DIGESTER

MODULE 1

Rapid Revision Notes

- Physical Chemistry
- Organic Chemistry
- Inorganic Chemistry
- Pharmaceutical Analysis
- Medicinal Chemistry

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GPAT DISCUSSION CENTER

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DIGESTER

Rapid Revision Notes

MODULE - I

YOUR GATEWAY TO SUCCESS

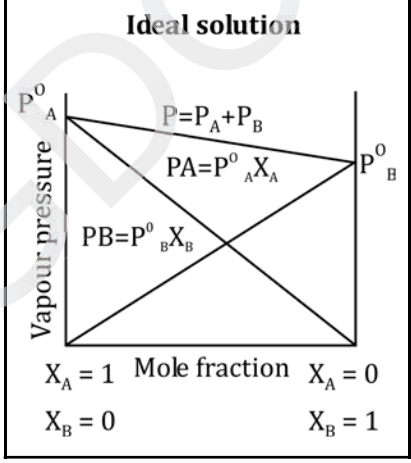
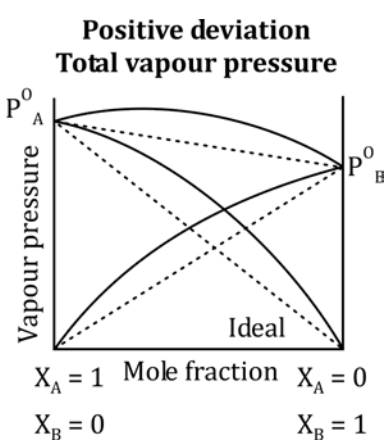
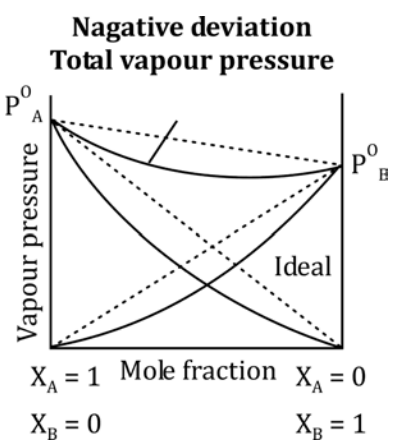
GPAT DISCUSSION CENTER

GPAT I NIPER I DRUG INSPECTOR I PHARMACIST

Dalton's law of partial pressures	The total pressure exerted by a mixture of gases is equal to the sum of the partial pressures exerted by each individual gas in the mixture. **$P_{total} = \sum ni=1pi$ (or) $P_{total} = P1 + P2 + P3 + ... + Pn$** Where, **$P_{total}$ = Total pressure exerted by the mixture of gases** **P1, P2,..., Pn are the partial pressures of the gases 1, 2,..., 'n' in the mixture of 'n' gases is the total pressure exerted by the mixture of gases**

DIGESTER –4

IDEAL AND NON IDEAL SOLUTION

IDEAL SOLUTION	NON-IDEAL SOLUTION	
	SOLUTION HAVING POSITIVE DEVIATION	SOLUTION HAVING NEGATIVE DEVIATION
They obey Raoult's law	They do not obey Raoult's law	They do not obey Raoult's law
A-B = A-A or B-B interactions	A-B < < A-A or B-B interactions	A-B > > A-A or B-B interactions
$\Delta H_{mix} = 0$	$\Delta H_{mix} > 0$	$\Delta H_{mix} < 0$
$\Delta V_{mix} >= 0$	$\Delta V_{mix} > 0$	$\Delta V_{mix} < 0$
Does not form an azeotrope miture	Forms azeotrope mixture	Forms azeotrope mixture
Example : Benzene and toluene, Hexane and heptane, All the dilute solutions nearly behave as an ideal solution	Example : Acetone and Carbon disulphide, Acetone and Benzene, Carbon Tetrachloride and Toluene, Acetone and Ethanol, Ethanol and Water	Example : Chloroform and Benzene, Chloroform and Diether, Acetone and Aniline, Nitric Acid and water, Acetic Acid and pyridine, Hydrochloric Acid and water
		

DIGESTER –12

IMPORTANT TERMIOLOGY IN ELECTROCHEMISTRY

TERM	DESCRIPTION
Specific conductivity	Measure of the ability of that material to conduct electricity. SI unit of conductance is **S (Siemens).** $\mathbf{K = \frac{1}{\rho}}$ Where, K = Conductivity ρ = Restivity of material
Molar conductivity	Conductance property of a solution containing one mole of the electrolyte. $\Lambda_m = \kappa \times \frac{1000}{\text{Molarity}}$
Equivalent conductance	Net conductance of every ion that is produced from one gram equivalent of a given substance. $\Lambda_{eq} = \kappa \times \frac{1000}{\text{Normality}}$
Faraday's First Law	The mass of a substance deposited or liberated at any electrode is directly proportional to the amount of charge passed. $\mathbf{Z = \frac{Eq.Wt}{96500}}$ Where, Z = Electrochemical Equivalent
Faraday's Second Law	Mass of a substance deposited or liberated at any electrode on passing a certain amount of charge is directly proportional to its chemical equivalent weight. Charge on one mole electrons = 1F = 96487 C $\frac{W_1}{W_2} = \frac{E_1}{E_2}$ Where, W_1 W_2 = Weight of substance E_1 E_2 = Equivalent weight
Kohlrausch's law	Equivalent conductivity of an electrolyte at infinite dilution is equal to the sum of the conductance of the anions and cations. $\lambda^{\infty}_{eq} = \lambda^{\infty}_{c} + \lambda^{\infty}_{a}$ **Where** λ^{∞}_{eq} **= Equivalence conductivity at In finite Dilution** λ^{∞}_{c} **= Conductivity of Cation** λ^{∞}_{a} **= Equivalence conductivity at Anion**
EMF series	Arrangement of elements in order of their increasing electrode potential values.

