NIPER JEE Pharmacy Subjects

Sample Paper – 9

M.S.(Pharm) / M.Pharm Joint Entrance Examination

Duration: 96 Minutes **Maximum Marks: 80**

Instructions

- This paper contains **160 single-correct Multiple Choice Questions** drawn from the pharmaceutical-sciences syllabus of the **NIPER Joint Entrance Examination** (M.S.(Pharm) / M.Pharm).
- Each correct answer carries **+0.5 marks**. **0.125 mark is deducted** for every wrong answer, and an unattempted question gets **0 marks**. Maximum marks: **80**.
- The paper runs continuously from **Q1 to Q160** across six parts: Pharmaceutics; Pharmacology & Toxicology; Pharmaceutical & Medicinal Chemistry; Pharmaceutical Analysis & QA; Pharmacognosy; and Pharmaceutical Biotechnology & Microbiology.
- Only **one** option is correct. Personal calculators, mobile phones, and other electronic gadgets are strictly prohibited.

Part A: Pharmaceutics

Q1. Strontium sulphate dissolves as $SrSO_4 \rightleftharpoons Sr^{2+} + SO_4^{2-}$. If its molar solubility in water is 5.0×10^{-4} mol/L at 25°C, its solubility product K_{sp} is:

(A) 5.0×10^{-4}

(B) 1.0×10^{-3}

(C) 5.0×10^{-8}

(D) 2.5×10^{-7}

Q2. A drug has an ether/water partition coefficient $P = 3$. When 400 mg of the drug in 100 mL of water is extracted once with 100 mL of ether, the mass of drug (mg) remaining in the water phase at equilibrium is:

(A) 100

(B) 300

(C) 133

(D) 75

Q3. For an ionic surfactant, the temperature below which its solubility is too low to form micelles, and above which solubility rises sharply as micelles begin to form, is called the:

(A) cloud point

(B) phase-inversion temperature

(C) Krafft point

(D) eutectic temperature

Q4. An emulsifier blend is made of 80% polysorbate (HLB $= 16$) and 20% sorbitan ester (HLB $= 6$). The resultant HLB of the blend is:

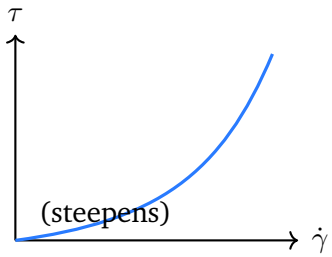
(A) 11.0

(B) 14.0

(C) 10.0

(D) 22.0

Q5. The single flow curve below bows toward the shear-rate axis: as the shear rate $\dot{\gamma}$ rises, the apparent viscosity increases. This behaviour, seen in concentrated deflocculated suspensions, is:



(A) Newtonian flow

(B) pseudoplastic flow

(C) Bingham plastic flow

(D) dilatant (shear-thickening) flow

Q6. As temperature increases, how do the viscosities of a typical liquid and a typical gas respectively change?

(A) liquid viscosity decreases; gas viscosity increases

(B) both decrease

(C) both increase

(D) liquid viscosity increases; gas viscosity decreases

Q7. A directly compressible powder has a bulk density of 0.42 g/mL and a tapped density of 0.56 g/mL. Its Carr's compressibility index is:

(A) 14%

(B) 33%

(C) 25%

(D) 20%

Q8. The angle of repose of a granule blend is measured as 41°. According to the standard scale, this value indicates a flow character that is:

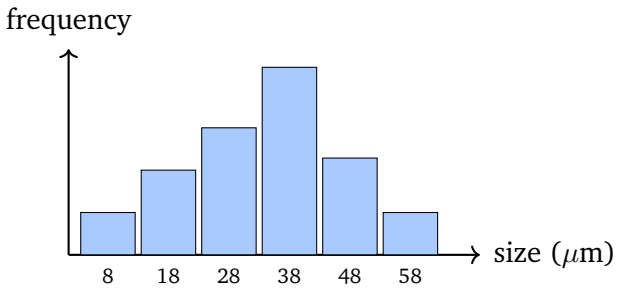
(A) excellent

(B) passable to poor

(C) very free flowing

(D) not measurable

Q9. The number-frequency histogram below describes a sieved powder. The modal (most frequent) size class, in μm, is:



(A) 8 – 18

(B) 18 – 28

(C) 28 – 38

(D) 38 – 48

Q10. A boric acid buffer is prepared from boric acid ($pK_a = 9.20$) and its sodium salt in a salt:acid molar ratio of 1:10. Taking $\log 10 = 1$, the pH of the buffer is:

(A) 9.20

(B) 10.20

(C) 8.20

(D) 7.20

Q11. Blood plasma and lacrimal fluid freeze at -0.52°C. A 1.0% w/v drug solution depresses the freezing point of water by 0.13°C. The amount of the drug needed to make 100 mL of solution isotonic (in % w/v) is:

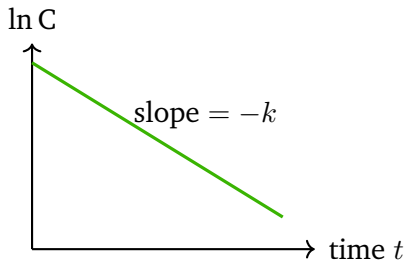
(A) 4.0

(B) 0.25

(C) 0.52

(D) 2.0

Q12. In the plot below the natural logarithm of the remaining drug concentration (ln C) decreases linearly with time at constant slope. The degradation therefore follows:



(A) zero-order kinetics

(B) first-order kinetics

(C) second-order kinetics

(D) third-order kinetics

Q13. A drug in solution degrades by first-order kinetics with a rate constant $k = 0.0347$ day^{-1}. Taking $\ln 2 = 0.693$, its half-life ($t_{1/2}$) is approximately:

(A) 35 days

(B) 10 days

(C) 20 days

(D) 50 days

Q14. In accelerated stability testing, the Q_{10} value of a degradation reaction represents the:

(A) factor by which the reaction rate changes for a 10°C rise in temperature

(B) activation energy divided by 10

(C) percentage drug lost in 10 months

(D) pH change for a 10-fold dilution

Q15. The Langmuir adsorption isotherm $\dfrac{x}{m} = \dfrac{abC}{1 + bC}$ is linearised by plotting:

(A) $\log(x/m)$ against $\log C$

(B) x/m against C

(C) x/m against $1/C$

(D) $C/(x/m)$ against C

Q16. For the 1:1 complexation D + L $\rightleftharpoons$ DL, two ligands give stability (formation) constants $K_1 = 2 \times 10^3$ M^{-1} and $K_2 = 5 \times 10^4$ M^{-1}. The ligand forming the more stable complex with the drug is:

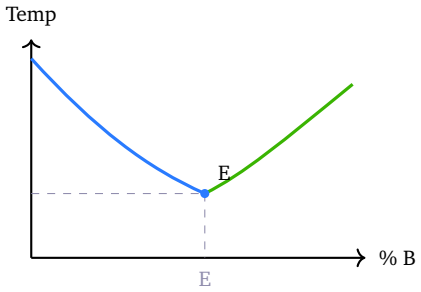
(A) ligand 1, because K_1 is smaller

(B) ligand 2, because the larger K means a more stable complex

(C) both equally stable

(D) neither forms a complex

Q17. The temperature–composition diagram below is for two solids that are miscible as liquids but immiscible as solids. The two liquidus curves meet at point E, the lowest temperature at which any liquid can exist. Point E is the:



(A) critical solution point

(B) triple point

(C) eutectic point

(D) glass transition point

Q18. According to the Noyes–Whitney equation $dC/dt = \dfrac{DA}{h}(C_s - C)$, micronising a poorly soluble drug increases its dissolution rate mainly because micronisation:

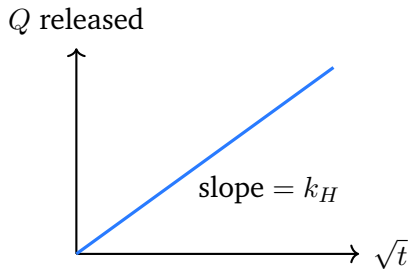
(A) increases the effective surface area A of the drug

(B) increases the diffusion-layer thickness h

(C) decreases the saturation solubility C_s

(D) decreases the diffusion coefficient D

Q19. For a matrix-type transdermal patch, the cumulative amount of drug released Q is plotted against $\sqrt{t}$ and gives a straight line through the origin (figure). This diffusion-controlled release obeys the:



(A) zero-order model

(B) first-order model

(C) Hixson–Crowell cube-root model

(D) Higuchi (square-root-of-time) model

Q20. In the Korsmeyer–Peppas model ($M_t/M_\infty = kt^n$) for drug release from a *spherical* matrix, a release exponent of $n = 0.85$ indicates that release is governed by:

(A) Fickian (diffusion-controlled) release

(B) pure zero-order from a slab

(C) case-II (polymer relaxation / erosion-controlled) transport

(D) no release at all

Q21. A candidate molecule shows both poor aqueous solubility and poor intestinal permeability, making oral bioavailability a major formulation challenge. In the Biopharmaceutics Classification System it is:

(A) Class I

(B) Class II

(C) Class III

(D) Class IV

Q22. Povidone (polyvinylpyrrolidone, PVP K-30) is dissolved in the granulating fluid of a wet-granulation tablet formulation chiefly to act as a:

(A) binder

(B) lubricant

(C) disintegrant

(D) glidant

Q23. For uncoated tablets of average weight 80 mg, the IP/USP weight-variation limit is $\pm 10\%$. The acceptable individual-tablet weight range (mg) is:

(A) 76 – 84

(B) 72 – 88

(C) 78 – 82

(D) 70 – 90

Q24. Among the standard hard-gelatin capsule shells used for human oral products, the size with the *smallest* fill volume (i.e. for the lowest fill weight) is:

(A) size 000

(B) size 0

(C) size 5

(D) size 1

Q25. A drug has a displacement value of 1.5 in cocoa butter. To prepare 8 suppositories, each moulded from a 2 g base and each containing 0.6 g of the drug, the mass of cocoa butter (g) required is:

(A) 12.8

(B) 16.0

(C) 11.2

(D) 9.6

Q26. When two electrodes connected to a lamp are dipped into an emulsion, the lamp glows brightly (the emulsion conducts electricity readily). The emulsion is therefore of the:

(A) water-in-oil (w/o) type

(B) dry-emulsion type

(C) multiple w/o/w type

(D) oil-in-water (o/w) type

Q27. In a pharmaceutical suspension, the final sediment occupies 15 mL of an original total suspension volume of 50 mL. The sedimentation volume (F) is:

(A) 0.50

(B) 0.30

(C) 3.33

(D) 0.15

Q28. Aqueous parenteral solutions in their final containers are most commonly sterilised by moist heat (autoclaving). The standard pharmacopoeial reference cycle is:

(A) 180°C for 30 minutes

(B) 100°C for 60 minutes

(C) 121°C for 15 minutes at 15 psi

(D) 60°C for 10 hours

Q29. Anhydrous wool fat (lanolin) can take up substantial amounts of water to form a w/o emulsion while remaining anhydrous itself. It is therefore classified as which type of ointment base?

(A) absorption base

(B) oleaginous (hydrocarbon) base

(C) water-soluble (PEG) base

(D) water-removable (o/w cream) base

Q30. In a pharmaceutical aerosol, the chief function of the liquefied-gas propellant is to:

(A) act as the therapeutic active ingredient

(B) provide the energy to expel the product and atomise it on actuation

(C) sterilise the formulation inside the can

(D) serve only as a tablet lubricant

Q31. A hammer mill reduces particle size predominantly by which mechanism?

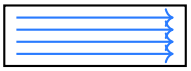
(A) intense shear in a narrow rotor-stator gap

(B) air-jet inter-particle collision

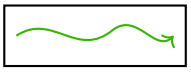
(C) high-velocity impact of swinging hammers against the feed

(D) slow compression between two heavy rollers

Q32. The two pipe-flow sketches below contrast smooth parallel streamlines (i) with chaotic swirling eddies (ii). The Reynolds-number range that lies *between* the laminar (i) and fully turbulent (ii) regimes (the transitional zone) is:



(i) laminar



(ii) turbulent

(A) less than 100

(B) less than 2100

(C) greater than 10000

(D) between 2100 and 4000

Q33. In the hot-air (tray) drying of wet granules, the moisture content at the point where drying changes from the constant-rate period to the falling-rate period is termed the:

(A) critical moisture content

(B) equilibrium moisture content

(C) bound moisture content

(D) free moisture content

Q34. Niosomes, used as a vesicular drug-delivery carrier and an alternative to liposomes, are bilayer vesicles formed mainly from:

(A) phospholipids and cholesterol only

(B) non-ionic surfactants (with cholesterol)

(C) a solid lipid matrix with no aqueous core

(D) cross-linked albumin microspheres

Part B: Pharmacology & Toxicology

Q35. A drug has an elimination rate constant of $0.20\,\mathrm{h}^{-1}$ and an apparent volume of distribution of 40 L. Its total body clearance is:

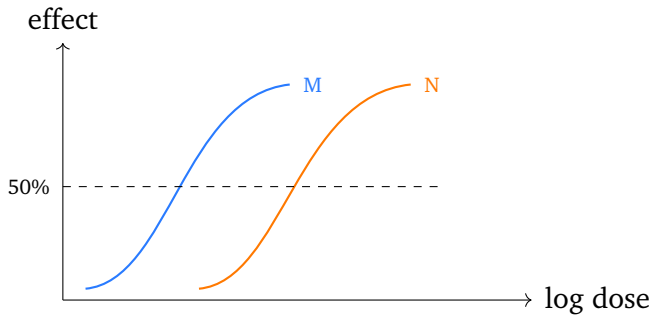
(A) 0.005 L/h

(B) 8 L/h

(C) 200 L/h

(D) 20 L/h

Q36. The two graded log dose-response curves below belong to drugs M and N acting on the same receptor and reaching the same maximal effect, with M lying to the left of N. The correct conclusion is:



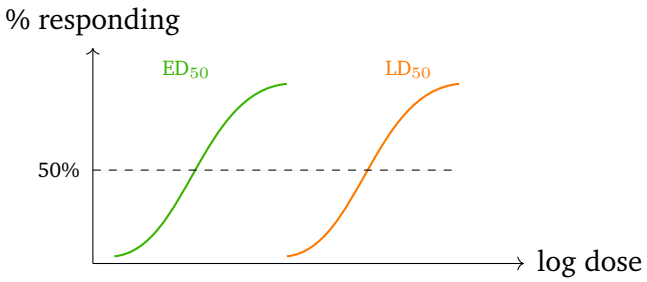
(A) N is more potent and more efficacious than M

(B) M and N differ in efficacy but not potency

(C) M is more potent than N (lower ED_{50}); both have equal efficacy (same E_{max})

(D) M is more efficacious than N

Q37. From the quantal dose-response curves below, a drug has an ED_{50} of 5 mg and an LD_{50} of 200 mg. Its therapeutic index (TI) is:



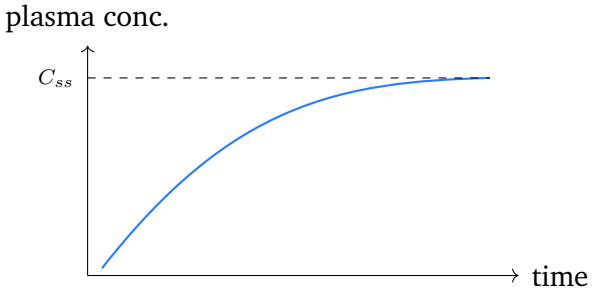
(A) 40

(B) 0.025

(C) 195

(D) 205

Q38. The plasma concentration-time profile below shows accumulation to steady state during a constant-rate IV infusion. For a drug with an elimination half-life of 8 hours, the time taken to reach approximately 94% of the steady-state concentration is about:



(A) 8 hours (1 half-life)

(B) 16 hours (2 half-lives)

(C) 24 hours (3 half-lives)

(D) 32 hours (4 half-lives)

Q39. A highly plasma-protein-bound drug (99% bound) is displaced from albumin so that the free fraction rises from 1% to 2%. The most immediate pharmacological consequence is:

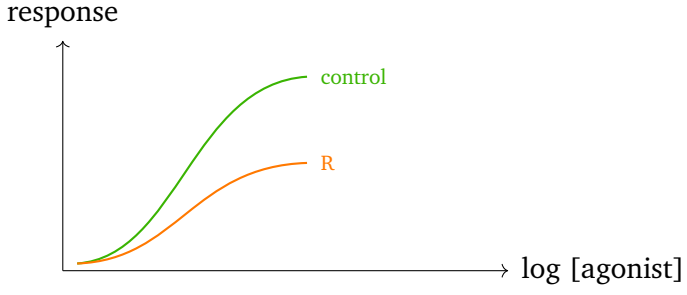
(A) A fall in the free (active) drug concentration

(B) A transient doubling of the free (pharmacologically active) drug concentration, increasing effect and toxicity until redistribution and elimination re-equilibrate

(C) No change in free drug because only bound drug is active

(D) Permanent loss of all drug activity

Q40. An antagonist shifts the agonist log dose-response curve as shown by curve R: the maximum is depressed and cannot be restored by adding more agonist. This profile identifies the antagonist as:



(A) A competitive (surmountable) antagonist

(B) A partial agonist

(C) An irreversible / non-competitive (insurmountable) antagonist that lowers E_{max}

(D) A chemical antagonist that inactivates the drug in solution

Q41. For a drug, the more clinically conservative measure of safety is the "certain safety factor" (margin of safety), defined as:

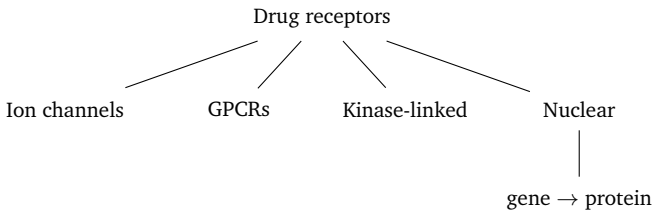
(A) LD_1 / ED_{99}

(B) LD_{50} / ED_{50}

(C) ED_{50} / LD_{50}

(D) LD_{99} / ED_1

Q42. In the receptor superfamily tree shown, the branch that signals over *hours* by binding intracellular receptors and altering gene transcription is occupied by which class of agents?



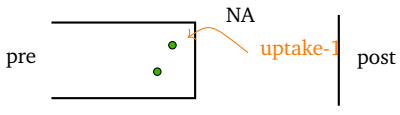
(A) Acetylcholine at nicotinic receptors

(B) Adrenaline at β-adrenoceptors

(C) Insulin at its receptor tyrosine kinase

(D) Glucocorticoids (e.g. dexamethasone) and thyroid hormone

Q43. At the noradrenergic varicosity depicted, cocaine and tricyclic antidepressants potentiate sympathetic transmission mainly because they:



(A) Block monoamine oxidase inside the nerve terminal

(B) Block the neuronal noradrenaline reuptake transporter (uptake-1), prolonging the action of released noradrenaline in the synaptic cleft

(C) Stimulate the release of stored noradrenaline like tyramine

(D) Block postsynaptic α_1-adrenoceptors

Q44. Which β-blocker is β_1-selective (cardioselective) and commonly preferred for chronic heart failure and hypertension when airway disease coexists?

(A) Carvedilol (non-selective α/β)

(B) Sotalol (non-selective with Class III action)

(C) Bisoprolol

(D) Labetalol (non-selective α/β)

Q45. Formoterol differs from salbutamol in that formoterol is a:

(A) Long-acting β_2-agonist (LABA) with a rapid onset, used for maintenance bronchodilation (with an inhaled corticosteroid), not as sole reliever

(B) Short-acting β_2-agonist identical in duration to salbutamol

(C) Selective α_1-agonist

(D) Muscarinic antagonist bronchodilator

Q46. Among antimuscarinics, which property explains why glycopyrrolate (a quaternary amine) lacks the central effects seen with hyoscine (scopolamine, a tertiary amine)?

