



Subject Title: PHARMACEUTICAL CHEMISTRY- THEORY

Subject Code: 20112

Important Instructions to examiners:

- The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- For programming language papers, credit may be given to any other program based on equivalent concept.
- As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No.	Sub No.	Answers	Marking Scheme
1		Answer any SIX of the following:	30M
1	a	Define the term Impurity. Discuss any four sources of impurities in pharmaceuticals Marking Scheme: Definition: 1M; Description of source of impurities: 1M each (Consider any four sources for 4M) Marking Scheme: Answer: Impurity: Undesirable matter which may or may not be toxic but present in the pharmaceutical substances. Sources of Impurities 1) Raw materials used in manufacture. 2) Processes used in manufacture. 3) Material of the plant 4) During storage 5) Accidental substitution or deliberate adulteration 6) Manufacturing hazards 1) Raw materials used in manufacture: <ul style="list-style-type: none">Traces of impurities in raw materials may be carried to contaminate the final product.E.g. common salt (NaCl) prepared from rock salt will almost certainly contain traces of calcium (Ca) and magnesium (Mg) compounds.Metallic zinc may be present as an impurity in zinc oxide (ZnO) sample as it is prepared by heating metallic zinc.	5M 1M 1M for each source-consider any 4 sources with explanation



Q. No.	Sub No.	Answers	Marking Scheme
		<p>2) Processes used in manufacture:</p> <ul style="list-style-type: none">• Some impurities are incorporated during the manufacturing process. This may occur due to• Reagents used in process.• Reagents added to remove other impurities.• Solvents - water is the cheapest solvent widely available. Tap water contains many ion impurities in small amounts like Cl⁻, Ca⁺⁺, Mg⁺⁺, Na⁺ etc• The intermediate products may come along the process in the final product as impurity <p>3) Material of the plant:</p> <ul style="list-style-type: none">• The vessels used in the manufacturing process are generally made up of metals like iron, copper, zinc, nickel, aluminium, and stainless steel. Due to the solvent action on the plant material the traces of metals i.e., impurities come in the product. Similarly, glass of an unsatisfactory standard and plastic containers used for handling liquid and semisolid products may yield traces of alkalies and antioxidants respectively. <p>4) During storage:</p> <ul style="list-style-type: none">• Filth - stored product may become contaminated with dust, insect, or insect excreta.• Decomposition of the product during storage - many chemical substances undergo changes or decomposition due to careless storage e.g., ferrous sulphate is slowly converted into insoluble ferric oxide by air and moisture.• Ether and chloroform decompose in the presence of light and air. Chloroform on decomposition gives carbonyl chloride (phosgene gas) so it should be stored in well filled, well-closed amber coloured bottle. <p>5) Accidental substitution or deliberate adulteration:</p> <ul style="list-style-type: none">• Accidental substitution can take place if toxic substances are stocked with other substances or compounds. Some pharmaceutical products may be adulterated with cheaper substitutes.• E.g., Honey may be adulterated with inverted sugar, potassium bromide with sodium bromide. <p>6) Manufacturing hazards:</p> <ul style="list-style-type: none">• Particulate contamination - accidental inclusion of dirt, glass, porcelain, metallic or plastic fragments from sieves, granulating, tableting, and filling machines or even from product containers is possible.	



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		<ul style="list-style-type: none">• Process error – Process errors arising from incomplete solution of solute in a liquid preparation must be detected by normal analytical procedures. Special care is required for highly potent medicaments of low dose (5 mg or less)• Cross contamination - the handling of powders, granules and tablets in large quantities creates considerable amount of air-borne dust and may lead to cross-contamination.<ul style="list-style-type: none">• Microbial contamination - liquid preparations and creams for topical application are prone to bacterial and fungal contamination. Special care should be taken in parenteral and ophthalmic preparations to avoid microbial contamination.• Packing errors - products of similar appearance as tablets of same size, colour and shape packed in similar containers may lead to mislabelling.	
1	b	<p>What do you mean by Volumetric analysis? Give it's classification depending on chemical reactions with one example of each</p> <p>Marking Scheme: Definition:1M; Classification with explanation of any four types:4M (1M for each class with example)</p> <p>Answer: Volumetric analysis:</p> <p>Volumetric (also known as titrimetric) analysis involves the gradual addition of a solution of accurately known concentration to the solution whose concentration is to be determined.</p> <p>OR</p> <p>Volumetric analysis involves the determination of volume of standard solution that reacts quantitatively and completely with the solution of the substance to be determined.</p> <p>Types of Volumetric analysis</p> <ol style="list-style-type: none">1. Acid-base or neutralization titration2. Redox or oxidation-reduction titration3. Precipitation titration4. Complexometric titration5. Non-aqueous titration <p>1. Acid-base or neutralization titration:</p> <ol style="list-style-type: none">i. An acid–base titration is a method of quantitative analysis for determining the concentration of an acid or base by exactly neutralizing it with a standard solution of base or acid having known concentration.ii. Thus, these are neutralization reactions with formation of salt and water as the end products.iii. A pH indicator is used to indicate the end point of acid-base neutralization reaction. <p>Ex:- $\text{NaOH} + \text{HCl} \longrightarrow \text{NaCl} + \text{H}_2\text{O}$</p>	<p>5M</p> <p>1M</p> <p>4M for classification along with explanation</p>

