SUMMER– 2022 EXAMINATION

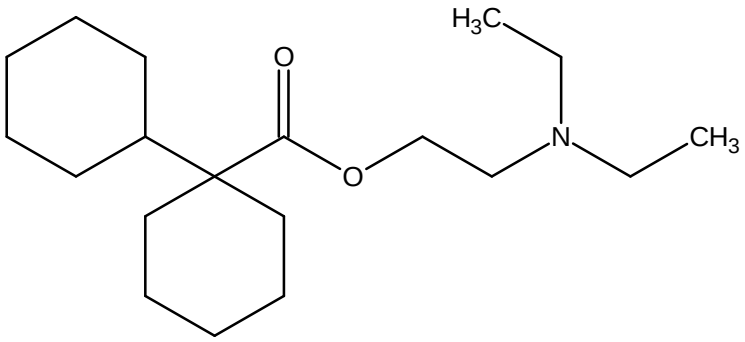
MODEL ANSWER

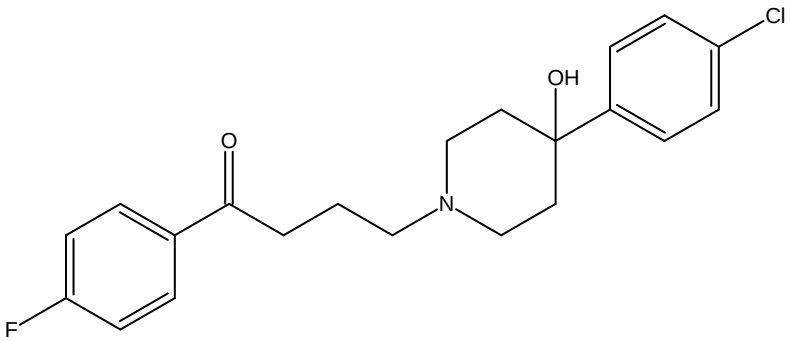
Subject Title: PHARMACEUTICAL CHEMISTRY Subject Code: **20112**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by the candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, the 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.
5) Credits may be given stepwise 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.
6) In case of some questions, credit may be given by judgement on part of the examiner of relevant answer based on the candidate's understanding.
7) For programming language papers, credit may be given to any other program based on an equivalent concept.
8) 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 in first year (first and second semesters) 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		**Attempt any SIX of the following:**	**30M**
1	**a**	**What is parasympatholytic agent? Classify it with suitable examples. Give the chemical structure, chemical name, and uses of Dicyclomine hydrochloride.** **Marking Scheme:** Definition – 1M; Classification with example – 1.5 M; Structure – 1 M; IUPAC Name: 0.5M; Uses: 1 M (2 uses) **Answer:** Parasympatholytic agents: Compounds which block the action of acetylcholine, (a neurohormone released in the parasympathetic system), is a parasympatholytic agent. Or A parasympatholytic agent is a substance or activity that reduces the activity of the parasympathetic nervous system. Or Antimuscarinic (or parasympatholytic, anticholinergic, atropine-like) drugs which antagonize the action of acetylcholine at muscarinic receptors **Classification of parasympatholytic agents-** *Chemical/structural classification* (method 1) a. Amino alcohol esters: e.g Atropine, Hyoscine, homatropine, Propantheline b. Amino Alkyl ethers: e.g.Benztropine, Chlorphenoxamine	**5M** **1M** **1.5M for** any one method classification

Q. No.	Sub No.	Answers	Marking Scheme
		c. Amino alcohols: e.g.Biperiden,Benzhexol, Procyclidine d. Amino amides: e.g.Aminopentamide, Isopropamide, Tropicamide ***Classification*** method 2 a. Natural: Solanaceous alkaloids and related compounds: E.g. Atropine, Hyoscine b. Semisynthetic Agents: E.g. Homatropine, Ipratropium bromide c. Synthetic drugs: i. Anti-secretory drugs: E.g. Clidinium, Diphenanil, Isopropamide ii. Antispasmodic drugs: E.g. Dicyclomine, glycopyrrolate, Propantheline iii. Mydriatic and cycloplegic drugs: E.g. Cyclopentolate, Tropicamide iv. Anti parkinsonism Drugs: E.g. Benztropine, Benzhexol, Procyclidine	**1M**
		Chemical structure of Dicyclomine Hydrochloride  **.HCl**	**0.5M**
		Chemical name 2-(diethylamino)ethyl [1,1'-bi(cyclohexane)]-1-carboxylate hydrochloride	**1M**
		Uses of Dicyclomine HCl: a. Dicyclomine is used to treat a certain type of intestinal problem called irritable bowel syndrome. b. Used as anticholinergics. c. It helps to reduce the symptoms of stomach and intestinal cramping. d. It is used in the treatment of abdominal pain.	**(Any 2 uses × 0.5)**
1	**b**	**Define Gravimetric analysis. State its principle and describe various steps involved in it.** **Marking Scheme:** Definition – 1M; Principle – 2M; Steps – 2M **Answer:** **Definition**: Gravimetric analysis, a method of quantitative chemical analysis in which the analyte is converted into a substance (of known composition) that can be separated from the sample and weighed.	**5M** **1M**

Q. No.	Sub No.	Answers	Marking Scheme
		Or Gravimetric analysis is a quantitative method for accurately determining the amount of a substance by selective precipitation of the substance from an aqueous solution. Or Gravimetric analysis is a method in analytical chemistry to determine the quantity of analyte based on the mass of a solid. **Principle:** The principle of gravimetric analysis is based on the estimation of the mass percent of an ion in an impure compound of known quantity by determining the mass of the same ion in a pure compound. In order to determine the mass, the ion of interest needs to be completely isolated. This isolation of ions is done with the help of precipitation The ion being analyzed is completely precipitated. **The steps commonly followed in gravimetric analysis are** 1. Preparation of a solution by using a known weight of the sample analyte. 2. Separation of the desired ion/element/radical in pure forms by various separation methods 3. After the ion has been separated, weighing the amount of the pure insoluble compound formed. 4. Calculating the value of the individual component of interest, based on the weight of the compound observed.	**2M** **2M**
1	**c**	**Draw the chemical structure of antipsychotics having piperidine nucleus. Give its chemical name, uses, formulations & popular brand name.** **Marking Scheme:** Name of antipsychotic having piperidine nucleus – 0.5 M; Structure – 1M; IUPAC name – 0.5M; Uses, formulations and popular brand name – each 1 M **Answer:** Antipsychotics having piperidine nucleus – Haloperidol **Structure of Haloperidol**  	**5M** **0.5M** **1M**