(A) Glycopyrrolate is a muscarinic agonist, not an antagonist

(B) Being a charged quaternary ammonium compound, glycopyrrolate poorly crosses the blood-brain barrier and acts peripherally, whereas the tertiary hyoscine enters the CNS

(C) Glycopyrrolate selectively blocks nicotinic receptors

(D) Hyoscine cannot cross any membrane

Q47. Sugammadex rapidly reverses neuromuscular blockade produced by rocuronium because sugammadex:

(A) Inhibits acetylcholinesterase, raising synaptic acetylcholine

(B) Is a depolarizing agonist that competes at the end-plate

(C) Activates plasma pseudocholinesterase to hydrolyse rocuronium

(D) Is a modified γ-cyclodextrin that encapsulates (chelates) the steroidal blocker in plasma, removing it from the neuromuscular junction

Q48. Thiopental, an ultra-short-acting barbiturate used for induction of anaesthesia, potentiates GABAergic inhibition by:

(A) Increasing the frequency of chloride channel opening (the benzodiazepine action)

(B) Blocking the GABA-A receptor as an antagonist

(C) Increasing the *duration* of GABA-A chloride channel opening, and at higher concentrations opening the channel directly even without GABA (explaining the lower safety margin)

(D) Inhibiting GABA transaminase

Q49. Aripiprazole is described as an atypical antipsychotic with a distinctive mechanism because it is:

(A) A dopamine D_2 partial agonist (with 5-HT_{1A} partial agonism and 5-HT_{2A} antagonism), stabilising dopaminergic tone

(B) A pure, high-affinity D_2 full antagonist like haloperidol

(C) A selective serotonin reuptake inhibitor

(D) A muscarinic agonist

Q50. Citalopram relieves depression by a mechanism best described as:

(A) Reversible inhibition of monoamine oxidase-A

(B) Selective inhibition of the serotonin (5-HT) reuptake transporter, with little effect on noradrenaline or dopamine transporters

(C) Balanced inhibition of both serotonin and noradrenaline reuptake (an SNRI action)

(D) Blockade of presynaptic α_2-autoreceptors

Q51. Methadone is used in opioid maintenance therapy and chronic pain. Besides being a μ-opioid agonist, a pharmacologically important additional property of methadone is that it:

(A) Is an opioid antagonist that precipitates withdrawal

(B) Has an ultra-short half-life requiring hourly dosing

(C) Acts only at peripheral κ receptors

(D) Has a long, variable half-life and NMDA-receptor antagonist activity, but can prolong the QT interval

Q52. Lamotrigine controls partial and generalised seizures (and stabilises mood in bipolar disorder) chiefly by:

(A) Enhancing GABA-A chloride currents like a benzodiazepine

(B) Blocking T-type calcium channels (the ethosuximide action)

(C) Blocking voltage-gated sodium channels in a use-dependent manner, stabilising neuronal membranes and reducing glutamate release

(D) Irreversibly inhibiting GABA transaminase

Q53. Among local anaesthetics, bupivacaine is noted for greater cardiotoxicity than lidocaine principally because bupivacaine:

(A) Binds cardiac sodium channels with high affinity and dissociates slowly (“fast-in, slow-out”), favouring re-entrant arrhythmias at toxic doses

(B) Has no effect on cardiac sodium channels

(C) Is an ester rapidly hydrolysed by plasma esterases

(D) Acts by blocking cardiac potassium channels only

Q54. Entacapone is added to a levodopa/carbidopa regimen in Parkinson's disease because entacapone:

(A) Is itself converted to dopamine in the brain

(B) Inhibits peripheral catechol-O-methyltransferase (COMT), reducing the breakdown of levodopa to 3-O-methyldopa and prolonging levodopa's plasma half-life

(C) Is a central dopamine D_2 antagonist

(D) Inhibits acetylcholinesterase

Q55. Ramipril, a prodrug, lowers blood pressure and is cardioprotective because its active metabolite ramiprilat:

(A) Directly blocks angiotensin II AT_1 receptors

(B) Blocks L-type calcium channels in vascular smooth muscle

(C) Inhibits angiotensin-converting enzyme, lowering angiotensin II and aldosterone while raising bradykinin (which can cause cough)

(D) Activates β_1-adrenoceptors

Q56. Diltiazem differs from amlodipine (a dihydropyridine) in that diltiazem:

(A) Is a pure arteriolar vasodilator with reflex tachycardia

(B) Has no effect on the heart

(C) Blocks β-adrenoceptors

(D) Is a non-dihydropyridine that also slows SA/AV nodal conduction and heart rate, making it useful for rate control in supraventricular tachyarrhythmias

Q57. Flecainide is classed as a Vaughan-Williams Class Ic antiarrhythmic, meaning its dominant action is:

(A) Marked sodium channel blockade with slow dissociation, strongly slowing conduction with little change in action-potential duration (contraindicated after myocardial infarction)

(B) Potassium channel blockade prolonging repolarisation (Class III)

(C) β-adrenoceptor blockade (Class II)

(D) Calcium channel blockade (Class IV)

Q58. Rivaroxaban differs from warfarin in mechanism because rivaroxaban:

(A) Inhibits vitamin-K epoxide reductase, reducing synthesis of factors II, VII, IX and X

(B) Is an oral direct factor Xa inhibitor with rapid onset and a fixed dose that does not require routine INR monitoring

(C) Potentiates antithrombin like heparin and is given only by injection

(D) Is a direct thrombin (factor IIa) inhibitor

Q59. Continuous dosing of isosorbide mononitrate for angina can lose effect over 24 hours. This nitrate tolerance is best managed by:

(A) Increasing the dose indefinitely

(B) Combining it with a phosphodiesterase-5 inhibitor

(C) Providing a daily nitrate-free interval (typically 8–12 h) to allow the vascular response to recover

(D) Switching the route to intravenous infusion only

Q60. Fexofenadine causes far less sedation than chlorpheniramine because fexofenadine:

(A) Is an H_2-receptor antagonist

(B) Has a much shorter duration of action

(C) Is a more potent muscarinic blocker

(D) Is a second-generation H_1 antagonist that is relatively polar and a P-glycoprotein substrate, so it poorly penetrates the blood-brain barrier

Q61. Etoricoxib is designed as a selective COX-2 inhibitor. The intended advantage and the principal trade-off are, respectively:

(A) Reduced gastrointestinal ulceration (COX-1 sparing) but an increased cardiovascular/thrombotic risk from reduced vascular prostacyclin

(B) Increased gastric bleeding but reduced cardiovascular risk

(C) Stronger antiplatelet effect than aspirin

(D) Complete loss of analgesic activity

Q62. During an acute gout flare, low-dose colchicine relieves pain by a mechanism quite distinct from urate-lowering drugs. Colchicine acts by:

(A) Inhibiting xanthine oxidase to lower urate production

(B) Binding tubulin and inhibiting microtubule polymerisation, impairing neutrophil migration and the inflammasome response to urate crystals

(C) Increasing renal uric acid excretion as a uricosuric

(D) Enzymatically degrading uric acid to allantoin

Q63. Clarithromycin, a macrolide antibiotic, is bacteriostatic mainly because it:

(A) Binds the 30S ribosomal subunit and causes mRNA misreading

(B) Inhibits bacterial DNA gyrase (topoisomerase II)

(C) Binds the 50S ribosomal subunit and blocks translocation, inhibiting bacterial protein synthesis

(D) Inhibits peptidoglycan cross-linking in the cell wall

Q64. Levofloxacin is bactericidal because it:

(A) Inhibits dihydropteroate synthase in folate synthesis

(B) Binds the 50S subunit peptidyl transferase

(C) Inhibits the 30S ribosomal subunit

(D) Inhibits bacterial DNA gyrase and topoisomerase IV, blocking DNA replication and supercoiling

Q65. Linezolid is active against resistant Gram-positive organisms (MRSA, VRE) because it:

(A) Binds the 23S rRNA of the 50S subunit and prevents formation of the 70S initiation complex, inhibiting protein synthesis at an early step

(B) Inhibits bacterial cell-wall synthesis by binding penicillin-binding proteins

(C) Inhibits RNA polymerase

(D) Inhibits dihydrofolate reductase

Q66. Vancomycin inhibits bacterial cell-wall synthesis by a mechanism different from the β-lactams. Vancomycin acts by:

(A) Binding penicillin-binding proteins (transpeptidases) like penicillin

(B) Binding the terminal D-alanyl-D-alanine of the peptidoglycan precursor, sterically blocking transglycosylation and transpeptidation

(C) Inhibiting the 30S ribosomal subunit

(D) Disrupting the outer-membrane lipopolysaccharide

Q67. Empagliflozin lowers blood glucose in type 2 diabetes by a mechanism that is insulin-independent. It:

(A) Stimulates insulin release from pancreatic β-cells like a sulfonylurea

(B) Inhibits intestinal α-glucosidase

(C) Inhibits the sodium-glucose co-transporter 2 (SGLT2) in the proximal renal tubule, reducing glucose reabsorption and increasing urinary glucose excretion

(D) Activates PPAR-γ to improve insulin sensitivity

Q68. In methanol poisoning the toxic metabolite (formic acid) causes metabolic acidosis and blindness. The rational antidote fomepizole works by:

(A) Chelating methanol directly in the blood

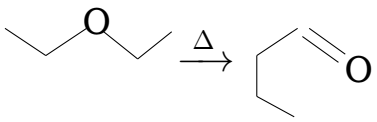
(B) Replenishing hepatic glutathione stores

(C) Competitively antagonising opioid receptors

(D) Inhibiting alcohol dehydrogenase, the enzyme that converts methanol to formaldehyde/formic acid, thereby halting toxic metabolite formation

Part C: Pharmaceutical & Medicinal Chemistry

Q69. When an allyl vinyl ether is heated, it undergoes a concerted [3,3]-sigmatropic shift to give a γ,δ-unsaturated carbonyl compound, as shown.



This thermal isomerisation is the:

(A) Claisen condensation

(B) Claisen rearrangement

(C) Cannizzaro reaction

(D) Knoevenagel condensation

Q70. A 1,5-diene, on heating, undergoes a degenerate or productive [3,3]-sigmatropic shift that interconverts the two ends of the diene system without any heteroatom involved. This all-carbon rearrangement is the:

(A) Cope rearrangement

(B) Curtius rearrangement

(C) Beckmann rearrangement

(D) Favorskii rearrangement

Q71. Treatment of a tertiary alcohol (or alkene) with a nitrile in the presence of strong acid, followed by aqueous work-up, gives an *N*-substituted amide via a stabilised carbocation trapped by the nitrile nitrogen. This is the:

(A) Ritter reaction giving a tertiary alcohol

(B) Gabriel synthesis giving a primary amine

(C) Hofmann elimination giving an alkene

(D) Ritter reaction giving an *N*-substituted amide

Q72. A ketone is reduced to the corresponding secondary alcohol by aluminium isopropoxide in isopropanol, with acetone formed as the by-product, through a cyclic six-membered transition state involving hydride transfer. This selective, reversible reduction is the:

(A) Clemmensen reduction

(B) Wolff–Kishner reduction

(C) Meerwein–Ponndorf–Verley (MPV) reduction

(D) Rosenmund reduction

Q73. The acid-catalysed addition of formaldehyde to an alkene, giving 1,3-diols, allylic alcohols or 1,3-dioxanes depending on conditions, is known as the:

(A) Wacker oxidation

(B) Reformatsky reaction

(C) Reimer–Tiemann reaction

(D) Prins reaction

Q74. The hydrolysis of the conjugate base (nitronate salt) of a primary or secondary nitroalkane under acidic conditions to yield an aldehyde or ketone is called the:

(A) Nef reaction giving a carboxylic acid

(B) Nef reaction giving a carbonyl compound (aldehyde/ketone)

(C) Henry reaction giving a nitroalcohol

(D) Mannich reaction giving an aminoketone

Q75. An aryl alkyl ketone reacts with sulfur and a secondary amine (morpholine) to give a thioamide in which the carbonyl has effectively migrated to the terminal carbon of the chain. This chain-walking transformation is the:

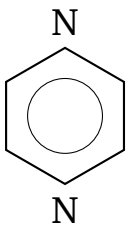
(A) Willgerodt–Kindler reaction

(B) Bouveault–Blanc reduction

(C) Oppenauer oxidation

(D) Stephen reaction

Q76. Identify the diazine heterocycle drawn below, a six-membered aromatic ring carrying two nitrogen atoms in the 1,4 (para) positions. It forms the core of drugs such as the antitubercular pyrazinamide.



(A) pyrimidine (1,3-diazine)

(B) pyridazine (1,2-diazine)

(C) pyrazine (1,4-diazine)

(D) piperazine

Q77. A tetrazole ring, the acidic –COOH bioisostere found in losartan, is a five-membered aromatic heterocycle. How many nitrogen atoms does the tetrazole ring contain?

(A) two nitrogen atoms

(B) four nitrogen atoms

(C) three nitrogen atoms

(D) one nitrogen atom

Q78. Pyrazine is a weak base (much weaker than pyridine). Which statement about its electronic structure is correct?

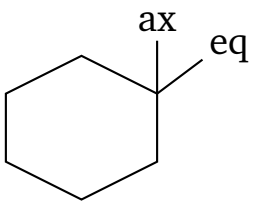
(A) It is non-aromatic because two nitrogens disrupt the sextet.

(B) Both nitrogen lone pairs are donated into the aromatic π sextet.

(C) It has 8 π electrons and is antiaromatic.

(D) It is aromatic with 6 π electrons; each N keeps an in-plane sp^2 lone pair, and the second electron-withdrawing N lowers basicity.

Q79. In the chair cyclohexane drawn below, a bulky *tert*-butyl group strongly prefers one orientation. Which orientation is favoured and why?



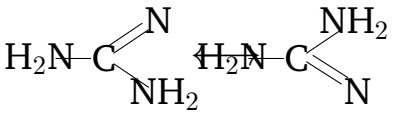
(A) Equatorial, to avoid 1,3-diaxial steric strain.

(B) Axial, because axial bonds are shorter.

(C) Axial, to maximise hyperconjugation.

(D) Either is equally stable; orientation does not matter.

Q80. The guanidinium ion (protonated guanidine) is an exceptionally strong conjugate acid's base because the positive charge is delocalised equally over three nitrogen atoms, as shown by the equivalent resonance structures.



The very high basicity of guanidine is best explained by:

(A) the inductive electron withdrawal of the three nitrogens

(B) resonance stabilisation of the guanidinium cation over three equivalent nitrogens (Y-aromaticity)

(C) aromatic delocalisation in a six-membered ring

(D) hydrogen bonding to the solvent only

Q81. Which of the following C–H positions is the **most acidic** (lowest pK_a), owing to stabilisation of the resulting carbanion by two flanking carbonyls?

(A) the α-CH of a simple ketone ($pK_a \approx 20$)

(B) a terminal alkyne C–H ($pK_a \approx 25$)

(C) the central CH_2 of pentane-2,4-dione (acetylacetone, $pK_a \approx 9$)

(D) an alkane C–H ($pK_a \approx 50$)

Q82. A molecule contains three non-equivalent stereocentres and no internal symmetry. What is the maximum number of stereoisomers possible?

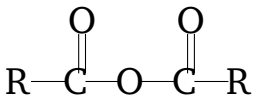
(A) 3

(B) 6

(C) 8

(D) 4

Q83. Identify the functional group present in the skeletal fragment drawn below.



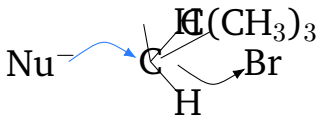
(A) ester

(B) acid anhydride

(C) ketone

(D) carboxylic acid

Q84. A neopentyl halide, $(CH_3)_3C–CH_2–Br$, reacts very sluggishly with nucleophiles by the S_N2 pathway. Backside attack (shown) is blocked by the neighbouring bulky group.



The principal reason for the slow rate is:

(A) severe steric hindrance to backside attack from the adjacent quaternary carbon

(B) the C–Br bond is unusually strong

(C) the substrate is aromatic

(D) bromide is a poor leaving group here

Q85. Metronidazole, used against anaerobic bacteria and protozoa, is a 5-nitroimidazole. Its selective toxicity arises because:

(A) it inhibits bacterial cell-wall synthesis like penicillin

(B) it blocks the 30S ribosomal subunit

(C) it is a folate antagonist

(D) its nitro group is reduced by anaerobic organisms to cytotoxic radicals that damage DNA

Q86. Theophylline and caffeine are methylxanthines. The bronchodilator action of theophylline is attributed mainly to:

(A) inhibition of phosphodiesterase (raising cyclic AMP) and adenosine-receptor antagonism

(B) irreversible cyclo-oxygenase acetylation

(C) $GABA_A$ chloride-channel potentiation

(D) β-lactam ring acylation of transpeptidase

Q87. Metformin, a first-line oral antidiabetic, belongs to which chemical class and acts chiefly by reducing hepatic gluconeogenesis (via AMPK activation)?

(A) sulfonylurea

(B) thiazolidinedione

(C) biguanide

(D) dipeptidyl-peptidase-4 inhibitor

Q88. Sildenafil produces vasodilation by inhibiting which enzyme, thereby prolonging the action of cyclic GMP in smooth muscle?

(A) cyclo-oxygenase-2

(B) phosphodiesterase type 5 (PDE5)

(C) angiotensin-converting enzyme

(D) monoamine oxidase

Q89. Allopurinol lowers serum uric acid in gout. Mechanistically it acts as a substrate analogue that inhibits which enzyme?

(A) xanthine oxidase

(B) HMG-CoA reductase

(C) dihydrofolate reductase

(D) carbonic anhydrase

Q90. Chloramphenicol exerts its antibacterial effect by binding to which target to inhibit peptide-bond formation?

(A) DNA gyrase

(B) the 30S ribosomal subunit

(C) dihydropteroate synthase

(D) the 50S ribosomal subunit (peptidyl transferase)

Q91. A ligand that binds a receptor and produces a response *opposite* to that of an agonist (lowering constitutive/basal activity below baseline) is best described as a(n):

(A) full agonist

(B) inverse agonist

(C) competitive antagonist

(D) partial agonist

Q92. According to Veber's rules for oral bioavailability, good permeability is favoured when a molecule has ≤ 10 rotatable bonds and a topological polar surface area (TPSA) below approximately:

(A) $20\,\text{Å}^2$

(B) $500\,\text{Å}^2$

(C) $140\,\text{Å}^2$

(D) $5\,\text{Å}^2$

Q93. Aspirin and the proton-pump inhibitors form which type of bond with their target enzymes, accounting for their long, "irreversible" duration of action?

(A) a covalent bond

(B) a single hydrogen bond

(C) a purely ionic interaction

(D) a weak van der Waals contact

Q94. Many antipsychotics and antihistamines (e.g. cetirizine, ciprofloxacin's side chain) contain a saturated six-membered ring with two nitrogens at the 1,4 positions. This ring is:

(A) morpholine

(B) piperidine

(C) imidazole

(D) piperazine

Q95. Co-trimoxazole combines sulfamethoxazole with trimethoprim. The rationale for this combination is that the two drugs:

(A) both inhibit the same single enzyme additively

(B) block two sequential steps of bacterial folate synthesis, giving synergistic action

(C) are chemically identical bioisosteres

(D) act on the bacterial cell wall together

Q96. Sodium phenoxide is heated with carbon dioxide under pressure and then acidified to give salicylic acid (the precursor of aspirin). This carboxylation is the:

(A) Kolbe–Schmitt reaction

(B) Kolbe electrolysis

(C) Gattermann reaction

(D) Houben–Hoesch reaction

Q97. Which pharmaceutical inorganic compound is used topically as a mild astringent and protective in calamine and sunscreen preparations?

(A) sodium thiosulfate

(B) potassium iodide

(C) zinc oxide

(D) ammonium chloride

Q98. The degradation rate of a drug solution doubles when the temperature is raised by 10 °C. If a sample degrades with a rate constant k at 25 °C, the approximate rate constant at 45 °C (assuming the ten-degree doubling holds) is:

(A) k (unchanged)

(B) $2k$

(C) $3k$

(D) $4k$

Part D: Pharmaceutical Analysis & Quality Assurance

Q99. The Karl Fischer titration is the pharmacopoeial method of choice for determining which quantity in a drug substance?

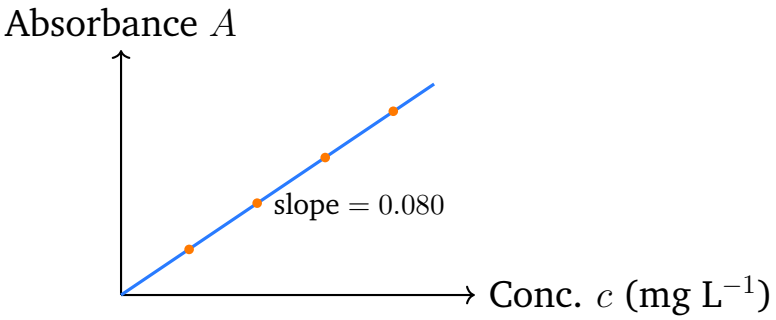
(A) Total ash value

(B) Water (moisture) content

(C) Acid value of a fixed oil

(D) Saponification value

Q100. A drug obeys Beer's law at its λ_{max}. The calibration line below passes through the origin with slope 0.080 L mg^{-1}. A sample solution gives an absorbance of 0.48. What is its concentration?



(A) 6.0 mg L^{-1}

(B) 0.038 mg L^{-1}

(C) 16.7 mg L^{-1}

(D) 0.48 mg L^{-1}

Q101. In cation-exchange chromatography used for separating ionic drug species, retention of an analyte is governed primarily by:

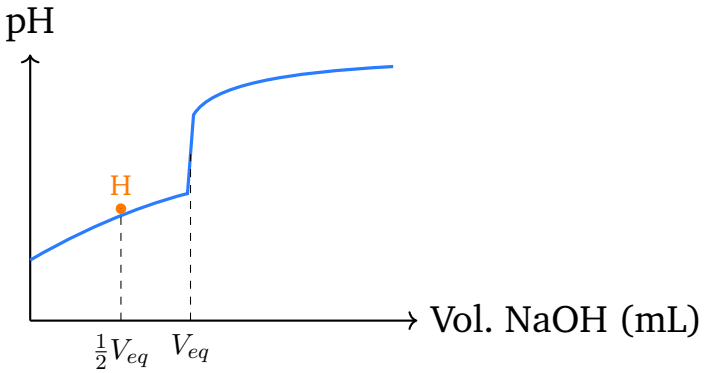
(A) Differences in analyte volatility

(B) Size-based exclusion from the pores

(C) Reversible electrostatic exchange of analyte cations with counter-ions on a negatively charged resin

(D) Partition between two immiscible liquids

Q102. The curve shows the titration of a weak monoprotic acid with NaOH. At the half-equivalence point **H** (half the equivalence volume), the pH of the solution equals which property of the acid?



(A) The pK_b of its conjugate base

(B) Exactly 7.00 in all cases

(C) The molar mass of the acid

(D) The pK_a of the acid

Q103. Fluorescence spectrophotometry (fluorimetry) is often preferred over ordinary UV absorption assay for trace analysis chiefly because:

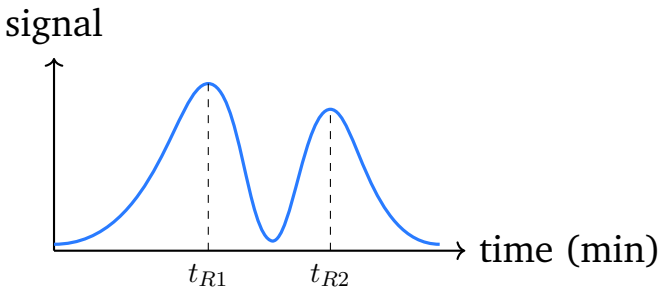
(A) It is more sensitive and selective, since emission is measured against a near-dark background rather than as a small difference between two large light intensities

(B) It requires no excitation light source

(C) It works only for non-fluorescent molecules

(D) Fluorescence intensity is independent of analyte concentration

Q104. For the two peaks in the chromatogram, $t_{R1} = 6.0$ min and $t_{R2} = 7.2$ min, with equal baseline widths $w_1 = w_2 = 0.80$ min. Using $R_s = 2(t_{R2} - t_{R1})/(w_1 + w_2)$, the resolution is:



(A) 0.67

(B) 1.5

(C) 3.0

(D) 0.75

Q105. In cerimetry, the strong oxidising titrant ceric ammonium sulphate is standardised and the end point is most commonly detected using which redox indicator?

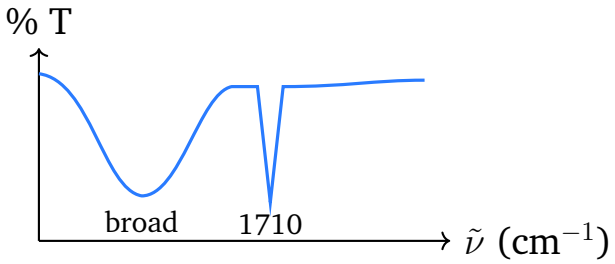
(A) Phenolphthalein

(B) Starch–iodide

(C) Ferroin (1,10-phenanthroline ferrous complex)

(D) Methyl orange

Q106. The schematic IR spectrum shows a very *broad* absorption stretching from about 2500 to 3300 cm^{-1} together with a strong band near 1710 cm^{-1}. This combination is most diagnostic of which functional group?



