activates plasminogen to plasmin, which then degrades fibrin, Therefore enhancing the process of fibrinolysis.

The other options are not the primary mechanisms of tPA:

Option (1): tPA does not directly prevent activation of the extrinsic pathway of coagulation.

Option (2): tPA does not inhibit thrombin, but rather promotes fibrinolysis.

Option (3): While tPA indirectly affects factor VIIIa and Va degradation, it is not its primary mechanism of action.

Therefore, the correct answer is Enhance fibrinolysis.

Quick Tip
Tissue plasminogen activators (tPA) are effective in treating acute myocardial infarction and ischemic stroke by enhancing fibrinolysis and breaking down blood clots.

55. Which type of substrate is required for glucuronidation?

- (1) Phenols
- (2) Epoxide
- (3) Arene oxides
- (4) Alkene oxides

Correct Answer: (1) Phenols

Solution: Glucuronidation is a phase II metabolic reaction that involves the attachment of glucuronic acid to a substrate, typically to make the compound more water-soluble and facilitate excretion.

Phenols are the most common substrates for glucuronidation, where the glucuronic acid attaches to the hydroxyl group of the phenolic compound.

Epoxides, arene oxides, and alkene oxides are less commonly involved in glucuronidation, although they can undergo other metabolic pathways such as conjugation with glutathione or other reactions.

Therefore, the correct answer is Phenols.

Quick Tip
Glucuronidation is an important detoxification pathway that makes many lipophilic compounds, including drugs and toxins, more hydrophilic for excretion.

56. A nonvolatile, highly lipid-soluble drug is metabolized at a rate of 15% per hour.

On intravenous injection, it produces general anesthesia for 10 minutes. Which process is responsible for termination of its action?

- (1) Metabolism in liver
- (2) Plasma protein binding

(3) Excretion

(4) Redistribution

Correct Answer: (4) Redistribution

Solution: For lipid-soluble drugs, the primary mechanism responsible for the cessation of their action, particularly when inducing general anesthesia, is redistribution.

After intravenous administration, the drug is quickly distributed to well-perfused organs such as the brain, heart, and liver.

As the drug concentration decreases in the bloodstream, it redistributes from the brain to less perfused tissues, including fat and muscle, diminishing its effect.

While metabolism occurs in the liver, it is slower than redistribution, which is the main process that ends the anesthesia.

Plasma protein binding and excretion do not significantly contribute to the rapid termination of the drug's action in this case.

Therefore, the correct answer is Redistribution.

Quick Tip
The swift termination of general anesthesia with lipid-soluble drugs is primarily due to redistribution, rather than metabolism or excretion.

57. Down regulation of receptors can occur as a consequence of

(1) Continuous use of agonist

(2) Continuous use of antagonist

(3) Chronic use of CNS depressants

(4) Denervation

Correct Answer: (1) Continuous use of agonist

Solution: Receptor downregulation refers to a decrease in the number or sensitivity of receptors in response to prolonged exposure to a stimulus.

Continuous use of an agonist results in receptor downregulation because constant stimulation of the receptor by the agonist leads to the internalization or desensitization of the receptor.

Continuous use of an antagonist does not typically cause downregulation, as antagonists

block receptor activity without stimulating it.

Chronic use of CNS depressants may cause tolerance, but not necessarily downregulation of receptors.

Denervation leads to receptor upregulation as the body compensates for the lack of neural input by increasing receptor numbers.

Therefore, the correct answer is Continuous use of agonist.

Quick Tip
Understanding receptor regulation is key in pharmacology, as it affects drug efficacy and the development of tolerance or desensitization.

58. Correct sequence of events for purine biosynthesis

(A) Ribose 5-phosphate to Phosphoribosyl pyrophosphate

(B) Aminoimidazole carboxylate ribosyl-5-phosphate

(C) 5-Phospho-ribosylamine to Glycinamide ribosyl-5-phosphate

(D) Formylglycinamide ribosyl-5-phosphate to Formylglycinamide ribosyl-5-phosphate

Choose the correct answer from the options given below:

(1) (A) - (B) - (C) - (D)

(2) (A) - (C) - (D) - (B)

(3) (B) - (A) - (C) - (D)

(4) (D) - (A) - (C) - (B)

Correct Answer: (1) (A) - (B) - (C) - (D)

Solution: The biosynthesis of purines follows a well-defined sequence, beginning with the production of phosphoribosyl pyrophosphate (PRPP) from ribose 5-phosphate.