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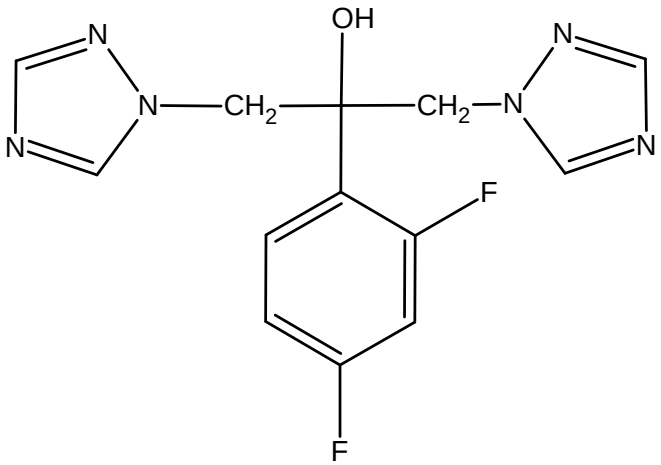
Q. No.	Sub No.	Answers	Marking Scheme
		Chemical Name of Haloperidol: 4-(4-(4-chlorophenyl)-4-hydroxypiperidin-1-yl)-1-(4-fluorophenyl)butan-1-one	**0.5M**
		Uses of haloperidol a. Haloperidol is an antipsychotic agent used to treat schizophrenia and other psychoses, as well as symptoms of agitation, irritability, and delirium. b. It is used to treat uncontrolled movements and outbursts of words/sounds related to Tourette's syndrome. c. Haloperidol is also used for severe behavior problems in hyperactive children when other treatments or medications have not worked. d. It is also used as antiemetic	**1M for any two uses**
		Formulations of haloperidol Tablets, Oral Solutions, Injections	**1M for each formulation**
		Popular brand names of haloperidol- (1 mark) – (*Assessor should consider other correct brand names)* Haldol, Halidace, Halobid, Hexidol, Dolteus, Serenace, Senorm LA Injection	**1M for two brand names**
1	**d**	**Draw the structure from the IUPAC name and write name of drug** **Marking Scheme:** Name of drug – 0.5 M; Structure – 2M **Answer:**	**5M**
		i) 2-(2,4-difluorophenyl)-1,3-di(1H-1,2,4,-triazol-1-yl) propan-2-ol	**0.5M**
		Name of drug – Fluconazole	**2M**
		Structure of Fluconazole 	

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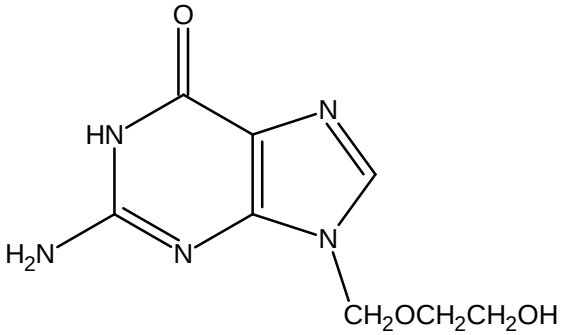
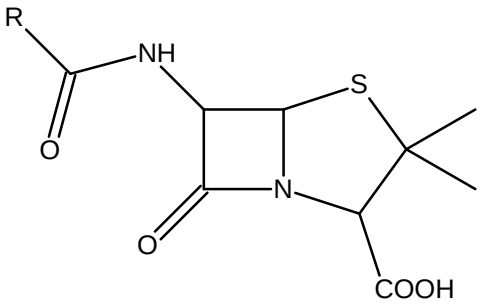
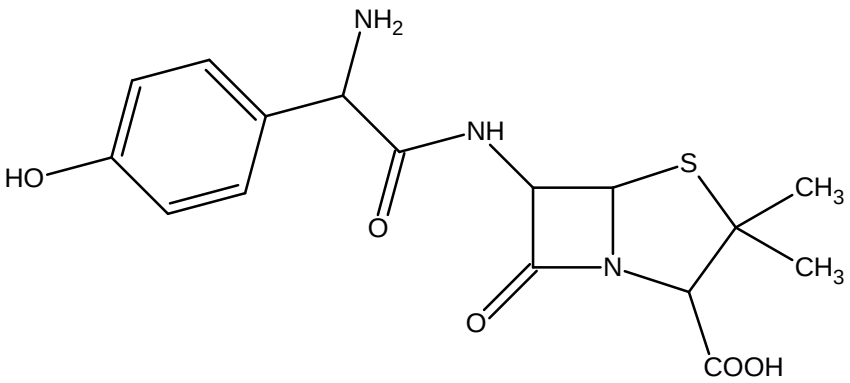
Q. No.	Sub No.	Answers	Marking Scheme
		ii) 2-amino-1,9-dihydro-9-[(2-hydoxyethoxy) methyl]-3H-purin-6-one Name of Drug – Acyclovir Structure of Acyclovir  	**0.5 M** **2M**
1	**e**	**Define and classify antimicrobial agents and explain their mechanism of action. Give pharmaceutical formulations, marketed preparations, storage conditions and uses of Boric acid.** **Marking Scheme:** Definition - 1M; Classification & Mechanism of action – 1.5M; Pharmaceutical formulation, marketed preparation and storage conditions – 0.5M each = 1.5M, Uses of boric acid – 1M. **Answer:** Antimicrobial Agent: An antimicrobial is an agent that kills microorganisms or stops their growth. An antimicrobial agent is defined as a natural or synthetic substance that kills or inhibits the growth of microorganisms such as bacteria, fungi and algae. **Classification and Mechanism of action:** Inorganic antimicrobial agents act by following mechanisms A. Oxidation – Hydrogen peroxide, Potassium permanganate B. Halogenation – Iodine, Bleaching powder C. Protein precipitation – Silver nitrate **Oxidation Mechanism:** a. The compounds act on protein containing sulphahydryl group (-SH). b. The sulphahydryl group present in microbial protein oxidised to a disulphide bridge. (–S—S–) c. Thus, alter the molecular shape of the protein, ultimately leading to the deactivation of the protein. d. 2 sulphahydryl group, –SH form a disulphide bridge (–S—S–) and inactivate its function.	**5M** **1M** **0.5M**

