GATE-1999

Section – I (Choose the Correct Answer)

1. (i) This question consists of 25 (Twenty-five) multiple choice questions each carrying one mark.
(ii) Choose the correct answer.
(iii) Enter (a) or (b), (c) or (d) as the case may be in the boxes corresponding to the questions in the first page of the answer book.

1.1 One of the following statements for adenylyl cyclase is wrong. Identify
(a) Is a membrane bound enzyme
(b) Inactivated by Phosphodiesterase
(c) Catalyses the A.M.P formation
(d) Active only when associated with G-Protein

1.2 Which one of the following devices is used to increase the efficiency of drug delivery via aerosols
(a) Tube spacers (b) Actuator
(c) Metered valve (d) Pressure valve

1.3 One of the uses given below for opioids is not correct. Indicate
(a) Antitussive (b) Analgesic
(c) Anti-inflammatory (d) Antidiarrhoeal

1.4 Which one of the following is used as a preservative in ophthalmic preparations
(a) Benzalkonium chloride (b) Phenol
(c) Benzoic acid (d) Chlorocresol

1.5 The activity of the following drugs is dependent on Phenyl-N-alkyl one piperidine moiety
(a) Meperidine (b) Imipramine
(c) Diazepam (d) Chlorpromazine

1.6 One of the organisms mentioned below is used as a biological indicator in I.P. for dry heat sterilization. Choose the correct one
(a) Bacillus stearothermophilus
(b) Spores of Bacillus subtilis
(c) Bacillus pumilus
(d) Spores of Bacillus cereus

1.7 The most common causative agent of Bacterial Pneumonia is
(a) Staphylococcus aureus
(b) Escherichia coli
(c) Streptococcus pneumoniae
(d) Mycoplasma pneumoniae

1.8 Creatinine clearance is used as a measurement for
(a) Glomerular filtration (b) Renal excretion rate
(c) Renal excretion ratio (d) Passive renal excretion

1.9 The correct starting material for the synthesis of Ethacrynic Acid
(a) 2,3-Dichloro phenoxy acetic acid
(b) 2,3-Dichloro phenoxy acetamide
(c) 2,3-Dichloro phenoxy propionic acid
(d) 2,3-Dichloro phenoxy butyric acid

1.10 Choose the correct metabolic process for Phenobarbitone
(a) p-Hydroxylation followed by reduction
(b) p-Hydroxylation followed by glucuronidation
(c) p-Hydroxylation followed by acetylation
(d) p-Hydroxylation followed by oxidation

1.11 Which one of the following antihistaminics is a basic ether
(a) Pheniramine maleate
(b) Triprolidine hydrochloride
(c) Diphenhydramine hydrochloride
(d) Promethazine hydrochloride

1.12 Conductivity cells are made up of
(a) Two silver rods
(b) Two parallel sheets of platinum
(c) Glass membrane with Ag/AgCl
(d) $Sb–Sb_2O_3$

1.13 The chemical shift value is
(a) Proportional to field strength
(b) Not proportional to field strength
(c) Ratio of the number of protons in each group
(d) Proportional to the total number of protons

1.14 Select the equation that gives the rate of drug dissolution from a tablet
(a) Fick's Law
(b) Henderson-Hasselbalch equation
(c) Noyes–Whitney equation
(d) Michaelis–Menten equation

1.15 Energy absorbed in the U.V. region produces changes in
(a) The rotational energy of the molecule
(b) The vibrational energy of the molecule
(c) The electronic energy of the molecule
(d) All the three energy levels of the molecule

1.16 Dose dumping is a problem in the formulation of
(a) Compressed tablets
(b) Suppositories
(c) Soft gelatin capsules
(d) Controlled-release drug products

1.17 The initial distribution of a drug into the tissue is determined chiefly by the
(a) Rate of blood flow to the tissue
(b) Plasma protein binding of the drug
(c) Affinity for the tissue
(d) Stomach emptying time

1.18 Choose the correct characteristic of the epidermal cells and cuticle of Atropa belladonna leaf
(a) Flat-walled with striated cuticle

(b) Wavy-walled with striated cuticle
(c) Algal cell walls with smooth cuticle
(d) Straight walls with wavy cuticle