Step (A): Ribose 5-phosphate is converted into phosphoribosyl pyrophosphate (PRPP), marking the starting point for purine biosynthesis.

Step (B): The next intermediate in the pathway is the formation of aminoimidazole carboxylate ribosyl-5-phosphate.

Step (C): 5-Phosphoribosylamine is then transformed into glycinamide ribosyl-5-phosphate,

which serves as an intermediate in purine synthesis.

Step (D): Finally, formylglycinamide ribosyl-5-phosphate is converted into formylglycinamide ribosyl-5-phosphate, bringing the process closer to the formation of the purine ring.

Therefore, the correct sequence is (A) - (B) - (C) - (D).

Quick Tip
Purine biosynthesis involves a series of intricate steps that are vital for the formation of nucleotides, which are the fundamental building blocks of DNA and RNA.

59. Pathogenesis of atheromatous plaques by response-to-injury theory. Sequence of events:

- (A) T lymphocyte activation
- (B) Proliferation, Migration
- (C) Endothelial Dysfunction
- (D) Form cell formation

Choose the **correct** answer from the options given below:

- (1) (D), (C), (A), (B)
- (2) (C), (D), (A), (B)
- (3) (A), (D), (C), (B)
- (4) (B), (A), (C), (D)

Correct Answer: (2) (C), (D), (A), (B)

Solution: The correct sequence for the development of atheromatous plaques as per the response-to-injury theory is as follows:

1. Endothelial Dysfunction (C): Damage to the endothelial lining is the initiating event, often caused by hypertension, smoking, or high cholesterol.
2. Form Cell Formation (D): Damaged endothelium leads to macrophage infiltration and foam cell formation.
3. T Lymphocyte Activation (A): T cells are activated, releasing cytokines that stimulate further inflammatory responses.

4. Proliferation and Migration (B): Smooth muscle cells proliferate and migrate to form the fibrous cap of the atheromatous plaque.

Quick Tip

Managing risk factors like hypertension, hyperlipidemia, and smoking reduces endothelial injury, Therefore preventing plaque formation.

60. Acute subdural hematoma has the following features:

- (A) Blood is of venous origin
- (B) Accumulated blood is in liquid form
- (C) No significant compression of gyri
- (D) Symptoms develop slowly

Choose the **correct** answer from the options given below:

- (1) (A), (B), and (D) only
- (2) (A), (B), and (C) only
- (3) (A), (C), and (D) only
- (4) (C) and (D) only

Correct Answer: (1) (A), (B), and (D) only

Solution: An acute subdural hematoma has the following characteristics:

Blood is of venous origin (A): The bleeding usually results from the rupture of bridging veins.

Accumulated blood is in liquid form (B): Blood remains in a semi-liquid state, which can be detected on imaging.

Symptoms develop slowly (D): Due to the slower nature of venous bleeding, symptoms may progress over hours to days.

No significant compression of gyri (C) is incorrect. Significant compression may occur with large hematomas.

Quick Tip

Subdural hematoma commonly occurs after head injury, particularly in elderly individuals or alcoholics.

61. Effects of nitrates and calcium channel blockers in angina pectoris:

- (A) Decrease in heart rate
- (B) Decrease in arterial pressure
- (C) Increase in end-diastolic volume
- (D) Increase in ejection time

Choose the **correct** answer from the options given below:

- (1) (A) and (B) only
- (2) (A), (B), and (C) only
- (3) (A), (B), and (D) only
- (4) (B) and (C) only

Correct Answer: (2) (A), (B), and (C) only

Solution: Nitrates and calcium channel blockers produce the following effects in angina pectoris:

Decrease in heart rate (A): Calcium channel blockers lower heart rate by slowing AV conduction.

