

NEET PG Pharmacology Sample Paper-4

Duration: 15 Minutes

Maximum Marks: 80

Instructions

- This paper contains **20** Multiple Choice Questions.
- Each correct answer carries **+4** mark. Incorrect answer: **-1** marks. Only **one** correct option.
- Unattempted questions carry **0** marks.
- Use of mobile phones, smartwatches, or any electronic gadgets is strictly prohibited.

Q1. A 57-year-old male with chronic kidney disease (Stage 4) requires an anticoagulant for deep vein thrombosis prophylaxis. Which of the following low molecular weight heparins or related anticoagulants is most heavily dependent on renal clearance, requiring strict monitoring or avoidance in this patient?

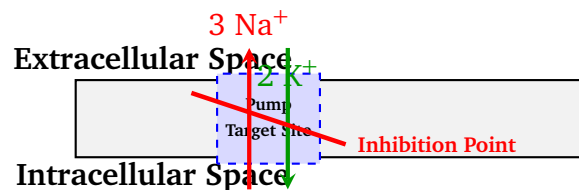
- (A) Enoxaparin
- (B) Unfractionated heparin
- (C) Fondaparinux
- (D) Warfarin

Q2. During a clinical trial, Drug X is found to have a high volume of distribution ($V_d > 400$ L). Which of the following properties is most likely characteristic of Drug X?

- (A) High plasma protein binding
- (B) Low lipid solubility
- (C) Extensive tissue binding
- (D) High ionization at physiological pH



- Q3.** A 32-year-old pregnant female at 28 weeks of gestation presents with a blood pressure of 160/100 mmHg. Which of the following antihypertensive agents acting via central alpha-2 adrenergic receptors is the drug of choice for managing chronic hypertension in pregnancy?
- (A) Clonidine
 (B) Alpha-methyldopa
 (C) Labetalol
 (D) Hydralazine
- Q4.** A 60-year-old male with chronic heart failure is started on an inotropic agent that selectively inhibits the Na^+/K^+ -ATPase pump to increase intracellular calcium levels and improve contractility. Which of the following diagrams correctly illustrates the target mechanism of this drug?



- (A) Digoxin
 (B) Milrinone
 (C) Dobutamine
 (D) Nesiritide
- Q5.** A 62-year-old open-angle glaucoma patient is prescribed a topical medication that lowers intraocular pressure by increasing the uveoscleral outflow of aqueous humor. Which of the following drugs matches this mechanism?
- (A) Timolol
 (B) Pilocarpine
 (C) Latanoprost
 (D) Dorzolamide



- Q6.** A 28-year-old male is initiated on first-line antitubercular therapy (ATT). Two months later, he complains of difficulty distinguishing green from red color and a decrease in visual acuity. Which of the following agents in his regimen is most likely responsible for this adverse effect?
- (A) Isoniazid
 - (B) Rifampicin
 - (C) Ethambutol
 - (D) Pyrazinamide
- Q7.** A 55-year-old patient diagnosed with Parkinson's disease is treated with a combination of Levodopa and Carbidopa. What is the primary pharmacological purpose of adding Carbidopa to this therapeutic regimen?
- (A) To inhibit central monoamine oxidase-B
 - (B) To inhibit peripheral DOPA decarboxylase
 - (C) To cross the blood-brain barrier and stimulate dopamine receptors
 - (D) To reduce the central metabolism of dopamine
- Q8.** A patient undergoes an elective surgical procedure under general anesthesia. Postoperatively, the patient experiences prolonged muscle paralysis and apnea following the administration of succinylcholine. This exaggerated response is most frequently due to a genetic deficiency in which of the following enzymes?
- (A) Acetylcholinesterase
 - (B) Pseudocholinesterase (Butyrylcholinesterase)
 - (C) Cytochrome P450 2D6
 - (D) Monoamine oxidase-A
- Q9.** An 8-year-old child presents with high-grade fever, sore throat, and a diffuse erythematous rash. The physician prescribes an antibiotic that acts by binding to the 50S ribosomal subunit, thereby inhibiting bacterial protein synthesis. Which of the following antibiotics belongs to this class?