1.19 Mepyramine hydrochloride is prepared from which one of the following compounds
(a) 1-(2-chloro benzhydryl)-Pyridine and 3-methyl benzylamine
(b) 1-(2-chloro benzhydryl)-Piperazine and 3-methyl benzylamine
(c) 1-(4-chloro benzhydryl)-Piperazine and 3-methyl benzylamine
(d) 1-(4-chloro benzhydryl)-Piperazine and 2-methyl benzylamine

1.20 Which one of the following is an Ex-Officio member of the State Pharmacy Council?
(a) Chief Pharmacist of Government Hospital
(b) Chief Administrative Medical Officer of the State
(c) Registered Pharmacist
(d) Assistant Drug Controller

1.21 Phloroglucinol and Hydrochloric acid produce pink or red colour with
(a) Cellulose cell walls (b) Lignified cell walls
(c) Cutinised cell walls (d) Mucilaginous cell walls

1.22 One of the forms mentioned below is used to issue licence for wholesale of drugs other than specified in Schedule C, C1 and X. Choose the correct one.
(a) Form 20 B (b) Form 20 BB
(c) Form 21 B (d) Form 20 A

1.23 Choose the correct chemical name for Chlorpromazine Hydrochloride
(a) 3-[2-(3-Chlorophenothiazin-10-yl) propyl] diethylamine hydrochloride
(b) 3-[2-(3-Chlorophenothiazin-10-yl) propyl] dimethylamine hydrochloride
(c) 3-[2-(3-Chlorophenothiazin-10-yl) propyl] diethylamino hydrochloride
(d) 3-[2-(3-Chlorophenothiazin-10-yl) propyl] diethyl amine hydrochloride

1.24 Wavelength of an IR radiation is 5×10^{-4} cm. Wave number corresponding to that is
(a) 4000 cm^{-1} (b) 2000 cm^{-1}
(c) 3000 cm^{-1} (d) 1000 cm^{-1}

1.25 Choose the synthetic adrenocortical steroid, which did not occur in nature
(a) 11β, 17α, 21-Trihydroxy-4-Pregnadiene-3,20-dione
(b) 17α, 21-Dihydroxy pregna-4-ene-3,11, 20-trione
(c) 11β, 21-Trihydroxy pregna-4-ene-3,20-dione
(d) 3-Oxo-17β, hydroxy androsta-4-ene

Section – II (Match The Following)

2. Match each of the Items 1 and 2 on the left with an appropriate item on the right [P,Q,R,S] and answer in the specific space provided in the answer book.

2.1 Match the correct heterocyclic system present in the medicinal agents given in [P]:

Medicinal Agent	Heterocyclic System
1. 5H-Dibenzo [b,f] azepine-5-carboxamide	[P] Nitrazepam
2. 1,4-Dihydro-1,8-Naphthyridine-4-one	[Q] Carbamazepine
	[R] Imipramine
	[S] Nalidixic acid

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.2 Match the titrants used for the following:

Substance	Titrant Options
1. Perchloric acid I.P.	[P] Perchloric acid
2. Phenethyl sodium I.P.	[Q] EDTA
	[R] Cetyl trimethyl ammonium sulphate
	[S] Tetra butyl ammonium hydroxide

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[S], 2-[P]

2.3 Starting materials for the synthesis of medicinal agents are listed below. Match them with the correct ones from [P] to [S].

Starting Material	Medicinal Agent Options
1. 2-Amino-5-chloro-benzophenone	[P] Ethosuximide
2. Butanone and ethyl cyanoacetate	[Q] Diazepam
	[R] Prochlorperazine
	[S] Propranolol

(a) 1-[Q], 2-[P] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.4 The ring structures present in the alkaloids listed below are given in [P] to [S]. Match them.