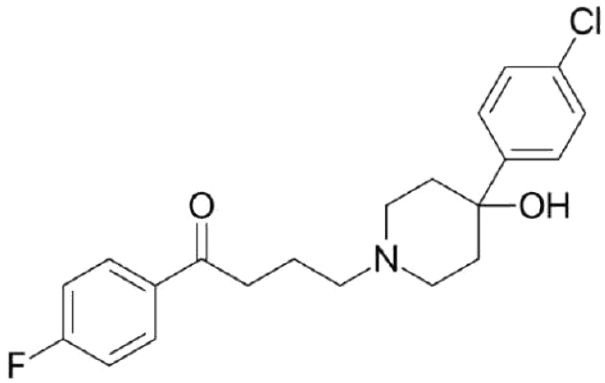


Q. No.	Sub No.	Answers	Marking Scheme
		<p>2. Redox or oxidation-reduction titration</p> <p>i. In redox reaction, Oxidation and reduction usually occur simultaneously. Oxidation reaction is the reaction where addition of oxygen or removal of hydrogen takes place, while in reduction, there will be addition of hydrogen or removal of oxygen.</p> <p>ii. Redox Titration reaction involves the transfer of electron between the reactant (titrant) and titrate takes place.</p> <p>iii. A redox titration is the same as an acid-base titration except it involves a redox reaction and generally does not require an indicator.</p> <p>iv. Various oxidising agents are employed in the reactions, and depending upon the agents used, they are classified into.</p> <p>1) Permanganate Titrations: Potassium permanganate is used as an oxidant it is also self-indicator.</p> <p>2) Dichromate Titrations: Potassium dichromate is used as an oxidant.</p> <p>3) Iodine Titrations: Iodine is used as an oxidising agent.</p> <p>4) Cerimetry: Ceric salts are used as oxidants.</p> $10\text{FeSO}_4 + 2\text{KMnO}_4 + 8\text{H}_2\text{SO}_4 \longrightarrow 5\text{Fe}_2(\text{SO}_4)_3 + \text{K}_2\text{SO}_4 + 2\text{MnSO}_4 + 8\text{H}_2\text{O}$	
		<p>3. Precipitation titration</p> <p>i. Precipitation titration is a type of titration which involves the formation of precipitate during the titration technique.</p> <p>ii. In precipitation titration, the titrant reacts with analyte and forms an insoluble substance called precipitate.</p> <p>iii. It continues till the last amount of analyte is consumed.</p> <p>iv. In this titration, a substance that precipitates from solution in a clearly visible form at the end point is used as an indicator, e.g. Potassium Chromate in Mohr's method, Ferric ammonium sulphate in Volhard's method etc</p> $\begin{array}{ccccccc} \text{AgNO}_3 & + & \text{X}^- & \rightarrow & \text{AgX} & + & \text{NO}_3^- \\ \text{(Silver nitrate)} & & \text{(halides)} & & \text{(silver halides-} & & \\ & & & & \text{white coloured precipitate)} & & \end{array}$ $\text{AgNO}_3 + \text{indicator} \rightarrow \text{Indicator complex (coloured) at the end point}$	
		<p>4. Complexometric titration</p> <p>When the formation of stable complex is the reaction involved, certain organic reagents such as ethylene diamine tetraacetic acid (EDTA) form a stable complex with various metal ions and are thus used for analysis of these metal ions</p>	



Q. No.	Sub No.	Answers	Marking Scheme
		<p>5. Non-aqueous titration</p> <p>When reaction takes place in non-aqueous solvent i.e. organic solvent. This type of titration is used for analysis of very weak acids and bases.</p>	
1	c	<p>Define Gastrointestinal agents. Classify with examples. Give uses of sodium bicarbonate & magnesium hydroxide</p> <p>Marking Scheme: Definition-1M; Classification with example – 2M; Use: 1M for each agent.</p> <p>Answer:</p> <p>Gastro-Intestinal Agents</p> <p>Agents used to treat gastrointestinal disturbance are known as gastrointestinal agents.</p> <p>Classification:</p> <div style="text-align: center;"> <pre> graph TD A[Gastrointestinal Agents] --> B[Acidifying agents] A --> C[Antacids] A --> D[Protective's & Adsorbent] A --> E[Saline Cathartics] B --- B1[Which increases acidity e.g. Dil HCl] C --- C1[Which Neutralized the excess of acid e.g. Sodium Bicarbonate] D --- D1[Which are used in the treatment of mild diarrhoea or dysentery e.g. Bismuth subcarbonate] E --- E1[Which bring about defecation (quickening or increasing evacuation from bowel e.g. Magnesium Sulphate)] </pre> </div> <p>Uses of Sodium bicarbonate: (0.5M for each use; consider any two uses)</p> <ul style="list-style-type: none"> Used as antacid Used as electrolyte replenishers Used in treatment of acidosis Used to produce systemic alkalosis <p>Uses of Magnesium hydroxide: (0.5M for each use; consider any two uses)</p> <ul style="list-style-type: none"> Used as non-systemic antacid Used as mild cathartic Used as a laxative to relieve occasional constipation. Used as an antacid to relieve indigestion, sour stomach, and heartburn 	<p>5M</p> <p>1M</p> <p>2M</p> <p>1M</p> <p>1M</p>
1	d	<p>Draw the structure of Haloperidol. Give its chemical name, uses, formulations & popular brand name.</p> <p>Marking Scheme: Structure of Haloperidol – 1M; Chemical name – 1M; Uses – 1M (0.5M for each use); Formulations – 1M; Brand name – 1M (Consider any one name)</p> <p>Answer:</p> <p>Structure of Haloperidol</p>	5M