- (A) Azithromycin
- (B) Amoxicillin
- (C) Doxycycline
- (D) Gentamicin

Q10. A 34-year-old female experiences severe postoperative nausea and vomiting (PONV). The anesthesiologist administers an intravenous drug that acts as a highly selective antagonist at central and peripheral 5 – HT₃ receptors. Which agent was administered?

- (A) Metoclopramide
- (B) Ondansetron
- (C) Domperidone
- (D) Aprepitant

Q11. A 24-year-old male with a history of epilepsy is brought to the emergency department in status epilepticus. The initial intravenous drug of choice to rapidly terminate the seizure activity acts by facilitating GABA_A receptor-mediated chloride conductance. Which drug is this?

- (A) Phenytoin
- (B) Lorazepam
- (C) Levetiracetam
- (D) Sodium Valproate

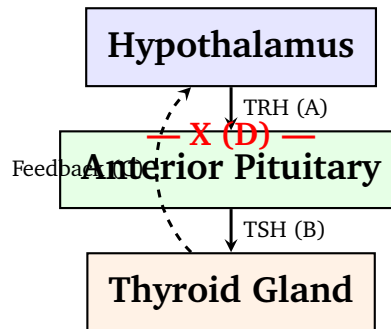
Q12. A 50-year-old male under treatment for acute myeloid leukemia develops a severe, systemic fungal infection. The medical team decides to initiate an intravenous antifungal agent known for inducing pore formation in the fungal cell membrane by binding to ergosterol, but notes its significant risk of nephrotoxicity. Name the drug.

- (A) Fluconazole
- (B) Caspofungin



- (C) Amphotericin B
- (D) Flucytosine

Q13. An experimental drug is evaluated for its action on the endocrine feedback loop governing thyroid hormones. The drug acts at the anterior pituitary level to selectively block receptors that stimulate thyrotropin release, as illustrated in the pathway diagram below. Which site is blocked?



- (A) Inhibition of Hypothalamic TRH synthesis
 - (B) Blockade of TSH action on Thyroid gland follicle cells
 - (C) Enhancement of negative systemic feedback pathways
 - (D) Antagonism of TRH receptors on pituitary thyrotrophs
- Q14.** A clinical pharmacologist is evaluating a new competitive antagonist. In the presence of a fixed concentration of this competitive antagonist, how do the log dose-response curve parameters of the agonist change?
- (A) The curve shifts to the right with a decrease in maximal response (E_{max})
 - (B) The curve shifts to the left with no change in maximal response (E_{max})
 - (C) The curve shifts to the right with no change in maximal response (E_{max})
 - (D) The curve shifts to the left with an increase in maximal response (E_{max})
- Q15.** A 29-year-old female presents with acute uncomplicated cystitis. She is prescribed a single-dose oral antibiotic that acts by inactivating the enzyme enolpyruvyl transferase, thereby blocking the synthesis of bacterial cell wall precursor UDP-N-acetylmuramic acid. Which antibiotic is this?



- (A) Nitrofurantoin
- (B) Fosfomycin
- (C) Ciprofloxacin
- (D) Cotrimoxazole

Q16. A 45-year-old executive presents with severe throbbing unilateral headache preceded by a visual aura. He is prescribed a drug that acts as a selective agonist at $5 - HT_{1B/1D}$ receptors to abort the acute attack. Which of the following medications is contraindicated in patients with significant coronary artery disease due to its vasoconstrictive properties?

- (A) Sumatriptan
- (B) Propranolol
- (C) Topiramate
- (D) Flunarizine

Q17. A 38-year-old male with a history of IV drug use presents with endocarditis. Blood cultures grow Methicillin-Resistant Staphylococcus aureus (MRSA). He is started on an intravenous antibiotic that inhibits cell wall synthesis by binding directly to the D-Ala-D-Ala terminus of the peptidoglycan precursor. Which drug matches this description?