Q. No.	Sub No.	Answers	Marking Scheme
		Halogenation Mechanism: a. Halogenation – Addition of halogens (-Cl, -Br, -I, -F) b. Amide groups present in protein at peptide linkage undergo chlorination with change in molecular shape and ultimate destruction of the protein. c. Hence kills the microbes.	**0.5M**
		Protein precipitation a. A good number of polar groups as well as groups having lone pair of electrons always present in protein structure and they act as ligands b. It will form "Complexes" with transition metal cations. c. Thus, resulting in the precipitation of the protein.	**0.5M**
		Pharmaceutical formulations Products containing boric acid can be liquids, granules, pellets, vaginal tablets, wettable powders	**0.5M**
		Marketed preparations Azo vaginal tablets, Borosprit ear drops, Cebran DPS eye/ear drops, Moisol powder	**0.5M**
		Storage conditions Stored in a well-closed container, in a cool, dry place.	**0.5M**
		Uses a. Boric acid is widely used as an antiseptic for the treatment of minor cuts and burns. b. This compound is also used in medical dressings and salves (an ointment used to promote healing of the skin or as protection). c. Very dilute solutions of boric acid can be used as an eyewash. d. Owing to its antibacterial properties, boric acid can also be used for the treatment of acne in humans. e. In its powdered form, it can also be sprinkled into socks and shoes to prevent athlete's foot (tinea pedis).	**1M** for any two uses
1	**f**	**Classify antibiotics according to chemical structure with examples. Draw and explain the structure of the basic nucleus of Penicillin. Also give structure of Amoxicillin with its chemical name.** **Marking Scheme:** Classification with example – 1.5M; Structure of basic nucleus – 1M; explanation – 1M; Structure of amoxicillin – 1M; Chemical Name – 0.5M **Answer:**	**5M**

Q. No.	Sub No.	Answers	Marking Scheme
		Chemical Classification of Antibiotics	**1.5M**
		a. Beta-lactam antibiotics i. Penicillins - example: phenoxymethylpenicillin, flucloxacillin and amoxicillin. ii. Cephalosporins - example: cefaclor, cefadroxil and cephalexin. b. Tetracyclines - example: doxycycline and Minocycline. c. Aminoglycosides - example: streptomycin d. Macrolides - example: erythromycin, azithromycin e. Polypeptides- example: bacitracin, f. Polyenes Antifungal antibiotics- example: Amphotericin, nystatin and candicidin g. Ansamycins- example: Rifamycins (Rifampin, Rifampicin, Rifabutin) h. Lincomycins example: Clindamycin. i. Antibiotics derived from single amino acid:- Examples: Cycloserine & Chloramphenicol j. Miscellaneous:- Examples: fusidic acid, griseofulvin, novobiocin etc	
		Basic Structure of Penicillin  	**1M**
		Explanation of basic structure * The basic chemical structure of all penicillins consists of a beta-lactam ring, a thiazolidine ring, and a side chain (6-aminopenicillanic acid). The antibacterial activity of the penicillins lies within the beta-lactam ring. * Penicillin core structure, where "R" is the variable group	**1M** (0.5/point)
		Structure of Amoxicillin  	**1M**

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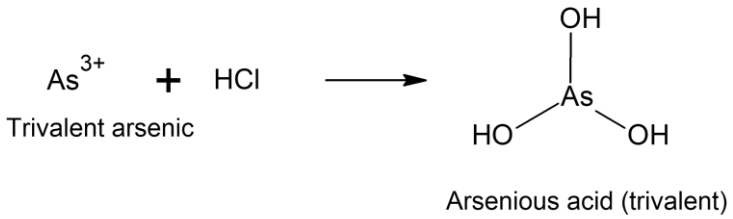
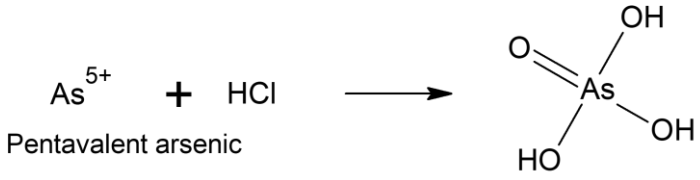
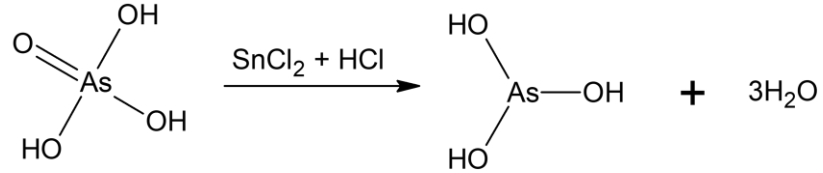
Q. No.	Sub No.	Answers	Marking Scheme
		Chemical Name of Amoxicillin: α-(p-hydroxy phenyl)- α- amino methyl penicillin OR α-amino-p-hydroxy benzyl penicillin	**0.5M**
1	**g**	**Explain reaction and principle involved in limit test of arsenic and draw a neat, labelled sketch of Gutzeit apparatus.** **Marking Scheme:** Reaction – 1.5M; Principle – 1.5M; Diagram – 2M **Answer:** **Limit Test for Arsenic – Reaction and Principle:** * It is also called as Gutzeit test and requires special apparatus called Gutzeit apparatus. * Limit test of Arsenic is based on the reaction of arsenic gas with hydrogen ion to form yellow stain on mercuric chloride paper in presence of reducing agents like stannous acid, potassium iodide. * The sample dissolved in stannated acid, which converts the arsenic impurities to arsenious acid to arsenic acid depending upon valency state of arsenic impurity present in the test sample.  Arsenious acid (trivalent)  Arsenic acid (pentavalent) * When acidic solution of sample treated with reducing agent (stannous chloride) converts pentavalent arsenic acid into trivalent arsenious acid  Arsenic acid (pentavalent) Arsenious acid (trivalent) * The Arsenious acid is then converted into gaseous hydride (arsine gas) with help of nascent hydrogen (which is produced by zinc and HCl).	**5M** **3M**