Q. No.	Sub No.	Answers	Marking Scheme
		 <p>Chemical name: 4-[4-(4-chlorophenyl)-4-hydroxypiperidin-1-yl]-1-(4-fluorophenyl)butan-1-one</p> <p>Uses:</p> <ol style="list-style-type: none">Haloperidol is an antipsychotic agent used to treat schizophrenia and other psychoses, as well as symptoms of agitation, irritability, and delirium.It is used to treat uncontrolled movements and outbursts of words/sounds related to Tourette's syndrome.Haloperidol is also used for severe behavior problems in hyperactive children when other treatments or medications have not worked.Used in the control of agitated state of mania and schizophrenia. <p>Formulations of Haloperidol:</p> <p>Tablet, Oral solution, Injection,</p> <p>Brand name of Haloperidol:</p> <p>Haldol, Serenace, Hexidol, Halidace, Dolsi, Halopel, Hpl, Halobid <i>(any other brand name should be considered)</i></p>	1M 1M 1M (0.5M for each use) 1M for any two dosage form 1M for any one correct name
1	e	<p>State what are Sympathomimetic drugs? Classify and give the structure and uses of Nor-epinephrine.</p> <p>Marking Scheme: Definition – 1M; Classification – 2M; Structure – 1M; Uses – 1M for 2 uses.</p> <p>Answer:</p> <p>Sympathomimetic drugs</p> <ul style="list-style-type: none">A drug or other substances which has effects like or the same as adrenaline (epinephrine).An adrenergic agent is a drug, or other substance, which has effects similar to, or the same as, to those of adrenergic nerve stimulation or injection of epinephrine (adrenaline or drug which stimulate adrenergic nerve. <p>Classification: <i>(Consider any one method of classification)</i></p>	5M 1M 2M



Q. No.	Sub No.	Answers	Marking Scheme
		<p>I method</p> <ul style="list-style-type: none">• Catecholamines. Eg. Noradrenaline, adrenaline, isoprenaline, dopamine.• Noncatecholamines. Eg. Phenylephrine hydrochloride, Mephentermine sulfate,• Imidazoline: Eg. Naphazoline <p>II method</p> <ul style="list-style-type: none">• Directly acting (act directly on α or β receptors) -e.g. Epinephrine, Norepinephrine,• Indirectly acting (act by providing more norepinephrine to act on α or β receptors)- e.g. Amphetamine, hydroxyamphetamine, and propylhexedrine, pseudoephedrine• Mixed acting (act by both mechanisms)- e.g. ephedrine, Metaraminol <p>III method</p> <ul style="list-style-type: none">• alpha-adrenoceptor agonists (α-agonists) e.g. Phenylephrine• beta-adrenoceptor agonists (β-agonists) e.g. Terbutaline, Salbutamol• Both alpha and beta agonist- Adrenaline, Noradrenaline <p>Structure of Nor-epinephrine:</p> <p>Uses of Nor-epinephrine:</p> <ul style="list-style-type: none">• Used in the treatment of Low blood pressure.• Used to relieve bronchial spasm in asthma.• Used as vasoconstrictor in dental use.• Used in treatment of heart block• Used in the emergency treatment of allergic reactions, to treat low blood pressure during septic shock• Used in eye surgery to maintain dilation of the pupil.	<p>1M</p> <p>1M (0.5M for each use)</p>

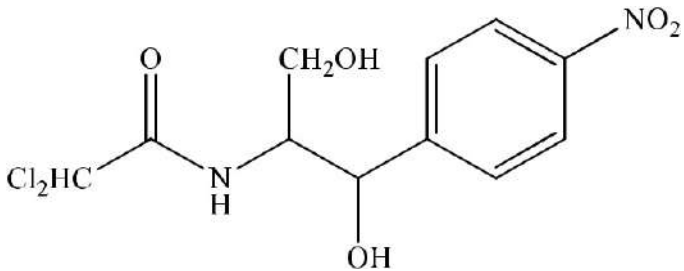


Q. No.	Sub No.	Answers	Marking Scheme
1	f	<p>Define and classify antimalarial drugs with example. Give structure and uses of Chloroquine phosphate</p> <p>Marking Scheme:</p> <p>Definition – 1M; Classification – 2M; Structure – 1M; Uses – 1M for 2 uses.</p> <p>Answer:</p> <p>Antimalarial Agents:</p> <p>The agents or drugs which prevent or cure the infectious disease malaria caused by protozoan plasmodium, characterized by successive chills fever, sweating and body pain.</p> <p>OR</p> <p>Antimalarial agents are a class of drugs specifically designed to treat and prevent malaria. These drugs work by targeting the malarial parasite, Plasmodium, which infects red blood cells and causes the disease.</p> <p>Classification:</p> <ol style="list-style-type: none"> Quinolines Antimalarials <ol style="list-style-type: none"> Cinchona Alkaloids – Quinine, Cinchonine 4-aminoquinolines – Chloroquine, Amodiaquine 8-aminoquinolines – Primaquine, Pamaquine Acridines dye – Quinacrine, Acriquine 4-quinoline carbinolamines – mefloquine Diaminopyrimidines – Pyrimethanamine Biguanides – Proguanil, Chloroproguanil Sulphones – Dapsone Misc. – Doxycycline. <p>Structure of Chloroquine phosphate</p> <p>OR</p>	<p>5M</p> <p>1M</p> <p>2M</p> <p>1M</p>