DIGESTER –20

STEREO ISOMERISM

Geometrical isomerism	Geometrical isomerism is possible in cyclic compounds There should be restriction of rotation if two carbons are linked with a cyclic structure.	
	Nomenclature of geometrical isomerism	
	Cis –Trans System	If same groups at same side then cis and if same groups at different side then trans. **Physical properties of cis-trans** Dipole moment = cis > trans Boiling point = cis > trans Melting point = trans > cis Stability = trans > cis
	E – Z System	**E (Entgegen):** When high priority groups are opposite side. **Z (Zussaman):** When high priority groups are same side.
Optical isomerism	Two or more than two compound have same molecular formula, some structural formula but different behavior towards plane polarized light. Specific rotation- Rotation produced by a solution of length of 10 centimeters and unit concentration (1 g/mL) for the given wavelength of the light at the given temperature. Specific roration, $[\alpha]^{t^{\circ}C}_{wavelenght} = \frac{\alpha_{obs}}{l \times C}$ **Racemic mixture:** Mixture of d and l isomer. **Meso form:** Optical isomer with a plane of symmetry.	
	Nomenclature of Optical isomerism	
	R-S system	Configuration R is given to the isomer in which sequence of groups is clockwise. Configuration S is given to the isomer in which sequence of groups is anticlockwise.
	D-l system	Dextro (d): The optical isomer which rotates the plane of the polarized light to the right (Clockwise) is known as dextrorotatory isomer. Laevo (l): The optical isomer which rotates the plane of the polarized light to the left (Anticlockwise) is known as laevorotatory isomer.
	Threo-erythro system	Same groups are present at the same side of the carbon chain erythro form. Same groups are present on the opposite side of the carbon chain threo form.
Conformational isomerism	Free rotation of carbon-carbon single bond, different arrangement of atoms in space are obtained. These arrangements are called conformers.	
	Staggered conformation	Atoms or groups bonded to carbons at each end of a C-C bond are as far apart as possible.
	Eclipsed conformation	Atoms bonded to carbons at each end of a carbon-carbon bond are directly opposed to one another.
	Skew or Gauche conformation	All other conformations in between eclipsed and staggered conformations.

DIGESTER –31

COMPARISON BETWEEN HYBRIDIZATIONS

Sp	Sp^2	Sp^3
Sp hybridization is the hybridization that takes place between an **s** atomic orbital and a **p** atomic orbital.	$\mathbf{Sp^2}$ hybridization is the mixing of one **s** atomic orbital with two **p** atomic orbitals.	$\mathbf{Sp^3}$ hybridization is the mixing of one **s** atomic orbital with three **p** atomic orbitals.
S characteristic percentage is 50%.	**S** characteristic percentage is 33.33%.	**S** characteristic percentage is 25%.
P characteristic percentage is 50%.	**P** characteristic percentage is 66.66%.	**P** characteristic percentage is 75%.
Angle between orbitals is 180° C.	Angle between orbitals is 120° C.	Angle between orbitals is 109.5° C.
Geometry of orbital arrangement is linear.	Geometry of orbital arrangement is trigonal planar.	Geometry of orbital arrangement is tetrahedral.
Results in two unhybridized **p** orbitals.	Results in one unhybridized **p** orbitals	Does not result in any un-hybridized **p** orbitals.

DIGESTER –32

BOND LENGTH

BOND	BOND LENGTH (Å)
C-C	1.54
C=C	1.34
C≡C	1.20
C-H(sp^3-s)	1.112
C-H(sp^2-s)	1.103
C-H(sp-s)	1.08
C-O	1.40

DIGESTER –33

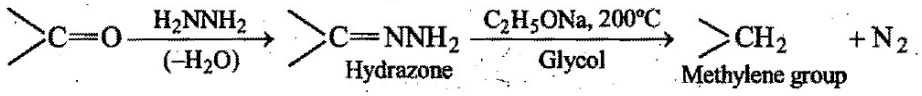
BOND ENERGY

BOND	BOND ENERGY (KCAL/MOL)
C-C	83
C=C	146
C≡C	192
C-H(sp^3-s)	97
C-H(sp^2-s)	104
C-H(sp-s)	120
C-O	186

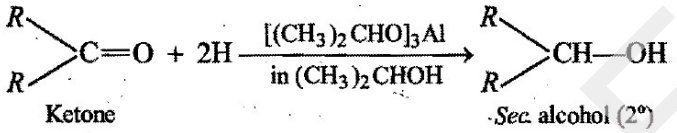
DIGESTER –34

IMPORTANT NAME REACTION

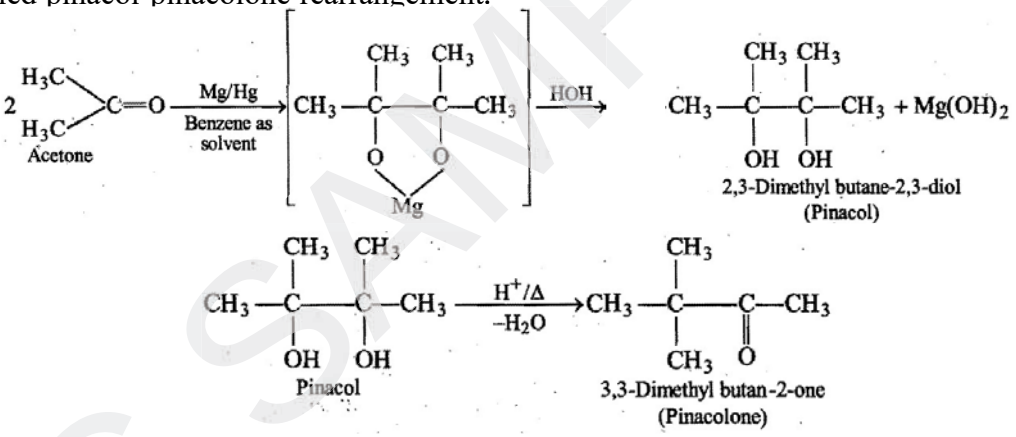
1. Wolff Kishner reduction/ Hung-milnon reaction → Aldehydes and ketones (>C=O) can be reduced to hydrocarbons in presence of excess of hydrazine and sodium alkoxide on heating.



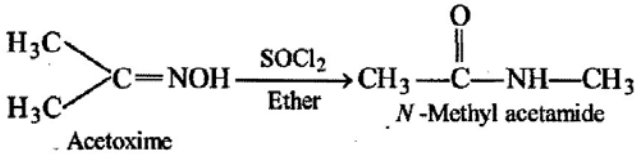
2. Meerweili-Ponndorf-Verley (MPV) reduction→ Ketones can also be reduced to secondary alcohols with aluminium isopropoxide in propan-2-ol solution and this is Meerweili-Ponndorf-Verley (MPV) reduction.