(A) An isolated alkene C=C

(B) A nitrile C≡N

(C) An ether C–O–C

(D) A carboxylic acid (O–H plus C=O)

Q107. In size-exclusion (gel-permeation) chromatography of a protein mixture, the order in which the components leave the column is:

(A) Largest molecules elute first, smallest last

(B) Smallest molecules elute first, largest last

(C) Most charged molecules elute first

(D) Most hydrophobic molecules elute first

Q108. Primary aromatic amine drugs such as sulphanilamide are assayed by diazotisation titration. The titrant used and the typical end-point detection are:

(A) Sodium thiosulphate; starch indicator

(B) Sodium nitrite; end point shown by an external starch-iodide paper (or potentiometrically)

(C) Silver nitrate; chromate indicator

(D) EDTA; Eriochrome Black T

Q109. In atomic absorption spectroscopy (AAS), the analytical signal arises because:

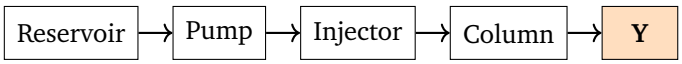
(A) Ground-state atoms in the flame emit light that is measured

(B) Molecules in solution absorb visible light

(C) Ground-state free atoms in the flame absorb resonance-line radiation from a hollow-cathode lamp

(D) Atoms are ionised and counted by mass

Q110. In the liquid-chromatograph block diagram, identify component **Y**, which is placed *after* the column and converts the separated analyte concentrations into a measurable electrical signal.



(A) Solvent reservoir

(B) High-pressure pump

(C) Sample injection valve

(D) Detector

Q111. Compared with ^{1}H NMR, routine proton-decoupled ^{13}C NMR spectra are characterised by:

(A) Singlet peaks (no C–H splitting) and a much wider chemical-shift range (about 0–220 ppm)

(B) Strong C–H spin–spin splitting in every peak

(C) A chemical-shift range narrower than that of ^{1}H

(D) Signals only from quaternary carbons

Q112. In a potentiometric acid–base titration, the end point is located *without* a visual indicator by monitoring the cell potential with which indicator electrode for hydrogen-ion activity?

(A) Dropping mercury electrode

(B) Glass electrode

(C) Platinum redox electrode

(D) Silver–silver chloride reference only

Q113. A back (residual) titration is preferred when:

(A) The analyte and titrant react instantly and completely in a direct titration

(B) No suitable standard solution exists

(C) The direct reaction is slow or the analyte is insoluble/volatile, so excess standard reagent is added and the unreacted excess is titrated

(D) Only a self-indicating titrant is available

Q114. A compound absorbs strongly in the readily accessible UV region (200–400 nm) mainly when it contains:

(A) Only saturated C–C and C–H single bonds

(B) A single isolated hydroxyl group

(C) No multiple bonds at all

(D) A chromophore, especially an extended conjugated π-system

Q115. Temperature programming is widely used in gas chromatography because it:

(A) Sharpens later-eluting peaks and shortens run time by gradually raising oven temperature during the analysis

(B) Keeps the column at a single fixed temperature throughout

(C) Replaces the need for a carrier gas

(D) Is used to cool the detector below ambient temperature

Q116. Which substance is a suitable *primary standard* for standardising a sodium hydroxide solution?

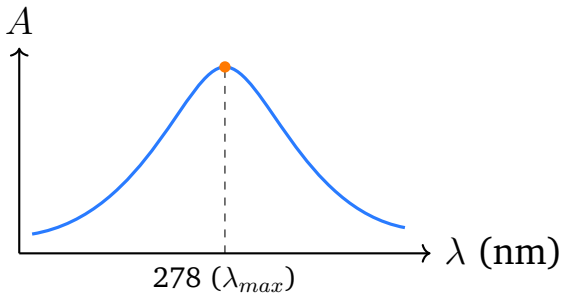
(A) Sodium hydroxide pellets themselves

(B) Potassium hydrogen phthalate (KHP)

(C) Concentrated hydrochloric acid

(D) Sodium thiosulphate solution

Q117. The UV curve marks λ_{max} at 278 nm, where the measured absorbance is 0.62 in a 1.0 cm cell for a 2.0×10^{-5} mol L^{-1} solution. The molar absorptivity ε (L mol^{-1} cm^{-1}) is:



(A) 1.24×10^{-5}

(B) 3.2×10^{4}

(C) 3.1×10^{4}

(D) 6.2×10^{5}

Q118. A colourless drug spot on a silica-gel TLC plate shows no fluorescence quenching under UV. Which simple, non-destructive technique is commonly used to render such a spot visible?

(A) Charring with concentrated sulphuric acid

(B) Exposing the plate to iodine vapour in a closed chamber

(C) Heating to 300 °C in air

(D) Dipping in molten paraffin

Q119. Before an HPLC assay is accepted, a *system suitability test* is run. Its purpose is to:

(A) Replace the need for a reference standard

(B) Determine the molecular structure of the impurity

(C) Sterilise the chromatographic system

(D) Verify that the whole system (column, mobile phase, instrument) performs adequately, using parameters such as resolution, tailing factor, plate count and %RSD of replicate injections

Q120. The *acid value* of a pharmaceutical fixed oil, determined titrimetrically, is defined as the number of milligrams of KOH required to neutralise the free fatty acids present in:

(A) 1 gram of the oil

(B) 1 millilitre of titrant

(C) 100 grams of the oil

(D) 1 mole of the oil

Q121. By the "nitrogen rule" in mass spectrometry, an organic compound that shows an *odd*-mass molecular ion ($M^{+\bullet}$) contains:

(A) No nitrogen atoms at all

(B) An even number of nitrogen atoms

(C) Only oxygen atoms

(D) An odd number of nitrogen atoms

Q122. According to the van Deemter equation $H = A + B/u + C\,u$, plate height H passes through a minimum as the mobile-phase linear velocity u is varied. This minimum corresponds to:

(A) The highest possible flow rate

(B) The lowest possible flow rate (near zero)

(C) The optimum velocity giving maximum column efficiency (smallest H, most plates)

(D) The point where resolution is zero

Part E: Pharmacognosy & Natural Products

Q123. A modern pharmacognosist groups crude drugs on the basis of the chemical character and immunological behaviour of their proteins, comparing antigen–antibody reactions between species to establish relationships. This relatively recent basis of grouping crude drugs is called:

(A) Morphological classification

(B) Serotaxonomical (chemotaxonomical) classification

(C) Alphabetical classification

(D) Pharmacological classification

Q124. Unorganized crude drugs are cell-free direct products of metabolism, whereas organized drugs are entire plant organs possessing a cellular structure. Which of the following sets contains **only organized** crude drugs?

(A) Benzoin, myrrh, kino

(B) Beeswax, agar, gelatin

(C) Catechu, opium, gum acacia

(D) Fennel fruit, quassia wood, vasaka leaf

Q125. Placing *Cassia*, *Glycyrrhiza* and *Trigonella* together because all three are members of the family Leguminosae (Fabaceae), without reference to their constituents or therapeutic use, is an example of which classification of crude drugs?

(A) Taxonomical (botanical) classification

(B) Chemical classification

(C) Morphological classification

(D) Pharmacological classification

Q126. Physostigmine (eserine), an indole alkaloid that reversibly inhibits acetylcholinesterase and is used as a miotic in glaucoma, is obtained from the dried ripe seeds of which plant?

(A) *Pilocarpus jaborandi*

(B) *Lobelia inflata*

(C) *Physostigma venenosum*

(D) *Cytisus scoparius*

Q127. Pseudoephedrine, a sympathomimetic decongestant present alongside ephedrine in *Ephedra* species, is best classified as which type of alkaloid,

given that its nitrogen lies in an open side chain and is derived from an amino acid?

(A) True alkaloid (ring nitrogen from amino acid)

(B) Protoalkaloid (biological amine, nitrogen not in a ring)

(C) Pseudo-alkaloid (nitrogen not from an amino acid)

(D) Glycoalkaloid

Q128. Brucine accompanies strychnine in the seeds of *Strychnos nux-vomica*. Structurally brucine differs from strychnine in bearing two additional substituents on its aromatic ring; these substituents are two:

(A) Hydroxyl groups

(B) Chlorine atoms

(C) Carboxyl groups

(D) Methoxy ($-OCH_3$) groups

Q129. An acidified alkaloidal solution is treated with a reagent prepared by dissolving iodine and potassium iodide in water (iodine–potassium iodide solution), giving a **reddish-brown precipitate**. This precipitation test for alkaloids is the:

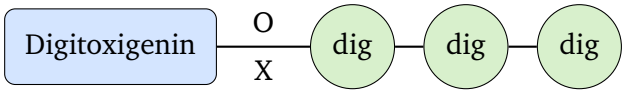
(A) Wagner's test

(B) Mayer's test

(C) Hager's test

(D) Murexide test

Q130. The schematic below represents digitoxin, the principal cardiac glycoside of *Digitalis purpurea*, in which the steroidal aglycone is joined through the linkage "X" to a chain of three identical 2,6-dideoxy sugars.



(O-glycosidic bond) (D) three digitoxose units

The aglycone digitoxigenin belongs to which structural class of cardiac glycoside?

(A) Anthraquinone aglycone

(B) Saponin (triterpene) aglycone

(C) Cardenolide (steroidal, five-membered butenolide ring)

(D) Bufadienolide (six-membered lactone ring)

Q131. Chrysophanol is an anthraquinone aglycone occurring in the rhizomes of *Rheum* and *Rumex* species. The presence of such free anthraquinones is confirmed when, after hydrolysis, the ammoniacal organic layer develops a characteristic colour in the modified Bornträger's test. This colour is:

(A) Blue-green

(B) Pink to cherry-red

(C) Yellow only

(D) Colourless

Q132. Gitalin is one of the cardiac glycosides of *Digitalis purpurea*. The 2-deoxysugar (digitoxose) residues carried by such *Digitalis* glycosides are specifically detected by a reddish-brown ring at the junction of glacial acetic acid (with traces of ferric chloride) and concentrated sulphuric acid in which test?

(A) Liebermann–Burchard test

(B) Legal's test

(C) Baljet test

(D) Keller–Kiliani test

Q133. Rutin is a flavonol glycoside in which the flavonol aglycone is linked to the disaccharide rutinose. On acid hydrolysis rutin yields rutinose together with which flavonol aglycone?

(A) Apigenin

(B) Hesperetin

(C) Quercetin

(D) Naringenin

Q134. White mustard seed (*Brassica alba / Sinapis alba*) owes its pungency to the glucosinolate sinalbin. On treatment with water the seed enzyme myrosinase hydrolyses sinalbin, but unlike the volatile isothiocyanate of black mustard, the product here is a **non-volatile, almost odourless** isothiocyanate. This product is:

(A) *p*-Hydroxybenzyl isothiocyanate (non-volatile)

(B) Allyl isothiocyanate (volatile)

(C) Eugenol

(D) Sinapic acid

Q135. Pimento (allspice), the dried unripe fruit of *Pimenta dioica* (*Pimenta officinalis*), yields a volatile oil whose chief phenolic constituent (about 60–80%) gives it a clove-like odour and carminative action. This principal constituent is:

(A) Menthol

(B) Eugenol

(C) Citral

(D) Linalool

Q136. The dried ripe fruit of *Cuminum cyminum* (cumin) yields a volatile oil whose characteristic odour is due chiefly to an aromatic monoterpene aldehyde (*p*-isopropylbenzaldehyde). This chief constituent of cumin oil is:

(A) Carvone

(B) Anethole

(C) Thymol

(D) Cuminaldehyde

Q137. Sandalwood oil, distilled from the heartwood of *Santalum album*, is valued in perfumery and as a urinary antiseptic. Its chief constituent (about 90%), a mixture of sesquiterpene alcohols, is:

(A) Eugenol

(B) Citronellal

(C) α- and β-santalol

(D) Geraniol

Q138. Two crude drugs are described: dragon's blood (the red resin from the fruits of *Daemonorops draco*) and locust bean gum (the galactomannan from the seeds of *Ceratonia siliqua*). Which statement correctly distinguishes them?

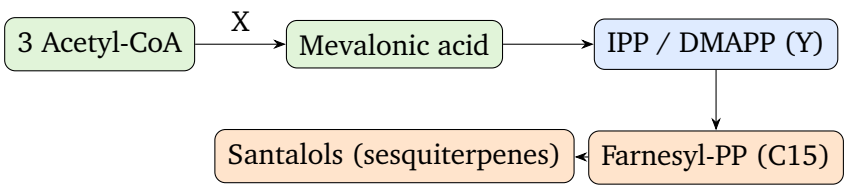
(A) Dragon's blood is a water-insoluble red resin, whereas locust bean gum is a galactomannan polysaccharide that hydrates in water to a viscous mucilage

(B) Both are nitrogen-containing alkaloidal resins

(C) Dragon's blood is a polysaccharide gum and locust bean gum is a resin

(D) Both dissolve completely in cold water to give clear true solutions

Q139. The biosynthetic scheme below outlines the route to the sesquiterpene alcohols of sandalwood oil. Identify the pathway X and the immediate C5 isoprene precursor Y.



(A) Shikimic acid pathway; erythrose-4-phosphate

(B) Acetate–mevalonate pathway; isopentenyl pyrophosphate (IPP)

(C) Acetate–malonate pathway; malonyl-CoA

(D) Pentose phosphate pathway; ribulose-5-phosphate

Q140. Hydrolysable gallotannins are esters of glucose with gallic acid. Gallic acid is biosynthesised directly from an early intermediate of which pathway, by aromatisation without proceeding all the way to the aromatic amino acids?

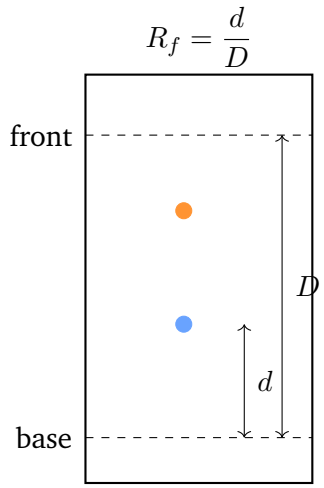
(A) Acetate–mevalonate pathway (from mevalonic acid)

(B) Acetate–malonate pathway (from malonyl-CoA)

(C) Krebs (citric acid) cycle (from citrate)

(D) Shikimic acid pathway (from 3-dehydroshikimic acid)

Q141. The TLC plate below is a chromatographic fingerprint of a herbal extract, showing the spotting line (base), two resolved spots and the solvent front.



A spot migrates $d = 1.5$ cm while the solvent front D advances 4.0 cm from the baseline. The R_f value of that spot is:

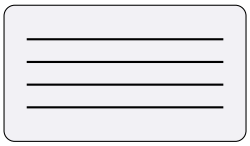
(A) 0.375

(B) 2.67

(C) 0.60

(D) 1.50

Q142. The microscopical sketch below shows a bundle of fine, needle-shaped calcium oxalate crystals lying parallel within a cell, a diagnostic character of drugs such as *Ipecac* and squill.



needle bundle

This parallel bundle of acicular crystals is called a:

(A) Rosette (cluster) crystal

(B) Prism crystal

(C) Raphide bundle

(D) Microsphenoidal crystal

Part F: Pharmaceutical Biotechnology & Microbiology

Q143. A type II restriction endonuclease recognises the palindrome `TCGA` and cleaves each strand between T and C (T|CGA), leaving short single-stranded extensions. This enzyme is:

(A) *Sma*I, which cuts CCC|GGG and leaves blunt ends

(B) *Nco*I, which cuts C|CATGG and leaves 5′ CATG overhangs

(C) *Taq*I, which cuts T|CGA and leaves 5′ CG overhangs

(D) *Hpa*I, which cuts GTT|AAC and leaves blunt ends

Q144. Bacteriophage λ is exploited as a cloning vector because a large central segment of its genome is dispensable. In an in-vitro packaging strategy using λ replacement vectors, foreign DNA is inserted in place of this central “stuffer” region chiefly because:

(A) The central region codes for lysogeny/integration functions not needed for lytic growth, so it can be replaced by an insert of similar size and still package into infective phage

(B) The central region carries the genes for the phage head, which must be removed before packaging

(C) Removing the central region destroys the *cos* ends required for packaging

(D) The insert must always be smaller than 2 kb to fit the head

Q145. A diagnostic laboratory amplifies several different target sequences in a single reaction tube by including several primer pairs together, each pair giving a product of distinct size resolved on one gel lane. This variant of PCR is called:

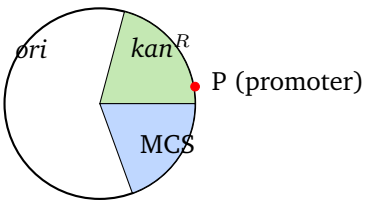
(A) Nested PCR

(B) Multiplex PCR

(C) Inverse PCR

(D) Colony PCR

Q146. The circular bacterial expression vector below carries an origin of replication (*ori*), a kanamycin-resistance marker (kan^R), and a cloning site placed immediately downstream of an inducible promoter P. For the inserted gene to be transcribed only when the inducer (e.g. IPTG) is added, the essential element is:



(A) The kanamycin-resistance gene, which drives transcription

(B) The origin of replication, which acts as the promoter

(C) A second antibiotic marker placed before the insert

(D) The inducible promoter P upstream of the cloning site, which controls transcription of the insert

Q147. Darbepoetin alfa is a recombinant analogue engineered to carry two extra N-linked glycosylation sites compared with native erythropoietin. The purpose of this added glycosylation is to:

(A) Prolong the serum half-life, allowing less frequent dosing for anaemia of chronic kidney disease

(B) Convert it into an oral tablet by resisting gastric acid

(C) Change its action from stimulating red cells to stimulating neutrophils

(D) Make it act as a thrombolytic enzyme

Q148. Denileukin diftitox is a recombinant fusion protein that joins interleukin-2 to the catalytic and translocation domains of diphtheria toxin. Its therapeutic logic is that the IL-2 portion:

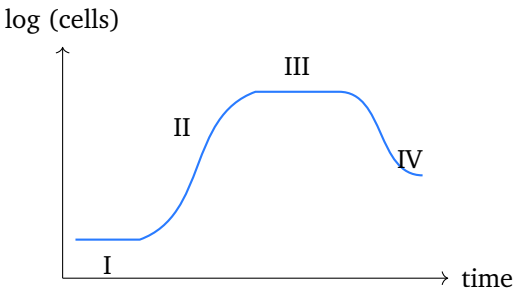
(A) Neutralises circulating diphtheria toxin in infected patients

(B) Targets the toxin to cells bearing the IL-2 receptor (e.g. certain T-cell lymphomas), which then internalise and are killed by the toxin

(C) Acts as an antibody that opsonises tumour cells for phagocytosis

(D) Provides passive immunity against tetanus

Q149. The batch growth curve below shows the four phases I–IV of a mould fermentation. Itaconic acid, an unsaturated dicarboxylic acid used as a monomer in synthetic resins, accumulates chiefly as a partial-overflow product late in the run; it is manufactured industrially by submerged aerobic fermentation of carbohydrate using mainly:



(A) *Acetobacter* species oxidising ethanol

(B) *Saccharomyces cerevisiae* under anaerobic conditions

(C) *Aspergillus terreus*

(D) *Lactobacillus delbrueckii*

Q150. In the industrial synthesis of vitamin C (L-ascorbic acid), the single **microbiological** step converts D-sorbitol to L-sorbose. This oxidation is carried out by:

(A) *Penicillium chrysogenum* during its idiophase

(B) *Streptomyces griseus* by reductive amination

(C) *Clostridium acetobutylicum* by the ABE pathway

(D) *Gluconobacter (Acetobacter) suboxydans*, which oxidises sorbitol to sorbose

Q151. Bacitracin, a polypeptide antibiotic used mainly in topical preparations because of its nephrotoxicity by the systemic route, is obtained by fermentation of:

(A) *Bacillus subtilis* (*Bacillus licheniformis*)

(B) *Streptomyces venezuelae*

(C) *Penicillium griseofulvum*

(D) *Micromonospora purpurea*

Q152. For an enzyme operating at saturating substrate, the **turnover number** (k_{cat}) is best defined as:

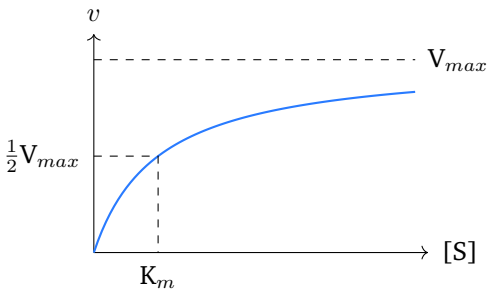
(A) The substrate concentration giving half-maximal velocity

(B) The number of substrate molecules converted to product per enzyme active site per unit time when the enzyme is saturated

(C) The ratio K_m/V_{max} at low substrate

(D) The total amount of product formed over the whole reaction

Q153. The Michaelis–Menten plot below is for a lipase entrapped within calcium-alginate beads. The dashed construction marks the [S] at which $v = \frac{1}{2}V_{max}$. Both the kinetic parameter read off here *and* the immobilisation method used are, respectively:



(A) Turnover number k_{cat}; covalent coupling

(B) V_{max}; adsorption

(C) Michaelis constant K_m; entrapment in a gel lattice

(D) Inhibition constant K_i; cross-linking

Q154. Secreted IgM circulates mainly as a pentamer held together by a J chain. A direct structural consequence of this pentameric form is that one IgM molecule has a theoretical antigen-binding valency of:

(A) 2 binding sites, like an IgG monomer

(B) 4 binding sites

(C) 5 binding sites

(D) 10 binding sites (two per monomer $\times$ five monomers)

Q155. Coating of a bacterium with antibody (IgG Fc) and complement fragment C3b, which are then recognised by Fc and C3b receptors on phagocytes so that ingestion is greatly enhanced, is the process of:

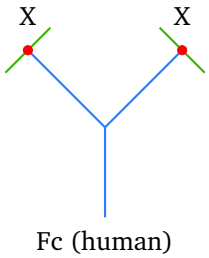
(A) Opsonisation

(B) Neutralisation

(C) Affinity maturation

(D) Clonal deletion

Q156. The therapeutic monoclonal antibody below is shown as a Y in which the antigen-binding loops (CDRs, marked X) are of rodent origin while *all* other framework and constant regions are human. In the WHO naming scheme this **humanised** antibody carries the sub-stem:



(A) `-ximab` (chimeric)

(B) `-zumab` (humanised)

(C) `-umab` (fully human)

(D) `-omab` (murine)

Q157. Drug-induced immune haemolytic anaemia, in which IgG antibodies bind to a drug–red-cell membrane complex and trigger complement-mediated and phagocytic destruction of the cells, is an example of which Gell and Coombs hypersensitivity reaction?

(A) Type I (IgE-mediated immediate)

(B) Type III (immune-complex)

(C) Type II (antibody-mediated cytotoxic)

(D) Type IV (delayed, T-cell mediated)

Q158. In the Ziehl–Neelsen (acid-fast) stain, certain bacteria resist decolourisation by acid-alcohol and retain the primary carbol-fuchsin dye, appearing red against a blue counterstain. This acid-fastness is due to the high content of **mycolic acid** in the cell wall, a feature characteristic of:

(A) *Escherichia coli*

(B) *Staphylococcus aureus*

(C) *Streptococcus pyogenes*

(D) *Mycobacterium* (and *Nocardia*) species

Q159. In thermal-death kinetics the **decimal reduction time** (D-value) at a stated temperature is defined as the time required to:

(A) Reduce the surviving microbial population by 90%, i.e. by one $\log_{10}$ cycle

(B) Raise the temperature by 10°C

(C) Kill 50% of the population

(D) Achieve complete sterility with no survivors

Q160. In the pharmacopoeial sterility test, two culture media are used so that both anaerobic/aerobic bacteria and fungi are detected. The medium chiefly intended to grow **anaerobic bacteria** (it contains a reducing agent to lower the redox potential) is:

(A) Soybean–casein digest medium (SCDM), incubated for fungi

(B) Fluid thioglycollate medium (FTM)

(C) Nutrient agar slants

(D) MacConkey agar

Detailed Solutions

Q1.