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Q. No.	Sub No.	Answers	Marking Scheme

$$H_3AsO_3 + 6\,H \longrightarrow AsH_3\uparrow + 3\,H_2O$$

Arsenious acid (trivalent) — Nascent Hydrogen — ARSINE GAS

* Arsine gas is carried through the tube by steam of hydrogen and out through the mercuric chloride paper. A reaction occurs between arsine and mercuric chloride which produces yellow colour stain.

$$AsH_3\uparrow + HgCl_2 \longrightarrow Hg(AsH_2)_2 + 2HCl$$

AsH_3: ARSINE GAS; $HgCl_2$: Mercuric Chloride Paper; $Hg(AsH_2)_2$: Mercuric Hydrogen Arsenide (Yellow/ Brown in colour)

Diagram of Gutzeit apparatus.

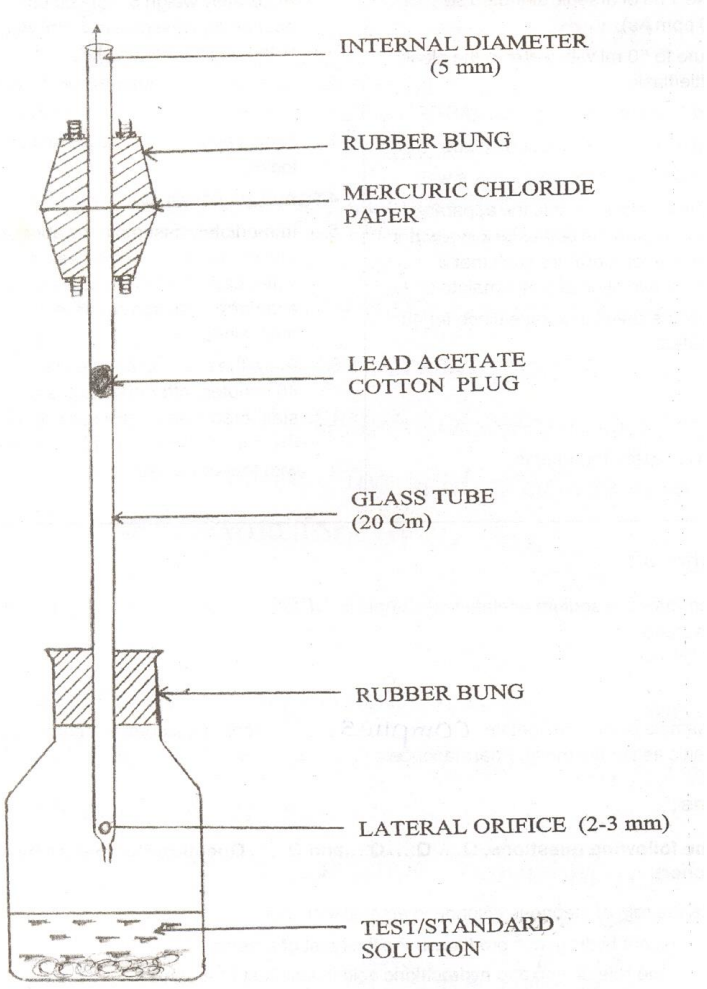

FIG : APPARATUS FOR ARSENIC LIMIT TEST

2M

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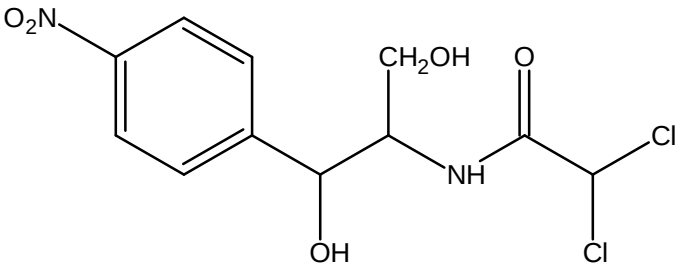
Q. No.	Sub No.	Answers	Marking Scheme
2		**Attempt any TEN of the following**	**30 M**
2	a	**Give any two brand names of -** **i) Diazepam** **ii) Amitryptyline** **iii) Carbamazepine** **Marking Scheme:** Two correct brand names of each drug – 1 M for each drug (Assessor should consider other correct brand names written by students) **Answer:** i. **Diazepam** - Valium, Calmpose, Sedanite ii. **Amitryptyline** - Eliwel, Amitone, Relidep, Amitrip, Tryptanol Amline, Tryptomer, Sarotena iii. **Carbamazepine** - Tegrital, Versitol Retard, Mazetol, Carbatol	**3M**
2	b	**Draw the chemical structure of chloramphenicol. Give its uses and brand name.** **Marking Scheme:** Structure – 1M; Uses – 1M (0.5M for each use); Brand names – 1M (two correct brand names) **Answer:** **Structure of Chloramphenicol**  **Uses of chloramphenicol:** * It is used in the treatment of bacterial infections. * It is used to treat bacterial eye infections. * Chloramphenicol has wide range of activity that includes gram positive and gram negative aerobic and anaerobic bacteria. * It is useful in treatment of typhoid fever, bacterial meningitis, Rickettsial Diseases etc. **Brand Name of Chloramphenicol:** Chlorostrep, O-mycin, Enterostrep, Enteromycin, Chloromycetin	**3M** **1M** **1M (0.5M×2 uses)** **1M (0.5M×2 brand name)**