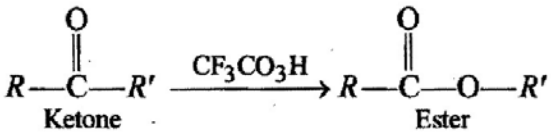
3. Pinacol-pinacolone rearrangement→ Two molecules of ketones undergo reduction in the presence of Mg/ Hg to form pinacol. Upon treatment with mineral acids, pinacol is converted into pinacolone. This transformation involves dehydration and rearrangement called pinacol-pinacolone rearrangement.



4. Beckmann rearrangement→ Ketoximes on treatment with acid catalyst such as conc. H_2SO_4, PCl_5, H_3PO_4, $SOCl_2$ or $C_6H_5SO_2Cl$ etc., undergo Beckmann rearrangement to form a substituted amide. This rearrangement is intramolecular and involves 1,2-shift.



5. Baeyer Villiger oxidation→ Aliphatic ketones undergo oxidation with Caro's acid (per monosulphuric acid, H_2SO_4) or per benzoic acid ($C_6H_5CO_3H$) or m-chloro perbenzoic acid or per acetic acid (CH_3CO_3H) or CF_3CO_3H, etc., to form esters or their hydrolysed products.



DIGESTER –35

NAMED REACTIONS

NAME REACTIONS	STARTING MATERIALS	CATALYST	END PRODUCT
Wolff Kishner reduction/ Hung-milnon reaction	Aldehydes and ketones	H_2NNH_2; C_2H_5ONa; Glycol	Methylene group
Meerweili-Ponndorf-Verley (MPV) reduction	Ketones	$[(CH_3)_2CHO]_3Al$; $(CH_3)_2CHOH$	2° alcohol
Pinacol-pinacolone rearrangement	Ketones	Mg/ Hg; mineral acid	2,3-dimethyl butane-2,3-dilol(Pinacol); 3,3-dimethyl butan-2-one (Pinacolone)
Beckmann rearrangement	Ketoximes	conc. H_2SO_4, PCl_5, H_3PO_4, $SOCl_2$ or $C_6H_5SO_2Cl$	N-methyl acetamide
Aldol condensation	carbonyl compounds	NaOH, $Ba(OH)_2$ or K_2CO_3	Aldol
Baeyer Villiger oxidation	Aliphatic ketones	(per monosulphuric acid, H_2SO_4) or per benzoic acid ($C_6H_5CO_3H$) or m-chloro perbenzoic acid or per acetic acid (CH_3CO_3H) or CF_3CO_3H	Esters
Cannizzaro's reactions	Aldehydes (with no α-hydrogen)	Conc. Alkali	Carboxylic acids
Tischenko's reaction	Aldehydes (with or without α-hydrogen)	$(C_2H_5O)_3Al$	Ester
Claisen-Schmidt reaction	aliphatic aldehyde or ketone (with α-hydrogen)	Dil. NaOH	α,β-unsaturated compound
Schmidt reaction	Carbonyl compounds	conc. H_2SO_4	Alkyl cyanide and N-alkyl formamide
Lederer Manase's reaction	Phenol	dilute acid or alkali	o- and p-hydroxy benzyl alcohol
Diazotisation	aromatic primary amine	$NaNO_2$; HCl	Diazonium salt

INORGANIC CHEMISTRY

DIGESTER –36

FEATURES OF INDIAN PHARMACOPOEIA

First pharmacopoeia publishes as "**Bengal pharmacopoeia**" in 1844.
First Indian Pharmacopoeia Committee in 1948, Chairman – **Dr. B. N. Ghosh.**

EDITION	SUPPLEMENT	FEATURES
1st - 1955	1960	• Covers 986 monographs • Titles of monograph in Latin language • Weight and measure in metric system
2nd - 1966	1975	• Titles of monograph in Latin language to English • Name of drugs first came • New analytical technique added
3rd – 1985 (2 Volume)	1989 and 1991	• Dissolution technique had been added • Microbial limit test prescribed for liquid preparation. • Flame photometry electrophoresis, flurometry added
4th - 1996 (2 Volume)	2000, 2002 and 2005	• Computer generated formulae are used • IR and UV spectrophotometry test added • Contain 1149 monographs and 123 appendices
5th - 2007 (3 Volume)	2008	• Volume one contain general notice, structure of IPC Volume two three contain general monographs
6th – 2010 (3 Volume)	2012	• Products of biotechnology, herbal products added. • Antiretroviral drug are added
7th – 2014 (4 Volume)	2015 and 2016	• Contain 2567 monographs • Radiopharmaceutical monographs are added
8th – 2018 (4 Volume)	2019	• General chemical test and TLC eliminated More specific test like IR, UV Spectrophotometer are added • Pyrogen test replaced by Bacterial Endotoxin Test

DIGESTER –37

SOURCE OF IMPURITIES

Raw Materials	Pharmaceutical substances are either isolated from natural sources or synthesized from chemical starting materials which have impurities.	
Method of Manufacture	Reagents employed in the manufacturing process	Calcium carbonate contains 'soluble alkali' as impurity
	Regents used to eliminate other impurities	Barium is used to remove sulphate from potassium bromide, (barium) as impurity at the end of process.
	Solvents	Water as solvent, it cotains Ca^{2+} Mg^{2+}, Na^{+},

Manufacturing hazards	Particulate matter	Accidental introduction of dirt or glass, porcelain, plastic or metallic fragments
	Cross-contamination of the product	By air-born dust
	Contamination by microbes	Bacteria, fungi, Algae etc can contaminate the final product
	Errors in the manufacturing process	An error on the efficiency of mixing, filling, tabletting, sterilization
Instability of the product	Chemical instability	Chemical decomposition
	Changes in physical properties	Changes in crystal size and shape, sedimentation, agglomeration and caking of the suspended particles
	Reaction with container material	Reaction between the container material and the content.

DIGESTER –38

LIMIT TEST

Limit test is defined as quantitative or semi quantitative test designed to identify and control small quantities of impurity which is likely to be present in the substance.