Solution

Concept — Solubility product: For the 1:1 salt $SrSO_4 \rightleftharpoons Sr^{2+} + SO_4^{2-}$, $K_{sp} = [Sr^{2+}][SO_4^{2-}] = s^2$ where s is the molar solubility. **Reasoning:** $s = 5.0 \times 10^{-4}$ mol/L, so $K_{sp} = (5.0 \times 10^{-4})^2 = 25 \times 10^{-8} = 2.5 \times 10^{-7}$. **Why the other options are wrong:**

- (A) 5.0×10^{-4} is the solubility s itself, not s^2.
- (B) 1.0×10^{-3} wrongly doubles s.
- (C) 5.0×10^{-8} mis-squares the coefficient ($5^2 = 25$, not 5).

Final Answer: $K_{sp} = s^2 = 2.5 \times 10^{-7} \Rightarrow$ D

Answer: (D) Go Back to Q1

Q2.

Solution

Concept — Single extraction: With equal volumes ($V_o = V_w$), the fraction remaining in water after one extraction is $\frac{V_w}{P\,V_o + V_w} = \frac{1}{P+1}$. **Reasoning:** Fraction in water $= \frac{1}{3+1} = \frac{1}{4}$, so mass remaining $= 400 \times \frac{1}{4} = 100$ mg (300 mg passes into ether). **Why the other options are wrong:**

- (B) 300 mg is the amount extracted *into* the ether, not left in water.
- (C) 133 mg wrongly uses $1/(P)$ rather than $1/(P+1)$.
- (D) 75 mg uses an incorrect fraction.

Final Answer: $400/(P+1) = 400/4 = 100$ mg $\Rightarrow$ A

Answer: (A) Go Back to Q2

Q3.

Solution

Concept — Krafft point: For ionic surfactants the Krafft point (Krafft temperature) is the temperature above which solubility rises steeply because micelles can form. **Reasoning:** Below the Krafft point the monomer solubility is below the critical micelle concentration, so micelles cannot form; above it, solubility increases

sharply and micellisation begins. **Why the other options are wrong:**

- (A) The cloud point is the *upper* temperature at which *non-ionic* surfactants turn turbid and separate.
- (B) Phase-inversion temperature is where an emulsion changes type (o/w $\leftrightarrow$ w/o).
- (D) Eutectic temperature relates to melting of solid mixtures, not micellisation.

Final Answer: ionic-surfactant micellisation threshold = Krafft point $\Rightarrow$ C

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — HLB of a blend: The HLB of a surfactant mixture is the weighted average HLB $= \sum f_i \, \text{HLB}_i$, where f_i is the mass fraction of each surfactant. **Reasoning:** HLB $= 0.80(16) + 0.20(6) = 12.8 + 1.2 = 14.0$. **Why the other options are wrong:**

- (A) 11.0 is the simple (unweighted) mean of 16 and 6.
- (C) 10.0 ignores the heavier weighting toward the high-HLB surfactant.
- (D) 22.0 wrongly adds the two HLB values.

Final Answer: $0.8(16) + 0.2(6) = 14.0 \Rightarrow$ B

Answer: (B) Go Back to Q4

Q5.

Solution

Concept — Dilatant flow: A flow curve that bows toward the shear-rate axis means apparent viscosity ($\eta = \tau/\dot{\gamma}$) *increases* with shear rate (shear-thickening). **Reasoning:** This is dilatant behaviour, typical of concentrated deflocculated suspensions of small particles (e.g. high-solids inorganic pigments) where particles dilate and the system stiffens at high shear. **Why the other options are wrong:**

- (A) Newtonian gives a straight line through the origin.
- (B) Pseudoplastic bows the *other* way (toward the stress axis; viscosity falls).
- (C) Bingham plastic has a yield intercept on the stress axis.

Final Answer: curve bows toward $\dot{\gamma}$ axis $\Rightarrow$ dilatant $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q5

Q6.

Solution

Concept — Temperature dependence of viscosity: Liquids and gases behave oppositely with temperature. **Reasoning:** In liquids, heating reduces intermolecular cohesion so viscosity *decreases* (Arrhenius-type, $\eta = Ae^{E_v/RT}$). In gases, viscosity arises from momentum transfer between molecules, which *increases* with temperature. **Why the other options are wrong:**

- (B) Both decreasing is wrong; gas viscosity rises with temperature.
- (C) Both increasing is wrong; liquid viscosity falls with temperature.
- (D) The directions are exactly reversed.

Final Answer: liquid $\downarrow$, gas $\uparrow$ $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q6

Q7.

Solution

Concept — Carr's index: Carr's % $= \dfrac{(\rho_{tapped} - \rho_{bulk})}{\rho_{tapped}} \times 100$. **Reasoning:** $= \dfrac{0.56 - 0.42}{0.56} \times 100 = \dfrac{0.14}{0.56} \times 100 = 25\%$, indicating passable-to-poor flow. **Why the other options are wrong:**

- (A) 14% is the raw density difference $\times 100$, not divided by tapped density.
- (B) 33% wrongly divides by the bulk density.
- (D) 20% under-estimates the difference.

Final Answer: $(0.14/0.56) \times 100 = 25\% \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — Angle of repose: Lower angles mean better flow; the scale is roughly $< 30^\circ$ excellent/good, 31–35° good, 36–40° fair, 41–45° passable, $> 56^\circ$ very poor. **Reasoning:** An angle of 41° falls in the passable-to-poor band (a granule blend that may need a glidant). **Why the other options are wrong:**

- (A) Excellent flow corresponds to angles around 25–30°.
- (C) Very free flowing would be well below 30°.
- (D) The angle of repose is always measurable for a heaped powder.

Final Answer: $41^\circ \Rightarrow$ passable-to-poor flow $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q8

Q9.

Solution

Concept — Particle-size distribution: The mode is the size class (bar) with the greatest frequency. **Reasoning:** The tallest bar in the histogram is the fourth one (height 3.1), centred on the 38 μm class, i.e. the 38–48 μm interval. **Why the other options are wrong:**

- (A) 8–18 is one of the shorter low-size bars.
- (B) 18–28 is a rising bar below the peak.
- (C) 28–38 is the bar just before the peak (height 2.1).

Final Answer: tallest bar lies in 38–48 μm $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q9

Q10.

Solution

Concept — Henderson-Hasselbalch: $\text{pH} = \text{pK}_a + \log \dfrac{[\text{salt}]}{[\text{acid}]}$. **Reasoning:** With salt:acid $= 1:10$, $\log(1/10) = \log(0.1) = -1$, so $\text{pH} = 9.20 + (-1) = 8.20$. **Why the other options are wrong:**

- (A) 9.20 ignores the 1:10 ratio (would need equal salt and acid).
- (B) 10.20 wrongly adds 1 (i.e. uses a 10:1 ratio instead).

- (D) 7.20 subtracts 2 instead of 1.

Final Answer: pH $= 9.20 - 1 = 8.20 \Rightarrow$ C

Answer: (C) Go Back to Q10

Q11.

Solution

Concept — Freezing-point-depression isotonicity: An isotonic solution must depress the freezing point of water by 0.52°C. The depression is proportional to concentration. **Reasoning:** A 1.0% solution gives 0.13°C; to reach 0.52°C the concentration must be $0.52/0.13 = 4$ times greater, i.e. 4.0% w/v. **Why the other options are wrong:**

- (B) 0.25 inverts the ratio.
- (C) 0.52 confuses the target depression value with a concentration.
- (D) 2.0 uses half of the required factor.

Final Answer: $(0.52/0.13) \times 1.0\% = 4.0\%$ w/v $\Rightarrow$ A

Answer: (A) Go Back to Q11

Q12.

Solution

Concept — Order of reaction by plot: First-order: $\ln C = \ln C_0 - kt$, so $\ln C$ versus t is linear with slope $-k$. **Reasoning:** A straight ln C vs time plot directly identifies first-order kinetics (the usual mode for drug hydrolysis in dilute solution). **Why the other options are wrong:**

- (A) Zero-order gives a linear C (not ln C) vs time plot.
- (C) Second-order gives a linear $1/C$ vs time plot.
- (D) Third-order gives a linear $1/C^2$ vs time plot.

Final Answer: linear ln C vs t $\Rightarrow$ first-order $\Rightarrow$ B

Answer: (B) Go Back to Q12

Q13.

Solution

Concept — First-order half-life: $t_{1/2} = \dfrac{0.693}{k}$, independent of initial concentration. **Reasoning:** $t_{1/2} = \dfrac{0.693}{0.0347} \approx 20$ days. **Why the other options are wrong:**

- (A) 35 days would correspond to a smaller k.
- (B) 10 days uses $2k$ in the denominator.
- (D) 50 days mis-divides.

Final Answer: $t_{1/2} = 0.693/0.0347 \approx 20$ days $\Rightarrow$ C

Answer: (C) Go Back to Q13

Q14.

Solution

Concept — Q_{10} factor: In Arrhenius-based stability work, Q_{10} is the ratio of the rate constant at $(T + 10)$°C to that at T°C. **Reasoning:** It tells how much faster degradation runs for every 10°C rise (commonly 2–3), letting one estimate accelerated-to-real-time correlations quickly. **Why the other options are wrong:**

- (B) Q_{10} is a rate ratio, not $E_a/10$.
- (C) It is not a percentage of drug lost.
- (D) It has nothing to do with dilution-induced pH change.

Final Answer: rate-change factor per 10°C rise $\Rightarrow$ A

Answer: (A) Go Back to Q14

Q15.

Solution

Concept — Langmuir linearisation: Rearranging $\dfrac{x}{m} = \dfrac{abC}{1+bC}$ gives $\dfrac{C}{x/m} = \dfrac{1}{ab} + \dfrac{C}{a}$. **Reasoning:** Hence a plot of $C/(x/m)$ against C is linear, with slope $1/a$ and intercept $1/(ab)$. **Why the other options are wrong:**

- (A) $\log(x/m)$ vs $\log C$ is the *Freundlich* linearisation, a different model.
- (B) x/m vs C is the (curved) raw isotherm.
- (C) x/m vs $1/C$ does not linearise the Langmuir form.

Final Answer: $C/(x/m)$ vs C is linear $\Rightarrow$ D

Answer: (D) Go Back to Q15

Q16.

Solution

Concept — Stability constant: A larger formation constant K means the equilibrium D + L $\rightleftharpoons$ DL lies further toward the complex, i.e. a more stable complex. **Reasoning:** $K_2 = 5 \times 10^4$ M^{-1} is 25 times larger than $K_1 = 2 \times 10^3$ M^{-1}, so ligand 2 forms the more stable complex. **Why the other options are wrong:**

- (A) A smaller K means a *less* stable complex.
- (C) Different K values cannot give equal stability.
- (D) Both nonzero K values show complexation does occur.

Final Answer: larger $K \Rightarrow$ ligand 2 more stable $\Rightarrow$ B

Answer: (B) Go Back to Q16

Q17.

Solution

Concept — Eutectic point: In a binary system miscible as liquid but immiscible as solid, the two liquidus curves meet at the lowest melting temperature. **Reasoning:** That intersection (E) is the eutectic point, where a melt of fixed composition solidifies to a fine mixture of both solids at a single temperature. **Why the other options are wrong:**

- (A) Critical solution point is for partially miscible *liquids* (e.g. phenol-water).
- (B) Triple point refers to a single substance (solid-liquid-vapour).
- (D) Glass transition is a property of amorphous solids, not a phase-diagram intersection.

Final Answer: lowest-melting intersection = eutectic point $\Rightarrow$ C

Answer: (C) Go Back to Q17

Q18.

Solution

Concept — Noyes-Whitney: $\frac{dC}{dt} = \frac{DA}{h}(C_s - C)$, where A is the effective surface area. **Reasoning:** Micronisation breaks particles into many smaller ones, greatly increasing the total exposed surface area A, which raises the dissolution rate. C_s, D and h are essentially unchanged. **Why the other options are wrong:**

- (B) Micronisation does not thicken h; if anything it is unaffected.
- (C) C_s (intrinsic solubility) is a thermodynamic property unchanged by size (ignoring very fine nanosizing).
- (D) D is a property of the medium, not altered by particle size.

Final Answer: micronisation increases surface area $A \Rightarrow$ A

Answer: (A) Go Back to Q18

Q19.

Solution

Concept — Higuchi model: $Q = k_H\sqrt{t}$; diffusion-controlled matrix release is linear with the square root of time. **Reasoning:** A straight line of Q vs $\sqrt{t}$ through the origin (slope k_H) is the signature of the Higuchi model, applicable here to a matrix-type transdermal patch. **Why the other options are wrong:**

- (A) Zero-order plots Q linearly vs t (not $\sqrt{t}$).
- (B) First-order plots $\log(\%\,\text{remaining})$ linearly vs t.
- (C) Hixson–Crowell plots the cube root of remaining mass vs t.

Final Answer: Q vs $\sqrt{t}$ linear $\Rightarrow$ Higuchi model $\Rightarrow$ D

Answer: (D) Go Back to Q19

Q20.

Solution

Concept — Korsmeyer-Peppas exponent (sphere): For a sphere, $n \leq 0.43$ is Fickian diffusion, $0.43 < n < 0.85$ anomalous, and $n = 0.85$ case-II (relaxation/erosion-controlled) transport. **Reasoning:** $n = 0.85$ for a spherical matrix marks case-II transport, governed by polymer-chain relaxation and erosion rather than simple diffusion. **Why the other options are wrong:**

- (A) Fickian diffusion for a sphere is $n \leq 0.43$.
- (B) The $n = 0.89$ zero-order limit applies to a *slab*, not a sphere (0.85).
- (D) A finite n with nonzero k means release does occur.

Final Answer: $n = 0.85$ (sphere) $\Rightarrow$ case-II transport $\Rightarrow$ C

Answer: (C) Go Back to Q20

Q21.

Solution

Concept — BCS: Class I high sol/high perm; Class II low sol/high perm; Class III high sol/low perm; Class IV low sol/low perm. **Reasoning:** Both poor solubility *and* poor permeability place the drug in Class IV, the most challenging class for oral delivery. **Why the other options are wrong:**

- (A) Class I is high/high.
- (B) Class II is low solubility but high permeability.
- (C) Class III is high solubility but low permeability.

Final Answer: low solubility + low permeability $\Rightarrow$ Class IV $\Rightarrow$ D

Answer: (D) Go Back to Q21

Q22.

Solution

Concept — Tablet binder: Binders impart cohesiveness so granules and tablets hold together; PVP is a widely used solution binder. **Reasoning:** Dissolved in the granulating fluid, PVP coats and bridges powder particles, forming strong granules on drying. **Why the other options are wrong:**

- (B) Lubricants (e.g. magnesium stearate) reduce die-wall friction.
- (C) Disintegrants (e.g. SSG) break the tablet apart.
- (D) Glidants (e.g. colloidal silica) improve powder flow.

Final Answer: PVP in the granulating fluid is a binder $\Rightarrow$ A

Answer: (A) Go Back to Q22

Q23.

Solution

Concept — Weight variation: For tablets of average weight 80 mg, the limit $\pm 10\%$ gives a band of 80 ± 8 mg. **Reasoning:** 10% of 80 mg $= 8$ mg, so the acceptable range is $80 - 8 = 72$ to $80 + 8 = 88$ mg. **Why the other options are wrong:**

- (A) 76–84 uses $\pm 5\%$.
- (C) 78–82 uses $\pm 2.5\%$.
- (D) 70–90 uses $\pm 12.5\%$.

Final Answer: $80 \pm 8 = 72$–88 mg $\Rightarrow$ B

Answer: (B) Go Back to Q23

Q24.

Solution

Concept — Capsule sizes: Hard-gelatin capsules for human use run from 000 (largest) down to 5 (smallest); the number increases as fill volume decreases. **Reasoning:** Size 5 has the smallest fill volume (about 0.13 mL), used for low-dose fills. **Why the other options are wrong:**

- (A) Size 000 is the *largest* human capsule.
- (B) Size 0 is large, not the smallest.
- (D) Size 1 is intermediate, larger than size 5.

Final Answer: smallest human capsule = size 5 $\Rightarrow$ C

Answer: (C) Go Back to Q24

Q25.

Solution

Concept — Displacement value (DV): Mass of base required = (total base for blanks) − (mass of drug ÷ DV), applied per suppository then scaled. **Reasoning:** Per suppository, drug 0.6 g displaces $0.6/1.5 = 0.4$ g of base, so base needed $= 2 - 0.4 = 1.6$ g. For 8 suppositories: $8 \times 1.6 = 12.8$ g. **Why the other options are wrong:**

- (B) 16.0 g ignores the displacement correction (8×2).

- (C) 11.2 g wrongly subtracts the full drug weight ($2 - 0.6$ then $\times 8$ mis-scaled).
- (D) 9.6 g uses the wrong DV.

Final Answer: $8 \times (2 - 0.6/1.5) = 8 \times 1.6 = 12.8$ g $\Rightarrow$ A

Answer: (A) Go Back to Q25

Q26.

Solution

Concept — Conductivity (electrical) test: The external (continuous) phase governs conductivity. Water conducts; oil does not. **Reasoning:** A brightly glowing lamp means the continuous phase is the conducting aqueous phase, so the emulsion is oil-in-water (o/w). **Why the other options are wrong:**

- (A) A w/o emulsion has an oily continuous phase and conducts poorly (lamp stays dim).
- (B) "Dry emulsion" is a powdered reconstitutable product, not relevant to this test.
- (C) A multiple w/o/w type is not identified simply by a bright lamp.

Final Answer: good conductivity $\Rightarrow$ aqueous external phase $\Rightarrow$ o/w $\Rightarrow$ D

Answer: (D) Go Back to Q26

Q27.

Solution

Concept — Sedimentation volume: $F = \dfrac{V_u}{V_0}$, the ratio of the final sediment volume to the original suspension volume. **Reasoning:** $F = 15/50 = 0.30$. A higher F (toward 1) indicates a more flocculated, easily redispersed system. **Why the other options are wrong:**

- (A) 0.50 mis-uses 25 mL as the sediment.
- (C) 3.33 inverts the ratio.
- (D) 0.15 wrongly divides by 100.

Final Answer: $F = 15/50 = 0.30 \Rightarrow$ B

Answer: (B) Go Back to Q27

Q28.

Solution

Concept — Moist-heat sterilisation: Saturated steam under pressure is the most reliable method for aqueous, heat-stable products. **Reasoning:** The standard reference cycle is 121°C for 15 minutes at 15 psi (above atmospheric), which delivers an adequate lethality (F_0) for terminal sterilisation. **Why the other options are wrong:**

- (A) 180°C/30 min is a *dry-heat* cycle (for glassware/oils).
- (B) 100°C/60 min (boiling) does not assure sterility of spores.
- (D) 60°C/10 h describes a low-temperature pasteurisation-type cycle, not autoclaving.

Final Answer: 121°C, 15 min, 15 psi $\Rightarrow$ C

Answer: (C) Go Back to Q28

Q29.

Solution

Concept — Absorption bases: These anhydrous bases (e.g. wool fat, hydrophilic petrolatum) can absorb water to form a w/o emulsion. **Reasoning:** Lanolin (anhydrous wool fat) takes up roughly its own weight of water while remaining itself anhydrous, the defining feature of an absorption base. **Why the other options are wrong:**

- (B) Oleaginous bases (e.g. petrolatum) absorb little water.
- (C) Water-soluble (PEG) bases contain no oil and wash off completely.
- (D) Water-removable (o/w cream) bases already contain water as the external phase.

Final Answer: lanolin takes up water $\Rightarrow$ absorption base $\Rightarrow$ A

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — Aerosol propellant: The propellant supplies the pressure that, on valve actuation, expels the product and breaks it into a fine spray. **Reasoning:** A liquefied-gas propellant maintains a constant head-space pressure and, as it flashes to vapour at the orifice, atomises the formulation. **Why the other options are wrong:**

- (A) The propellant is an inactive carrier, not the active drug.
- (C) It does not sterilise the contents.
- (D) It is not a tablet lubricant.

Final Answer: propellant expels and atomises the product $\Rightarrow$ B

Answer: (B) Go Back to Q30

Q31.

Solution

Concept — Hammer mill: A hammer mill carries swinging hammers on a high-speed rotor that strike the feed, shattering it by impact until particles pass the screen. **Reasoning:** The dominant mechanism is high-velocity impact (with some attrition), giving moderately fine powder. **Why the other options are wrong:**

- (A) Rotor-stator shear is the mechanism of a *colloid* mill.
- (B) Air-jet inter-particle collision is the *fluid energy* mill.
- (D) Slow compression between rollers describes a *roller* mill.

Final Answer: hammer mill works by impact $\Rightarrow$ C

Answer: (C) Go Back to Q31

Q32.

Solution

Concept — Reynolds number regimes: $\mathrm{Re} = \dfrac{\rho v d}{\eta}$; < 2100 laminar, 2100–4000 transitional, > 4000 turbulent. **Reasoning:** The zone lying *between* the laminar (i) and fully turbulent (ii) regimes is the transitional range, $\mathrm{Re} = 2100$–4000. **Why the other options are wrong:**

- (A) Re < 100 is firmly laminar (creeping flow).
- (B) Re < 2100 is the whole laminar regime, not the transition.
- (C) Re > 10000 is firmly turbulent.

Final Answer: transitional flow $\Rightarrow$ Re 2100–4000 $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q32

Q33.

Solution

Concept — Drying-rate curve: The constant-rate period (surface-moisture evaporation) ends at the *critical moisture content*, after which the falling-rate period begins. **Reasoning:** At the critical moisture content the surface can no longer be kept fully wet; internal diffusion of moisture now limits drying, so the rate falls. **Why the other options are wrong:**

- (B) Equilibrium moisture content is the irreducible moisture left at the end of drying.
- (C) Bound moisture is held by the solid and exerts a lowered vapour pressure.
- (D) Free moisture is the moisture above the equilibrium value, available for removal.

Final Answer: constant-to-falling transition = critical moisture content $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q33

Q34.

Solution

Concept — Niosomes: Niosomes are bilayer vesicles formed from non-ionic surfactants (e.g. spans/brijs) usually with cholesterol, enclosing an aqueous compartment. **Reasoning:** They are a cheaper, more chemically stable alternative to liposomes (which use phospholipids), and can entrap both hydrophilic and lipophilic drugs. **Why the other options are wrong:**

- (A) Phospholipid + cholesterol vesicles are *liposomes*.
- (C) A solid lipid matrix with no aqueous core describes solid lipid nanoparticles.
- (D) Cross-linked albumin microspheres are a different carrier entirely.