Alkaloid	Ring Structure Options
1. Codeine	[P] Phenanthrene
2. Ergotamine	[Q] Indole
	[R] Quinoline
	[S] Isoquinoline

(a) 1-[Q], 2-[S] (b) 1-[Q], 2-[R]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[Q]

2.5 The following terms are used to describe the parts of certain plants listed in [P] to [S]. Match them.

Term	Plant Options
1. Hypanthium	[P] Prunus communis

2. Rhytidome	[Q] Cinnamon bark
	[R] Quinoline
	[S] Isoquinoline

(a) 1-[Q], 2-[S] (b) 1-[Q], 2-[R]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[Q]

2.6 The chief active constituents of some umbelliferous fruits are listed in [P] to [S]. Match them with their correct source.

Plant Source	Constituent Options
1. Foeniculum vulgare	[P] Anethole
2. Cuminum cyminum	[Q] Carvone
	[R] Khellin
	[S] Linalool

(a) 1-[S], 2-[Q] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[R]

2.7 Some substances used in tablet coating process are given. Match them with their correct use mentioned in [P] to [S].

Substance	Use Options
1. Shellac	[P] Polishing
2. Hydroxy propyl methyl cellulose	[Q] Seal coating
	[R] Film former
	[S] Sub-coating

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[R]

2.8 Some materials used in the manufacture of pharmaceutical dosage forms are given. Match them with their use mentioned in [P] to [S].

Material	Use Options
1. Sorbitol	[P] Preservative for capsules
2. Titanium dioxide	[Q] Plasticizer for soft gelatin capsules
	[R] Diluent for tablets
	[S] Opacifier for gelatin mass

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[S], 2-[P]

2.9 Given below are the aerosol systems. Match them with their correct propellants given in [P] to [S].

Aerosol System	Propellant Options
1. Aerosol for oral use	[P] Propane
2. Aerosol for topical use	[Q] Oxygen
	[R] Methane
	[S] Trichloro-monofluoro methane

(a) 1-[Q], 2-[S] (b) 1-[S], 2-[P]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.10 Some of the applications for immobilized enzyme systems are given below. Match with the process listed in [P] to [S].

Application	Process Options
1. Amino oxidase	[P] N-oxidation of drugs containing hydrazine
2. Flavoprotein oxidase	[Q] Resolution of DL-amino acid
	[R] D-Amino acid production
	[S] Nucleotide production from RNA

(a) 1-[Q], 2-[S] (b) 1-[Q], 2-[P]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.11 Systematic chemical names of the medicinal agents are given in [P] to [S]. Match them.

Medicinal Agent	Chemical Name Options
1. Indomethacin	[P] 13β-methyl-17β-hydroxy-18,19-dinor-17α-pregn-4-en-20-yn-3-one
2. Levonorgestrel	[Q] 13β-methyl-17β-hydroxy-18-nor-17α-pregn-4-en-20-yn-3-one
	[R] 1-(2-chlorobenzoyl)-5-methoxy-2-methyl indol-3-yl acetic acid
	[S] 1-(4-chloro benzoyl)-5-methoxy-2-methyl indol-3-yl acetic acid

(a) 1-[S], 2-[P] (b) 1-[R], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.12 Storage conditions as per I.P. for different preparations are given. Match them with the correct temperature prescribed.

Condition	Temperature Options
1. Cold	[P] Between 2°C and 8°C
2. Warm	[Q] Below 20°C
	[R] Any temperature between 30°C and 40°C
	[S] Above 40°C

(a) 1-[P], 2-[R] (b) 1-[R], 2-[P]
(c) 1-[Q], 2-[R] (d) 1-[P], 2-[S]

2.13 The wavelengths of two different regions of the electromagnetic spectrum are given from [P] to [S]. Match them.

Region	Wavelength Range (μm)
1. Infrared region	[P] 2.5 to 8.0 μm
2. Visible region	[Q] 0.4 to 0.8 μm
	[R] 0.8 to 0.35 μm
	[S] 0.4 to 2.0 μm

(a) 1-[Q], 2-[S] (b) 1-[R], 2-[Q]
(c) 1-[P], 2-[Q] (d) 1-[P], 2-[R]

2.14 Match the correct applications mentioned in [P]–[D] with the two equations

Equation	Application Options
1. Nernst equation	[P] Potential
2. Ilkovic equation	[Q] Migration current
	[R] Diffusion current
	[S] Conductance

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[P], 2-[R] (d) 1-[P], 2-[S]

2.15 Certain drug combinations are given below. Match them with the correct drug interaction given in [P] to [S].

Drug Combination	Interaction Options
1. Phenobarbitone and Digitoxin	[P] Induction of hepatic microsomal enzyme under digitalization
2. Aspirin and Methotrexate	[Q] Potentiation of the activity of digitalis
	[R] Less absorption of methotrexate
	[S] Displacement of protein-binding site → increased toxicity of methotrexate

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.16 Mechanism of action of drugs listed below are given in [P] to [S]. Match them.