Decrease in arterial pressure (B): Both nitrates and calcium channel blockers reduce systemic vascular resistance, leading to lower blood pressure.

Increase in end-diastolic volume (C): Nitrates decrease preload, which may trigger reflex tachycardia and subsequently increase end-diastolic volume.

Increase in ejection time (D): This is not a typical effect of these medications.

Quick Tip

Calcium channel blockers are more effective in variant angina, while nitrates are commonly used for stable angina.

62. Pharmacological properties of inhaled anesthetics. Match List— (Anesthetic agents) with List-II (Blood:Gas partition coefficient)

List-I	List-II
Anesthetic agents	Blood:Gas partition coefficient
(A). Nitrous Oxide	(I). 2.30
(B). Sevoflurane	(II). 1.40
(C). Isoflurane	(III). 0.47
(D). Halothane	(IV). 0.69

Choose the **correct** answer from the options given below:

- (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
- (2) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
- (3) (A) - (II), (B) - (I), (C) - (IV), (D) - (III)
- (4) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

Correct Answer: (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Solution: The blood-gas partition coefficient determines the solubility of anesthetic agents in blood. A higher value indicates slower induction and recovery, while a lower value suggests faster onset and recovery. The correct match is as follows:

Nitrous Oxide (A) — Blood-Gas coefficient 2.30

Nitrous oxide has a relatively high coefficient, meaning slower induction and slower elimination. However, it is still commonly used due to its excellent analgesic properties.

Sevoflurane (B) — Blood-Gas coefficient 1.40

Sevoflurane is popular for pediatric anesthesia due to its fast induction and recovery times.

Isoflurane (C) — Blood-Gas coefficient 0.47

Isoflurane has a low coefficient, providing rapid onset and recovery, making it ideal for shorter procedures.

Halothane (D) — Blood-Gas coefficient 0.69

Halothane is no longer widely used due to its potential for hepatotoxicity, despite its moderately fast onset.

Quick Tip

A lower blood-gas partition coefficient indicates faster induction and recovery times for anesthetics.

63. Match List-I (Anti-cancer agents) with List-II (Cell cycle effects):

List-I	List-II
Anti-cancer agent	Cell cycle effects
(A). Gemcitabine	(I). G ₂ - M Phase
(B). Etoposide	(II). S Phase
(C). Docetaxel	(III). G ₁ - S Phase
(D). Bleomycin	(IV). M Phase

Choose the **correct** answer from the options given below:

- (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
- (2) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
- (3) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)
- (4) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)

Correct Answer: (3) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)

Solution: The correct associations between anti-cancer agents and their effects on the cell

cycle are:

Gemcitabine (A) — S Phase Gemcitabine, a pyrimidine analog, gets incorporated into DNA and inhibits DNA synthesis during the S phase of the cell cycle. It is commonly used for treating pancreatic, lung, and breast cancers.

Etoposide (B) — G1 - S Phase Etoposide, a topoisomerase II inhibitor, induces DNA breaks during the G1 - S phase, inhibiting cell proliferation. It is frequently used in the treatment of testicular and lung cancers.

Docetaxel (C) — M Phase Docetaxel stabilizes microtubules, causing cell arrest in the M phase. It is a crucial drug in the treatment of metastatic breast and prostate cancers.

Bleomycin (D) — G2 - M Phase Bleomycin causes DNA strand breaks, particularly affecting the G2 - M phase. It is widely used in the treatment of Hodgkin's lymphoma, testicular cancer, and squamous cell carcinoma.

Quick Tip

Many chemotherapeutic agents are phase-specific. Drugs such as Gemcitabine (S phase) and Docetaxel (M phase) are particularly effective against rapidly dividing cells.