Final Answer: non-ionic surfactant vesicles = niosomes $\Rightarrow$ B

Answer: (B) Go Back to Q34

Q35.

Solution

Concept — Clearance: Clearance links the elimination rate constant to the volume of distribution by $CL = k_e \times V_d$. **Reasoning:** $CL = 0.20\,\text{h}^{-1} \times 40\,\text{L} = 8$ L/h. This is the volume of plasma cleared of drug per hour. **Why the other options are wrong:**

- (A) 0.005 L/h divides k_e by V_d.
- (C) 200 L/h divides V_d by k_e.
- (D) 20 L/h ignores k_e (uses $V_d/2$).

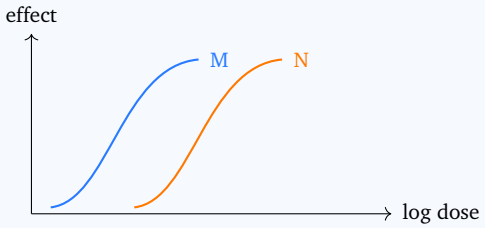
Final Answer: $CL = 0.20 \times 40 = 8$ L/h $\Rightarrow$ B

Answer: (B) Go Back to Q35

Q36.

Solution

Concept — Potency vs efficacy: On a graded log dose-response curve, a leftward position means a lower ED_{50} (greater potency); an equal plateau means equal efficacy (E_{max}). **Reasoning:** M lies to the left of N but both reach the same maximum, so M needs less drug for the same effect (more potent) while efficacy is identical.



Why the other options are wrong:

- (A) Equal plateau means equal efficacy, and M (not N) is more potent.
- (B) They differ in potency, not efficacy.
- (D) Same E_{max} means equal efficacy.

Final Answer: M more potent, equal efficacy $\Rightarrow$ C

Answer: (C) Go Back to Q36

Q37.

Solution

Concept — Therapeutic index: TI $=$ LD_{50}/ED_{50}; a larger value means a wider safety margin. **Reasoning:** TI $= 200/5 = 40$. **Why the other options are wrong:**

- (B) 0.025 inverts the ratio (ED_{50}/LD_{50}).
- (C) 195 subtracts the doses instead of dividing.
- (D) 205 adds the doses.

Final Answer: TI $= 200/5 = 40 \Rightarrow$ A

Answer: (A) Go Back to Q37

Q38.

Solution

Concept — Steady state on infusion: Approach to steady state depends only on half-life: about 50%, 75%, 87.5%, 94% and 97% of C_{ss} are reached after 1, 2, 3, 4 and 5 half-lives. **Reasoning:** 94% corresponds to 4 half-lives. With $t_{1/2} = 8$ h, that is $4 \times 8 = 32$ h. **Why the other options are wrong:**

- (A) 8 h (1 half-life) gives only 50%.
- (B) 16 h (2 half-lives) gives 75%.
- (C) 24 h (3 half-lives) gives 87.5%.

Final Answer: 4 half-lives $= 32$ h for $\sim$94% $\Rightarrow$ D

Answer: (D) Go Back to Q38

Q39.

Solution

Concept — Protein-binding displacement: Only free (unbound) drug is pharmacologically active; for a highly bound drug a small change in bound fraction can greatly change the free fraction. **Reasoning:** Rising free fraction from 1% to 2% transiently doubles the active free concentration, increasing effect and toxicity until the now-available drug redistributes and is cleared, re-establishing equilibrium. **Why the other options are wrong:**

- (A) Displacement raises, not lowers, free drug.
- (C) Free, not bound, drug is the active species.
- (D) Activity is not permanently lost.

Final Answer: Transient doubling of free active drug $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q39

Q40.

Solution

Concept — Insurmountable antagonism: A non-competitive or irreversible antagonist lowers the agonist E_{max}, and extra agonist cannot restore the maximum (insurmountable). **Reasoning:** Curve R has a depressed plateau that more agonist cannot overcome, the signature of an irreversible/non-competitive antagonist (contrast a competitive antagonist, which gives a parallel rightward shift with unchanged E_{max}). **Why the other options are wrong:**

- (A) A competitive antagonist preserves E_{max}.
- (B) A partial agonist itself produces a response from baseline.
- (D) Chemical antagonism is inactivation in solution, not this curve shape.

Final Answer: Depressed, unrestorable maximum = irreversible/non-competitive $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q40

Q41.

Solution

Concept — Margin of safety: The certain safety factor (margin of safety) is a stricter index than the therapeutic index because it compares the dose lethal to a few with the dose effective in nearly all. **Reasoning:** It is defined as LD_1/ED_{99}, i.e. the dose lethal to 1% over the dose effective in 99%. A value greater than 1 indicates that an almost fully effective dose is still below a barely lethal dose. **Why the other options are wrong:**

- (B) LD_{50}/ED_{50} is the ordinary therapeutic index, not the margin of safety.
- (C) ED_{50}/LD_{50} inverts the index.
- (D) LD_{99}/ED_1 overstates safety using extreme opposite percentiles.

Final Answer: Margin of safety = LD_1/ED_{99} $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q41

Q42.

Solution

Concept — Receptor signalling timescales: Ion channels act in milliseconds, GPCRs in seconds, kinase-linked receptors in minutes, and nuclear (intracellular) receptors over hours via gene transcription. **Reasoning:** Glucocorticoids and thyroid hormone are lipophilic, cross the cell membrane and bind intracellular nuclear receptors that act as transcription factors, altering protein synthesis over hours, the slowest branch shown. **Why the other options are wrong:**

- (A) Nicotinic ACh is a ligand-gated ion channel (milliseconds).
- (B) β-adrenoceptors are GPCRs (seconds).
- (C) The insulin receptor is a tyrosine kinase (minutes).

Final Answer: Glucocorticoids/thyroid hormone act via nuclear receptors $\Rightarrow$ D

Answer: (D) Go Back to Q42

Q43.

Solution

Concept — Termination of noradrenergic transmission: The action of released noradrenaline is ended mainly by neuronal reuptake (uptake-1) via the noradrenaline transporter, not by extracellular metabolism. **Reasoning:** Cocaine and tricyclic antidepressants block uptake-1, so released noradrenaline persists in the cleft and its sympathetic effect is enhanced and prolonged. **Why the other options are wrong:**

- (A) MAO inhibition is the action of MAOIs, not these agents.
- (C) Releasing stored noradrenaline is the indirect (tyramine/amphetamine) mechanism.
- (D) Blocking α_1-adrenoceptors would reduce, not potentiate, the response.

Final Answer: Block neuronal noradrenaline reuptake (uptake-1) $\Rightarrow$ B

Answer: (B) Go Back to Q43

Q44.

Solution

Concept — Cardioselective β-blockade: β_1-selective blockers spare bronchial β_2 receptors and are preferred when airway disease coexists. **Reasoning:** Bisoprolol is a highly β_1-selective agent used in hypertension and as one of the evidence-based β-blockers in chronic heart failure, with relatively little bronchoconstriction at therapeutic doses. **Why the other options are wrong:**

- (A) Carvedilol blocks both α and β (non-selective).
- (B) Sotalol is non-selective and has additional Class III activity.
- (D) Labetalol is a non-selective α/β blocker.

Final Answer: Bisoprolol is β_1-selective $\Rightarrow$ C

Answer: (C) Go Back to Q44

Q45.

Solution

Concept — LABA: Formoterol is a long-acting β_2-agonist (LABA) used for maintenance control, with the unusual feature of a rapid onset. **Reasoning:** Formoterol relaxes bronchial smooth muscle for around 12 hours and is used (with an inhaled corticosteroid) for maintenance, not as a sole reliever, because LABA monotherapy in asthma increases risk. **Why the other options are wrong:**

- (B) It is long-acting, not short-acting like salbutamol.
- (C) It is a β_2-agonist, not an α_1-agonist.
- (D) It is not a muscarinic antagonist.

Final Answer: Rapid-onset long-acting β_2-agonist $\Rightarrow$ A

Answer: (A) Go Back to Q45

Q46.

Solution

Concept — Quaternary vs tertiary antimuscarinics: Charge determines CNS penetration; quaternary amines are poorly lipid-soluble and stay peripheral. **Reasoning:** Glycopyrrolate is a quaternary ammonium compound that crosses the blood-brain barrier poorly, so it lacks the central sedative/antiemetic and con-

fusional effects of the tertiary, lipophilic hyoscine (scopolamine), which readily enters the CNS. **Why the other options are wrong:**

- (A) Glycopyrrolate is a muscarinic antagonist, not an agonist.
- (C) It blocks muscarinic, not nicotinic, receptors.
- (D) Hyoscine does cross membranes, including the BBB.

Final Answer: Quaternary glycopyrrolate poorly crosses the BBB $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q46

Q47.

Solution

Concept — Sugammadex: Sugammadex is a selective relaxant-binding agent, a modified γ-cyclodextrin. **Reasoning:** It encapsulates aminosteroid neuromuscular blockers (rocuronium, vecuronium) in plasma, lowering their free concentration so the drug diffuses away from the neuromuscular junction; recovery is rapid and does not depend on acetylcholinesterase inhibition. **Why the other options are wrong:**

- (A) AChE inhibition (neostigmine) is the older, slower reversal method.
- (B) It is not a depolarizing agonist.
- (C) Rocuronium is not metabolised by pseudocholinesterase.

Final Answer: γ-cyclodextrin encapsulates the steroidal blocker $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q47

Q48.

Solution

Concept — Barbiturate action on GABA-A: Barbiturates increase the *duration* of chloride channel opening (benzodiazepines increase the *frequency*). **Reasoning:** Thiopental prolongs GABA-A channel opening and, at higher concentrations, can open the channel directly without GABA. This GABA-independent action explains the lower safety margin and pronounced respiratory depression of barbiturates compared with benzodiazepines. **Why the other options are wrong:**

- (A) Increasing opening frequency is the benzodiazepine mechanism.
- (B) It potentiates, not antagonises, GABA-A.

- (D) It does not inhibit GABA transaminase (that is vigabatrin).

Final Answer: Prolongs Cl^- channel opening, can open it directly $\Rightarrow$ C

Answer: (C) Go Back to Q48

Q49.

Solution

Concept — Aripiprazole: Aripiprazole is a dopamine D_2 partial agonist (a "dopamine system stabiliser"). **Reasoning:** As a partial agonist it dampens excessive dopaminergic activity (mesolimbic) yet provides some tone where dopamine is low, and it adds 5-HT_{1A} partial agonism and 5-HT_{2A} antagonism. This profile gives antipsychotic effect with a lower liability for extrapyramidal effects and prolactin rise. **Why the other options are wrong:**

- (B) Haloperidol-type full D_2 antagonism is the typical, not atypical, mechanism.
- (C) It is not an SSRI.
- (D) It is not a muscarinic agonist.

Final Answer: D_2 partial agonist (dopamine stabiliser) $\Rightarrow$ A

Answer: (A) Go Back to Q49

Q50.

Solution

Concept — SSRI selectivity: Citalopram is one of the most selective serotonin reuptake inhibitors. **Reasoning:** It blocks the serotonin transporter (SERT) with very little affinity for the noradrenaline or dopamine transporters, raising synaptic 5-HT while sparing the anticholinergic, antihistaminic and cardiac effects typical of tricyclics. **Why the other options are wrong:**

- (A) Reversible MAO-A inhibition describes moclobemide.
- (C) Balanced 5-HT/NA reuptake block is an SNRI (e.g. venlafaxine).
- (D) Blocking α_2-autoreceptors describes mirtazapine.

Final Answer: Selective serotonin reuptake inhibition $\Rightarrow$ B

Answer: (B) Go Back to Q50

Q51.

Solution

Concept — Methadone: Methadone is a synthetic μ-opioid agonist with additional NMDA-receptor antagonism and a long, variable half-life. **Reasoning:** Its long half-life allows once-daily dosing for maintenance, and NMDA antagonism may aid neuropathic pain and limit tolerance; however accumulation and QT-interval prolongation are important safety concerns. **Why the other options are wrong:**

- (A) It is an agonist, not an antagonist.
- (B) Its half-life is long, not ultra-short.
- (C) It acts at central μ receptors, not only peripheral κ.

Final Answer: Long-acting μ-agonist with NMDA antagonism and QT risk $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q51

Q52.

Solution

Concept — Lamotrigine: Lamotrigine produces use-dependent blockade of voltage-gated sodium channels. **Reasoning:** By stabilising the inactivated state of Na^+ channels it limits sustained repetitive firing and decreases release of excitatory glutamate, controlling partial and generalised seizures and stabilising mood in bipolar disorder. **Why the other options are wrong:**

- (A) GABA-A potentiation is the benzodiazepine action.
- (B) T-type calcium channel block is the ethosuximide action for absence seizures.
- (D) Irreversible GABA transaminase inhibition is vigabatrin.

Final Answer: Use-dependent Na^+ channel block reducing glutamate release $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q52

Q53.

Solution

Concept — Bupivacaine cardiotoxicity: All local anaesthetics block sodium channels, but bupivacaine binds cardiac channels avidly and dissociates slowly. **Reasoning:** Its "fast-in, slow-out" kinetics mean cardiac Na^+ channels remain blocked between beats, predisposing to refractory re-entrant ventricular arrhythmias and myocardial depression at toxic plasma levels; lidocaine dissociates quickly and is far less cardiotoxic. **Why the other options are wrong:**

- (B) It does affect cardiac sodium channels strongly.
- (C) Bupivacaine is an amide, not a rapidly hydrolysed ester.
- (D) The dominant cardiotoxic action is on sodium, not solely potassium, channels.

Final Answer: High-affinity, slow-dissociating cardiac Na^+ block $\Rightarrow$ $\boxed{A}$

Answer: (A) Go Back to Q53

Q54.

Solution

Concept — COMT inhibition: Entacapone is a peripheral catechol-O-methyltransferase inhibitor. **Reasoning:** COMT methylates levodopa to inactive 3-O-methyldopa. By inhibiting peripheral COMT, entacapone prolongs the plasma half-life of levodopa, increases the amount reaching the brain and smooths the clinical response, reducing "wearing-off". **Why the other options are wrong:**

- (A) It is not converted to dopamine.
- (C) It is not a dopamine D_2 antagonist.
- (D) It does not inhibit acetylcholinesterase.

Final Answer: Peripheral COMT inhibition prolonging levodopa $\Rightarrow$ $\boxed{B}$

Answer: (B) Go Back to Q54

Q55.

Solution

Concept — ACE inhibitor prodrug: Ramipril is hydrolysed to its active diacid ramiprilat, an angiotensin-converting enzyme inhibitor. **Reasoning:** Ramiprilat lowers angiotensin II (reducing vasoconstriction and aldosterone) and slows bradykinin breakdown, lowering blood pressure and afterload; accumulated bradykinin underlies the characteristic dry cough. **Why the other options are wrong:**

- (A) Direct AT_1 blockade describes ARBs (e.g. losartan).
- (B) L-type calcium channel block is a CCB action.
- (D) It does not activate β_1-adrenoceptors.

Final Answer: Ramiprilat inhibits ACE, lowering angiotensin II $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q55

Q56.

Solution

Concept — Non-dihydropyridine CCB: Diltiazem (and verapamil) act on both vascular and cardiac (nodal) calcium channels, unlike dihydropyridines. **Reasoning:** Diltiazem slows SA and AV nodal conduction and heart rate in addition to vasodilation, making it useful for rate control in supraventricular tachyarrhythmias. Amlodipine, a dihydropyridine, is a relatively pure vasodilator with little direct cardiac effect. **Why the other options are wrong:**

- (A) That arteriolar/reflex-tachycardia profile describes dihydropyridines.
- (B) It clearly affects the heart.
- (C) It is not a β-blocker.

Final Answer: Non-dihydropyridine slowing nodal conduction $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q56

Q57.

Solution

Concept — Class Ic antiarrhythmics: Class Ic agents are potent sodium channel blockers with slow dissociation kinetics. **Reasoning:** Flecainide markedly slows phase-0 depolarisation and conduction velocity with minimal effect on action-potential duration. The CAST trial showed increased mortality when used after myocardial infarction, so it is reserved for patients without structural heart disease. **Why the other options are wrong:**

- (B) K^+ channel block prolonging repolarisation is Class III.
- (C) β-blockade is Class II.
- (D) Calcium channel block is Class IV.

Final Answer: Strong, slowly-dissociating Na^+ block (Class Ic) $\Rightarrow$ A

Answer: (A) Go Back to Q57

Q58.

Solution

Concept — Direct factor Xa inhibitor: Rivaroxaban is an oral direct inhibitor of activated factor X (Xa). **Reasoning:** By blocking factor Xa it reduces thrombin generation; it has a rapid onset, predictable pharmacokinetics and a fixed dose that does not require routine INR monitoring, unlike warfarin. **Why the other options are wrong:**

- (A) Inhibiting vitamin-K epoxide reductase is warfarin's mechanism.
- (C) Potentiating antithrombin by injection describes heparin.
- (D) Direct thrombin (IIa) inhibition describes dabigatran.

Final Answer: Oral direct factor Xa inhibitor, no routine INR $\Rightarrow$ B

Answer: (B) Go Back to Q58

Q59.

Solution

Concept — Nitrate tolerance: Continuous nitrate exposure causes tolerance, with loss of vasodilator response over hours. **Reasoning:** Providing a daily nitrate-free interval of about 8–12 hours (asymmetric dosing of isosorbide mononitrate)

restores responsiveness and is the standard way to prevent tolerance. **Why the other options are wrong:**

- (A) Escalating the dose does not overcome tolerance and increases adverse effects.
- (B) A PDE-5 inhibitor with nitrates is contraindicated (severe hypotension).
- (D) Continuous IV infusion would worsen, not prevent, tolerance.

Final Answer: Daily nitrate-free interval restores response $\Rightarrow$ C

Answer: (C) Go Back to Q59

Q60.

Solution

Concept — Second-generation H_1 antihistamines: Newer H_1 blockers are less sedating because they cross the blood-brain barrier poorly. **Reasoning:** Fexofenadine is relatively polar and is a substrate of P-glycoprotein, which actively pumps it out of the CNS, so central H_1 occupancy and sedation are minimal compared with the lipophilic first-generation chlorpheniramine. **Why the other options are wrong:**

- (A) It is an H_1, not H_2, antagonist.
- (B) It has a long, once-daily duration.
- (C) It has weak muscarinic blockade, not strong.

Final Answer: Polar P-gp substrate that poorly enters the CNS $\Rightarrow$ D

Answer: (D) Go Back to Q60

Q61.

Solution

Concept — COX-2 selectivity: Selective COX-2 inhibitors spare COX-1-derived gastric prostaglandins but reduce endothelial prostacyclin. **Reasoning:** Etoricoxib lowers gastrointestinal ulcer/bleeding risk by sparing protective COX-1 prostaglandins, but by reducing vascular prostacyclin (PGI_2) without inhibiting platelet thromboxane, it tilts the balance toward thrombosis, raising cardiovascular risk. **Why the other options are wrong:**

- (B) Reverses both effects.

- (C) Coxibs have weak antiplatelet action, unlike aspirin.
- (D) Analgesic activity is retained.

Final Answer: Less GI ulceration but higher cardiovascular risk $\Rightarrow$ A

Answer: (A) Go Back to Q61

Q62.

Solution

Concept — Colchicine in acute gout: Colchicine is an anti-inflammatory, not a urate-lowering, drug. **Reasoning:** It binds tubulin and prevents microtubule polymerisation, impairing neutrophil chemotaxis, phagocytosis and inflammasome (NLRP3) activation in response to monosodium urate crystals, thereby relieving the acute flare. **Why the other options are wrong:**

- (A) Xanthine oxidase inhibition describes allopurinol/febuxostat.
- (C) Uricosuric action describes probenecid.
- (D) Degrading urate to allantoin describes rasburicase.

Final Answer: Tubulin binding blocking neutrophil/inflammasome response $\Rightarrow$ B

Answer: (B) Go Back to Q62

Q63.

Solution

Concept — Macrolides: Macrolides bind the 50S ribosomal subunit and inhibit protein synthesis. **Reasoning:** Clarithromycin binds 23S rRNA of the 50S subunit and blocks translocation of the peptidyl-tRNA, stalling elongation and giving a bacteriostatic effect.

Why the other options are wrong:

- (A) 30S binding with mRNA misreading describes aminoglycosides.
- (B) DNA gyrase inhibition describes fluoroquinolones.
- (D) Peptidoglycan cross-link inhibition describes β-lactams.

Final Answer: 50S binding blocking translocation $\Rightarrow$ C

Answer: (C) Go Back to Q63

Q64.

Solution

Concept — Fluoroquinolones: Fluoroquinolones target bacterial type II topoisomerases. **Reasoning:** Levofloxacin inhibits DNA gyrase (mainly in Gram-negatives) and topoisomerase IV (mainly in Gram-positives), preventing supercoiling and strand separation required for DNA replication, which is bactericidal. **Why the other options are wrong:**

- (A) Dihydropteroate synthase inhibition describes sulfonamides.
- (B) 50S peptidyl transferase inhibition describes chloramphenicol.
- (C) 30S inhibition describes aminoglycosides/tetracyclines.

Final Answer: Inhibits DNA gyrase and topoisomerase IV $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q64

Q65.

Solution

Concept — Oxazolidinones: Linezolid acts at an early, unique step of bacterial protein synthesis. **Reasoning:** It binds the 23S rRNA of the 50S subunit and prevents formation of the functional 70S initiation complex, so translation cannot begin. This novel site means little cross-resistance, making it useful against MRSA and VRE. **Why the other options are wrong:**

- (B) Binding penicillin-binding proteins describes β-lactams.
- (C) RNA polymerase inhibition describes rifampicin.
- (D) DHFR inhibition describes trimethoprim.

Final Answer: Blocks 70S initiation complex formation $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q65

Q66.

Solution

Concept — Glycopeptides: Vancomycin inhibits cell-wall synthesis at the substrate level, not at the enzyme (PBP) level. **Reasoning:** It binds the terminal D-alanyl-D-alanine of the peptidoglycan precursor, sterically preventing the transglycosylation and transpeptidation that the β-lactams block at the enzyme. Resistance arises when the terminus changes to D-Ala-D-Lac. **Why the other options are wrong:**

- (A) Binding PBPs/transpeptidases is the β-lactam mechanism.
- (C) 30S inhibition is a protein-synthesis mechanism.
- (D) LPS disruption is not vancomycin's action (and Gram-negatives are intrinsically resistant).

Final Answer: Binds D-Ala-D-Ala, blocking peptidoglycan assembly $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q66

Q67.

Solution

Concept — SGLT2 inhibitors: Gliflozins act in the kidney, independent of insulin. **Reasoning:** Empagliflozin blocks the sodium-glucose co-transporter 2 in the proximal convoluted tubule, reducing renal glucose reabsorption so excess glucose is excreted in urine (glucosuria), lowering plasma glucose with a low risk of hypoglycaemia and added cardiorenal benefit. **Why the other options are wrong:**

- (A) Stimulating insulin release describes sulfonylureas.
- (B) Intestinal α-glucosidase inhibition describes acarbose.
- (D) PPAR-γ activation describes thiazolidinediones.