- (A) Linezolid
- (B) Vancomycin
- (C) Daptomycin
- (D) Ceftriaxone

Q18. A patient with a history of severe major depressive disorder is brought to the emergency department with altered mental status, generalized tremors, hyperreflexia, and clonus. Her family mentions she recently started an over-the-counter cough syrup containing dextromethorphan while taking her prescribed antidepressant. Which of the following drugs is most likely responsible for this interaction?

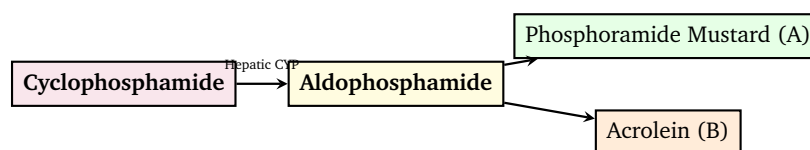


- (A) Fluoxetine
- (B) Bupropion
- (C) Amitriptyline
- (D) Mirtazapine

Q19. A patient presenting with acute organophosphate poisoning exhibits severe miosis, bradycardia, bronchospasm, and excessive salivation. Which of the following agents is a specific competitive antagonist that reverses these muscarinic manifestations?

- (A) Pralidoxime
- (B) Physostigmine
- (C) Atropine
- (D) Neostigmine

Q20. A patient undergoing chemotherapy with a certain alkylating agent experiences severe hemorrhagic cystitis due to the accumulation of a toxic metabolite in the urinary bladder. The pathway mapping the liver metabolism and byproduct generation is shown below. Which intermediate or byproduct is responsible for this localized bladder toxicity?



- (A) Phosphoramidate mustard
- (B) Acrolein
- (C) Aldophosphamide
- (D) Cyclophosphamide parent compound



Detailed Solutions

Q1.

Solution

Concept: Anticoagulant therapy in patients with advanced renal impairment requires understanding the clearance pathway of each drug. Low molecular weight heparins and synthetic pentasaccharides are primarily excreted unchanged by the kidneys, accumulating dangerously in severe chronic kidney disease.

Solution:

- (a) Fondaparinux is a synthetic pentasaccharide that selectively inhibits factor Xa. It is entirely eliminated by renal excretion. In Stage 4 chronic kidney disease (GFR under 30 mL/min), its clearance drops by nearly half, leading to a high risk of major bleeding.
- (b) Enoxaparin, a low molecular weight heparin, also relies on renal elimination, but can be dose-adjusted in advanced chronic kidney disease. Fondaparinux is contraindicated in severe kidney dysfunction.
- (c) Unfractionated heparin undergoes non-renal clearance via the reticuloendothelial system and endothelial cells at therapeutic doses, making it safer in severe renal failure.
- (d) Warfarin is metabolized heavily by hepatic cytochrome P450 enzymes into inactive compounds, meaning its clearance remains completely independent of renal filtration capacity.

Final Answer: Fondaparinux is heavily dependent on renal clearance.

Answer: (C)

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Q2.

Solution

Concept: The apparent volume of distribution is a kinetic parameter quantifying how extensively a drug disperses into extravascular body tissues relative to plasma. It reflects a drug's relative affinity for cellular structures versus plasma proteins.

Solution:

- (a) A volume of distribution exceeding total body water (around 42 liters), such as 400 liters, indicates that the drug is sequestered heavily inside tissue components like fat, muscle, or specific intracellular organelles.
- (b) Extensive tissue binding draws the drug out of the vascular compartment into peripheral storage sites, reducing the measurable plasma concentration and driving up the calculated volume of distribution.
- (c) High plasma protein binding keeps a drug restricted inside the vascular system, maintaining high plasma levels and resulting in a small volume of distribution.
- (d) Hydrophilic, poorly lipid-soluble, or heavily ionized drugs stay confined to plasma and extracellular fluids because they cannot easily pass through hydrophobic cellular lipid bilayers.

Final Answer: Extensive tissue binding is characteristic of the drug.

Answer: (C)

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Q3.