SUBSTANCE	PRINCIPAL	REACTION	RESULT
Chloride	Chloride ion reacts with silver nitrate in the presence of dilute nitric acid.	Cl^- (Chloride ion) + $AgNO_3$ (Silver Nitrate) $\xrightarrow{dil.HCL}$ $AgCl\downarrow$ (White Precipitate) (Siver Chloride) + NO_3^-	Produces silver chloride as white precipitate. opalescence produce in sample solution should not be greater than standard solution
Sulphate	Sulphate ion reacts with barium chloride in the presence of dilute hydrochloric acid and produces barium sulphate.	SO_4^- (Sulphate ion) + $BaCl_2$ (Barium Chlride) $\xrightarrow{dil.HCl}$ $BaSO_4\downarrow$ (Barium Sulphate) + $2Cl^-\uparrow$ (Chloride ion)	Turbidity of test solution is less than that of standard solution the compound will pass the limit test of sulphate.
Iron	Iron Interact with Thioglycolic acid in the presence of citric acid and ammonical alkaline solution.	Fe^{2+} (Ferrous ion) + $2CH_2S$–COOH (Thyoglycolic acid) $\xrightarrow[\text{Ammonical alkaline Solution}]{\text{Citric acid}}$ CH_2S–COO, Fe^{2+}, OOC–CH_2S (Ferrous glycolate) → (Purple coloured Complex)	The purple color produce in sample solution should not be greater than standard solution.

Aluminium hydroxide gel	$Al(OH)_3$	$AlCl_3 + 3Na_4OH \rightarrow Al(OH)_3 + 3NH_4Cl$	Used in treatment of peptic ulcer, Constipative in nature
Aluminium Phosphate (phosphagel)	$AlPO_4$	$AlCl_3 + Na_3PO_4$ **$\rightarrow AlPO_4 \downarrow + PO_3$**	Used as an adsorbent for bacterial toxoid
Mg trisilicate	$2MgO.3SiO_2.xH_2O$	$Na_2O.SiO_2 + MgSO_4$ (2 : 3)) $\rightarrow$ Mg. $SiO_2 + Na_2SO_4 \rightarrow$ Magnesium silicate	Food additive good acid neutralizing properties
Magnesium oxide (Magnesia)	MgO	$(MgCO_3)_2Mg(OH)_25H_2O \rightarrow MgO + Co_2 + H_2O$	Antacid and laxative
Magnesium carbonate	$MgCO_3$	$MgSO_4 + Na_2CO_3 \rightarrow Na_2SO_4 + MgCO_3$	mild laxative
Magnesium hydroxide (milk of magnesia)	$Mg(OH)_2$	$Mg_{2+} + 2OH \rightarrow Mg(OH)_2$	Laxative to relive constipation
PROTECTIVE AND ADSORBENTS			
Bismuth subcarbonate	$(BiO)_2CO_3$	-	Protective in lotions and ointments
Bismuth subgallate	$Bi(OH)_2C_7H_5O_5$	-	Astringent and protective
Kaolin	Hydrated aluminium silicate	-	Protective in lotions and ointments
SALINE CATHARTICS			
Magnesium sulphate (Epsom salt)	$MgSO_4.7H_2O$	$MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$	Saline laxative treatment of Mg deficiency
Sodium potassium tartrate (Rochelle's salt)	$C_4H_4KnaO_6.4H_2O$	$KHC_4H_4O_6 + Na_2CO_3 \rightarrow C_4H_4O_6KNa{\cdot}4H_2O$	Saline purgative food additive
Disodium hydrogen phosphate (Phosphor soda)	$Na_2HPO_4.12H_2O$	$2NaOH + H_3PO_4 \rightarrow NaHPO_4 + 2H_2O$	Pharmaceutical Aid and saline cathartics buffering agent

•	Sodium sulphate (S-35) solution.	•	Extracellular flood volume determination
•	Sodium-per-technate (Tc-99) Injection	•	Brain scanning thyroid function test
•	Technetium Sulphide (Tc-99) Colloidal solution.	•	Liver and spleen scars
•	Yb-169 DTPA (Diethylenetriaminopenteacetate)	•	Brain scanning and determine action of GFR in kidney.

DIGESTER –52

LIST OF INORGANIC SUBSTANCES ALONG WITH CHEMICAL COMPOSITION AND USES

INORGANIC SUBSTANCES	CHEMICAL COMPOSITION	USES
Antimony potassium	$C_4H_4O_7SbK.\ H_2O$	Orally used emetic and treatment of kala-azar by I.V.
Barium sulphate	$BaSO_4$	Radio - opaque contrasts media for the X-ray examination of GIT.
Borax	$Na_2B_4O_7.10H_2O$	Antibacterial
Boric acid	H_3BO_3	Local anti-infective
Calcium carbonate	$CaCO_3$	Non-Systemic antacid
Calcium chloride	$CaCl_2$	Electrolyte replenishes
Calcium gluconate	$C_{12}H_2O_{11}Ca.H_2O$	Calcium replacer
Chlorinated lime		Disinfection of water
Di-calcium phosphate	$CaHPO_4.2H_2O$	Source of Ca, P and diluent m tablet
Ferrous sulphate	$FeSO_4.7H_2O$	Hematinic
Hydrogen peroxide	H_2O_2	Oxidising agent
Light Kaolin	$Al_2O_3.2SiO_2.2H_2O$	Adsorbent (GIT infection)
Magnesium hydroxide	$Mg(OH)_2$	Antacid and Laxative
Magnesium Oxide	MgO	Antacid
Magnesium sulphate	$MgSO_4.7H_2O$	Saline cathartic sedative
Magnesium trisilicate	$2MgO.3SiO_2.xH_2O$	Antacid
Mercurous chloride	$HgCl_2$	Cathartic
Nitrous oxide	N_2O	Gas
Phosphoric acid	H_3PO_4	Pharmaceutical acid
Plaster of parish	$CaSO_4.\ H_2O$	Surgical acid
Potassium chloride	KCl	Electrolyte replacer
Potassium Citrate	$C_6H_5K_5H_2O$	Systemic alkalaniser
Potassium iodide	KI	Expectorant
Potassium permanganate	$KMnO_4$	Antiseptic, Oxidizing agent
Selenium Sulphate	SiS_2	Antidandruff
Silver nitrate	$AgNO_3$	Antibacterial
Sodium Acetate	$CH_3COONa.3H_2O$	Used for peritoneal dialysis
Sodium Benzoate	C_6H_5COONa	Preservative