Final Answer: Inhibits renal SGLT2, increasing glucose excretion $\Rightarrow$ $\boxed{\text{C}}$

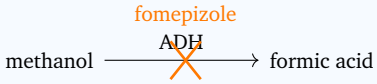
Answer: (C) Go Back to Q67

Q68.

Solution

Concept — Methanol poisoning: The toxicity of methanol comes from its metabolite formic acid, formed via alcohol dehydrogenase (ADH). **Reasoning:**

Fomepizole is a potent competitive inhibitor of alcohol dehydrogenase. By blocking conversion of methanol to formaldehyde and then formic acid, it prevents the acidosis and optic-nerve toxicity, allowing the parent alcohol to be excreted (or removed by dialysis).



Why the other options are wrong:

- (A) It does not chelate methanol.
- (B) Glutathione repletion is the acetylcysteine mechanism for paracetamol.
- (C) Opioid antagonism describes naloxone.

Final Answer: Inhibits alcohol dehydrogenase, halting toxic metabolite formation $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q68

Q69.

Solution

Concept — Claisen rearrangement: An allyl vinyl ether undergoes a concerted [3,3]-sigmatropic shift on heating. **Reasoning:** The reaction passes through a chair-like six-membered transition state; the C–O bond breaks while a new C–C bond forms, converting the ether into a γ,δ-unsaturated carbonyl compound. No catalyst is needed. **Why the other options are wrong:**

- (A) Claisen *condensation* is a base-mediated ester self-condensation, not a sigmatropic shift.
- (C) Cannizzaro is a base-induced aldehyde disproportionation.
- (D) Knoevenagel condenses an aldehyde with an active-methylene compound.

Final Answer: Claisen rearrangement $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q69

Q70.

Solution

Concept — Cope rearrangement: A 1,5-diene undergoes a thermal [3,3]-sigmatropic shift, the all-carbon analogue of the Claisen. **Reasoning:** Through a six-membered (chair) transition state the σ bond migrates, interconverting the two ends of the 1,5-diene with no heteroatom involved. Substituents that stabilise the new alkene drive it forward. **Why the other options are wrong:**

- (B) Curtius converts an acyl azide to an isocyanate.
- (C) Beckmann rearranges a ketoxime to an amide.
- (D) Favorskii contracts an α-halo ketone ring.

Final Answer: Cope rearrangement $\Rightarrow$ A

Answer: (A) Go Back to Q70

Q71.

Solution

Concept — Ritter reaction: A carbocation is trapped by a nitrile nitrogen, then hydrolysed to an amide. **Reasoning:** Strong acid generates a stable (tertiary/benzylic) carbocation from the alcohol or alkene; the nitrile nitrogen attacks it to give a nitrilium ion, which water converts on work-up into an *N*-substituted amide. It is a key route to *tert*-alkyl amines after hydrolysis. **Why the other options are wrong:**

- (A) The product is an amide, not an alcohol.
- (B) Gabriel uses phthalimide to make primary amines.
- (C) Hofmann elimination gives an alkene from an ammonium salt.

Final Answer: Ritter reaction giving an *N*-substituted amide $\Rightarrow$ D

Answer: (D) Go Back to Q71

Q72.

Solution

Concept — Meerwein–Ponndorf–Verley reduction: Aluminium isopropoxide reduces a ketone to an alcohol via hydride transfer. **Reasoning:** A cyclic six-membered transition state transfers a hydride from the isopropoxide α-carbon to

the carbonyl carbon; acetone is released. The reaction is the reverse of the Oppenauer oxidation and is chemoselective (leaves C=C intact). **Why the other options are wrong:**

- (A) Clemmensen reduces C=O fully to CH_2 (Zn/Hg, HCl).
- (B) Wolff–Kishner reduces C=O to CH_2 via a hydrazone.
- (D) Rosenmund reduces an acyl chloride to an aldehyde.

Final Answer: MPV reduction $\Rightarrow$ C

Answer: (C) Go Back to Q72

Q73.

Solution

Concept — Prins reaction: Acid-catalysed addition of formaldehyde to an alkene. **Reasoning:** Protonated formaldehyde (an oxocarbenium) adds across the C=C; the resulting carbocation is trapped by water or a second formaldehyde, giving 1,3-diols, allylic alcohols or 1,3-dioxanes depending on conditions. **Why the other options are wrong:**

- (A) Wacker oxidation converts a terminal alkene to a methyl ketone (Pd/Cu).
- (B) Reformatsky uses an α-haloester and zinc with a carbonyl.
- (C) Reimer–Tiemann formylates phenols with $CHCl_3$/base.

Final Answer: Prins reaction $\Rightarrow$ D

Answer: (D) Go Back to Q73

Q74.

Solution

Concept — Nef reaction: A nitronate salt is hydrolysed to a carbonyl compound. **Reasoning:** The nitroalkane is first deprotonated to its nitronate (aci-form) salt; acidic hydrolysis then converts the C=N–O unit into a C=O, giving an aldehyde (from a primary nitroalkane) or a ketone (from a secondary one), with N_2O as by-product. **Why the other options are wrong:**

- (A) The Nef gives a carbonyl, not a carboxylic acid.
- (C) The Henry (nitroaldol) reaction *forms* a nitroalcohol, the opposite direction.

- (D) Mannich gives a β-aminoketone.

Final Answer: Nef reaction giving a carbonyl compound $\Rightarrow$ B

Answer: (B) Go Back to Q74

Q75.

Solution

Concept — Willgerodt–Kindler reaction: An aryl alkyl ketone, sulfur and a secondary amine give a terminal thioamide. **Reasoning:** Under the reaction the carbonyl effectively "walks" to the end of the alkyl chain, producing an ω-aryl thioamide (with morpholine the Kindler variant). It is historically important for arylacetic-acid synthesis. **Why the other options are wrong:**

- (B) Bouveault–Blanc reduces esters to alcohols with Na/EtOH.
- (C) Oppenauer oxidises secondary alcohols to ketones.
- (D) Stephen reduces a nitrile to an aldehyde ($SnCl_2$/HCl).

Final Answer: Willgerodt–Kindler reaction $\Rightarrow$ A

Answer: (A) Go Back to Q75

Q76.

Solution

Concept — Diazines: The three diazines differ in the relative positions of the two ring nitrogens. **Reasoning:** Two nitrogens at the 1,4 (para) positions of an aromatic six-membered ring define **pyrazine**. It is the core of pyrazinamide. (1,2 = pyridazine; 1,3 = pyrimidine.) **Why the other options are wrong:**

- (A) Pyrimidine has the nitrogens at 1,3.
- (B) Pyridazine has them adjacent, at 1,2.
- (D) Piperazine is the fully saturated (non-aromatic) 1,4-diazine.

Final Answer: Pyrazine (1,4-diazine) $\Rightarrow$ C

Answer: (C) Go Back to Q76

Q77.

Solution

Concept — Tetrazole: A five-membered aromatic ring containing the maximum number of ring nitrogens short of all-N. **Reasoning:** Tetrazole has four nitrogen atoms and one carbon in the ring. It is acidic ($pK_a \approx 4.9$), ionising like a carboxylate, which is why it serves as a metabolically stable –COOH bioisostere in losartan and other sartans. **Why the other options are wrong:**

- (A) Two nitrogens describe a diazole (imidazole/pyrazole).
- (C) Three nitrogens describe a triazole.
- (D) One nitrogen describes pyrrole.

Final Answer: Four nitrogen atoms $\Rightarrow$ B

Answer: (B) Go Back to Q77

Q78.

Solution

Concept — Aromaticity and basicity of pyrazine: Like pyridine, each ring nitrogen keeps an in-plane lone pair outside the π system. **Reasoning:** Pyrazine is aromatic with 6 π electrons; each sp^2 nitrogen holds a lone pair in the ring plane (available for protonation). Because the second electron-withdrawing nitrogen destabilises the conjugate acid, pyrazine is a much weaker base than pyridine. **Why the other options are wrong:**

- (A) The two nitrogens do not destroy aromaticity; the sextet is intact.
- (B) The lone pairs are in-plane, not part of the sextet (that is pyrrole-type behaviour).
- (C) It has 6, not 8, π electrons and is aromatic.

Final Answer: Aromatic, sp^2 in-plane lone pairs, second N lowers basicity $\Rightarrow$ D

Answer: (D) Go Back to Q78

Q79.

Solution

Concept — 1,3-Diaxial strain: An axial substituent on a chair suffers steric clashes with the two axial hydrogens three carbons away. **Reasoning:** A bulky *tert*-butyl group locks the ring almost entirely in the conformation that places it **equatorial**, avoiding severe 1,3-diaxial repulsions (its A-value is about 4.9 kcal/mol). **Why the other options are wrong:**

- (B) Axial and equatorial C–H bonds are essentially the same length; bond length is irrelevant.
- (C) Hyperconjugation does not drive the bulky group axial.
- (D) The two orientations are far from equal in energy for a bulky group.

Final Answer: Equatorial, to avoid 1,3-diaxial strain $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q79

Q80.

Solution

Concept — Y-aromatic guanidinium: The protonated guanidine cation is stabilised by symmetric resonance over three nitrogens. **Reasoning:** The positive charge is delocalised equally across three equivalent C–N bonds (Y-delocalisation), giving exceptional resonance stabilisation of the conjugate acid. A stable conjugate acid means guanidine is a very strong base ($pK_{aH} \approx 13.6$). **Why the other options are wrong:**

- (A) Induction would *withdraw* electrons and lower basicity.
- (C) Guanidine is acyclic; there is no aromatic ring.
- (D) Solvent H-bonding is minor compared with the internal resonance.

Final Answer: Resonance stabilisation over three nitrogens $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q80

Q81.

Solution

Concept — Active-methylene acidity: A C–H flanked by two carbonyls gives an unusually stabilised enolate. **Reasoning:** The central CH_2 of acetylacetone (pentane-2,4-dione) is deprotonated to a carbanion delocalised over *both* carbonyl oxygens, giving $pK_a \approx 9$, far more acidic than a single ketone (20), an alkyne (25) or an alkane (50). **Why the other options are wrong:**

- (A) A single carbonyl stabilises the enolate far less.
- (B) Terminal alkynes are weakly acidic but well above 1,3-diketones.
- (D) Alkane C–H is essentially non-acidic.

Final Answer: Central CH_2 of acetylacetone $\Rightarrow$ C

Answer: (C) Go Back to Q81

Q82.

Solution

Concept — Counting stereoisomers: With n independent stereocentres the maximum number of stereoisomers is 2^n. **Reasoning:** For three non-equivalent stereocentres and no internal symmetry, the maximum is $2^3 = 8$ stereoisomers (four pairs of enantiomers). **Why the other options are wrong:**

- (A) 3 confuses the count with the number of centres.
- (B) 6 has no basis in the 2^n rule.
- (D) 4 would be 2^2, i.e. only two stereocentres.

Final Answer: $2^3 = 8$ stereoisomers $\Rightarrow$ C

Answer: (C) Go Back to Q82

Q83.

Solution

Concept — Functional-group recognition: Two acyl groups sharing one bridging oxygen define an anhydride. **Reasoning:** The fragment shows R–C(=O)–O–C(=O)–R, i.e. two carbonyls joined through a single oxygen, which is the acid-anhydride functional group. **Why the other options are wrong:**

- (A) An ester has only one carbonyl, R–C(=O)–O–R.

- (C) A ketone has C=O flanked by two carbons, no bridging O.
- (D) A carboxylic acid bears –C(=O)–OH (an O–H), not a second acyl.

Final Answer: Acid anhydride ⇒ B

Answer: (B) Go Back to Q83

Q84.

Solution

Concept — Steric effects in S_N2: Backside attack requires an unhindered approach to the electrophilic carbon. **Reasoning:** Although neopentyl bromide is a primary halide, the adjacent quaternary *tert*-butyl carbon shields the backside trajectory. The nucleophile cannot approach 180° to Br without severe steric clash, so the S_N2 rate collapses. **Why the other options are wrong:**

- (B) The C–Br bond strength is normal for a primary halide.
- (C) The substrate is aliphatic, not aromatic.
- (D) Bromide is a good leaving group.

Final Answer: Steric hindrance to backside attack ⇒ A

Answer: (A) Go Back to Q84

Q85.

Solution

Concept — Nitroimidazole activation: Metronidazole is a prodrug activated by anaerobic reduction. **Reasoning:** Inside anaerobes the 5-nitro group is reduced (by ferredoxin/low-redox systems absent in aerobic host cells) to reactive nitro radical anions and nitroso species that fragment DNA. This redox requirement gives selective toxicity to anaerobes and protozoa. **Why the other options are wrong:**

- (A) It does not act on the cell wall.
- (B) Ribosomal binding is the aminoglycoside mechanism.
- (C) Folate antagonism is the sulfonamide/trimethoprim mechanism.

Final Answer: Anaerobic nitro reduction to DNA-damaging radicals ⇒ D

Answer: (D) Go Back to Q85

Q86.

Solution

Concept — Methylxanthine pharmacology: Theophylline acts through cyclic-nucleotide and adenosine pathways. **Reasoning:** It inhibits phosphodiesterase (raising intracellular cyclic AMP and relaxing bronchial smooth muscle) and antagonises bronchoconstrictor adenosine receptors. Both effects produce bronchodilation. **Why the other options are wrong:**

- (B) COX acetylation is aspirin's mechanism.
- (C) $GABA_A$ potentiation is the benzodiazepine/barbiturate mechanism.
- (D) Transpeptidase acylation is the β-lactam mechanism.

Final Answer: PDE inhibition plus adenosine antagonism $\Rightarrow$ A

Answer: (A) Go Back to Q86

Q87.

Solution

Concept — Antidiabetic drug classes: Metformin is the prototype biguanide. **Reasoning:** Metformin's two linked guanidine units make it a biguanide. It activates AMP-activated protein kinase, suppressing hepatic gluconeogenesis without stimulating insulin release, so it does not cause hypoglycaemia alone. **Why the other options are wrong:**

- (A) Sulfonylureas (e.g. glibenclamide) stimulate insulin secretion.
- (B) Thiazolidinediones (e.g. pioglitazone) are PPARγ agonists.
- (D) DPP-4 inhibitors (gliptins) raise incretin levels.

Final Answer: Biguanide $\Rightarrow$ C

Answer: (C) Go Back to Q87

Q88.

Solution

Concept — PDE5 inhibition: Sildenafil prolongs cyclic-GMP signalling in vascular smooth muscle. **Reasoning:** Nitric oxide raises cyclic GMP, causing vasodilation. Sildenafil inhibits phosphodiesterase type 5, the enzyme that degrades cyclic GMP, so cyclic GMP persists and smooth muscle stays relaxed. **Why the other options**

are wrong:

- (A) COX-2 inhibition is the coxib mechanism.
- (C) ACE inhibition is the "-pril" mechanism.
- (D) MAO inhibition concerns monoamine metabolism, not cyclic GMP.

Final Answer: Phosphodiesterase type 5 (PDE5) $\Rightarrow$ B

Answer: (B) Go Back to Q88

Q89.

Solution

Concept — Gout pharmacotherapy: Allopurinol blocks uric-acid formation. **Reasoning:** Allopurinol (and its active metabolite oxypurinol) is a purine analogue that inhibits xanthine oxidase, the enzyme converting hypoxanthine and xanthine to uric acid, thereby lowering serum urate. **Why the other options are wrong:**

- (B) HMG-CoA reductase is the statin target.
- (C) Dihydrofolate reductase is the methotrexate/trimethoprim target.
- (D) Carbonic anhydrase is the acetazolamide target.

Final Answer: Xanthine oxidase $\Rightarrow$ A

Answer: (A) Go Back to Q89

Q90.

Solution

Concept — Chloramphenicol target: It is a 50S ribosomal inhibitor. **Reasoning:** Chloramphenicol binds the 50S subunit and blocks peptidyl transferase, preventing peptide-bond formation, so it is bacteriostatic and broad-spectrum. **Why the other options are wrong:**

- (A) DNA gyrase is the fluoroquinolone target.
- (B) The 30S subunit is bound by aminoglycosides/tetracyclines.
- (C) Dihydropteroate synthase is the sulfonamide target.

Final Answer: The 50S subunit (peptidyl transferase) $\Rightarrow$ D

Answer: (D) Go Back to Q90

Q91.

Solution

Concept — Inverse agonism: Some receptors have constitutive (basal) activity that a ligand can suppress. **Reasoning:** An inverse agonist binds the same site as an agonist but stabilises the inactive receptor state, lowering signalling *below* the baseline. This differs from a neutral antagonist, which only blocks without changing basal tone. **Why the other options are wrong:**

- (A) A full agonist maximises the response.
- (C) A competitive antagonist gives zero intrinsic effect, not a negative one.
- (D) A partial agonist gives a submaximal positive response.

Final Answer: Inverse agonist $\Rightarrow$ B

Answer: (B) Go Back to Q91

Q92.

Solution

Concept — Veber's rules: Oral permeability correlates with rotatable-bond count and polar surface area. **Reasoning:** Veber proposed that good oral bioavailability is favoured by ≤ 10 rotatable bonds and a topological polar surface area (TPSA) $\leq 140\,\text{Å}^2$ (or ≤ 12 total H-bond donors+acceptors), complementing Lipinski's rule of five. **Why the other options are wrong:**

- (A) $20\,\text{Å}^2$ is far too restrictive.
- (B) $500\,\text{Å}^2$ is far too large for good permeability.
- (D) $5\,\text{Å}^2$ is unrealistically small.

Final Answer: About $140\,\text{Å}^2 \Rightarrow$ C

Answer: (C) Go Back to Q92

Q93.

Solution

Concept — Covalent (irreversible) inhibition: Some drugs form a permanent bond with their target. **Reasoning:** Aspirin acetylates a serine of cyclo-oxygenase, and omeprazole forms a disulfide with the H^+/K^+-ATPase cysteine; both are covalent bonds. Recovery of activity then needs new enzyme synthesis, giving a long

duration far outlasting the plasma half-life. **Why the other options are wrong:**

- (B), (C), (D) Single hydrogen bonds, ionic contacts and van der Waals forces are weak and reversible, and could not explain the long irreversible action.

Final Answer: A covalent bond $\Rightarrow$ A

Answer: (A) Go Back to Q93

Q94.

Solution

Concept — Piperazine ring: A saturated six-membered ring with nitrogens at 1 and 4. **Reasoning:** Cetirizine, many antipsychotics and the side chains of fluoroquinolones such as ciprofloxacin carry a piperazine ring (1,4-diazinane). Its two basic nitrogens improve water solubility and tune receptor binding. **Why the other options are wrong:**

- (A) Morpholine has one N and one O.
- (B) Piperidine has a single nitrogen.
- (C) Imidazole is an aromatic five-membered ring.

Final Answer: Piperazine $\Rightarrow$ D

Answer: (D) Go Back to Q94

Q95.

Solution

Concept — Sequential blockade: Co-trimoxazole inhibits two consecutive enzymes of one pathway. **Reasoning:** Sulfamethoxazole blocks dihydropteroate synthase and trimethoprim blocks dihydrofolate reductase; hitting two sequential steps of folate biosynthesis produces synergy and reduces resistance. **Why the other options are wrong:**

- (A) They inhibit different enzymes, not the same one.
- (C) They are chemically distinct, not identical bioisosteres.
- (D) Neither acts on the cell wall.

Final Answer: Sequential blockade of folate synthesis (synergy) $\Rightarrow$ B

Answer: (B) Go Back to Q95

Q96.

Solution

Concept — Kolbe–Schmitt reaction: Carboxylation of sodium phenoxide with CO_2. **Reasoning:** Sodium phenoxide reacts with CO_2 under pressure; the phenoxide ortho carbon attacks CO_2, and acid work-up gives salicylic acid, the precursor of aspirin and methyl salicylate. **Why the other options are wrong:**

- (B) Kolbe electrolysis decarboxylates carboxylates to alkanes.
- (C) The Gattermann reaction formylates arenes (HCN/HCl).
- (D) Houben–Hoesch acylates phenols with a nitrile.

Final Answer: Kolbe–Schmitt reaction $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q96

Q97.

Solution

Concept — Pharmaceutical inorganic protectives: Zinc oxide is a topical astringent/protective. **Reasoning:** Zinc oxide is a mild astringent and physical sunblock used in calamine lotion, dusting powders and sunscreens; it soothes and protects irritated skin and reflects UV light. **Why the other options are wrong:**

- (A) Sodium thiosulfate is a cyanide antidote.
- (B) Potassium iodide is an expectorant/antithyroid agent.
- (D) Ammonium chloride is an acidifying expectorant.

Final Answer: Zinc oxide $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q97

Q98.

Solution

Concept — Temperature coefficient (Q_{10}): Each 10 °C rise multiplies the rate by a factor (here 2). **Reasoning:** From 25 to 45 °C is two 10 °C steps, so the rate is multiplied by $2 \times 2 = 4$. The rate constant becomes about $4k$. This rapid acceleration underlies accelerated stability testing. **Why the other options are wrong:**

- (A) The rate clearly increases with temperature.

- (B) $2k$ corresponds to only one 10 °C step.
- (C) $3k$ does not follow from successive doublings.

Final Answer: About $4k$ (two doublings) $\Rightarrow$ D

Answer: (D) Go Back to Q98

Q99.

Solution

Concept — Karl Fischer titration: a coulometric/volumetric method specific for water, based on the reaction of water with iodine and sulphur dioxide in a methanol–base medium. **Reasoning:** The Karl Fischer reagent consumes iodine in direct proportion to the water present, so the method quantifies the water (moisture) content of a drug substance with high specificity, even in the presence of other constituents. **Why the other options are wrong:**

- (A) Ash value is a gravimetric (ignition) test, not a Karl Fischer titration.
- (C) Acid value is a separate acid–base titration of free fatty acids.
- (D) Saponification value is found by alkaline hydrolysis and back titration.

Final Answer: Water (moisture) content $\Rightarrow$ B

Answer: (B) Go Back to Q99

Q100.

Solution

Concept — Beer's law calibration: for a line through the origin, $A = (\text{slope}) \times c$, so $c = A/\text{slope}$. **Reasoning:** With slope 0.080 L mg^{-1} and $A = 0.48$, the concentration is $c = 0.48/0.080 = 6.0$ mg L^{-1}. The slope already bundles εl, so dividing absorbance by it gives concentration directly. **Why the other options are wrong:**

- (B) 0.038 multiplies 0.48×0.080 instead of dividing.
- (C) 16.7 inverts the slope wrongly ($1/0.080 \times \ldots$ misapplied).
- (D) 0.48 simply restates the absorbance, not the concentration.

Final Answer: $c = 0.48/0.080 = 6.0$ mg L^{-1} $\Rightarrow$ A

Answer: (A) Go Back to Q100

Q101.