Solution

Concept: Managing severe gestational hypertension demands medications that safely lower systemic vascular resistance without reducing uteroplacental blood flow, causing fetal cardiovascular depression, or inducing known teratogenic anomalies.

Solution:

- (a) Alpha-methyldopa is a centrally acting alpha-2 adrenergic receptor agonist. It is metabolized to alpha-methylnorepinephrine, which stimulates central inhibitory receptors to reduce sympathetic outflow and lower arterial blood pressure.
- (b) It has a decades-long record of safety in pregnancy, demonstrating no long-term adverse developmental effects on the fetus, making it a preferred choice for chronic hypertension in pregnancy.
- (c) Clonidine also stimulates central alpha-2 receptors, but abrupt cessation risks rebound hypertensive crises, and its clinical safety database in pregnant populations is less extensive.
- (d) Labetalol is a combined alpha and beta blocker, and hydralazine is a direct vasodilator. While both are widely utilized for acute severe hypertension in pregnancy, they do not act via alpha-2 receptors.

Final Answer: Alpha-methyldopa is the drug of choice.

Answer: (B)

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Q4.

Solution

Concept: Inotropic therapeutics for heart failure aim to optimize myocardial contractility by increasing the presence of free calcium ions within cardiac myocytes during the systolic contraction cycle.

Solution:

- (a) Digoxin binds selectively to the extracellular side of the alpha subunit of the sodium-potassium-ATPase pump, blocking the active outward movement of three sodium ions and inward movement of two potassium ions.
- (b) This pump inhibition causes an accumulation of intracellular sodium, which diminishes the transmembrane sodium gradient required to drive the sodium-calcium exchanger.
- (c) The slowed activity of this exchanger reduces calcium extrusion, retaining calcium inside the cell to be taken up by the sarcoplasmic reticulum, boosting inotropic contraction.
- (d) Milrinone functions differently as a phosphodiesterase inhibitor, dobutamine operates as a beta-1 receptor agonist, and nesiritide acts as a recombinant human B-type natriuretic peptide.

Final Answer: Digoxin matches the illustrated pump inhibition mechanism.

Answer: (A)

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Q5.

Solution

Concept: Aqueous humor dynamics dictate intraocular pressure. Glaucoma therapies lower this pressure by either suppressing fluid production at the ciliary body or enhancing fluid clearance via the trabecular meshwork or uveoscleral route.

Solution:

- (a) Latanoprost is a synthetic prostaglandin F-2-alpha analogue that stimulates specific prostanoid receptors in the eye, relaxing the ciliary muscle and widening extracellular spaces within the uveoscleral pathway.
- (b) This remodeling significantly enhances uveoscleral outflow, effectively draining excess aqueous humor and consistently reducing intraocular pressure in open-angle glaucoma.
- (c) Timolol is a topical beta blocker that lowers intraocular pressure strictly by reducing the production of aqueous humor from the ciliary processes.
- (d) Pilocarpine is a muscarinic miotic that contracts the ciliary muscle to open up the trabecular meshwork, while dorzolamide is a carbonic anhydrase inhibitor that reduces fluid secretion.

Final Answer: Latanoprost increases uveoscleral outflow.

Answer: (C)

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Q6.

Solution

Concept: The adverse effect profiles of first-line antitubercular therapies require vigilant clinical surveillance. Individual agents exhibit specific organ toxicities that mandate prompt drug cessation to prevent permanent functional impairment.

Solution:

- (a) Ethambutol is known to induce retrobulbar optic neuritis as its primary severe adverse reaction. This toxicity presents as a gradual loss of visual acuity and diminished red-green color discrimination.
- (b) The visual impairment is typically dose-dependent and can become irreversible if the drug is continued after initial ocular symptoms manifest.
- (c) Isoniazid is primarily tied to peripheral neuropathy, treated with pyridoxine, and hepatic injury. Rifampicin causes harmless orange-red discoloration of body secretions and hepatotoxicity.
- (d) Pyrazinamide is highly associated with hyperuricemia, potentially triggering acute gouty arthritis, alongside its potential to cause severe drug-induced hepatitis.