64. Match List-I with List-II of Hormones and Disorders

List-I	List-II
Hormone	Disorder
(A). Growth Hormone	(I). Pheochromocytoma
(B). Antidiuretic Hormone	(II). Grave's Disease
(C). T_3 and T_4	(III). Acromegaly
(D). Adrenaline	(IV). Diabetes Insipidus

Choose the correct answer from the options given below:

(1) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

(2) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)

(3) (A) - (I), (B) - (IV), (C) - (II), (D) - (III)

(4) (A) - (III), (B) - (I), (C) - (IV), (D) - (II)

Correct Answer: (3) (A) - (I), (B) - (IV), (C) - (II), (D) - (III)

Solution: Growth hormone (A): Excess growth hormone leads to acromegaly (III), a condition characterized by abnormal growth of bones and tissues, particularly in the hands and face.

Antidiuretic hormone (B): A deficiency in this hormone leads to diabetes insipidus (IV), where the kidneys are unable to conserve water, leading to frequent urination and excessive thirst.

T3 and T4 (C): These thyroid hormones are involved in regulating metabolism, and their excess can lead to Grave's disease (II), an autoimmune disorder that causes hyperthyroidism.

Adrenaline (D): Excess adrenaline is associated with pheochromocytoma (I), a rare tumor of the adrenal gland that causes high blood pressure, sweating, and palpitations.

Therefore, the correct matching is (A) - (I), (B) - (IV), (C) - (II), (D) - (III).

Quick Tip

Hormonal imbalances can lead to a wide variety of disorders, each with its own set of symptoms and treatments. Understanding the hormones involved is key to diagnosing and managing these conditions.

65. Sandarac is a resin obtained from the stem of

(1) Grindelia camporum

(2) Pistacia lentiscus

(3) Tetraclinis articulata

(4) Guaiacum officinale

Correct Answer: (3) Tetraclinis articulata

Solution: Sandarac resin is obtained from the stem of Tetraclinis articulata, a species of cypress-like trees found in Mediterranean regions.

Sandarac is used in varnishes, lacquers, and as a glazing agent due to its hard, glossy finish when dried.

The other plants listed are not known for producing Sandarac resin.

Therefore, the correct answer is *Tetraclinis articulata*.

Quick Tip

Sandarac resin is valued in the art and craft industries due to its ability to form a durable, glossy finish when used in varnishes and lacquers.

66. Nominated members of the Drugs Technical Advisory Board are

- (1) 8
- (2) 7
- (3) 6
- (4) 5

Correct Answer: (3) 6

Solution: The Drugs Technical Advisory Board (DTAB) is an advisory body under the Drugs and Cosmetics Act of India, which helps in advising the central government on matters related to the approval of drugs and ensuring drug quality and safety.

The DTAB consists of 6 nominated members. These members include experts from various fields such as pharmaceuticals, medical sciences, and law.

The other options are incorrect, as the number of nominated members is specifically 6.

Therefore, the correct answer is 6.

Quick Tip

The Drugs Technical Advisory Board (DTAB) plays a vital role in drug regulation, ensuring that medicines are safe, effective, and of high quality.

67. Following are the characteristics of tannins except:

- (1) Tannins are colloidal solutions with water
- (2) Small molecular weight are soluble in water
- (3) Molecular weight ranges from 250-400
- (4) Can bind with proteins and form insoluble or soluble tannin-protein complexes

Correct Answer: (2) Small molecular weight are soluble in water

Solution: Tannins are a group of polyphenolic compounds found in plants, and they have several important characteristics:

Tannins are colloidal solutions in water and exhibit strong astringency.

They typically have a molecular weight in the range of 500-3000, though some smaller tannins exist.

Tannins can bind to proteins, forming both soluble and insoluble complexes, which is why they are often used in the tanning of leather.

Tannins with small molecular weight are typically less soluble in water, as they tend to aggregate and form insoluble complexes.

Therefore, the correct answer is Small molecular weight are soluble in water.

Quick Tip
Tannins are often used in the food and beverage industry for their astringency and ability to bind proteins, and they are also important in traditional medicine.

68. Identify the chemical constituent of Nutmeg

(1) Ellimicin

(2) Citral

(3) Piperine

(4) Curcumin

Correct Answer: (3) Piperine

Solution: Nutmeg is a spice derived from the seed of the tree *Myristica fragrans*. The primary active chemical constituent in nutmeg is piperine, which gives the spice its pungent flavor.