Q. No.	Sub No.	Answers	Marking Scheme
		<p>Uses:</p> <ul style="list-style-type: none"> • Chloroquine is used to prevent and treat malaria. • It is also used to treat liver infection caused by protozoa (extraintestinal amebiasis). • Chloroquine may also be used to treat coronavirus (COVID-19) in certain hospitalized patients. • To treat giardiasis, rheumatoid arthritis, systemic erythematosis. 	<p>1M (0.5M for each use)</p>
1	g	<p>Define and classify antibiotics giving suitable examples. Give structure and uses of Chloramphenicol.</p> <p>Marking Scheme: Definition – 1M; Classification with example – 2M; Structure – 1M; Uses – 1M for 2 uses.</p> <p>Answer:</p> <p>Antibiotics: Chemical compounds derived from living organism and capable to inhibit the growth of micro-organism or kill the micro-organism are called as antibiotics. OR The substances which <u><i>produced by micro-organism</i></u> and have capacity to inhibit the growth or destroy the microorganism are called as antibiotics.</p> <p>Classification:</p> <p>Chemical classification of antibiotics</p> <ol style="list-style-type: none"> 1. Beta-lactam antibiotics: <ol style="list-style-type: none"> a. Penicillin - Phenoxymethylpenicillin, flucloxacillin, amoxicillin. b. Cephalosporins - Cefaclor, cefadroxil and cephalexin. 2. Tetracyclines: Doxycycline and Minocycline. 3. Aminoglycosides: Streptomycin 4. Macrolides: Erythromycin, azithromycin 5. Polypeptides: Bacitracin, 6. Polyenes Antifungal antibiotics: Amphotericin, Nystatin and Candicidin 7. Ansamybins: Rifamycins (Rifampin, Rifampicin, Rifabutin) 8. Lincomycins: Clindamycin. 9. Quinolones: Ciprofloxacin, levofloxacin and norfloxacin 10. Antibiotics derived from single aminoacid: s-Cycloserine & Chloramphenicol 11. Miscellaneous: s-fusidic acid, griseofulvin, novobiocin etc <p><i>(Classification of antibiotics based on chemical structure is expected however if students write classification of antibiotics-based Mode of action or Spectrum of activity; the same should be considered for 1M)</i></p>	<p>5M</p> <p>1M</p> <p>2M</p>



Q. No.	Sub No.	Answers	Marking Scheme
		<p>Classification of antibiotics according to Mode of Action</p> <ol style="list-style-type: none"> Inhibitors of bacterial cell wall synthesis: Penicillin, Cephalosporins Inhibitors of Protein synthesis: Tetracyclines, Chloramphenicol, Macrolide, Aminoglycoside Inhibitors of Nucleic acids metabolism (DNA/RNA): Griseofulvin, Actinomycin <p>Classification of antibiotics depending on spectrum of activity</p> <ol style="list-style-type: none"> Narrow Spectrum: Bacitracin Broad Spectrum: Cephalosporin <p>Structure of chloramphenicol:</p>  <p>Uses of chloramphenicol:</p> <ol style="list-style-type: none"> It was used in the treatment of typhoid. It may be used as a second-line agent in the treatment of tetracycline-resistant cholera. It is also useful in the treatment of brain abscesses. It is also applied locally for treatment of ear, eye and skin infection. It is used in treatment of Rickettsia, Chlamydia and mycoplasma. 	<p>1M</p> <p>1M (0.5M for each use)</p>
2		Answer any <u>TEN</u> of the following:	30 M
2	a	<p>Explain principle and procedure involved in limit test for Iron.</p> <p>Marking Scheme: Principle-1.5M; Procedure- 1.5M</p> <p>Answer:</p> <p>Limit Test for Iron (Principle)</p> <ul style="list-style-type: none"> The limit test for iron is based on the interaction of iron with thioglycolic acid in the presence of citric acid and ammonia solution. Iron forms a purple-coloured ferrous thioglycolate complex. The original state of iron is insignificant as thioglycolic acid reduces ferric (Fe^{3+}) to ferrous ion (Fe^{2+}). 	<p>3M</p> <p>1.5M</p>