Final Answer: Ethambutol is responsible for the visual adverse effects.

Answer: (C)

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Q7.

Solution

Concept: Dopaminergic replacement in Parkinson's disease relies on maximizing the delivery of active neurotransmitters to the central nervous system while limiting systematic side effects generated in the periphery.

Solution:

- (a) Levodopa readily crosses the blood-brain barrier via L-amino acid transporters, whereas dopamine cannot enter the central nervous system from systemic circulation.
- (b) When administered alone, more than ninety percent of levodopa is rapidly converted to dopamine in the periphery by the enzyme aromatic L-amino acid decarboxylase (DOPA decarboxylase).
- (c) Carbidopa is a peripheral inhibitor of DOPA decarboxylase that cannot cross the blood-brain barrier. It prevents peripheral levodopa breakdown, increasing its availability for central uptake.
- (d) By minimizing peripheral dopamine accumulation, carbidopa dramatically reduces peripheral side effects like severe nausea, vomiting, and orthostatic hypotension while allowing lower therapeutic doses of levodopa.

Final Answer: Carbidopa inhibits peripheral DOPA decarboxylase.

Answer: (B)

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Q8.

Solution

Concept: Neuromuscular blocking agents are categorized by their metabolism. Depolarizing blockers like succinylcholine rely on rapid plasma enzyme degradation to limit their duration of action to a few minutes.

Solution:

- (a) Succinylcholine is rapidly broken down in the bloodstream by pseudocholinesterase, also called butyrylcholinesterase or plasma cholinesterase, before reaching the neuromuscular junction.
- (b) An inherited genetic variant resulting in atypical or deficient pseudocholinesterase halts this rapid vascular clearance, allowing succinylcholine to persist at the motor endplate.
- (c) This leads to a prolonged depolarizing block, causing extended respiratory muscle paralysis and post-operative apnea that requires ongoing mechanical ventilation.
- (d) True acetylcholinesterase is concentrated at nerve synapses and breaks down acetylcholine, not systemic succinylcholine. Cytochrome P450 2D6 and monoamine oxidase handle unrelated central or hepatic drug clearance pathways.

Final Answer: Pseudocholinesterase deficiency is responsible for the prolonged paralysis.

Answer: (B)

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Q9.

Solution

Concept: Bacterial protein synthesis inhibitors are classified by their affinity for specific ribosomal subunits. This target selectivity prevents translation and halts bacterial replication or kills the pathogen.

Solution:

- (a) Azithromycin belongs to the macrolide class of antibiotics. It binds reversibly to the 23S rRNA molecule of the 50S bacterial ribosomal subunit, blocking transpeptidation and translocation during protein synthesis.
- (b) It is often chosen to manage respiratory or pharyngeal infections like streptococcal pharyngitis in pediatric patients who exhibit hypersensitivity reactions to beta-lactam options.
- (c) Amoxicillin is a beta-lactam that interferes with peptidoglycan cell wall cross-linking by targeting transpeptidase enzymes rather than blocking protein translation.
- (d) Doxycycline belongs to the tetracycline class, and gentamicin is an aminoglycoside. Both of these classes exert their pharmacological effects by binding to the smaller 30S ribosomal subunit.

Final Answer: Azithromycin binds to the 50S ribosomal subunit.

Answer: (A)

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Q10.

Solution

Concept: The emetic reflex involves neurotransmitter signals in the solitary tract nucleus and the chemoreceptor trigger zone. Blocking these receptors prevents post-operative emetic distress.

Solution:

- (a) Ondansetron is a highly selective competitive antagonist at serotonin 5-HT-3 receptors located on vagal nerve terminals in the gut wall and centrally within the chemoreceptor trigger zone.
- (b) By blocking serotonin binding at these sites, it cuts off the emetic signaling cascade triggered by surgical procedures, volatile anesthetics, or chemotherapeutic agents.
- (c) Metoclopramide displays primary dopamine D2 antagonism along with weak 5-HT-3 blocking actions at high doses, but carries a risk of extrapyramidal side effects.
- (d) Domperidone acts strictly as a peripheral dopamine D2 receptor antagonist, and aprepitant works by blocking neurokinin-1 receptors, preventing substance P from initiating emesis.