MEDICINAL CHEMISTRY

DIGESTER –53

DRUG AND STARTING MATERIAL AND SYNTHESIS

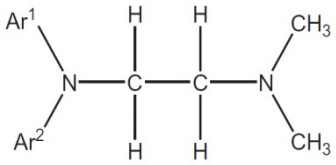
S.NO	DRUG	STARTING MATERIAL	SYNTHESIS
1.	Acetazolamide	5-amino-2-mercapto-1,3,4thiadiazole	5-amino-2-mercapto-1,3,4thiadiazole
2.	Allopurinol	Cyanoacetamide	Cyanoacetamide + Formamide HCl
3.	Amodiaquine	Paracetamol	Paracetamol + 7-chloro-4-amino quinoline + Diethyl amine
4.	Ascorbic acid (Vit. C)	Ribose	Ribose
5.	Aspirin	Salicylic acid	Salicylic acid + acetic anhydride
6.	Atenolol	Phenoxy acetamide	Phenoxy acetamide + Epichlorhydrine + Isopropylamine
7.	Amitriptyline	Phthalic anhydride	Phthalic anhydride +Phenyl acetic acid + sod. acetate
8.	Albendazole	4-merecapto phenylacetamide	4-merecapto phenylacetamide + bromopropane
9.	Acetazolamide	Hydrazine hydrate	Hydrazine hydrate + Ammonium thiocyanate
10.	Amiloride	o – phenylenediamine	o – phenylenediamine+ oxalaldehyde glyoxal
11.	Benzocaine	p-nitrotoluene	p-nitrotoluene + Ethanol
12.	Biotin (Vit. B_7)	Bisbenzyl succinic acid	Bisbenzyl succinic acid
13.	Bupivacaine	α-picoline	α-picoline + 2,6-dimethyl aniline
14.	Busulfan	Methanesulphonyl chloride	Methanesulphonyl chloride +1,4-butanediol
15.	Chlorambucil	Phenylbutyric acid	Phenylbutyric acid + Dichloroethyl amine
16.	Chloramphenicol	p-nitrobenzoic acid	p-nitrobenzoic acid + 1,3-Propandiol
17.	Chlorphenesin	p-chlorophenol	p-chlorophenol + pchloropropan-2,3-diol
18.	Chloroquine	7-chloro-4-amino quinoline	7-chloro-4-amino quinoline + 1methyl-butyl + Diethyl amine
19.	Chlorotrianisene	Anisole	Anisole + p-methoxy benzyl chloride + Olefin
20.	Chlorpheniramine	p-chlorobenzyl chloride	p-chlorobenzyl chloride + Pyridine HCl + Copper chloride

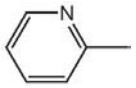
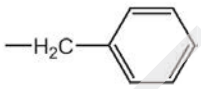
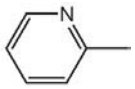
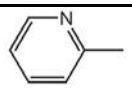
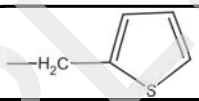
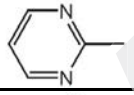
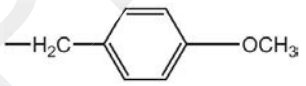
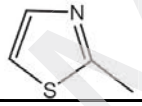
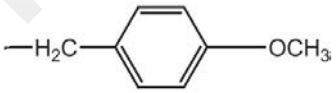
DIGESTER –55

AUTACOIDS AND RELATED DRUGS

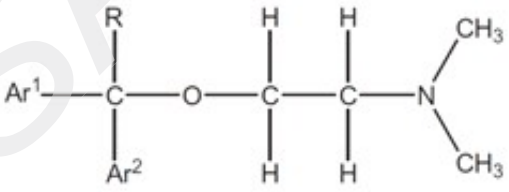
CLASSIFICATION

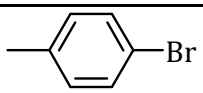
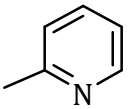
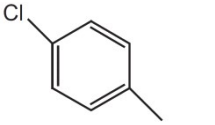
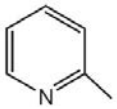
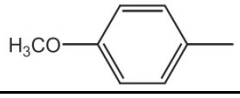
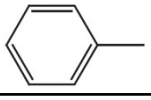
1. **H_1-Antagonists with classical structures**
   a. **Ethylene diamine derivatives**

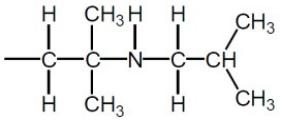
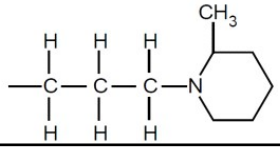


DRUG NAME	AR¹	AR²
Tripelennamine		
Pyrilamine		
Methapyrilene		
Thonzylamine		
Zolamine		

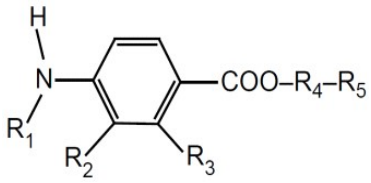
   b. **Amino alkyl ether analogues**



DRUG NAME	AR¹	AR²	R
Diphenhydramine	$-C_6H_5$	$-C_6H_5$	-H
Bromodiphenhydramine	$-C_6H_5$		-H
Doxylamine	$-C_6H_5$		$-CH_3$
Carbinoxamine			-H
Medrylamine			-H

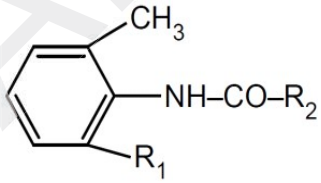
NAME	R_1	R_2
Isobucaine	–H	
Piperocaine	–H	

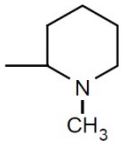
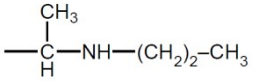
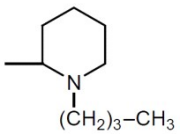
2. p-Amino benzoic acid derivatives