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		<ul style="list-style-type: none"> Subsequently, ferrous ions react with thioglycolic acid to form a coordination compound, namely the ferrous thioglycolate complex. This complex produces a purple colour only in an alkaline medium, which is why an ammonia solution is used. Citric acid is employed to prevent the precipitation of iron with ammonia. It forms an ammonium citrate buffer that maintains iron in solution by creating soluble complexes with iron. <div style="text-align: center; margin: 10px 0;"> <p style="text-align: center;"> $2\text{Fe}^{+3} + 2 \text{HS}-\text{C}(\text{H}_2)-\text{C}(=\text{O})-\text{OH} \longrightarrow 2\text{Fe}^{+2} + \text{C}_2\text{S}_2(\text{COOH})_2 + 2\text{H}^+$ Ferric ions Thioglycolic acid Ferrous ions Dithioglycolic acid </p> </div> <div style="text-align: center; margin: 10px 0;"> <p style="text-align: center;"> $2 \text{HS}-\text{C}(\text{H}_2)-\text{C}(=\text{O})-\text{OH} + \text{Fe}^{+2} \longrightarrow \text{Fe}(\text{S}_2\text{O}_2)_2 + 2\text{H}^+$ Thioglycolic acid Ferrous ions Ferrous thioglycolate complex </p> </div>													
		<p>Procedure:</p> <p>Prepare the standard solution (A) and the test solution (B) as mentioned in the following table and compare the purple colour against a white background.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Standard solution (A)</th> <th style="width: 50%;">Test solution (B)</th> </tr> </thead> <tbody> <tr> <td>In a Nessler's cylinder, Take 2.0 mL of iron standard solution (20 ppm Fe).</td> <td>In a Nessler's cylinder, add specific amount of sample as per IP and dissolve in 20 mL of water.</td> </tr> <tr> <td>Add 2 mL of a 20% w/v solution of iron-free citric acid.</td> <td>Add 2 mL of a 20% w/v solution of iron-free citric acid.</td> </tr> <tr> <td>Then, add 0.1 mL of thioglycolic acid, mix well, make alkaline with iron free ammonia solution.</td> <td>Then, add 0.1 mL of thioglycolic acid, mix well, make alkaline with iron free ammonia solution.</td> </tr> <tr> <td>Dilute to 50 mL with distilled water and allow to stand for 5 minutes</td> <td>Dilute to 50 mL with distilled water and allow to stand for 5 minutes.</td> </tr> <tr> <td colspan="2">View the colour intensity produced against white background and compare with standard</td> </tr> </tbody> </table>	Standard solution (A)	Test solution (B)	In a Nessler's cylinder, Take 2.0 mL of iron standard solution (20 ppm Fe).	In a Nessler's cylinder, add specific amount of sample as per IP and dissolve in 20 mL of water.	Add 2 mL of a 20% w/v solution of iron-free citric acid.	Add 2 mL of a 20% w/v solution of iron-free citric acid.	Then, add 0.1 mL of thioglycolic acid, mix well, make alkaline with iron free ammonia solution.	Then, add 0.1 mL of thioglycolic acid, mix well, make alkaline with iron free ammonia solution.	Dilute to 50 mL with distilled water and allow to stand for 5 minutes	Dilute to 50 mL with distilled water and allow to stand for 5 minutes.	View the colour intensity produced against white background and compare with standard		1.5M
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2	b	<p>Describe Mohr's method for precipitation titrations with reaction.</p> <p>Marking Scheme: Method-2M; Reaction- 1M</p> <p>Answer:</p> <p>Mohr's Method:</p> <ul style="list-style-type: none">• Mohr's method is a type of precipitation titration used to determine the concentration of chloride ions in a solution.• It is based on the reaction between silver nitrate (AgNO_3) and chloride ions (Cl^-) in an aqueous solution to form a silver chloride (AgCl) precipitate.• The Mohr's method involves the addition of a known volume of silver nitrate solution of known concentration to the solution containing chloride ions.• The silver nitrate is added until all the chloride ions have reacted, forming a white precipitate of silver chloride.• The endpoint of the titration is determined by using an indicator such as potassium chromate which gives a brick red precipitate at the end point of the titration.• The amount of silver nitrate solution added to the sample can be used to calculate the concentration of chloride ions present in the sample, using stoichiometry of the reaction.• It is a simple, inexpensive, and reliable method for the determination of chloride ions in aqueous solutions.• However, it may suffer from some limitations such as interference from other ions in the sample, and the need for careful handling of the silver nitrate solution due to its toxicity and light sensitivity. <p>Reaction:</p> $\begin{array}{ccccccc} \text{AgNO}_3 & + & \text{NaCl} & \rightarrow & \text{AgCl} & + & \text{NaNO}_3 \\ \text{Silver Nitrate} & & \text{Sodium chloride} & & \text{(Silver chloride)} & & \\ & & & & \text{(white coloured precipitate)} & & \end{array}$ $2\text{Ag}^+ + \text{CrO}_4^{2-} \rightarrow \text{Ag}_2\text{CrO}_4$ $\text{AgNO}_3 + \text{indicator} \rightarrow \text{indicator complex (Reddish brown) at the end point}$	<p>3M</p> <p>2M</p> <p>1M</p>
2	c	<p>Draw the structure from given IUPAC name .</p> <ol style="list-style-type: none">5, 5-diphenylimidazolidine-2, 4-dione.3 (2-chloro-10H-phenothiazin-10-yl)-N, N-dimethylpropan-1-amine7-chloro-1, 3-dihydro-1-methyl-5-phenyl-1, 4-benzodiazepine-2-one. <p>Marking Scheme: Each correct structure – 1M.</p>	3M



Q. No.	Sub No.	Answers	Marking Scheme
		<p>Answer:</p> <p>i. 5, 5-diphenylimidazolidine-2, 4-dione</p> <p>ii. 3 (2-chloro-10H-phenothiazin-10-yl)-N, N-dimethylpropan-1-amine</p> <p>iii. 7-chloro-1, 3-dihydro-1-methyl-5-phenyl-1, 4-benzodiazepine-2-one</p>	<p>1M</p> <p>1M</p> <p>1M</p>
2	d	<p>What are cholinergic antagonists? Give their examples. Name the drug used in Parkinsonism.</p> <p>Marking Scheme: Definition: 1M; Example: 1M (Any two examples); Drugs used in Parkinsonism – 1M (Any two drugs)</p> <p>Answer:</p> <p>Cholinergic antagonists:</p> <ul style="list-style-type: none">• Block or interfere with actions of acetylcholine (Ach)• Opposing the actions of the neurotransmitter acetylcholine.• Antagonise the actions of the muscarine so they are also called as antimuscarinic agents.• Inhibit the transmission of parasympathetic nerve impulses, thereby reducing spasms of smooth muscles.	<p>3M</p> <p>1M</p>