Final Answer: Ondansetron is the selective 5-HT-3 antagonist.

Answer: (B)

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Q11.

Solution

Concept: The primary management of status epilepticus involves the immediate administration of rapid-acting medications that cross the blood-brain barrier and enhance central inhibitory neurotransmission to terminate synchronous seizure activity.

Solution:

- (a) Lorazepam is a high-potency benzodiazepine that serves as the first-line intravenous drug of choice for status epilepticus. It binds with high affinity to specific regulatory sites on the gamma-aminobutyric acid type A receptor complex.
- (b) This binding allosterically modulates the receptor, significantly increasing the frequency of chloride channel opening in response to native inhibitory neurotransmitters. The resulting influx of chloride ions hyperpolarizes the postsynaptic membrane, reducing neuronal excitability.
- (c) Compared to diazepam, lorazepam is less lipid-soluble and undergoes slower redistribution out of brain tissues into peripheral fat stores, providing a longer effective duration of anticonvulsant action within the central nervous system.
- (d) Phenytoin acts primarily by blocking voltage-gated sodium channels and is used for seizure recurrence prevention. Levetiracetam modulates synaptic vesicle protein 2A, while sodium valproate possesses multiple mechanisms including blocks on sodium channels and T-type calcium channels.

Final Answer: Lorazepam

Answer: (B)

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Q12.

Solution

Concept: Systemic mycotic interventions require selecting agents that exhibit high selectivity for fungal cell structures over host cells, though certain high-efficacy polyene antimicrobials possess intrinsic dose-limiting organic toxicities.

Solution:

- (a) Amphotericin B is a powerful polyene antifungal antibiotic that displays a high binding affinity for ergosterol, a crucial lipid component found predominantly within the cell membranes of susceptible fungal pathogens.
- (b) Upon binding to ergosterol, molecules of amphotericin B aggregate to form specialized transmembrane pores or ion channels. This disruption increases membrane permeability, leading to the rapid leakage of essential intracellular monovalent ions and cell death.
- (c) A major clinical limitation of amphotericin B is its prominent nephrotoxicity, which arises because the drug can bind with a lower but significant affinity to cholesterol molecules present in human renal tubular membranes.
- (d) Fluconazole is an azole that inhibits ergosterol synthesis. Caspofungin is an echinocandin that targets cell wall glucan synthesis, and flucytosine is an antimetabolite that blocks fungal nucleic acid synthesis.

Final Answer: Amphotericin B

Answer: (C)

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Q13.

Solution

Concept: The endocrine regulation of thyroid hormones is governed by a highly integrated hypothalamic-pituitary-thyroid axis, where individual regulatory hormones control downstream organ synthesis and systemic homeostasis.

Solution:

- (a) Thyrotropin-releasing hormone is synthesized by paraventricular neurons within the hypothalamus and travels through the hypophyseal portal system to reach the anterior pituitary gland, where it stimulates thyrotroph cells.
- (b) These thyrotroph cells express specific G-protein coupled receptors that, when activated by thyrotropin-releasing hormone, stimulate the synthesis and secretion of thyroid-stimulating hormone into the systemic blood circulation.
- (c) An experimental drug that acts directly at the anterior pituitary level to block these specific receptors prevents thyrotropin-releasing hormone from binding, as depicted by the specific inhibition block labeled as point D.
- (d) This targeted mechanism represents direct receptor antagonism on pituitary thyrotrophs, whereas blocking hypothalamic synthesis, disrupting negative systemic feedback pathways, or blocking thyroid-stimulating hormone action on the thyroid gland involve entirely separate physiological sites.

Final Answer: Antagonism of TRH receptors on pituitary thyrotrophs

Answer: (D)

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Q14.