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Q. No.	Sub No.	Answers	Marking Scheme
2	C	**State what is meant by 'Volumetric analysis. Enlist its types and explain one precipitation type of titration.**	**3M**
		Marking Scheme: Definition – 1M; List of its type – 1M; Explanation of any one precipitation type of titration – 1M	
		Answer:	
		Volumetric analysis: 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. Or Volumetric (also known as titrimetric) analysis involves the determination of volume of standard solution that reacts quantitatively and completely with the solution of the substance to be determined.	**1M**
		Types of Volumetric analysis 1. Acid-base or neutralization titration 2. Redox or oxidation-reduction titration 3. Precipitation titration 4. Complexometric titration 5. Non-aqueous titration	**1M**
		Precipitation titration • In precipitation titration, reaction occurs in which two ions bond together to form insoluble salt in the aqueous solution. The insoluble salt is referred to as precipitate. • The titrant reacts with the analyte and forms an insoluble substance. • The titration is continued till the last drop of analyte is consumed. • When the titrant is in excess it reacts with the indicator and signals termination of reaction by forming coloured precipitate.	**1M** for any one type of explanation
		Argentometric titrations: The titration in which silver nitrate (AgNO3) is used as a precipitating agent is named as argentometric titration. The titration is used to determine halides like Cl-, Br-, and I- $AgNO_3$ + X^- → AgX + NO_3 (silver nitrate) (halides) (silver halides white coloured precipitate) $AgNO_3$ + indicator → indicator complex (coloured) at the end point	

Q. No.	Sub No.	Answers	Marking Scheme

Types of argentometric titrations:

1. Mohr's method
2. Volhard's method
3. Fajan's method
4. Gay-lussac method

Mohr's method:

- The method was proposed by Mohr in 1856.
- The method is employed for the estimation of halides with standard solution of silver nitrate using potassium chromate as an indicator.
- The estimation is carried out in a neutral medium.
- Theory:
- In this method, the given chloride solution (NaCl) is titrated with a standard silver nitrate solution. When Cl- ions are precipitated as silver chloride (AgCl)

$$\mathbf{AgNO_3\ (aq) + NaCl\ (aq) \rightarrow AgCl\ (s) + NaNO3\ (aq)}$$

- A small amount of $K_2Cr_2O_4$ (potassium chromate) is added to the chloride solution which acts as an indicator.
- When $AgNO_3$ is gradually added, the end point is confirmed by the permanent appearance of brick red coloured precipitate of Ag2Cr2O4

$$\mathbf{Ag^+(aq) + Cl^-(aq) \leftrightarrow AgCl\ (s)}$$

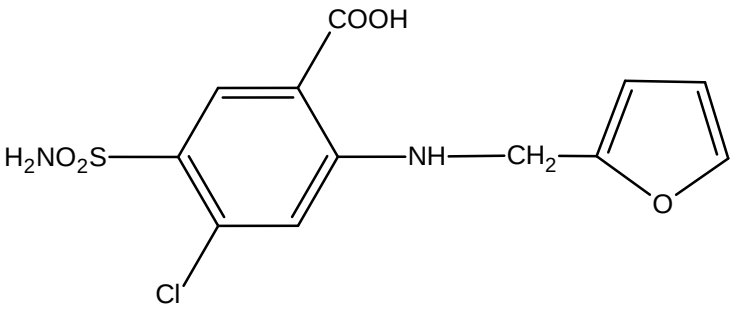
$$\mathbf{2Ag^+ + CrO_4^{2-} \leftrightarrow Ag_2Cr_2O_4}$$

Volhard's method:

- The method was first proposed by Volhard in 1874.
- Initially the method was developed for the estimation of silver ions, later halide estimation is also determined.
- The method is carried out in acidic medium
- Theory:
- The method involves the addition of an excess amount of silver nitrate ($AgNO_3$) solution to the halides for the back titration.

$$\mathbf{AgNO_3\ (aq) + KCl\ (aq) \rightarrow AgCl\ (s) + KNO_3\ (aq)}$$

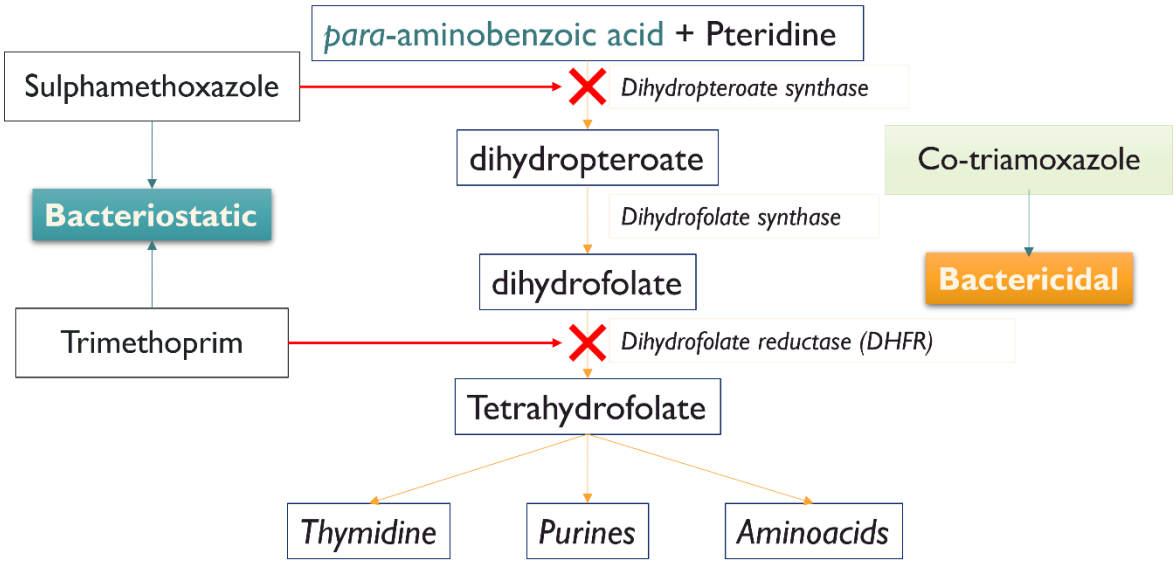
- The excess of silver ions is titrated against potassium thiocyanate (KSCN) or ammonium thiocyanate (NH_4SCN) using iron (III) salt as an indicator in acidic medium.
- The end point is detected by the formation of blood red colour (reddish brown colour)