Drug	Mechanism Options
1. α-Methyl Dopa	[P] Multiple sites including α_2 agonism
2. Minoxidil	[Q] Catecholamine release
	[R] Sympathetic neuronal block
	[S] Non-selective vasodilatation

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.17 Listed below are some important metabolic products of the drugs given in [P] to [S]. Match them.

Drug	Metabolite Options
1. p-Fluoro phenyl acetic acid glycine conjugate	[P] Paracetamol
2. Diphenyl methoxy acetic acid glucuronide conjugate	[Q] Dioxaline furoate
	[R] Haloperidol
	[S] Diphenhydramine

(a) 1-[Q], 2-[S] (b) 1-[R], 2-[S]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.18 Listed below is the percentage of protein binding of some drugs given in [P] to [S]. Match them.

% Protein Binding	Drug Options
1. 0%	[P] Oxyphenbutazone
2. 99%	[Q] Lisinopril
	[R] Hexobarbital
	[S] Morphine

(a) 1-[Q], 2-[P] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.19 The items listed from [P] to [S] can be identified by the tests given below.

Test	Identification Options
1. Coomb's test	[P] Candida albicans
2. Coagulase test	[Q] Virulent streptococcus aureus
	[R] Mycobacterium tuberculosis
	[S] Non-agglutinating antibodies

(a) 1-[Q], 2-[S] (b) 1-[S], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.20 For the following drugs, specific mechanisms of action are given in [P] to [S]. Match them.

Drug	Mechanism of Action Options
1. Spironolactone	[P] Non-competitively inhibits the enzyme carbonic anhydrase
2. Acetazolamide	[Q] Inhibits the transport of Na^+ and Cl^- in loop of Henle
	[R] Competitive inhibitor of aldosterone at the receptors in the distal tubule
	[S] Direct inhibition of Na^+ and Cl^- reabsorption at proximal portion

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.21 Given below are different Schedules as per the Drugs and Cosmetics Act. Match them with the items mentioned in [P] to [S].

Schedule	Description Options
1. Schedule FF	[P] Standards for ophthalmic preparations
2. Schedule M	[Q] Diseases or ailments for which a drug may not purport to prevent or cure
	[R] Life period of drugs
	[S] Requirements of factory premises

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.22 Two types of detectors are given below. Match them with the instrument given in [P] to [S].

Detector	Instrument Options
1. Flame ionization detector	[P] IR Spectrophotometer
2. Golay pneumatic detector	[Q] UV Spectrophotometer
	[R] Flame photometer
	[S] Gas chromatograph

(a) 1-[S], 2-[P] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.23 Appropriate structural formulae for Monocyclic monoterpene and Bicyclic monoterpene are given in [P] to [S]. Match them.

Type of Monoterpene	Structure Options
1. Monocyclic monoterpene	[P]
2. Bicyclic monoterpene	[Q]
	[R]
	[S]

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[P], 2-[S]

2.24 Two methods of sterilization are given for the materials listed from [P] to [S]. Match them.

Method	Material Options
1. Dry heat	[P] Rooms
2. γ-radiation	[Q] Plastic syringes
	[R] Talcum Powder
	[S] Intravenous admixture

(a) 1-[Q], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[Q] (d) 1-[P], 2-[S]

2.25 Listed are some of the microscopical characters of bark powder obtained from the plants mentioned in [P] to [S]. Match them.