Solution

Concept — Ion-exchange chromatography: separation rests on reversible electrostatic binding of charged analytes to oppositely charged groups fixed on the resin. **Reasoning:** A cation-exchange resin carries negatively charged sites (e.g. sulphonate). Analyte cations exchange with the mobile counter-ions; those binding more strongly are retained longer. Elution is controlled by ionic strength and pH of the eluent. **Why the other options are wrong:**

- (A) Volatility governs gas chromatography, not ion exchange.
- (B) Size exclusion is a different mode that does not rely on charge.
- (D) Liquid–liquid partition is the basis of partition chromatography.

Final Answer: Reversible electrostatic exchange of cations on a negatively charged resin $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q101

Q102.

Solution

Concept — Henderson–Hasselbalch at half-equivalence: $\text{pH} = \text{p}K_a + \log \dfrac{[\text{A}^-]}{[\text{HA}]}$. **Reasoning:** At the half-equivalence point exactly half the weak acid has been neutralised, so $[\text{A}^-] = [\text{HA}]$ and the log term is zero. Hence $\text{pH} = \text{p}K_a$. Point H therefore reads the $\text{p}K_a$ of the acid directly off the curve. **Why the other options are wrong:**

- (A) $\text{p}K_b$ of the conjugate base differs from $\text{p}K_a$ (they sum to $\text{p}K_w$).
- (B) $\text{pH} = 7$ only at the equivalence point of a strong acid–strong base titration, not here.
- (C) Molar mass is unrelated to a pH value.

Final Answer: pH at H equals the $\text{p}K_a$ $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q102

Q103.

Solution

Concept — Fluorimetry sensitivity: emission is detected against a dark background, whereas absorbance is a small difference between two large light signals. **Reasoning:** Because the emitted light is measured directly (often at right angles to the excitation beam), even faint fluorescence stands out, giving detection limits often orders of magnitude lower than UV absorption. The choice of two wavelengths (excitation and emission) also adds selectivity. **Why the other options are wrong:**

- (B) An excitation source is essential; without it there is no fluorescence.
- (C) Only fluorescent (or derivatised) molecules can be measured this way.
- (D) Fluorescence intensity is, in dilute solution, proportional to concentration.

Final Answer: Greater sensitivity/selectivity from a dark-background measurement $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q103

Q104.

Solution

Concept — Resolution: $R_s = \dfrac{2(t_{R2} - t_{R1})}{w_1 + w_2}$. **Reasoning:** Substituting, $R_s = \dfrac{2(7.2 - 6.0)}{0.80 + 0.80} = \dfrac{2(1.2)}{1.6} = \dfrac{2.4}{1.6} = 1.5$. A value of 1.5 corresponds to baseline (essentially complete) resolution. **Why the other options are wrong:**

- (A) 0.67 omits the factor of 2 and inverts the ratio.
- (C) 3.0 forgets to divide by the width sum.
- (D) 0.75 drops the factor of 2.

Final Answer: $R_s = 2(1.2)/1.6 = 1.5 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q104

Q105.

Solution

Concept — Cerimetry end point: Ce^{4+}/Ce^{3+} is a strong oxidising couple whose end point is shown by a redox indicator. **Reasoning:** Ferroin (the iron(II)–1,10-phenanthroline complex) is the classic redox indicator for cerimetric titrations: it is red in the reduced form and pale blue when oxidised, giving a sharp colour change at the equivalence point. **Why the other options are wrong:**

- (A) Phenolphthalein is an acid–base indicator, not redox.
- (B) Starch–iodide is used in iodometry, not cerimetry.
- (D) Methyl orange is an acid–base indicator.

Final Answer: Ferroin redox indicator $\Rightarrow$ C

Answer: (C) Go Back to Q105

Q106.

Solution

Concept — IR of carboxylic acids: a very broad O–H stretch (hydrogen-bonded dimer) over 2500–3300 cm^{-1} plus a strong C=O near 1710 cm^{-1}. **Reasoning:** The wide, hump-shaped O–H band arises from strong intermolecular hydrogen bonding of the acid dimer, while the carbonyl gives the sharp band near 1710 cm^{-1}. Together these two features are essentially a fingerprint for the –COOH group. **Why the other options are wrong:**

- (A) An isolated C=C is weak, near 1640 cm^{-1}, with no broad O–H.
- (B) A nitrile shows a sharp band near 2250 cm^{-1}, not this pattern.
- (C) An ether shows only C–O stretches near 1100 cm^{-1}, no broad O–H or C=O.

Final Answer: Broad O–H plus C=O $\Rightarrow$ carboxylic acid $\Rightarrow$ D

Answer: (D) Go Back to Q106

Q107.

Solution

Concept — Size-exclusion chromatography: separation by molecular size; large molecules cannot enter the gel pores. **Reasoning:** The largest molecules are excluded from the pores, travel only through the interstitial volume, and so elute first. Smaller molecules diffuse into the pores, take a longer path, and elute later. Elution order is therefore decreasing molecular size. **Why the other options are wrong:**

- (B) Reverses the true order; smallest molecules elute last.
- (C) Charge governs ion exchange, not size exclusion.
- (D) Hydrophobicity governs reverse-phase, not size exclusion.

Final Answer: Largest first, smallest last $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q107

Q108.

Solution

Concept — Diazotisation titration: a primary aromatic amine reacts with nitrous acid (from sodium nitrite + acid) to form a diazonium salt. **Reasoning:** The titrant is standard sodium nitrite solution. The end point, when the slightest excess of nitrous acid appears, is detected by an external starch-iodide paper turning blue (or, more precisely, by a potentiometric dead-stop technique). **Why the other options are wrong:**

- (A) Thiosulphate/starch belongs to iodometry.
- (C) Silver nitrate/chromate is the argentometric Mohr method.
- (D) EDTA/EBT is a complexometric titration for metal ions.

Final Answer: Sodium nitrite titrant with starch-iodide (or potentiometric) end point $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q108

Q109.

Solution

Concept — AAS principle: free ground-state atoms absorb their own resonance-line radiation. **Reasoning:** The sample is atomised in a flame to give ground-state atoms. A hollow-cathode lamp made of the element of interest emits its sharp resonance lines, which these atoms absorb. The decrease in transmitted intensity (per Beer's law) measures the element's concentration. **Why the other options are wrong:**

- (A) Measuring emitted light is flame emission/flame photometry, not absorption.
- (B) Molecular solution absorption is UV-visible spectrophotometry.
- (D) Counting ions by mass is mass spectrometry (e.g. ICP-MS).

Final Answer: Ground-state atoms absorb hollow-cathode resonance radiation $\Rightarrow$ C

Answer: (C) Go Back to Q109

Q110.

Solution

Concept — HPLC flow path: reservoir $\rightarrow$ pump $\rightarrow$ injector $\rightarrow$ column $\rightarrow$ detector. **Reasoning:** The component immediately after the column that senses the separated analytes and turns their concentration into an electrical signal (UV, fluorescence, RI, etc.) is the detector. In the diagram it is the last block, Y. **Why the other options are wrong:**

- (A) The reservoir holds mobile phase at the start of the path.
- (B) The pump delivers mobile phase under pressure, before the injector.
- (C) The injector introduces sample, before the column.

Final Answer: Y is the detector $\Rightarrow$ D

Answer: (D) Go Back to Q110

Q111.

Solution

Concept — Proton-decoupled ^{13}C NMR: broadband decoupling removes C–H coupling, and carbon shifts span a wide range. **Reasoning:** Under proton decoupling each chemically distinct carbon gives a single line (no $^{1}J_{CH}$ splitting), and the ^{13}C scale runs roughly 0–220 ppm, far wider than the $\sim$0–12 ppm of ^{1}H. This spreads peaks out and simplifies the spectrum. **Why the other options are wrong:**

- (B) Decoupling deliberately suppresses C–H splitting, so peaks are singlets.
- (C) The ^{13}C range is much wider, not narrower, than ^{1}H.
- (D) All carbons appear, not only quaternary ones.

Final Answer: Singlets over a wide ($\approx$0–220 ppm) range $\Rightarrow$ A

Answer: (A) Go Back to Q111

Q112.

Solution

Concept — Potentiometric pH titration: the glass electrode is the standard indicator electrode for H^+ activity. **Reasoning:** The glass membrane develops a potential that varies linearly (Nernstian) with pH. Paired with a reference electrode, it tracks pH as titrant is added; the end point is the steepest point of the potential-versus-volume curve, found without any visual indicator. **Why the other options are wrong:**

- (A) The dropping mercury electrode is used in polarography.
- (C) A platinum redox electrode senses redox couples, not pH.
- (D) The Ag/AgCl electrode is the reference, not the H^+-sensing indicator electrode.

Final Answer: Glass electrode $\Rightarrow$ B

Answer: (B) Go Back to Q112

Q113.

Solution

Concept — Back titration: add a measured excess of standard reagent, then titrate the unreacted portion. **Reasoning:** When the direct reaction is too slow, or the analyte is insoluble or volatile (so a sharp direct end point is impossible), a known excess of standard reagent is reacted with the analyte and the leftover excess is titrated. The analyte is found by difference. **Why the other options are wrong:**

- (A) A fast, complete reaction is exactly when a direct titration is preferred.
- (B) Back titration still needs standard solutions; lack of one does not justify it.
- (D) A self-indicating titrant is unrelated to the choice of back titration.

Final Answer: Used when the direct reaction is slow or the analyte is insoluble/volatile $\Rightarrow$ C

Answer: (C) Go Back to Q113

Q114.

Solution

Concept — UV absorption needs a chromophore: unsaturated, π-electron-containing groups absorb in the accessible UV. **Reasoning:** Electronic transitions in the 200–400 nm region (mainly $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$) require a chromophore. Extended conjugation lowers the transition energy, shifting and intensifying absorption into the readily measured near-UV. **Why the other options are wrong:**

- (A) Saturated σ bonds absorb only in the far UV ($<$190 nm).
- (B) An isolated –OH ($n \rightarrow \sigma^*$) absorbs below 200 nm, hard to use.
- (C) With no multiple bonds there is no near-UV chromophore.

Final Answer: A chromophore / extended conjugated π-system $\Rightarrow$ D

Answer: (D) Go Back to Q114

Q115.

Solution

Concept — Temperature programming in GC: the oven temperature is increased during the run. **Reasoning:** At a single low temperature, high-boiling components elute very late as broad, flat peaks. Raising the temperature progressively drives these later analytes off faster, sharpening their peaks and cutting total run time, while early components still separate at the lower starting temperature. **Why the other options are wrong:**

- (B) That describes isothermal operation, the opposite of programming.
- (C) A carrier gas is still essential in GC.
- (D) Programming heats the column oven, not cools the detector.

Final Answer: Gradually raising oven temperature sharpens late peaks and shortens the run $\Rightarrow$ A

Answer: (A) Go Back to Q115

Q116.

Solution

Concept — Primary standard: a pure, stable, non-hygroscopic solid of known high equivalent weight used to standardise a titrant. **Reasoning:** Potassium hydrogen phthalate (KHP) is the classic primary standard for NaOH: it is pure, stable, weighable, and reacts 1:1 with hydroxide. Its accurately weighed mass fixes the exact NaOH concentration. **Why the other options are wrong:**

- (A) NaOH itself is hygroscopic and absorbs CO_2, so it is not a primary standard.
- (C) Concentrated HCl is volatile and of uncertain concentration.
- (D) Sodium thiosulphate solution is itself standardised, not a primary standard.

Final Answer: Potassium hydrogen phthalate (KHP) $\Rightarrow$ B

Answer: (B) Go Back to Q116

Q117.

Solution

Concept — Beer–Lambert law: $A = \varepsilon c l$, so $\varepsilon = A/(c\,l)$. **Reasoning:** Here $A = 0.62$, $l = 1.0$ cm, $c = 2.0\times10^{-5}$ mol L^{-1}. Thus $\varepsilon = 0.62/(2.0\times10^{-5}\times1.0) = 3.1\times10^{4}$ L mol^{-1} cm^{-1}. **Why the other options are wrong:**

- (A) 1.24×10^{-5} multiplies instead of dividing by the concentration.
- (B) 3.2×10^{4} comes from rounding $0.62/2.0$ incorrectly as $0.64/2.0$.
- (D) 6.2×10^{5} uses $c = 1.0 \times 10^{-6}$ by a power-of-ten slip.

Final Answer: $\varepsilon = 0.62/(2.0 \times 10^{-5}) = 3.1 \times 10^{4} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q117

Q118.

Solution

Concept — Non-destructive TLC visualisation: iodine vapour forms reversible coloured adducts with many organic compounds. **Reasoning:** Placing the developed plate in a closed jar containing iodine crystals lets iodine vapour adsorb onto the spots, turning them yellow-brown. The effect is reversible (spots fade in air), so the analyte is not destroyed and can be recovered or further examined. **Why the other options are wrong:**

- (A) Charring with sulphuric acid is destructive.
- (C) Heating to 300 °C would char/decompose the analyte.
- (D) Molten paraffin is not a recognised visualisation method.

Final Answer: Iodine-vapour exposure $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q118

Q119.

Solution

Concept — System suitability test (SST): a check that the chromatographic system as a whole is fit for the intended assay. **Reasoning:** Before reporting results, the analyst injects standards and checks parameters such as resolution between critical pairs, tailing (asymmetry) factor, theoretical plate count, and the %RSD of replicate injections. Only if these meet preset limits is the system deemed suitable.

Why the other options are wrong:

- (A) A reference standard is still required; SST does not replace it.
- (B) Structure elucidation is the job of MS/NMR, not an SST.
- (C) SST is a performance check, not a sterilisation step.

Final Answer: Verifies overall system performance via resolution, tailing, plate count, %RSD $\Rightarrow$ D

Answer: (D) Go Back to Q119

Q120.

Solution

Concept — Acid value: a measure of free fatty acid in a fixed oil, expressed as mg of KOH. **Reasoning:** By definition the acid value is the number of milligrams of potassium hydroxide required to neutralise the free fatty acids present in *one gram* of the oil. It is found by titrating the oil with standard alcoholic KOH using phenolphthalein. **Why the other options are wrong:**

- (B) It is referenced to mass of oil, not volume of titrant.
- (C) The defining quantity is 1 g, not 100 g, of oil.
- (D) Fixed oils are mixtures, so "per mole" is not meaningful.

Final Answer: mg KOH to neutralise free acids in 1 g of oil $\Rightarrow$ A

Answer: (A) Go Back to Q120

Q121.

Solution

Concept — Nitrogen rule: a neutral organic molecule with an odd molecular mass must contain an odd number of nitrogen atoms. **Reasoning:** For C, H, O and the usual elements only nitrogen contributes an odd valence/mass combination that flips the parity. So an odd-mass $M^{+\bullet}$ signals an odd number of nitrogens (1, 3, . . .); an even mass means zero or an even number of nitrogens. **Why the other options are wrong:**

- (A) Having no nitrogen would give an even molecular mass.
- (B) An even number of nitrogens gives an even mass.
- (C) Oxygen-only compounds have even molecular masses.

Final Answer: Odd-mass $M^{+\bullet}$ $\Rightarrow$ odd number of nitrogen atoms $\Rightarrow$ D

Answer: (D) Go Back to Q121

Q122.

Solution

Concept — van Deemter curve: $H = A+B/u+C\,u$ has a minimum plate height at an optimum velocity. **Reasoning:** As u rises, the B/u (longitudinal diffusion) term falls while the $C\,u$ (mass-transfer) term grows; their balance gives a minimum H at $u_{opt} = \sqrt{B/C}$. The smallest H means the most theoretical plates and thus maximum column efficiency. **Why the other options are wrong:**

- (A) At the highest flow the $C\,u$ term makes H large (poor efficiency).
- (B) At near-zero flow the B/u term makes H large.
- (D) The minimum is the most efficient point, not where resolution vanishes.

Final Answer: Optimum velocity giving smallest H / maximum efficiency $\Rightarrow$ C

Answer: (C) Go Back to Q122

Q123.

Solution

Concept — Serotaxonomical classification: A modern, relatively recent basis of grouping crude drugs that uses the chemical and immunological behaviour of plant proteins (antigen–antibody serum reactions) to establish relationships between species. **Reasoning:** Comparing serological/chemical protein characters between species to group drugs is serotaxonomy (a branch of chemotaxonomy), distinct from the older morphological or pharmacological schemes. **Why the other options are wrong:**

- (A) Morphological grouping is by the plant part used.
- (C) Alphabetical grouping is merely by name order.
- (D) Pharmacological grouping is by therapeutic action.

Final Answer: Grouping by protein/immunological characters is serotaxonomical classification $\Rightarrow$ B

Answer: (B) Go Back to Q123

Q124.

Solution

Concept — Organized vs unorganized drugs: Organized drugs are entire plant organs (leaf, wood, fruit, seed) with a cellular structure; unorganized drugs are cell-free exudates, secretions or extracts. **Reasoning:** Fennel fruit, quassia wood and vasaka leaf are all organized plant organs with definite cellular tissue, so option (D) is the set that is entirely organized. **Why the other options are wrong:**

- (A) Benzoin, myrrh and kino are resin/gum-resin exudates (unorganized).
- (B) Beeswax, agar and gelatin are cell-free secretory/extractive products.
- (C) Catechu, opium and acacia are extracts/latex/gum exudates.

Final Answer: Fennel fruit, quassia wood and vasaka leaf are all organized $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q124

Q125.

Solution

Concept — Taxonomical classification: Crude drugs are grouped according to the botanical (taxonomical) position of the source plant: family, genus and species. **Reasoning:** *Cassia*, *Glycyrrhiza* and *Trigonella* are placed together solely because all belong to the family Leguminosae (Fabaceae); this botanical basis is taxonomical classification. **Why the other options are wrong:**

- (B) Chemical grouping is by constituent class.
- (C) Morphological grouping is by plant part.
- (D) Pharmacological grouping is by therapeutic action.

Final Answer: Grouping by botanical family is taxonomical classification $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q125

Q126.

Solution

Concept — Calabar bean alkaloids: Physostigmine (eserine) is an indole alkaloid and reversible cholinesterase inhibitor from the Calabar bean. **Reasoning:** The dried ripe seeds of *Physostigma venenosum* (Leguminosae) are the source of physostigmine, used as a miotic in glaucoma. **Why the other options are wrong:**

- (A) *Pilocarpus jaborandi* yields pilocarpine.
- (B) *Lobelia inflata* yields lobeline.
- (D) *Cytisus scoparius* yields sparteine.

Final Answer: Source is the Calabar bean *Physostigma venenosum* $\Rightarrow$ C

Answer: (C) Go Back to Q126

Q127.

Solution

Concept — Alkaloid classification: True alkaloids have ring nitrogen derived from an amino acid; protoalkaloids (biological amines) have an amino-acid-derived nitrogen lying outside any ring; pseudo-alkaloids have nitrogen not from an amino acid. **Reasoning:** Pseudoephedrine, like ephedrine, has its nitrogen in an open side chain (not in a heterocyclic ring) and is derived from phenylalanine, so it is a protoalkaloid (a biological amine). **Why the other options are wrong:**

- (A) Its nitrogen is not in a ring, so it is not a true alkaloid.
- (C) Its nitrogen does arise from an amino acid, so it is not a pseudo-alkaloid.
- (D) It carries no sugar, so it is not a glycoalkaloid.

Final Answer: Pseudoephedrine is a protoalkaloid $\Rightarrow$ B

Answer: (B) Go Back to Q127

Q128.

Solution

Concept — Strychnos alkaloids: *Strychnos nux-vomica* seeds contain the indole alkaloids strychnine and brucine; brucine is the dimethoxy derivative of strychnine. **Reasoning:** Brucine differs from strychnine by bearing two methoxy ($-OCH_3$) groups on the benzene ring of the indole nucleus, which makes it less toxic and useful for resolving racemates. **Why the other options are wrong:**

- (A) The substituents are methoxy, not free hydroxyl, groups.
- (B) There are no chlorine atoms in brucine.
- (C) There are no carboxyl groups added.

Final Answer: Brucine is the 2,3-dimethoxy (two $-OCH_3$) derivative of strychnine $\Rightarrow$ D

Answer: (D) Go Back to Q128

Q129.

Solution

Concept — Alkaloid precipitating reagents: Wagner's reagent is iodine in potassium iodide solution; with alkaloids it gives a reddish-brown precipitate. **Reasoning:** A reddish-brown precipitate from an acidified alkaloidal solution treated with iodine–potassium iodide is the classic positive Wagner's test for alkaloids. **Why the other options are wrong:**

- (B) Mayer's (potassium mercuric iodide) gives a cream/white precipitate.
- (C) Hager's (picric acid) gives a yellow precipitate.
- (D) Murexide is a test for purines (xanthines), not a general alkaloid precipitant.

Final Answer: Reddish-brown precipitate with iodine–KI is Wagner's test $\Rightarrow$ A

Answer: (A) Go Back to Q129

Q130.

Solution

Concept — Cardiac glycoside aglycones: Cardenolides bear a steroidal aglycone with a five-membered α,β-unsaturated γ-butenolide ring; bufadienolides bear a six-membered doubly-unsaturated lactone. **Reasoning:** Digitoxigenin, the aglycone of digitoxin from *Digitalis purpurea*, carries the five-membered butenolide ring, so it is a cardenolide. The schematic shows it O-glycosidically linked to three digitoxose (2,6-dideoxy) sugars. **Why the other options are wrong:**

- (A) It is steroidal, not an anthraquinone.
- (B) It is not a triterpene saponin.
- (D) The six-membered lactone is the bufadienolide type (e.g. squill), not digitoxigenin.

Final Answer: Digitoxigenin is a cardenolide aglycone $\Rightarrow$ C

Answer: (C) Go Back to Q130

Q131.

Solution

Concept — Bornträger's test: Free anthraquinones, liberated by hydrolysis and oxidation, impart a pink-to-cherry-red colour to an ammoniacal (alkaline) organic layer. **Reasoning:** Chrysophanol is an anthraquinone; on the modified Bornträger's test the freed anthraquinone gives the characteristic pink-to-red colour in the ammonia layer, confirming its presence. **Why the other options are wrong:**

- (A) A blue-green colour is not the Bornträger's reaction.
- (C) The aqueous anthraquinone solution may be yellow, but the diagnostic ammoniacal layer turns pink-red.
- (D) A positive test is coloured, not colourless.

Final Answer: The ammoniacal layer turns pink to cherry-red $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q131

Q132.

Solution

Concept — Keller–Kiliani test: This test detects 2-deoxysugars of cardiac glycosides by a reddish-brown ring at the junction of glacial acetic acid (with ferric chloride) and concentrated sulphuric acid. **Reasoning:** Gitalin, a *Digitalis purpurea* cardiac glycoside, carries digitoxose (a 2-deoxysugar); these deoxy-sugars give the characteristic Keller–Kiliani colour reaction. **Why the other options are wrong:**

- (A) Liebermann–Burchard detects the steroid nucleus, not the deoxy-sugar.
- (B) Legal's (sodium nitroprusside) detects the cardenolide lactone ring.
- (C) Baljet detects the unsaturated lactone ring, not the deoxy-sugar.

Final Answer: The 2-deoxysugar is detected by the Keller–Kiliani test $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q132

Q133.