Q. No.	Sub No.	Answers	Marking Scheme
		$AgNO_3 + KSCN \rightarrow AgSCN + KNO_3$ $Fe^{3+} + SCN^- \rightarrow Fe(SCN)_3$ **Fajan's method:** • It was introduced in the year 1923 by K.Fajan. • Adsorption indicators are used in this method e.g. fluoroscien, dichloro-fluorosciene, eosine etc. **Theory:** • It involves titration of $AgNO_3$ with any halide solution in presence of adsorption indicators. • Adsorption indicators adsorbs on the precipitate formed and gives pink colour. **Gay-Lussac's method:** • It is also known as turbidity method. • It involves titration of $AgNO_3$ with standard halide solution in presence of nitric acid and barium nitrate. • At the end point coagulation process is accelerated and disappearance of turbidity occurs.	
2	d	**What are diuretics? Draw the chemical structure of diuretics having furan nucleus. Give its chemical name and uses.** **Marking Scheme:** Definition – 1M; Structure 1M; Chemical name – 0.5 M; Uses – 0.5M **Answer:** **Diuretics:** Diuretics are drugs which increase the rate of urine excretion by kidneys. It acts by inhibiting reabsorption of sodium and its osmotic equivalent amount of water. A diuretic is any substance that promotes diuresis, the increased production of urine. **Frusemide/Furosemide has furan nucleus in its structure**  	**3M** **1M** **1M**

Q. No.	Sub No.	Answers	Marking Scheme
		Chemical name: 4-chloro-2-((furan-2-ylmethyl)amino)-5-sulfamoylbenzoic acid **Uses of Furosemide** * It is used as a diuretic. * It is useful for treatment of oedema associated with CHF, liver cirrhosis and renal diseases. * It is used to treat high blood pressure (hypertension).	**0.5M** **0.5M**
2	**e**	**Define 'Neoplasm' and classify antineoplastic agents with example.** **Marking Scheme:** Definition – 1M; Classification – 2M **Answer:** **Neoplasm** Neoplasm is the medical term for Cancer or tumor which means a relatively autonomous growth of tissues. The term neoplasm refers to an abnormal growth of tissue caused by the rapid division of cells that have undergone some form of mutation. A neoplasm is a type of abnormal and excessive growth of tissue. This abnormal growth usually forms a mass, when it may be called a tumor. **Classification of antineoplastic agents** **Antineoplastic drugs are medications used to treat cancer.** Classification: 1. Alkylating Agents. a. Nitrogen mustard drugs: Mustine, Chormabucil, cyclophosphamide b. Aziridines: Thiotepa c. Alkyl sulphonate: Busulphan d. Nitrosourea group compound: Lomustine 2. Antimetabolites: Methotrexate, Mercaptopurine, Azathioprine, Fluorouracil 3. Antibiotics: Actinomycin, Daunorubicin, Doxorubicin 4. Plant Products: Sulphates of vinblastine and vincristine. 5. Hormones and related drugs: Glucocorticoids, Tamoxifen 6. Miscellaneous agents: Hydroxyurea, Cisplatin	**3M** **1M** **2M**
2	**f**	**Enlist different "sources of impurities" and describe any two sources.** **Marking Scheme:** List of various sources of impurities – 1M; description of any two sources – 1M for each source	**3M**

Q. No.	Sub No.	Answers	Marking Scheme
		Answer: **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** * 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 **2. Processes used in manufacture** * 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 **3. Material of the plant** * 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. **4. During storage:** * 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	**1M** **2M** (1M for any two-source description)

Q. No.	Sub No.	Answers	Marking Scheme
		* 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. **5. Accidental substitution or deliberate adulteration** * 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. **6. Manufacturing hazards:** * 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. * Process error - gross 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 * 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	
2	**g**	**What is co-trimoxazole? Explain its mechanism of action and give two brand names of Co-trimoxazole.** **Marking Scheme:** Definition – 1M; Mechanism of action – 1.5M; Brand Name – 0.5M. **Answer:** **Co-trimoxazole:** An antibacterial drug composed of two active principles. Or Cotrimoxazole is the combination of two drugs i.e. Sulfamethoxazole and Trimethoprim in a proportion of 5:1.	**3M** **1M**

Q. No.	Sub No.	Answers	Marking Scheme
		Mechanism of action * Co-trimoxazole inhibits successive steps in the folate synthesis pathway. * Sulphamethoxazole - a sulfonamide derivatives - Dihydropteroate synthase inhibitor * Therapeutic effects induced by competing with p-aminobenzoic acid (PABA) in the biosynthesis of dihydrofolate. * Trimethoprim a competitive inhibitor of dihydrofolate reductase (DHFR) and blocks the conversion of folic acid to tetrahydofolic acid (THF). * Tetrahydrofolate is crucial in the synthesis of purines, thymidine, and methionine which are needed to produce DNA and proteins * Combination of Sulphamethoxazole and Trimethoprim by synergism produces a bactericidal effect.  **Brand names: (0.5 mark each for any two-brand name)** Septran, Spectra DS, Bactrim, Sulfatrim, Ciplin, Uritrim, Eeptabid, Sepmax	**1.5M** **0.5 M**
2	**h**	**Define and classify antihypertensive agents. Draw the chemical structure of captopril.** **Marking Scheme:** Definition – 1M; Classification – 1M; Chemical structure – 0.5M. **Answer:** Definition: An agent that reduces elevated blood pressure is called as an antihypertensive agent. The drugs which are useful for treatment of hypertension are called as antihypertensive agents.	**3M** **1M**

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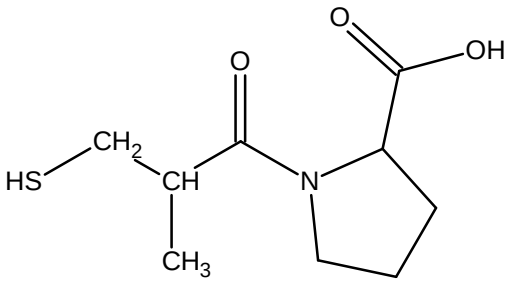
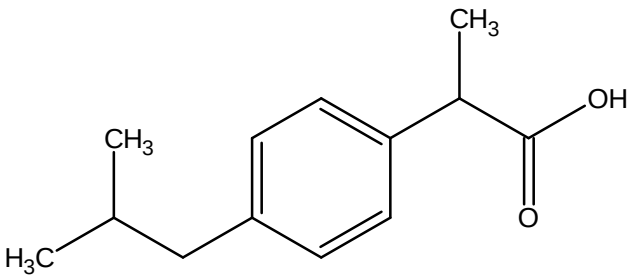
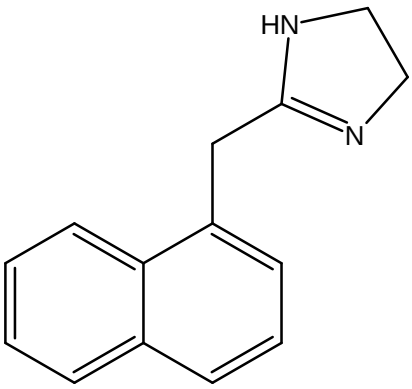
Subject Title: PHARMACEUTICAL CHEMISTRY Subject Code: **20112**