Microscopical Characters	Plant Options
1. Narrow, slender, lignified phloem fibres occurring singly or in tangential rows of 2–5; lignified, colourless, narrow, sub-rectangular parenchyma with small starch grains; less amount of cork	[P] Cinchona succirubra
2. Wider phloem fibres, larger starch grains, longer fibres, abundant cork	[Q] Cinnamomum zeylanicum
	[R] Cinnamomum cassia
	[S] Holarrhena antidysenterica

(a) 1-[R], 2-[S] (b) 1-[P], 2-[Q]
(c) 1-[R], 2-[P] (d) 1-[Q], 2-[R]

PART – B

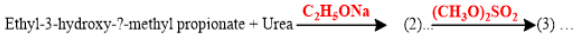
This section consists of 20 (TWENTY) questions of 5 (FIVE) marks each. Attempt any 15 (FIFTEEN) questions.

3. Draw the structure of **Anthraquinone, Oxanthrone, Anthranol, Anthrone,** and **Dianthrone.**

4. Starting from m-chloraniline, draw a scheme for the preparation of **chlorothiazide** and then **hydrochlorothiazide.** Give the structural formulae of all reactants, reagents and products.

5. Write complete equations for the following reaction:
(a) [1-(4-hydroxy phenyl)-2-amino propanol] + 1-phenoxy-2-propyl bromide → ?
(b) What is the common name of the medicinal agent formed?
(c) To which pharmacological category it can be included.

6. (a) Complete the following synthesis by writing the full equation:



(b) Streptomycin acts as a triacidic base - which groups are responsible for this.

7. Draw the structures of the products obtained at 1, 2, 3, 4, and 5.

8. (a) What is cell constant? How is it determined?
(b) Give the reason for the following:
(i) In conductometric titration the titrant should be at least ten times as concentrated as the solution being titrated.
(ii) Temperature control is important in conductometric titrations.

9. Name the type of stomata present in the following medicinal plants –
(a) Palisade ratio (d) Vein islet number
(c) Stomatal index (b) Stomatal number
(e) Vein islet termination number

10. Give the reagent used for detecting purine derivatives.

11. (a) How does Benzodiazepines produce the "Yin Yang" effect?
(b) How anxiolytic activity can be confirmed?
(c) Why presence of – S(OH) group confers shorter duration of action?
(d) Why intravenous solution of Diazepam cause precipitation when mixed with aqueous solution?
(e) What is the clinical use of Adenosine?

12. List the quality control tests specified in I.P. for injections.

13. A solution of a drug contained 1000 units/mL initially when prepared. It was analysed after a period of 40 days and was found to contain 600 units/mL. Assuming the decomposition is of first order, at what time will the drug have decomposed to one-half of its original concentration?

14. What are the five basic components present in tablet-compressing machines? Give their specific uses. (Answer each point in one sentence only.)

15. (a) Name the product of which freezing drying works.
(b) Name the four basic components of freeze dryer.

16. Define the following two terms (answers in one sentence each):
(i) Diplonid (ii) Plasmid (iii) Genome

17. Name four important components of a gas chromatograph.

18. Given below are the names of common micro-organisms and starting materials used for biosynthesis. Name the probable compounds formed or changes effected.
(i) Acetobacter suboxydans / D-Sorbitol
(ii) Rhizopus arrhizus / Progesterone
(iii) Curvularia lunata / Progesterone
(b) Name the enzymes present in the following microbes:
(i) Aspergillus oryzae (ii) Clostridium histolyticum

19. Some of the anticancer drugs act at the following specific sites in a manner exclusive for them:
(a) Converted to fraudulent and inhibits purine biosynthesis.
(b) Converted to fraudulent and inhibits thymidylate synthetase.
(c) Intercalates in DNA and stabilizes the DNA topoisomerase II complex.
(d) Binds tubulin and inhibits microtubule formation.
(e) Inhibits proliferation of lymphocytes.

Name the class of compounds accordingly.

20. (a) Give the mechanism of action of the following:
(i) Nystatin (ii) Griseofulvin (iii) Omeprazole
(b) (i) Give the names of the immediate precursors of catecholamines.
(ii) Which is the rate-limiting enzyme in catecholamine biosynthesis?

21. In the microbiological assay of Bacitracin I.P., mention:
(i) Method adopted (ii) Organism used
(iii) pH of the media (iv) Incubation time
(v) Incubation temperature

22. (a) Give three methods of recording the IR spectra of solids.
(b) Name two ways (phases) by which partition chromatography can be conducted.