NAME	R_1	R_2	R_3	R_4	R_5
Benzocaine	–H	–H	–H	$-CH_2-CH_3$	–
Butamben	–H	–H	–H	$-(CH_2)_3\ CH_3$	–
Procaine	–H	–H	–H	$-CH_2-CH_2-$	$-N(C_2H_5)_2$
Chloroprocaine	–H	–H	–Cl	$-CH_2-CH_2-$	$-N(C_2H_5)_2$
Tetracaine	$-C_4H_9$	–H	–H	$-CH_2-CH_2-$	$-N(CH_3)_2$
Butacaine	–H	–H	–H	$-CH_2-CH_2-CH_2$	$-N(C_4H_9)_2$

3. Anilide derivatives (2,6 Xylidine)



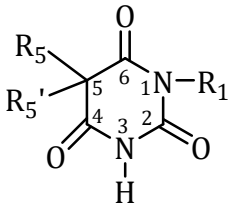
NAME	R_1	R_2
Lidocaine/Lignocaine	$-CH_3$	$-CH_2-N(C_2H_5)_2$
Mepivacaine	$-CH_3$	
Prilocaine	–H	
Bupivacaine	$-CH_3$	

DIGESTER –58

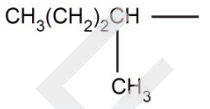
DRUG ACTING ON CENTRAL NERVOUS SYSTEM

SEDATIVE AND HYPNOTICS

Barbiturates → Barbiturates are further classified on the basis of duration of their action.

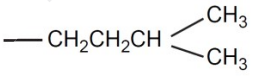
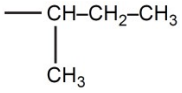
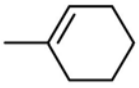
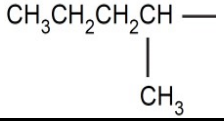
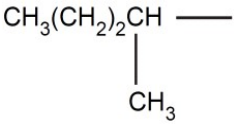
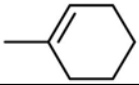
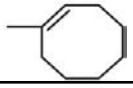


a. Short-acting barbiturates (less than 3 hr)

DRUG NAME	R_1	R_5	$R_{5'}$
Thiopentone	–H	$-C_2H_5$	

(At C-2 = S instead of O)

b. Intermediate-acting barbiturates (3–6 hr)

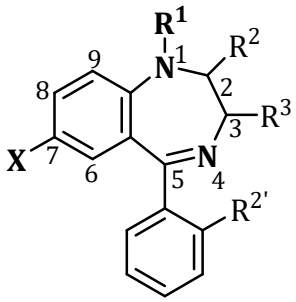
DRUG NAME	R_1	R_5	$R_{5'}$
Amobarbital	–H	$-C_2H_5$	
Butabarbital	–H	$-C_2H_5$	
Aprobarbital	–H	CH_2= CH–CH_2–	$(CH_3)_2CH$–
Talbutal	–H	CH_2= CH–CH_2–	$CH_3CH_2CH(CH_3)$–
Butalbital	–H	CH_2= CH–CH_2–	$(CH_3)_2CHCH_2$–
Hexobarbital	$-CH_3$	$-CH_3$	
Pentobarbital	–H	$-C_2H_5$	
Secobarbital	–H	CH_2= CH–CH_2–	
Cyclobarbital	–H	$-C_2H_5$	
Heptabarbital	–H	$-C_2H_5$	

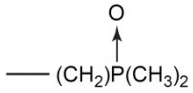
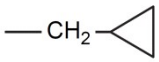
c. Long-acting barbiturates (6 hr or more than 6 hr)

DRUG NAME	R^3	R_5	$R_{5'}$
Phenytoin	–H	$-C_6H_5$	$-C_6H_5$
Phenyl ethyl hydantoin	–H	$-C_2H_5$	$-C_6H_5$

Mephenytoin	$-CH_3$	$-C_2H_5$	$-C_6H_5$
Ethotoin	$-C_2H_5$	–H	$-C_6H_5$

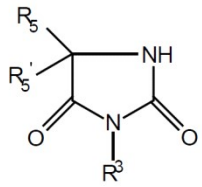
Benzodiazepines



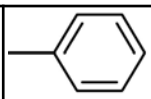
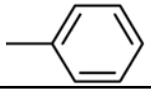
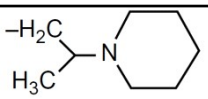
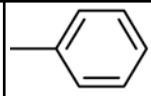
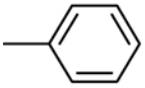
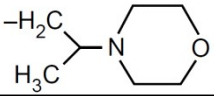
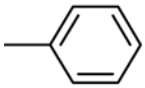
DRUG NAME	R^1	R^2	R^3	X	$R^{2'}$
Diazepam	$-CH_3$	=O	–H	–Cl	–H
Oxazepam	–H	=O	–OH	–Cl	–H
Chlordesmethyl	–H	=O	–H	–Cl	–Cl
Fosazepam		=O	–H	–Cl	–H
Prazepam		=O	–H	–Cl	–H
Nitrazepam	–H	=O	–H	$-NO_2$	–H
Nordiazepam	–H	=O	–H	–Cl	–H
Nimetazepam	$-CH_3$	=O	–H	$-NO_2$	–H
Flunitrazepam	$-CH_3$	=O	–H	$-NO_2$	–F
Flurazepam	$-(CH_2)_2N(C_2H_5)_2$	=O	–H	–Cl	–F
Quazepam	$-CH_2CF_3$	=S	–H	–Cl	–F
Halozepam	$-CH_2CF_3$	=O	–H	–Cl	–H
Temazepam	$-CH_3$	=O	–OH	–Cl	–H
Lorazepam	–H	=O	–OH	–Cl	–Cl
Clonazepam	–H	=O	–H	$-NO_2$	–Cl
Doxefazepam	$-CH_2OH$	=O	–OH	–Cl	–F

ANTICONVULSANTS/ ANTIEPILEPTICS

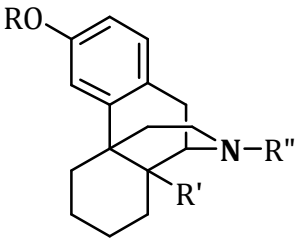
1. Hydantoins

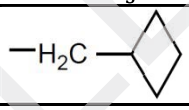


DRUG NAME	R^3	R_5	$R_{5'}$
Phenytoin	–H	$-C_6H_5$	$-C_6H_5$
Phenyl ethyl hydantoin	–H	$-C_2H_5$	$-C_6H_5$
Mephenytoin	$-CH_3$	$-C_2H_5$	$-C_6H_5$
Ethotoin	$-C_2H_5$	–H	$-C_6H_5$