Q. No.	Sub No.	Answers	Marking Scheme
		<ul style="list-style-type: none">• These drugs do not prevent the release of acetylcholine at nerve endings, but they can act by competing with it, for the cholinergic receptor sites. <p>Examples of cholinergic antagonists: (Consider any two examples for 1M)</p> <ul style="list-style-type: none">• Atropine• Hyoscine• Homatropine• Ipratropium bromide• Cyclopentolate• Tropicamide• Clidinium bromide• Dicyclomine• Propantheline• Biperiden• Bentrropine <p>Drugs used in Parkinsonism: (Consider any two examples for 1M) Benztropine, Benzhexol, Biperiden, Procyclidine</p>	<p>1M (0.5M for each example)</p> <p>1M</p>
2	e	<p>Draw the structure of propranolol. Give its uses and popular brand name.</p> <p>Marking Scheme: Structure of propranolol-1M; Uses-1M (any two uses); Brand name-1M.</p> <p>Answer:</p> <p>Structure of propranolol</p> <p>Uses:</p> <ul style="list-style-type: none">• It is used to treat- tremors, angina (chest pain), hypertension (high blood pressure), heart rhythm disorders and Other heart or circulatory conditions.• It is also used to treat or prevent heart attacks, and to reduce the severity and frequency of migraine headaches. <p>Brand name: Betacap, Ciplar, Ciplar-LA, Inderal, Provanol, Pranosol, Besprol, Arminol; <i>(any other brand name should be considered)</i></p>	<p>3M</p> <p>1M</p> <p>1M (0.5M for each use)</p> <p>1M for anyone name</p>

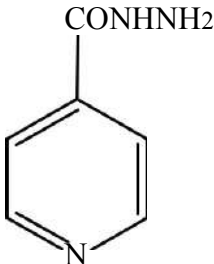
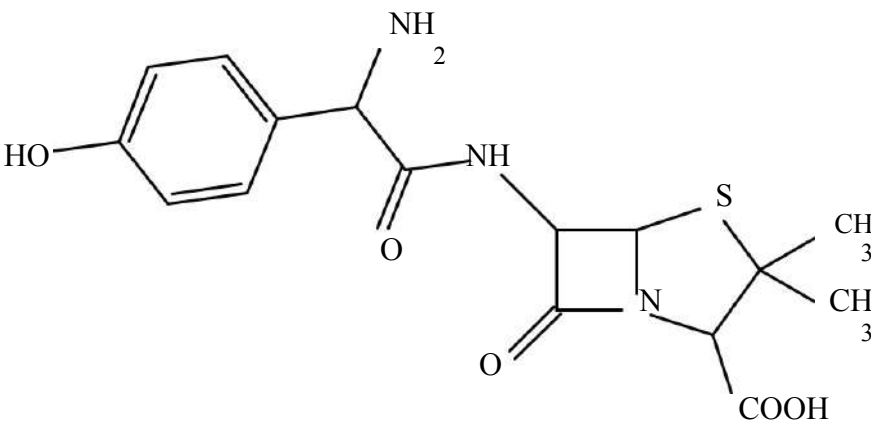


Q. No.	Sub No.	Answers	Marking Scheme												
2	f	<p>Classify diuretics with example. Write structure of frusemide.</p> <p>Marking Scheme: Classification with example: 2M (Consider any four classes); Structure: 1M.</p> <p>Answer:</p> <p>Classification of Diuretics:</p> <table><tbody><tr><td>1. Thiazide Diuretics</td><td>Hydrochlorthiazide, Chlorothiazide, Benzothiazide</td></tr><tr><td>2. Loop / High-ceiling Diuretics</td><td>Furosemide, Bumetanide, Ethacrynic acid, Torsemide</td></tr><tr><td>3. Carbonic anhydrase inhibitors</td><td>Acetazolamide, Methazolamide.</td></tr><tr><td>4. Potassium-sparing diuretics</td><td>Aldosterone antagonists: spironolactone Sodium channel blockers: amiloride and triamterene.</td></tr><tr><td>5. Osmotic diuretics</td><td>Mannitol, Urea, Glycerine</td></tr><tr><td>6. Methylxanthines</td><td>Aminophylline, Caffeine</td></tr></tbody></table> <p>Structure of frusemide</p> <p>2M (0.5M for each class with example)</p> <p>1M</p>	1. Thiazide Diuretics	Hydrochlorthiazide, Chlorothiazide, Benzothiazide	2. Loop / High-ceiling Diuretics	Furosemide, Bumetanide, Ethacrynic acid, Torsemide	3. Carbonic anhydrase inhibitors	Acetazolamide, Methazolamide.	4. Potassium-sparing diuretics	Aldosterone antagonists: spironolactone Sodium channel blockers: amiloride and triamterene.	5. Osmotic diuretics	Mannitol, Urea, Glycerine	6. Methylxanthines	Aminophylline, Caffeine	
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2	g	<p>What is Diabetes mellitus? Give structure and chemical name of metformin.</p> <p>Marking Scheme: Definition: 1M; Structure: 1M; Chemical Name: 1M</p> <p>Answer:</p> <p>Diabetes mellitus:</p> <p>Diabetes mellitus is a condition in which the pancreas no longer produces enough insulin or cells stop responding to the insulin that is produced, so that glucose in the blood cannot be absorbed into the cells of the body.</p> <p>OR</p> <ul style="list-style-type: none">• A group of diseases that result in too much sugar in the blood (high blood glucose)• Insulin deficiency• Hyperglycaemia	<p>3M</p> <p>1M</p>												