Ellimicin is found in cardamom, not nutmeg.

Citral is found in lemon grass and lemon peel, not nutmeg.

Curcumin is the active compound in turmeric, not nutmeg.

Therefore, the correct answer is Piperine.

Quick Tip

Piperine, found in black pepper and nutmeg, is known for its bioavailability-enhancing effects and can increase the absorption of other compounds in the body.

69. Straw foxglove is also known as:

- (1) *Digitalis lanata*
- (2) *Digitalis lutea*
- (3) *Digitalis thapsi*
- (4) *Digitalis dubia*

Correct Answer: (1) *Digitalis lanata*

Solution: Straw foxglove is scientifically known as *Digitalis lanata*.

It is a biennial plant belonging to the Scrophulariaceae family and is a significant source of digoxin and digitoxin, which are potent cardiac glycosides used in heart failure and atrial fibrillation.

Digitalis lanata is preferred over *Digitalis purpurea* because it has a higher yield of digoxin, a safer and more effective cardiac glycoside.

In contrast:

Digitalis lutea and *Digitalis thapsi* are lesser-known *Digitalis* species with low cardiac glycoside content.

Digitalis dubia is not commonly utilized in medicine.

Quick Tip

Digoxin extracted from *Digitalis lanata* is widely used for heart conditions. Proper dosage management is essential to avoid toxicity.

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Digitalis dubia is not commonly utilized in medicine.

Quick Tip
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71. Select the right plant growth regulator used for cell elongation and is agronomically important in determining plant height and fruit set:

(1) Auxins

(2) Gibberellins

(3) Abscissic acid

(4) Ethylene

Correct Answer: (2) Gibberellins

Solution: Gibberellins (GA) are plant growth regulators that play a crucial role in promoting cell elongation, stem elongation, flowering, and fruit development.

Gibberellins are particularly important in determining plant height and improving fruit set in agricultural crops.

Key roles of gibberellins include:

Stimulating cell division and elongation in stems.

Breaking seed dormancy and enhancing germination.

Improving fruit size and quality, especially in grapes and apples.

In contrast:

Auxins primarily promote root growth, apical dominance, and tropic movements.

Abscisic acid (ABA) inhibits plant growth and induces dormancy.

Ethylene is a gaseous hormone that regulates fruit ripening and leaf abscission.

Quick Tip
Gibberellins are widely used in horticulture to promote seed germination, increase fruit size, and improve crop yield.

72. Process of Shodhana can be performed using fluids

(A). Triphalakasaya

(B). Vasapatra svarasa

(C). Nirgundi patra svarasa with haridra churna

(D). Gomutra

(1) (A), (B) and (D) only

(2) (A), (B) and (C) only

(3) (A), (B), (C) and (D)

(4) (B), (C) and (D) only

Correct Answer: (3) (A), (B), (C) and (D)

Solution: In Ayurveda, the process of Shodhana is a detoxification procedure that is commonly performed using various fluids. These fluids help in purging toxins from the body and restoring balance. The following fluids are used for Shodhana:

(A) Triphalakasaya: A herbal preparation made from Triphala, often used in detoxification.

(B) Vasapatra Svarasa: A fluid prepared from the leaves of specific plants used for therapeutic cleansing.

(C) Nirgundi Patra Svarasa with Haridra Churna: A combination of Nirgundi leaf juice and

turmeric powder, used for its purifying properties.

(D) Gomutra: Cow urine, which is considered sacred and has medicinal properties used in detoxification.

Therefore, all the given options are used in the Shodhana process.

Quick Tip
Shodhana is an important concept in Ayurvedic medicine, and these fluids help remove impurities from the body, promoting overall health.