Solution

Concept: Receptor pharmacology classifies antagonists based on their capacity to alter agonist potency and maximum efficacy during equilibrium binding studies on functional cellular tissues.

Solution:

- (a) A competitive antagonist binds reversibly to the exact same receptor active site as the native agonist molecule, meaning that the two compounds compete directly with one another for receptor occupancy.
- (b) Because the binding is completely reversible, the inhibitory effect of a fixed concentration of a competitive antagonist can be fully overcome by increasing the concentrations of the agonist to outcompete the antagonist.
- (c) Consequently, in the presence of a competitive antagonist, the log dose-response curve of the agonist shifts parallel to the right, indicating a decrease in agonist potency without any change in the maximal response.
- (d) Non-competitive antagonists bind irreversibly or to separate allosteric sites, which decreases the maximum functional response of the agonist curve because the inhibition cannot be overcome by adding more agonist.

Final Answer: The curve shifts to the right with no change in maximal response (E_{\max})

Answer: (C)

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Q15.

Solution

Concept: Targeted antimicrobial therapy for uncomplicated lower urinary tract infections utilizes specialized agents that achieve high concentrations in the urine and disrupt early stages of bacterial cell wall assembly.

Solution:

- (a) Fosfomycin is a bactericidal antibiotic that acts as a structural analogue of phosphoenolpyruvate. It is actively transported into bacterial cells via specialized glucose-6-phosphate or glycerophosphate transport systems.
- (b) Once inside the cytoplasm, fosfomycin covalently binds and permanently inactivates the enzyme enolpyruvyl transferase, preventing the condensation of phosphoenolpyruvate with uridine diphosphate-N-acetylglucosamine.
- (c) This specific enzymatic block halts the early synthesis of uridine diphosphate-N-acetylmuramic acid, a fundamental building block required for constructing the protective peptidoglycan layer of the bacterial cell wall.
- (d) Nitrofurantoin works by damaging bacterial DNA via reactive intermediates. Ciprofloxacin is a fluoroquinolone that inhibits DNA gyrase, and cotrimoxazole is a combination antifolate agent that blocks sequential steps in bacterial folic acid synthesis.

Final Answer: Fosfomycin

Answer: (B)

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Q16.

Solution

Concept: Abortive migraine pharmacotherapy targets specific serotonin receptor subtypes to reverse neurogenic inflammation and intracranial vasodilation, but these structural actions carry distinct vascular contraindications.

Solution:

- (a) Sumatriptan belongs to the triptan class of medications and acts as a highly selective agonist at serotonin 5-HT_{1B} and 5-HT_{1D} receptors located on intracranial blood vessels and trigeminal nerve terminals.
- (b) Activation of these receptors induces therapeutic vasoconstriction of dilated cranial vessels and suppresses the presynaptic release of pro-inflammatory neuropeptides, effectively aborting acute migraine attacks.
- (c) However, because these 5-HT_{1B} and 5-HT_{1D} receptors are also structurally present on human coronary arteries, sumatriptan can induce coronary vasospasm, making it strictly contraindicated in patients with coronary artery disease.
- (d) Propranolol is a beta-blocker, topiramate is an anticonvulsant, and flunarizine is a calcium channel blocker; these three drugs are used for migraine prophylaxis rather than acute abortive therapy.

Final Answer: Sumatriptan

Answer: (A)

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Q17.

Solution

Concept: Eradicating resistant Gram-positive pathogens like Methicillin-Resistant Staphylococcus aureus requires cell wall synthesis inhibitors that target late-stage peptidoglycan cross-linking through non-enzymatic binding mechanisms.

Solution:

- (a) Vancomycin is a glycopeptide antibiotic that binds with high affinity to the terminal D-alanyl-D-alanine residues of nascent peptidoglycan pentapeptide chains within the bacterial cell wall.
- (b) This highly specific steric hindrance prevents both transglycosylation and transpeptidation reactions, blocking the proper cross-linking and polymerization of the peptidoglycan matrix and leading to bacterial cell lysis.
- (c) Because this mechanism does not rely on binding to penicillin-binding proteins, vancomycin remains fully active against strains that possess altered penicillin-binding proteins, such as Methicillin-Resistant Staphylococcus aureus.
- (d) Linezolid is an oxazolidinone that inhibits bacterial translation by binding to the 50S subunit. Daptomycin is a lipopeptide that depolarizes the cell membrane, and ceftriaxone is a cephalosporin inactive against these resistant strains.