Answer Key

PART (SECTION - I)

1.1- b	1.2 - a	1.3 - c	1.4 - a	1.5 - a	1.6 - b	1.7 - c	1.8 - a	1.9 - a	1.10 - b
1.11 - c	1.12 - b	1.13 - a	1.14 - c	1.15 - d	1.16 - d	1.17 - a	1.18 - b	1.19 - c	1.20 - b
1.21 - b	1.22 - a	1.23 – c	1.24 – b	1.25 - a					

PART (SECTION - II)

2.1- a	2.2 - d	2.3 - a	2.4 - d	2.5 - a	2.6 - b	2.7 - a	2.8 - a	2.9 - b	2.10 - b
2.11 - a	2.12 - d	2.13 - a	2.14 - c	2.15 - d	2.16 - d	2.17 - b	2.18 - a	2.19 - b	2.20 - c
2.21 - d	2.22 - a	2.23 - c	2.24 - c	2.25 - a					

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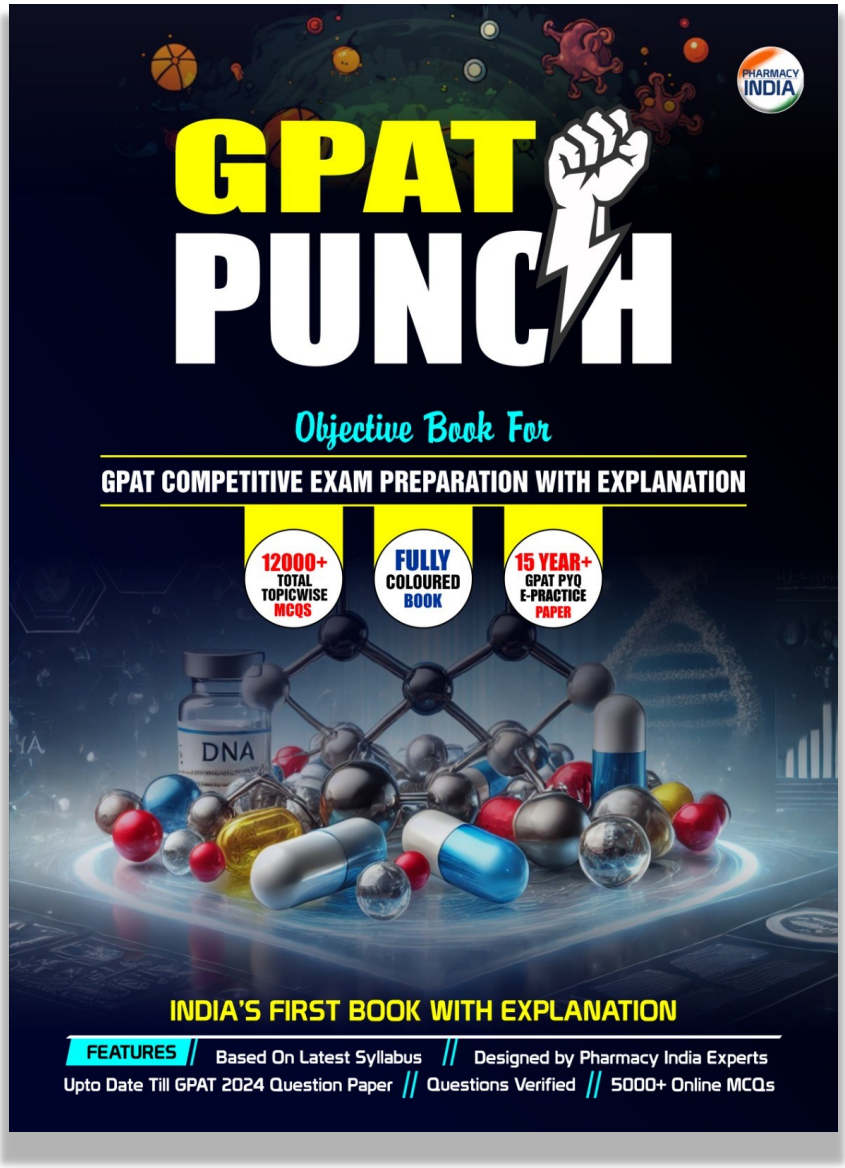