73. Biosynthesis of atropine takes place in the following sequence

(A).Tropine+Tropic acid

(B).Tropic acid

(C).Phenyl pyruvic acid

(D).Phenylalanine

(1) (A), (B), (C), (D)

(2) (D), (B), (C), (A)

(3) (D), (C), (B), (A)

(4) (C), (B), (D), (A)

Correct Answer: (1) (A), (B), (C), (D)

Solution: The biosynthesis of atropine, a tropane alkaloid, involves a series of steps that occur in the plant's biochemical pathway:

(A) Tropine + Tropic acid: This is the first step, where tropine combines with tropic acid to form atropine.

(B) Tropic acid: Derived from phenylalanine and involved in the biosynthesis of tropane alkaloids.

(C) Phenyl pyruvic acid: It is converted into tropic acid, a precursor in the biosynthesis of atropine.

(D) Phenylalanine: This is the precursor amino acid from which phenyl pyruvic acid is derived.

Therefore, the correct sequence is (A), (B), (C), (D).

Quick Tip

Atropine is synthesized in plants through a series of steps starting from phenylalanine, which is converted into various intermediates before the final atropine molecule is formed.

74. Match List-I with List-II of Schedule and Provisions

List-I	List-II
Schedule	Provisions
(A). F1- Part IA	(I). Provisions applicable to the manufacture and standardisation of diagnostic agents
(B). F1- Part IB	(II). Provisions applicable to the production of sera from living animals
(C). F1- Part II	(III). Provisions applicable to the production of bacterial vaccines
(D). F1- Part III	(IV). Provisions applicable to the production of viral vaccines

Choose the correct answer from the options given below:

- (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
- (2) (A) - (II), (B) - (III), (C) - (I), (D) - (IV)
- (3) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)
- (4) (A) - (III), (B) - (II), (C) - (IV), (D) - (I)

Correct Answer: (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Solution: The F1 Schedule provides provisions for the manufacture and regulation of various pharmaceutical products. Each part addresses different types of products:

- (A) F1 - Part IA: Relates to the manufacture and standardization of diagnostic agents (I).
- (B) F1 - Part IB: Covers the production of sera from living animals (II).
- (C) F1 - Part II: Deals with the production of bacterial vaccines (III).
- (D) F1 - Part III: Pertains to the production of viral vaccines (IV).

Therefore, the correct matching is (A) - (I), (B) - (II), (C) - (III), (D) - (IV).

Quick Tip

Understanding the F1 Schedule helps in ensuring compliance with regulatory standards for pharmaceutical manufacturing, including vaccines and diagnostic agents.

75. Match List-I with List-II of Chemical Test and End Point

List-I	List-II
Chemical Test	End point
(A). Liebermann -Burchard test	(I). Pink colour
(B). Salkowski test	(II). Violet colour
(C). Zimmermann test	(III). Yellow coloured ring
(D). Antimony trichloride test	(IV). Violet to blue coloured ring

Choose the correct answer from the options given below:

- (1) (A) - (IV), (B) - (II), (C) - (III), (D) - (I)
(2) (A) - (III), (B) - (II), (C) - (I), (D) - (IV)
(3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
(4) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)

Correct Answer: (1) (A) - (IV), (B) - (II), (C) - (III), (D) - (I)

Solution: Various chemical tests are employed to identify specific compounds by observing distinct color changes or endpoints. The following tests are matched with their respective compounds and resulting colors:

Step 1: Identifying the Tests and Their Endpoints

(A) Liebermann-Burchard Test

Detects sterols and bile acids.

The characteristic endpoint is a violet to blue colored ring.

Matching Code: (IV)

(B) Salkowski Test

Detects steroids.

The characteristic endpoint is a violet color.

Matching Code: (II)

(C) Zimmermann Test

Used to detect phenolic compounds.

The characteristic endpoint is a yellow-colored ring.

Matching Code: (III)

(D) Antimony Trichloride Test

Identifies phenols.

The characteristic endpoint is a pink color.

Matching Code: (I)

Step 2: Correct Matching Sequence

(A) - (IV), (B) - (II), (C) - (III), (D) - (I)

Step 3: Conclusion These tests are crucial in organic chemistry for detecting key functional groups and ensuring accurate compound identification.

Quick Tip
These chemical tests are widely used in laboratory settings for quality control, compound identification, and research in organic chemistry.