Final Answer: Vancomycin

Answer: (B)

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Q18.

Solution

Concept: Serotonin syndrome is a highly predictable, life-threatening drug-induced hyper-serotonergic state that results from the co-administration of multiple agents that enhance central serotonergic neurotransmission through complementary pathways.

Solution:

- (a) Fluoxetine is a selective serotonin reuptake inhibitor that increases the extracellular concentration of serotonin within synaptic clefts by selectively inhibiting the presynaptic serotonin transporter protein.
- (b) Dextromethorphan, commonly found in over-the-counter antitussive formulations, acts as a weak serotonin reuptake inhibitor in addition to its primary actions as an NMDA receptor antagonist.
- (c) When a patient taking fluoxetine consumes dextromethorphan, the combined blockade of serotonin reuptake causes a profound accumulation of serotonin, overstimulating central 5-HT-1A and 5-HT-2A receptors.
- (d) This overstimulation triggers classic hyperserotonergic symptoms, including altered mental status, neuromuscular hyperactivity, hyperreflexia, and clonus. Bupropion, amitriptyline, and mirtazapine do not carry the same high immediate risk when mixed with dextromethorphan.

Final Answer: Fluoxetine

Answer: (A)

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Q19.

Solution

Concept: Managing organophosphate poisoning requires immediate pharmacological interventions that address the toxic accumulation of acetylcholine at peripheral and central muscarinic receptor sites.

Solution:

- (a) Organophosphate compounds bind irreversibly to acetylcholinesterase, inactivating the enzyme and causing a dangerous build-up of native acetylcholine at muscarinic and nicotinic neuroeffector junctions.
- (b) Atropine is a tertiary amine alkaloid that acts as a highly selective competitive antagonist at muscarinic acetylcholine receptors, completely blocking acetylcholine binding at these specific sites.
- (c) By blocking muscarinic receptors, atropine reverses the life-threatening signs of organophosphate toxicity, such as severe bradycardia, excessive bronchial secretions, bronchospasm, and pupillary miosis.
- (d) Pralidoxime is a cholinesterase reactivator that functions by removing the organophosphate group from the acetylcholinesterase enzyme before aging occurs, which targets both nicotinic and muscarinic manifestations but is not a receptor antagonist.

Final Answer: Atropine

Answer: (C)

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Q20.

Solution

Concept: The hepatic biotransformation of certain oxazaphosphorine alkylating agents generates both therapeutic cytotoxic compounds and toxic structural byproducts that pool inside the urinary excretion pathways.

Solution:

- (a) Cyclophosphamide is a functional prodrug that undergoes primary metabolic activation in the liver via cytochrome P450 enzymes to produce the intermediate compound 4-hydroxycyclophosphamide, which equilibrates with aldophosphamide.
- (b) Aldophosphamide is subsequently transported through the bloodstream to peripheral tissues, where it spontaneously cleaves into two distinct chemical entities: phosphoramidate mustard and acrolein.
- (c) Phosphoramidate mustard is the desired active alkylating agent that cross-links DNA to exert cytotoxic anticancer actions. In contrast, acrolein is an unsaturated aldehyde with no therapeutic antineoplastic properties.
- (d) Acrolein concentrates inside the urinary bladder during renal excretion, where it directly damages the delicate urothelium, inducing severe sloughing, mucosal inflammation, and classic hemorrhagic cystitis.

Final Answer: Acrolein

Answer: (B)

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	C	3	B	4	A	5	C
6	C	7	B	8	B	9	A	10	B
11	B	12	C	13	D	14	C	15	B
16	A	17	B	18	A	19	C	20	B