Q. No.	Sub No.	Answers	Marking Scheme
		Classification: 1. ACE inhibitors: Captopril, Enalapril, Ramipril 2. Angiotensin antagonist: Losartan, Candesartan 3. Calcium channel blockers: Verapamil, Nifedipine, 4. Diuretics: a. Thiazides: hydrochlorothiazide b. High ceiling: furosemide c. Potassium sparing: spironolactone 5. Beta-adrenergic blockers: Propranolol, Metoprolol, Atenolol 6. Alpha-adrenergic blockers: Prazosin, Terazosin 7. Alpha + beta adrenergic blockers: Labetalol, Carvedilol 8. Central sympatholytic: Clonidine, Methyldopa 9. Vasodilators: Hydralazine, Minoxidil sodium	**1M**
		Structure of Captopril  	**1M**
2	**i**	**Give structure, properties, uses and brand names of Ibuprofen** **Marking Scheme:** Structure – 1M; Properties – 0.5M; Uses – 1M; Brand Name – 0.5M. **Answer:** **Structure of Ibuprofen:**  **Properties:** * It occurs as white crystals or white crystalline powder having characteristic odour	**3M** **1M** **0.5M**

Q. No.	Sub No.	Answers	Marking Scheme
		* It is very slightly soluble in water but freely soluble in alcohol * It is soluble in aqueous solution of alkali **Uses:** * Ibuprofen is painkiller for a range of aches and pains including back pain, toothache or menstrual pain. (Used as analgesics and anti-inflammatory) * It also treats inflammation such as strains and sprains and pain from arthritis. **Brand Names:** Brufen, Ibugesic, Acifen	**1M for 2 uses** **0.5M**
2	**j**	**Classify Adrenergic drugs. Draw the structure and give the chemical name of Naphazoline**. **Marking Scheme:** Classification – 1.5 M; Structure – 1M; IUPAC Name – 0.5M **Answer:** **Adrenergic drugs**: A drug or other substances which has effects like or the same as adrenaline (epinephrine). **Classification of Adrenergic drugs** The adrenergic drugs can be classified based on their chemical structure. 1. Catecholamines – Adrenaline, Nor-adrenaline, Isoprenaline 2. Non-Catecholamines – phenylephrine, Salbutamol, Terbutaline, Ephedrine, Pseudoephedrine. 3. Imidazoline derivatives – Naphazoline, Tetrahydrozolium. **Structure of Naphazoline**  **Chemical Name** 2-(naphthalen-1-ylmethyl)-4,5-dihydro-1*H*-imidazole	**3M** **1.5M** **1M** **0.5M**

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MODEL ANSWER

Subject Title: PHARMACEUTICAL CHEMISTRY Subject Code: **20112**

Q. No.	Sub No.	Answers	Marking Scheme
2	k	**Explain Diabetes mellitus. Classify hypoglycemic agents with examples**	3M
		Marking Scheme: Explanation of disease with symptoms and types – 1.5 M; Classification – 1.5M	
		Answer:	
		Diabetes mellitus	1.5M
		∗ Metabolic disorders in which there are high blood sugar levels over a prolonged period. ∗ Diabetes mellitus is characterized by persistent hyperglycemia usually with glucosuria. The different factors involved in its origin are hereditary, immunological, age and stress. ∗ Symptoms includes hyperglycemia, glucosuria, ketonemia, ketonuria, hyperlipidemia, polyuria, polydipsia, Polyphagia, etc. ∗ Diabetes mellitus is divided into following types. o Type 1 – Insulin dependent or Juvenile Onset o Type 2 – Noninsulin dependent or Maturity onset o Gestational Diabetes – Onset of glucose intolerance in women during pregnancy. Excludes women who were diabetic before pregnancy.	
		Classification of Hypoglycemic agents 1. Insulin Preparation: Parenterally 2. Oral hypoglycemic agents – Orally	1.5M
		Insulin – ∗ Fast acting ∗ Intermediate acting ∗ Long acting	
		Oral hypoglycemic agents a. Sulfonylureas: Tolbutamide, Chlorpropamide, Tolazamide, Acetohexamide, Glipizide, Glyburide, Glimepiride, Glicazide b. Thiazolindiones: Rosiglitazone, Pioglitazone c. Biguanidines: Metformin, Phenformin d. Nonsulfonylureas: Metaglinides, Repaglinides, Nateglinides e. α-glucosidase inhibitor: Acarbose, Miglitol. f. DPP-4 inhibitors e.g.sitagliptin, saxagliptin, vildagliptin, linagliptin, alogliptin g. SGLT2 inhibitors: dapagliflozin and canagliflozin h. Cycloset: e.g.bromocriptine	

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MODEL ANSWER

Subject Title: PHARMACEUTICAL CHEMISTRY Subject Code: **20112**

Q. No.	Sub No.	Answers	Marking Scheme
3		**Attempt the following**	**20M**
3	a	**Select the drug from the following which act as alkylating agents.** A) 5-Fluorouracil B) Doxorubicin C) Cyclophosphamide D) Vincristine **Correct Answer: C) Cyclophosphamide**	**1M**
3	b	**In what dosage form Azithromycin is given?** **Answer:** * Azithromycin is given in following dosage forms * Azithromycin Oral Suspension * Azithromycin Capsule IP * Azithromycin Tablets IP * Azithromycin Dry Syrup * Azithromycin Injection	**1M For any two types**
3	c	**The basic heterocyclic ring present in phenytoin is _____.** A) Pyrazole B) Imidazole C) Imidazolidine D) Pyrazolidine **Correct Answer: C) Imidazolidine**	**1M**
3	d	**To prepare a solution of accurately known volume, use a_____.** A) Beaker B) Conical flask C) Volumetric Flask D) Measuring Cylinder **Correct Answer: C) Volumetric Flask**	**1M**
3	e	Cathartics are the drugs used to A) Relieve acidity B) Relieve constipation C) Reduce gastrointestinal irritation D) All of the above **Correct Answer: B) Relieve constipation**	**1M**
3	f	**In limit test for sulphate, to prevent the super saturation of BaSO4, a small amount of _____ has been added in the reagent.** A) Alcohol B) Dilute HCl C) Potassium sulphate D) Barium chloride **Correct Answer: A) Alcohol**	**1M**