Solution

Concept — Flavonol glycosides: Rutin is a flavonol glycoside; its aglycone is the flavonol quercetin and its sugar is the disaccharide rutinose (rhamnose + glucose). **Reasoning:** On acid hydrolysis rutin yields rutinose plus quercetin, the 3,3',4',5,7-pentahydroxyflavone aglycone. **Why the other options are wrong:**

- (A) Apigenin is a flavone, not the aglycone of rutin.
- (B) Hesperetin is the aglycone of hesperidin.
- (D) Naringenin is a flavanone (from naringin).

Final Answer: Rutin hydrolyses to rutinose + quercetin $\Rightarrow$ C

Answer: (C) Go Back to Q133

Q134.

Solution

Concept — Glucosinolates of mustard: Black mustard (sinigrin) gives volatile allyl isothiocyanate, whereas white mustard (sinalbin) gives a non-volatile isothiocyanate. **Reasoning:** Myrosinase hydrolyses sinalbin to *p*-hydroxybenzyl isothiocyanate, which is non-volatile and almost odourless, explaining why white mustard lacks the pungent volatile smell of black mustard. **Why the other options are wrong:**

- (B) Allyl isothiocyanate is the volatile product of black mustard (sinigrin).
- (C) Eugenol is a clove constituent, unrelated.
- (D) Sinapic acid is a phenolic acid, not the isothiocyanate.

Final Answer: Sinalbin yields non-volatile *p*-hydroxybenzyl isothiocyanate $\Rightarrow$ A

Answer: (A) Go Back to Q134

Q135.

Solution

Concept — Pimento (allspice) oil: The volatile oil of *Pimenta dioica* fruit is dominated by the phenol eugenol, giving a clove-like odour. **Reasoning:** Eugenol forms about 60–80% of pimento oil and accounts for its aroma and carminative/local-analgesic properties. **Why the other options are wrong:**

- (A) Menthol is from peppermint.
- (C) Citral is from lemongrass.
- (D) Linalool dominates coriander oil, not pimento.

Final Answer: Chief constituent of pimento oil is eugenol $\Rightarrow$ B

Answer: (B) Go Back to Q135

Q136.

Solution

Concept — Cumin oil: The volatile oil of *Cuminum cyminum* fruit is characterised by the aromatic aldehyde cuminaldehyde (*p*-isopropylbenzaldehyde). **Reasoning:**

Cuminaldehyde is the chief odour principle of cumin oil, distinguishing it from other umbelliferous fruits. **Why the other options are wrong:**

- (A) Carvone characterises caraway/spearmint.
- (B) Anethole characterises anise/fennel.
- (C) Thymol characterises thyme/ajowan.

Final Answer: The chief constituent of cumin oil is cuminaldehyde $\Rightarrow$ D

Answer: (D) Go Back to Q136

Q137.

Solution

Concept — Sandalwood oil: The oil distilled from *Santalum album* heartwood is composed chiefly of the sesquiterpene alcohols α- and β-santalol. **Reasoning:**

Santalols make up about 90% of sandalwood oil and are responsible for its odour and urinary-antiseptic action. **Why the other options are wrong:**

- (A) Eugenol is from clove/pimento.
- (B) Citronellal is from citronella/lemongrass.
- (D) Geraniol is from geranium/palmarosa oils.

Final Answer: Sandalwood oil consists chiefly of α- and β-santalol $\Rightarrow$ C

Answer: (C) Go Back to Q137

Q138.

Solution

Concept — Resin vs gum: Dragon's blood is a water-insoluble red resin; locust bean gum is a galactomannan polysaccharide that hydrates in water. **Reasoning:**

Dragon's blood (from *Daemonorops draco* fruits) is a hard red resin insoluble in water, whereas locust bean gum (carob seed, *Ceratonia siliqua*) is a galactomannan that swells/hydrates in water to a viscous mucilage. Option (A) states this correctly. **Why the other options are wrong:**

- (B) Neither is an alkaloidal/nitrogenous resin.
- (C) The identities are reversed.
- (D) Dragon's blood is insoluble; neither gives a clear true solution.

Final Answer: Dragon's blood is an insoluble resin; locust bean gum is a hydrating galactomannan $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q138

Q139.

Solution

Concept — Acetate–mevalonate pathway: Three acetyl-CoA units form HMG-CoA, which is reduced to mevalonic acid and then to the C5 isoprene unit isopentenyl pyrophosphate (IPP) and its isomer DMAPP. **Reasoning:** The scheme proceeds acetyl-CoA $\rightarrow$ mevalonic acid $\rightarrow$ IPP/DMAPP $\rightarrow$ farnesyl-PP (C15) $\rightarrow$ santalols, so X is the acetate–mevalonate pathway and Y is IPP, the immediate C5 isoprene precursor. **Why the other options are wrong:**

- (A) Shikimate gives aromatic compounds, not sesquiterpenes.
- (C) Acetate–malonate gives fatty acids/polyketides.
- (D) The pentose phosphate pathway supplies sugars/NADPH.

Final Answer: X = acetate–mevalonate pathway, Y = IPP $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q139

Q140.

Solution

Concept — Shikimic acid pathway: Gallic acid (and hence hydrolysable gallotannins) arises by aromatisation of 3-dehydroshikimic acid, an early shikimate-pathway intermediate, without going on to the aromatic amino acids. **Reasoning:**

Gallotannins are glucose esters of gallic acid; gallic acid is formed directly from 3-dehydroshikimate, so the biosynthetic origin is the shikimic acid pathway. **Why the other options are wrong:**

- (A) Mevalonate gives terpenoids.
- (B) Acetate–malonate gives phloroglucinol-type (condensed) phenols, not gallic acid.
- (C) The Krebs cycle does not aromatise to gallic acid.

Final Answer: Gallic acid is derived from 3-dehydroshikimate of the shikimic acid pathway $\Rightarrow$ D

Answer: (D) Go Back to Q140

Q141.

Solution

Concept — Retardation factor (R_f): R_f is the ratio of the distance travelled by the solute to the distance travelled by the solvent front, both measured from the baseline; it is dimensionless and lies between 0 and 1. **Reasoning:** Here $R_f = d/D = 1.5/4.0 = 0.375$, a valid value between 0 and 1. **Why the other options are wrong:**

- (B) 2.67 is D/d (the inverse) and exceeds 1, which is impossible.
- (C) 0.60 does not match the given distances.
- (D) 1.50 is the raw distance d in cm, not the ratio.

Final Answer: $R_f = 1.5/4.0 = 0.375 \Rightarrow$ A

Answer: (A) Go Back to Q141

Q142.

Solution

Concept — Calcium oxalate crystals: Calcium oxalate occurs as prisms, microsphenoidal crystals, rosette aggregates and raphides (needle bundles), each a diagnostic powder character. **Reasoning:** A bundle of fine, parallel, needle-shaped (acicular) crystals lying together in a cell, as sketched, is a raphide bundle, seen for example in ipecac and squill. **Why the other options are wrong:**

- (A) A rosette is a star-shaped cluster, not parallel needles.
- (B) Prisms are single rectangular crystals.
- (D) Microsphenoidal crystals are tiny and individual.

Final Answer: The parallel needle bundle is a raphide bundle $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q142

Q143.

Solution

Concept — Sticky vs blunt cutters: An enzyme that cleaves the two strands of a palindrome at staggered positions leaves single-stranded overhangs; a central symmetric cut gives blunt ends. **Reasoning:** *Taq*I recognises TCGA and cuts T|CGA on each strand, leaving complementary 5′-CG overhangs (cohesive ends). It is a thermostable enzyme from *Thermus aquaticus*, useful where digestion at higher temperature is wanted. **Why the other options are wrong:**

- (A) *Sma*I cuts CCC|GGG centrally, giving blunt ends.
- (B) *Nco*I does leave overhangs but its site is CCATGG, not TCGA.
- (D) *Hpa*I cuts GTT|AAC centrally, blunt ends.

Final Answer: *Taq*I cutting T|CGA leaves cohesive ends $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q143

Q144.

Solution

Concept — λ replacement vectors: In replacement (substitution) vectors, the central third of the λ genome carries integration/recombination genes needed only for lysogeny, not for lytic propagation, so it can be swapped for foreign DNA. **Reasoning:** The dispensable central "stuffer" is excised and replaced by an insert

of comparable size; the recombinant genome then packages into infective particles in vitro provided the total length lies within the packaging limits set by the *cos* ends. Genes for head, tail and replication lie in the flanking arms and are retained. **Why the other options are wrong:**

- (B) The head genes are in the arms, not the replaceable centre.
- (C) The *cos* ends lie at the genome termini and are kept intact.
- (D) λ accepts inserts of up to $\sim$20 kb, far larger than 2 kb.

Final Answer: The central lysogeny region is dispensable for lytic growth and is replaced by the insert $\Rightarrow$ A

Answer: (A) Go Back to Q144

Q145.

Solution

Concept — Multiplex PCR: Several primer pairs are combined in one reaction so that multiple targets amplify simultaneously, each yielding a product of a distinct size. **Reasoning:** Because the amplicons differ in length, they separate as distinct bands in a single gel lane, allowing several genes or pathogens to be screened at once. This saves template, time and cost and is widely used in diagnostics and genotyping. **Why the other options are wrong:**

- (A) Nested PCR uses two successive primer pairs on one target to boost specificity.
- (C) Inverse PCR amplifies unknown flanking DNA using outward-facing primers.
- (D) Colony PCR screens bacterial colonies for an insert, not multiple targets at once.

Final Answer: Many primer pairs in one tube giving several sized products is multiplex PCR $\Rightarrow$ B

Answer: (B) Go Back to Q145

Q146.

Solution

Concept — Expression vector elements: For controlled expression, the gene must sit downstream of an **inducible promoter**; transcription then starts only when the inducer is supplied. **Reasoning:** In the map, P is the inducible promoter placed just upstream of the multiple cloning site. Adding IPTG relieves repression so RNA polymerase transcribes the insert. The *ori* merely allows replication and kan^R selects transformants; neither drives transcription. **Why the other options are wrong:**

- (A) The resistance gene selects cells; it does not transcribe the insert.
- (B) The origin governs replication, not transcription.
- (C) A second selection marker has no role in inducible transcription.

Final Answer: The inducible promoter P upstream of the cloning site controls insert transcription $\Rightarrow$ D

Answer: (D) Go Back to Q146

Q147.

Solution

Concept — Glyco-engineering for half-life: Adding N-linked carbohydrate (and the sialic acid it bears) slows renal and receptor-mediated clearance of a glycoprotein, lengthening its plasma residence. **Reasoning:** Darbepoetin alfa carries two extra N-glycosylation sites versus erythropoietin, raising its sialic-acid content. This gives it a roughly three-fold longer serum half-life, so it can be dosed less frequently while still stimulating erythropoiesis in anaemia of chronic kidney disease. **Why the other options are wrong:**

- (B) Extra glycosylation does not make a protein orally stable; it is still injected.
- (C) It still acts on the EPO receptor, stimulating red cells, not neutrophils.
- (D) It has no thrombolytic (clot-dissolving) activity.

Final Answer: Added glycosylation prolongs half-life for less frequent dosing $\Rightarrow$ A

Answer: (A) Go Back to Q147

Q148.

Solution

Concept — Targeted (immuno)toxins: A targeting ligand fused to a toxin delivers the catalytic poison selectively to cells bearing the matching receptor. **Reasoning:** In denileukin diftitox the IL-2 moiety docks onto IL-2 receptors over-expressed on certain malignant T cells; the fusion is internalised and the diphtheria-toxin fragment then halts protein synthesis (by ADP-ribosylating EF-2), killing the target cell. The IL-2 part is thus the "address label". **Why the other options are wrong:**

- (A) It does not neutralise diphtheria toxin; it uses the toxin as a payload.
- (C) IL-2 is a cytokine, not an opsonising antibody.
- (D) It gives no passive immunity against tetanus.

Final Answer: IL-2 targets the toxin to IL-2-receptor-bearing tumour cells $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q148

Q149.

Solution

Concept — Itaconic acid fermentation: Itaconic acid is produced from sugars by a filamentous fungus that diverts the TCA-cycle intermediate cis-aconitate via aconitate decarboxylase. **Reasoning:** The industrial producer is *Aspergillus terreus*, grown by submerged aerobic culture, with acid accumulating late in the run (curve phases III–IV) once growth has slowed. The growth curve simply illustrates that this overflow product builds up after the rapid log phase. **Why the other options are wrong:**

- (A) *Acetobacter* oxidises ethanol to acetic acid, not itaconic acid.
- (B) *Saccharomyces* ferments sugar to ethanol/CO_2.
- (D) *Lactobacillus* yields lactic acid.

Final Answer: Itaconic acid is made by *Aspergillus terreus* $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q149

Q150.

Solution

Concept — Vitamin C (Reichstein) route: The classical ascorbic-acid process is mostly chemical, but one stereospecific oxidation, D-sorbitol to L-sorbose, is done microbiologically. **Reasoning:** *Gluconobacter* (*Acetobacter*) *suboxydans*, an acetic-acid bacterium, oxidises sorbitol regioselectively to L-sorbose, which is then converted chemically to 2-keto-L-gulonic acid and finally to ascorbic acid. Only this single step is enzymatic/microbial. **Why the other options are wrong:**

- (A) *Penicillium chrysogenum* makes penicillin, not sorbose.
- (B) *Streptomyces griseus* produces streptomycin; no reductive amination here.
- (C) The ABE (*Clostridium*) fermentation gives solvents, not sorbose.

Final Answer: *Gluconobacter (Acetobacter) suboxydans* oxidises sorbitol to sorbose $\Rightarrow$ D

Answer: (D) Go Back to Q150

Q151.

Solution

Concept — Bacitracin source: Bacitracin is a cyclic polypeptide antibiotic that blocks cell-wall synthesis by interfering with the bactoprenol (lipid-carrier) cycle. **Reasoning:** It is produced by fermentation of *Bacillus subtilis/Bacillus licheniformis* (the Tracy strain). Because parenteral use is nephrotoxic, it is restricted mainly to topical antibacterial preparations. **Why the other options are wrong:**

- (B) *Streptomyces venezuelae* yields chloramphenicol.
- (C) *Penicillium griseofulvum* yields griseofulvin (an antifungal).
- (D) *Micromonospora purpurea* yields gentamicin.

Final Answer: Bacitracin comes from *Bacillus subtilis/licheniformis* $\Rightarrow$ A

Answer: (A) Go Back to Q151

Q152.

Solution

Concept — Turnover number k_{cat}: k_{cat} equals $V_{max}/[E]_{total}$ and measures how many substrate molecules one active site converts to product per second at saturation. **Reasoning:** It is a first-order rate constant describing the catalytic step once the enzyme is fully loaded with substrate. A higher k_{cat} means a faster catalyst per active site, independent of how much enzyme is present. **Why the other options are wrong:**

- (A) The [S] giving half-V_{max} is K_m, not k_{cat}.
- (C) Catalytic efficiency is k_{cat}/K_m, not K_m/V_{max}.
- (D) Total product formed depends on time and enzyme amount, not the turnover number itself.

Final Answer: k_{cat} is molecules converted per active site per unit time at saturation $\Rightarrow$ B

Answer: (B) Go Back to Q152

Q153.

Solution

Concept — K_m from the curve and entrapment: On a Michaelis–Menten plot the [S] at which $v = \frac{1}{2}V_{max}$ is the Michaelis constant K_m; trapping the enzyme inside a gel lattice is entrapment. **Reasoning:** Setting $v = \frac{1}{2}V_{max}$ in $v = V_{max}[S]/(K_m + [S])$ gives $[S] = K_m$, exactly the value marked by the dashed lines. The lipase here is physically caged within calcium-alginate beads without covalent modification, the defining feature of **entrapment**. **Why the other options are wrong:**

- (A) The half-V_{max} point gives K_m, not k_{cat}; alginate beads are not covalent coupling.
- (B) V_{max} is the upper asymptote, not the half-maximal [S].
- (D) The figure marks no inhibitor; alginate caging is not cross-linking.

Final Answer: The half-V_{max} [S] is K_m and the method is entrapment $\Rightarrow$ C

Answer: (C) Go Back to Q153

Q154.

Solution

Concept — IgM pentamer valency: Each immunoglobulin monomer has two Fab arms, hence two antigen-binding sites; five monomers joined by a J chain give a pentamer. **Reasoning:** 2 sites per monomer $\times$ 5 monomers $=$ 10 theoretical binding sites. In practice steric hindrance lowers the effective valency for large antigens to about five, but the structural (theoretical) valency is ten, which underlies IgM's powerful agglutination. **Why the other options are wrong:**

- (A) Two sites describes a single IgG/IgM monomer, not the pentamer.
- (B) Four would correspond to a dimer.
- (C) Five is the number of monomers, not of binding sites.

Final Answer: The IgM pentamer has 10 antigen-binding sites $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q154

Q155.

Solution

Concept — Opsonisation: Coating a microbe with opsonins (IgG Fc and complement C3b) marks it for efficient uptake by phagocytes that bear Fc and C3b receptors. **Reasoning:** The phagocyte recognises the bound Fc and C3b, bridging it firmly to the target and greatly increasing the rate of ingestion and killing. This is a key effector function of antibody and complement. **Why the other options are wrong:**

- (B) Neutralisation blocks a toxin or virus directly; it does not promote phagocytosis.
- (C) Affinity maturation is the rise in antibody affinity over an immune response.
- (D) Clonal deletion removes self-reactive lymphocytes during tolerance.

Final Answer: Antibody/C3b coating that enhances phagocytosis is opsonisation $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q155

Q156.

Solution

Concept — mAb nomenclature by source: The sub-stem before `-mab` encodes the antibody's origin: `-o-` murine, `-xi-` chimeric, `-zu-` humanised, `-u-` fully human. **Reasoning:** A humanised antibody keeps only the rodent CDR loops (region X) grafted into an otherwise fully human framework and constant region, as drawn. It therefore takes the sub-stem `-zumab` (for example trastuzumab, omalizumab). **Why the other options are wrong:**

- (A) `-ximab` is chimeric (whole rodent variable domains on human constant regions).
- (C) `-umab` is fully human, with no rodent sequence.
- (D) `-omab` is fully murine.

Final Answer: A humanised antibody carries the sub-stem `-zumab` $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q156

Q157.

Solution

Concept — Type II hypersensitivity: In Type II reactions IgG or IgM antibodies bind antigens on a cell surface and cause destruction by complement and phagocytes (antibody-mediated cytotoxicity). **Reasoning:** In drug-induced immune haemolytic anaemia, IgG attaches to a drug–red-cell membrane complex; complement and splenic phagocytes then lyse and remove the coated cells. Because the antibody acts on cell-bound antigen to destroy the cell, it is classic Type II. **Why the other options are wrong:**

- (A) Type I is IgE-mediated immediate allergy.
- (B) Type III involves soluble immune complexes depositing in tissues.
- (D) Type IV is delayed and T-cell mediated, not antibody driven.

Final Answer: Antibody-mediated red-cell destruction is Type II hypersensitivity $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q157

Q158.

Solution

Concept — Acid-fast staining: Acid-fast organisms have a waxy, mycolic-acid-rich cell wall that holds carbol-fuchsin so strongly that acid-alcohol cannot decolourise it. **Reasoning:** In Ziehl–Neelsen staining, *Mycobacterium* (and the partially acid-fast *Nocardia*) retain the red dye while all other cells are decolourised and take up the methylene-blue counterstain. The mycolic acid is the structural basis of this property. **Why the other options are wrong:**

- (A) *E. coli* is a Gram-negative rod, not acid-fast.
- (B) *Staphylococcus aureus* is Gram-positive but not acid-fast.
- (C) *Streptococcus pyogenes* is Gram-positive, non acid-fast.

Final Answer: Mycolic-acid-rich, acid-fast organisms are *Mycobacterium* (and *Nocardia*) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q158

Q159.

Solution

Concept — Decimal reduction time (D-value): Because microbial death is logarithmic (first order), the D-value is the time at a fixed temperature to kill 90% of the population, i.e. drop it by one $\log_{10}$ unit. **Reasoning:** If a population falls from 10^6 to 10^5 in a given time at the stated temperature, that time is the D-value. It quantifies how resistant the organism is and feeds directly into sterilisation cycle (F_0) calculations. **Why the other options are wrong:**

- (B) The temperature change for a ten-fold change in D is the z-value, not D.
- (C) D is a 90% (1-log), not a 50%, reduction.
- (D) Complete sterility needs many D-cycles; D is just one decimal reduction.

Final Answer: D-value is the time for a 90% (one-log) kill $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q159

Q160.

Solution

Concept — Sterility-test media: The pharmacopoeial test uses fluid thioglycollate medium (FTM) for anaerobic and aerobic bacteria and soybean–casein digest medium (SCDM) for fungi and aerobic bacteria. **Reasoning:** FTM contains thioglycollate (a reducing agent) plus a little agar to lower and maintain a low redox potential, so anaerobes grow in its depths while aerobes grow near the surface. SCDM is incubated at the lower temperature mainly for fungi and aerobes. Hence the anaerobe-supporting medium is FTM. **Why the other options are wrong:**

- (A) SCDM is the aerobic/fungal medium, not the anaerobic one.
- (C) Nutrient agar slants are not a pharmacopoeial sterility-test medium.
- (D) MacConkey agar is a selective medium for enteric Gram-negatives, not a sterility-test medium.

Final Answer: The reducing, anaerobe-supporting medium is fluid thioglycollate medium $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q160

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	D	2	A	3	C	4	B	5	D
6	A	7	C	8	B	9	D	10	C
11	A	12	B	13	C	14	A	15	D
16	B	17	C	18	A	19	D	20	C
21	D	22	A	23	B	24	C	25	A
26	D	27	B	28	C	29	A	30	B
31	C	32	D	33	A	34	B	35	B
36	C	37	A	38	D	39	B	40	C
41	A	42	D	43	B	44	C	45	A
46	B	47	D	48	C	49	A	50	B
51	D	52	C	53	A	54	B	55	C
56	D	57	A	58	B	59	C	60	D
61	A	62	B	63	C	64	D	65	A
66	B	67	C	68	D	69	B	70	A
71	D	72	C	73	D	74	B	75	A
76	C	77	B	78	D	79	A	80	B
81	C	82	C	83	B	84	A	85	D
86	A	87	C	88	B	89	A	90	D
91	B	92	C	93	A	94	D	95	B
96	A	97	C	98	D	99	B	100	A
101	C	102	D	103	A	104	B	105	C
106	D	107	A	108	B	109	C	110	D
111	A	112	B	113	C	114	D	115	A
116	B	117	C	118	B	119	D	120	A
121	D	122	C	123	B	124	D	125	A
126	C	127	B	128	D	129	A	130	C
131	B	132	D	133	C	134	A	135	B
136	D	137	C	138	A	139	B	140	D
141	A	142	C	143	C	144	A	145	B
146	D	147	A	148	B	149	C	150	D
151	A	152	B	153	C	154	D	155	A
156	B	157	C	158	D	159	A	160	B