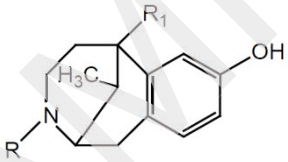
Dipanone			$-COC_2H_5$	
Phenadoxone			$-COC_2H_5$	
Propoxyphene		$-CH_2-C_6H_5$	$-COC_2H_5$	$-CH(CH_3)CH_2N(CH_3)_2$

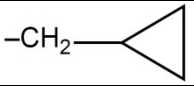
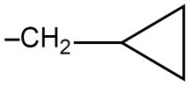
4. Morphinan analogues



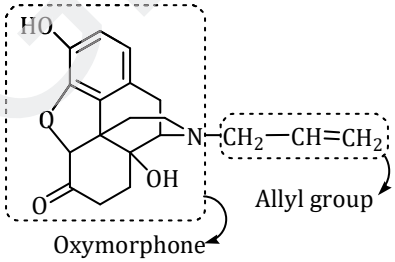
DRUG NAME	R	R′	R″
Levorphanol	–H	–H	$-CH_3$
Butorphanol	–H	–OH	
Dextromethorphan	$-CH_3$	–H	$-CH_3$

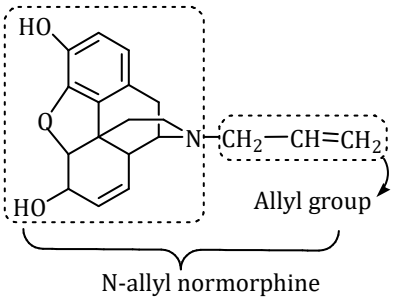
5. Morphan analogues or benzazocine derivatives

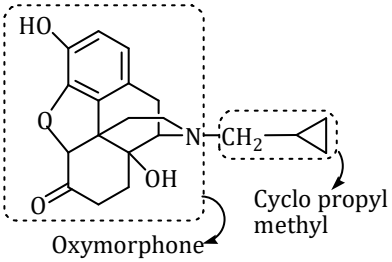


DRUG NAME	R	R_1
Pentazocine	$-CH_2-CH=C(CH_3)_2$	$-CH_3$
Phenazocaine	$-CH_2-CH_2-C_6H_5$	$-CH_3$
Cyclazocine		$-CH_3$
Ketazocine		=O
Metazocine	$-CH_3$	$-CH_3$

NARCOTIC ANTAGONISTS







PHARMACEUTICAL ANALYSIS

DIGESTER –65

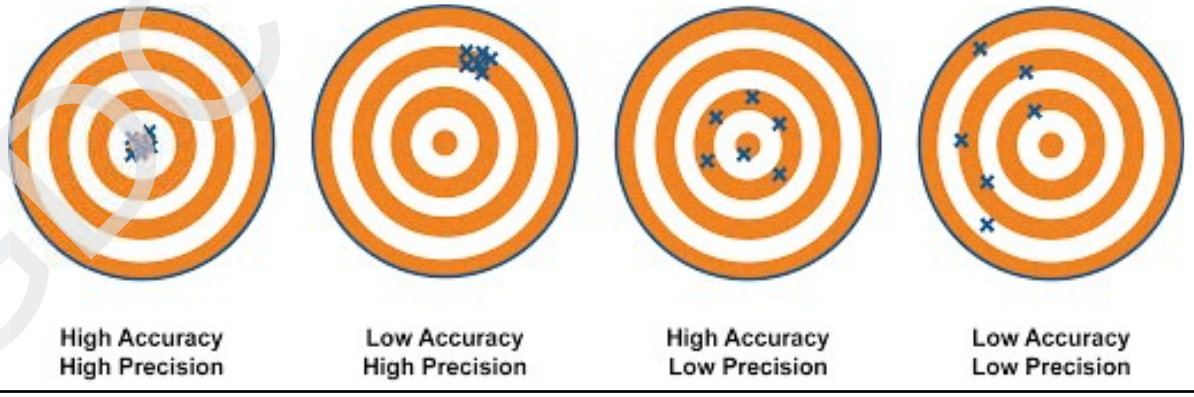
TYPES OF ERROR

Error is the difference between the true result (accepted true result) and the measured result.	
Determinate Error	Determinate errors are caused by faults in the analytical procedure or the instruments used in the analysis. Determinate errors are systematic errors.
Indeterminate Error	Indeterminate errors are not constant or biased. They are random in nature and are the cause of slight variations in results of replicate samples made by the same analyst under the same conditions
Gross Error	Gross errors differ from indeterminate and determinate errors. They usually occur only occasionally, are often large, and may cause a result to be either high or low. They are often the product of human errors.
Absolute error	Absolute error = Observed value – True or most probable value
Relative error	Relative error = Absolute error /True value×1000 per thousand

DIGESTER –66

ACCURACY AND PRECISION

Accuracy	Accuracy is the closeness of experimental value to the true value.
Precision	Precision is the closeness of measurement from one another.
Reproducibility	Reproducibility expresses the precision between laboratories
Repeatability	Repeatability expresses the precision under the same operating conditions over a short interval of time.