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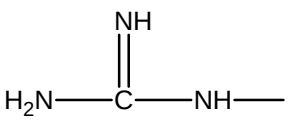
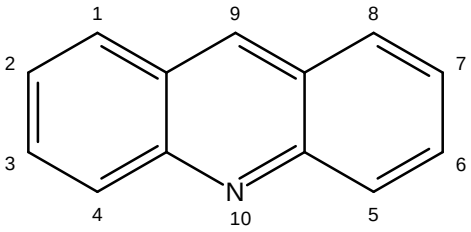
Q. No.	Sub No.	Answers	Marking Scheme
3	g	**To prevent the dental caries, toothpaste should contain** A) Strontium chloride B) Zinc chloride C) Sodium metaphosphate D) Sodium fluoride **Correct Answer: D) Sodium fluoride**	**1M**
3	h	**The antifungal drug, ketoconazole contains _____ heterocyclic ring** A) Imidazole B) Pyridine C) Acridine D) Pyrimidines **Correct Answer: A) Imidazole**	**1M**
3	i	**Lasix is a popular brand name of** A) Hydrochlorothiazide B) Furosemide C) Amiloride D) Acetazolamide **Correct Answer: B) Furosemide**	**1M**
3	j	**Name the antidepressant agent, which is a dibenzazepine derivatives** A) Citalopram B) Fluoxetine C) Imipramine D) Paroxetine **Correct Answer: C) Imipramine**	**1M**
3	k	**Match the followings.** 1. Class I a) Calcium channel blockers 2. Class II b) Beta-blockers 3. Class III c) Sodium channel blockers 4. Class IV d) Potassium channel blocker Options. A) 1-a, 2-b, 3-c, 4-d B) 1-d, 2-b, 3-a, 4-c C) 1-b, 2-c, 3-a, 4-d D) 1-c, 2-b, 3-d, 4-a **Correct Answer: D) 1-c, 2-b, 3-d, 4-a**	**1M**
3	l	**The Name of the following group is** 	**1M**

Q. No.	Sub No.	Answers	Marking Scheme
		A) Anilino B) Amidino C) Guanidino D) Amino **Correct Answer: C) Guanidino**	
3	m	**In what dosage form Isosorbide Dinitrate is given?** Isosorbide Dinitrate is given in following dosage form 1. Dilute Isosorbide Dinitrate IP 2. Isosorbide Dinitrate Capsule 3. Isosorbide Dinitrate Tablet	**1M for any two correct dosage form**
3	n	**Which of the following NSAID's is phenylacetic acid derivative?** A) Diflusinal B) Aspirin C) Mefenamic acid D) Diclofenac **Correct Answer: D) Diclofenac**	**1M**
3	o	**Give structure and method of numbering for Acridine.**  	**1M** **0.5 M** for structure **0.5M** for numbering
3	p	**Write name and uses of drug containing imidazoline heterocycle.** **Marking Scheme:** Name of drug – 0.5 M; Uses of drug – 0.5M *(Student may write another drug which contains imidazoline heterocyclic ring. Examiner needs to ensure it from structure of that drug)* **Answer:** The drug containing imidazoline heterocycle is **Clonidine** **Uses of Clonidine – Useful for treatment of** 1) Hypertension, 2) Attention Deficit Hyperactivity Disorder 3) Drug Withdrawal (Opioid, Alcohol, or Nicotine 4) Menopausal flushing 5) Diarrhoea 6) Spasticity 7) certain pain conditions.	**1M** **0.5 M** **0.5M For one use**

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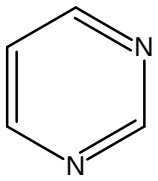
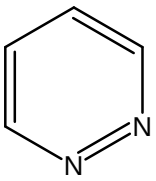
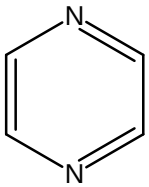
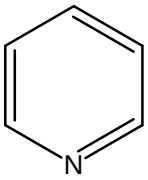
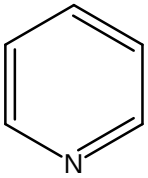
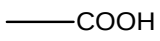
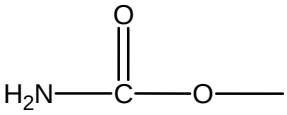
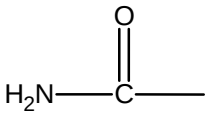
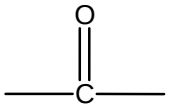
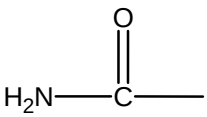
Subject Title: PHARMACEUTICAL CHEMISTRY Subject Code: **20112**

Q. No.	Sub No.	Answers	Marking Scheme
3	q	**The structure of pyridine ring is** A.  B.  c.  D.  **Correct Answer: D)** 	**1M**
3	r	**2-acetoxybenzoic acid is the IUPAC name of?** A) Paracetamol B) Aspirin C) Mefenamic acid D) Ibuprofen **Correct Answer: B) Aspirin**	**1M**
3	s	**The structure of carbamoyl group is** A.  B.  c.  D.  **Correct Answer: c)** 	**1M**

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MODEL ANSWER

Subject Title: PHARMACEUTICAL CHEMISTRY Subject Code: **20112**

Q. No.	Sub No.	Answers	Marking Scheme
3	**t**	**Which of the following drug is a direct acting cholinomimetic agent?** A) Parathion B) Physostigmine C) Carbachol D) Pyridostigmine **Correct Answer: C) Carbachol**	**1M**