Q. No.	Sub No.	Answers	Marking Scheme
		<p>Structure of Metformin:</p> <p>Chemical Name of Metformin: 1,1-dimethylbiguanide or 1,1-dimethyl biguanidine hydrochloride</p>	<p>1M</p> <p>1M</p>
2		<p>State what are NSAID's? Give uses and popular brand names of Aspirin.</p> <p>Marking Scheme: Definition of NSAID's:1M; Uses:1M (0.5M for each use); Popular brand name: 1M for any one brand name.</p> <p>Answer:</p> <p>Nonsteroidal anti-inflammatory drugs (NSAID's):</p> <p>The drugs which do not have the steroidal nucleus & are used to diminish or reduce inflammation & give relief from pain in arthritis & rheumatic diseases are called non-steroidal anti-inflammatory agents. NSAIDs work by inhibiting the activity of cyclooxygenase enzymes (COX-1 or COX-2).</p> <p>Uses of Aspirin-</p> <ul style="list-style-type: none"> • Used as an antipyretic to reduce fever. • Used as an anti-inflammatory medication. • Used long-term to help prevent further heart attacks and blood clots (an antiplatelet activity). • Used for Angina (heart-related chest pain), heart attack and Stroke. • Used as an analgesic to relieve minor aches and pains. <p>Popular brand names of Aspirin-</p> <p>Ecosprin, Dispirin, Asprin, CV sprin, ASA, Loprin, Alpyrin, Anacin, Apidin <i>(any other brand name should be considered)</i></p>	<p>3M</p> <p>1M</p> <p>1M (0.5M for each use)</p> <p>1M</p>
2	i	<p>Define and classify antitubercular drugs. Draw the structure of Isoniazid (INH).</p> <p>Marking Scheme: Definition:1M; Classification:1M; Structure of Isoniazid:1M.</p> <p>Answer:</p> <p>Antitubercular drugs:</p> <p>Antitubercular medications are a group of drugs used to treat tuberculosis, a disease caused by Mycobacterium tuberculosis (M-TB).</p> <p>Classification of Antitubercular drugs-</p> <ol style="list-style-type: none"> a. p-amino salicylic acid derivative – e.g. PAS b. Pyridine derivatives – e.g. Isoniazid, Ethionamide c. Pyrazine derivatives- e.g. Pyrazinamide 	<p>3M</p> <p>1M</p> <p>1M</p>



Q. No.	Sub No.	Answers	Marking Scheme
		<p>d. Ethylene diamine derivatives – e.g. Ethambutol</p> <p>e. Fluoroquinolones- Ofloxacin, Levofloxacin, Moxifloxacin</p> <p>f. Antibiotics – e.g. Cycloserine, Streptomycin, Rifampicin</p> <p>Structure of Isoniazid:</p> 	1M
2	j	<p>What are β-lactum antibiotics? Give the structure and uses of Amoxicillin.</p> <p>Marking Scheme: Definition:1M; Structure:1M; Uses:1M (0.5M for each use)</p> <p>Answer:</p> <p>β-lactum antibiotics:</p> <ul style="list-style-type: none">Beta-lactam antibiotics are a class of antibiotics that contain a beta-lactam ring (a four membered cyclic amide ring) in their chemical structure. They are bactericidal agents that prevent bacteria from forming cell walls.Example: Penicillin, Cephalosporins <p>Structure of Amoxicillin:</p> 	3M
		<p>Uses of Amoxicillin:</p> <ul style="list-style-type: none">Amoxicillin is a penicillin antibiotic.It is used to treat bacterial infections, such as chest infections (including pneumonia) and dental abscesses.It is also used with other medications to treat stomach/intestinal ulcers caused by the bacteria H. pylori and to prevent the ulcers from returning.Used to treat bacterial infection such as middle ear infection, strep throat, pneumonia, skin infections, and urinary tract infections among others.	1M (0.5M for each use)



Q. No.	Sub No.	Answers	Marking Scheme
2	k	<p>Classify antineoplastic drugs with example. Discuss uses of cisplatin.</p> <p>Marking Scheme: Classification:2M (with examples); Uses:1M (0.5M for each use)</p> <p>Answer:</p> <p>Classification of Anti-neoplastic Agents</p> <ul style="list-style-type: none">• Alkylating agents: ✓ Mustine, Cyclophosphamide, Busulfan, Chlorambucil, Thiotepea.• Antimetabolites: ✓ Folic Acid Analogues - Methotrexate, ✓ Pyrimidine Analogues - Fluorouracil, ✓ Purine Analogues - 6-mercaptopurine, 6-thioguanine.• Antibiotics: (Anticancer Antibiotics) -Dactinomycin, Doxorubicin, Mitomycin-C, Daunorubicin.• Hormones and antagonists: Diethylstilbesterol, tamoxifem.• Plant products - Vinca alkaloids: Vincristine, Vinblastine• Enzymes: Asparaginase• Miscellaneous Agents: Cisplatin, Carboplatin, procarbazine, Hydroxyurea. <p>Uses of Cisplatin:</p> <ul style="list-style-type: none">• Cisplatin is particularly effective against testicular cancer.• Used to treat several cancers<ul style="list-style-type: none">○ Testicular cancer,○ Ovarian cancer,○ Cervical cancer,○ Bladder cancer,○ Head and neck cancer,○ Esophageal cancer,○ Lung cancer,○ Brain tumors.	<p>3M</p> <p>2M</p> <p>1M (0.5M for each use)</p>
3		Attempt ALL questions	20 M
		<i>Important Instructions: In case, multiple answer options are observed for the same sub question of question No. 3, the option (Answer) appearing first in the answer book shall be treated as answer and assessed accordingly.</i>	
3	a	<p>Guitzet's test apparatus is used to carry out limit test of _____</p> <p>Marking Scheme: 1M for correct answer.</p> <p>Answer: Arsenic</p>	1M