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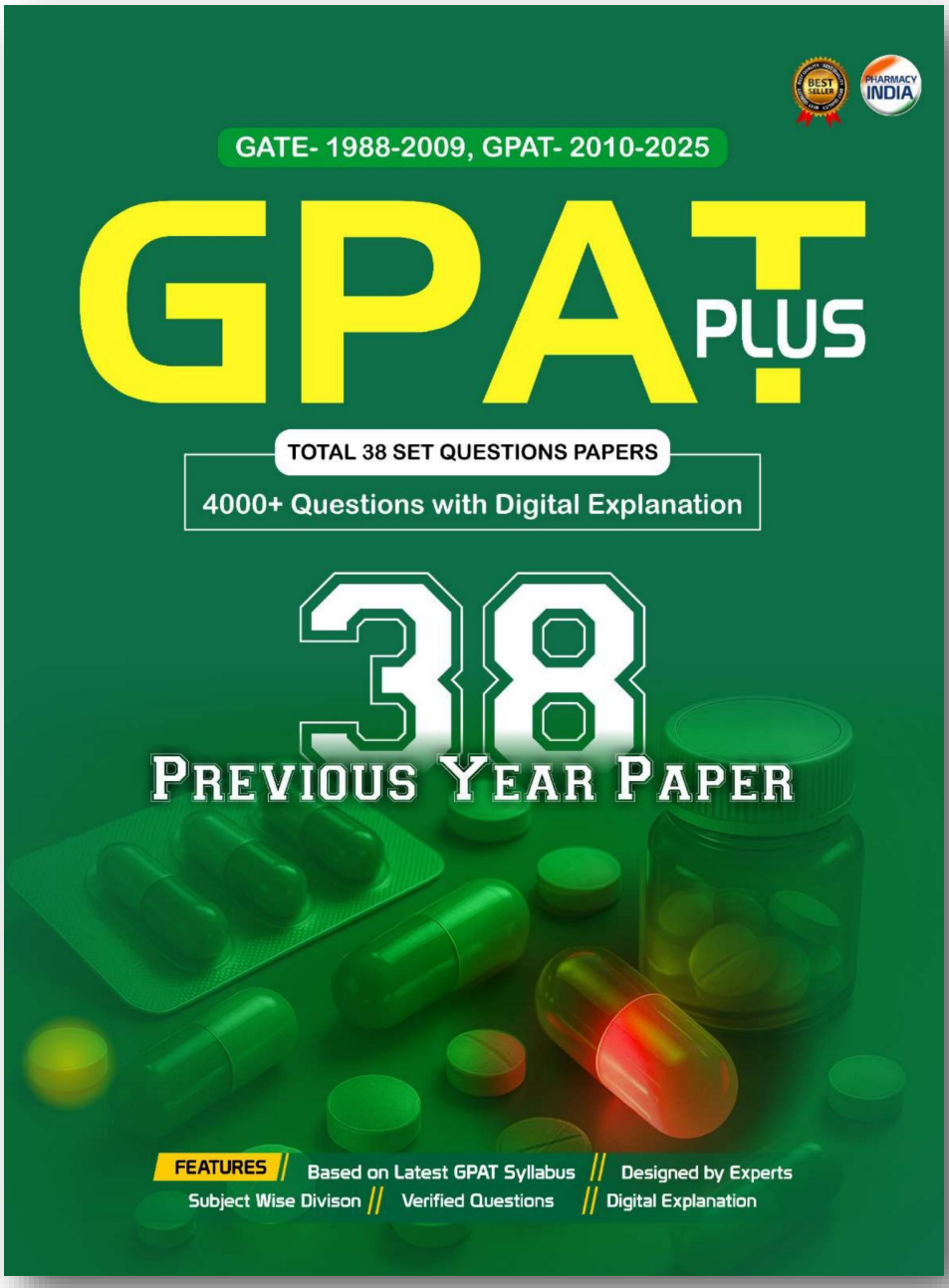

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