Q. No.	Sub No.	Answers	Marking Scheme
3	b	<p>Name the indicator used in the assay of sodium chloride.</p> <p>Marking Scheme: 1M for correct answer (Consider any one correct indicator)</p> <p>Answer: Potassium chromate or Ferric ammonium Sulphate (Ferric alum)</p>	1M
3	c	<p>State the uses of Hydrogen peroxide.</p> <p>Marking Scheme: 1M for correct use. (Consider any one correct use of H₂O₂)</p> <p>Answer: Antiseptic or Disinfectant or Oxidizing Agent or Bleaching Agent or Removal of wax from ears.</p>	1M
3	d	<p>Use of ferrous sulphate is _____</p> <p>Marking Scheme: 1M for correct use. (Consider any one correct use of FeSO₄)</p> <p>Answer: Haematinics or used to treat and prevent iron deficiency anaemia.</p>	1M
3	e	<p>Which one of the following five membered unsaturated heterocycle containing oxygen?</p> <p>i. Pyridine ii. Oxazole iii. Pyrrole iv. Furan</p> <p>Marking Scheme: 1M for correct option (Consider any one correct option)</p> <p>Answer: ii. Oxazole or iv. Furan</p>	1M
3	f	<p>The suffix "ole" is used for</p> <p>i. Five membered unsaturated ring ii. Six membered unsaturated ring iii. Five membered saturated ring iv. Six membered saturated ring</p> <p>Marking Scheme: 1M for correct option</p> <p>Answer: i) Five membered unsaturated ring</p>	1M
3	g	<p>Which of the following is not a five membered ring</p> <p>i. pyridine ii. Furan iii. Imidazole iv. Oxazole</p>	1M



Q. No.	Sub No.	Answers	Marking Scheme
		Marking Scheme: 1M for correct option Answer: i) pyridine	
3	h	The prefix Thia / Thio is used for a heteroatom_____ Marking Scheme: 1M for correct answer Answer: Sulphur	1M
3	i	Write brand name of phenytoin. Marking Scheme: 1M for any one correct brand name of Phenytoin Answer: Dilantin or Eptoin or FenToin or Episol or Celetoin or any other correct brand name of phenytoin	1M
3	j	In what dosage form diazepam is given? Marking Scheme: 1M for any one correct dosage form of diazepam Answer: Tablet or injection or Suppository or Syrup	1M
3	k	Acetyl-choline is an - i. Cholinergic blocker ii. Adrenergic blocker iii. Adrenergic agent iv. Cholinergic agent Marking Scheme: 1M for correct option Answer: iv) Cholinergic agent	1M
3	l	_____ is an imidazoline derivative and a direct active sympathomimetic amine with vasoconstrictive activity. Marking Scheme: 1M for correct answer Answer: Naphazoline	1M
3	m	Name the pharmacological category of quinidine sulphate. Marking Scheme: 1M for any one correct category Answer: Antiarrhythmic or Antimalarial	1M
3	n	Captopril is used in treatment of_____. Markin Scheme: 1M for correct answer Answer: Hypertension or high blood pressure.	1M



Q. No.	Sub No.	Answers	Marking Scheme
3	o	<p>Which of the following diuretic is a derivative of anthranilic acid -</p> <ol style="list-style-type: none">FrusemideUreaSpironolactoneEthacrynic acid <p>Marking Scheme: 1M for correct option Answer: i) Frusemide</p>	1M
3	p	<p>Mefanamic acid is used in _____</p> <p>Marking Scheme: 1M for any one correct use of mefenamic acid Answer:</p> <ul style="list-style-type: none">It is NSAID used to relieve mild to moderate painPain associated with Dysmenorrhea (Menstrual pain)Treatment of Rheumatoid arthritis and Osteoarthritis.	1M
3	q	<p>Crocic is a popular brand name of _____.</p> <p>Marking Scheme: 1M for correct answer Answer: Paracetamol</p>	1M
3	r	<p>Brand name of Remdesivir is _____.</p> <p>Marking Scheme: 1M for any one correct brand name Answer: Cipami or Remdac or Desrem or Redyx or Remwin or Remdiz or Remizac or Covifor or any other correct option.</p>	1M
3	s	<p>In what dosage form azithromycin is given?</p> <p>Marking Scheme: 1M for any one correct dosage form of azithromycin. Answer: Tablet or Syrup or Injection or Suspension</p>	1M
3	t	<p>Name antimetabolites used as antineoplastic agents.</p> <p>Marking Scheme: 1M for any one drug which is antimetabolites used as antineoplastic agents. Answer: Methotrexate, Mercaptopurine, Thioguanine, Fludarabine, Cladaribine, Fluorouracil, Cytarabine, Gemcitabin</p>	1M