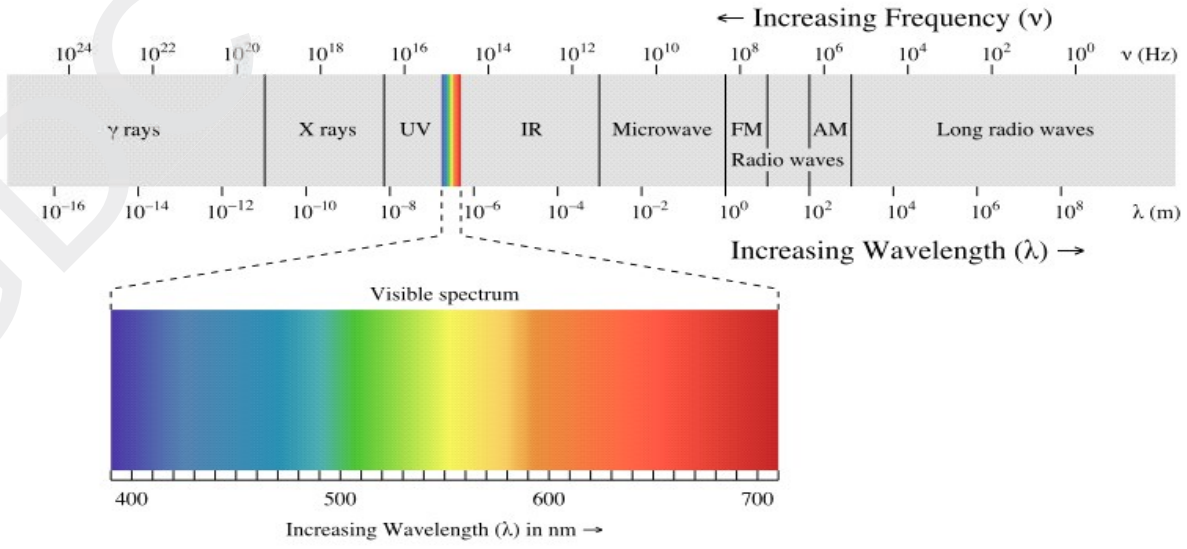
DIGESTER –67

PRECISION MEASURE

Mean or average or relative mean deviation	Mean is obtained by dividing the sum of a set of measurements by the number of individual results in the set. $\text{mean, } m = \frac{\sum Mn}{n}$ Where M is individual measurement n is the total number of measure
Median	Median is a about which all the other value are equally distributed.
Mean deviation	Mean deviation of a single measurement is the mean of the derivations of all the individual measurements. $d^- = \frac{\sum[Mn - m]}{N}$ d^-= mean deviation = Absolute value of the deviation of the M_n^{th} number
Relative mean deviation	Relative mean deviation is the mean deviation divided by the mean. Relative mean deviation = $\frac{\text{mean deviation}}{\text{mean}} \times 100$
Average deviation	Average deviation $D = \frac{d^-}{\sqrt{n}}$ d^-= Average deviation n = Total number of measurements
Standard deviation	$s = \sqrt{\frac{\sum (Mn - m)^2}{N}}$

DIGESTER –68

ELECTROMAGNETIC SPECTRUM



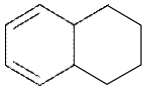
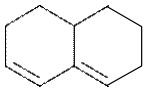
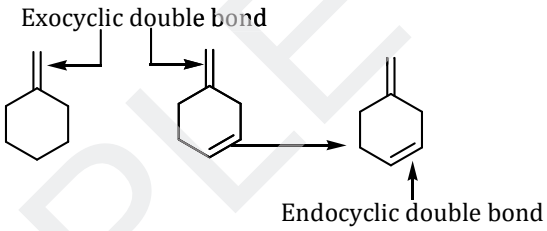
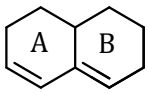
DIGESTER –77

UV -VISIBLE SPECTROSCOPY

Beer's law	Find relationship between transmittance and concentration of medium
Lambert's law	Find relationship between transmittance and thickness of medium
Beer Lambert law	**A = ε.Cl** Where, ε = Molar absorption coefficient C = Concentration l = Thickness
Molar absorption coefficient	**ε = A/ Cl**
Transmittance	**$T = I_T / Io$**
Absorbance	**A = -log T**
Specific absorbance	**$Є = (A_{1cm}^{1\%} \times mol.wt)/10$**
Bathochromic (Red shift)	λ_{max} Towards to longer Wavelength
Hypsochromic (Blue shift)	λ_{max} Towards to shorter Wavelength
Hyperchromic	Increases in the intensity
Hypochromic	Decrease in the intensity
Isobestic point	Every absorption curve which is contained in spectrum of compound taken at different pH.
Chromophore	Molecular group that absorb visible or UV light and imparts colour to the compound. Example: **Nitro group, Azo group**
Auxochrome	They do not have any characteristic absorption on their own but can modify the absorption of chromphore. Example: **-OH, –OR, $–NH_2$, -NHR**
K-Bands	Originates due to л⟶л* transition in a compound with conjugated л system Very intense band with high ε_{max} Present in conjugated dienes like butadienes
R-Bands	These are forbidden transitions, originates due to n⟶л* Transition of electron of atleast one lone pair of electron on hetero atom Have very low ε_{max} value , below 100
B-Bands	Originates due to л⟶л* transition in aromatic or hetero-aromatic molecules
E-Bands	Originates due to electronic transitions in the benzenoid system In cyclic conjugation, they shows two absorption bands in UV spectra.
Energy value order for transition	**$\sigma \rightarrow \sigma^* > n \rightarrow \sigma^* > \pi \rightarrow \pi^* > n \rightarrow \pi^*$**

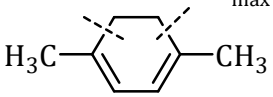
DIGESTER –78

WOODWARD FIESER RULE

Homoannular diene:	It is a cyclic diene having conjugated double bond in the same ring. Example: 
Heteroannular diene	It is a cyclic diene in which double bonds in conjugation are present in different rings. Example: 
Endocyclic double bond	A double bond present in a ring.
Exocyclic double bond	A double bond in which one of the double bond is a part of a ring system. Example:   Ring A has one endocyclic and one exocyclic double bond. Ring B has only one endocyclic double bond.

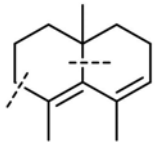
WOODWARD FIESER RULE FOR CONJUGATED DIENE, TRIENE SYSTEMS		
Parent Values	Homoannular conjugated diene	253 nm
	Heteroannular conjugated diene	214 nm
	Acyclic conjugated diene	217 nm
	Acyclic triene	245 nm
Increment	Each alkyl substituentor Ring residue	+5 nm
	Exocyclic double bond	+5 nm
	Double bond extending conjugation	+30 nm
Auxochromes	-Cl, -Br	+5 nm
	-OH/-OR/-SH	+6 nm
	-SR	+30 nm
	$-NR_2$	+60 nm
	-OCOCH3	+0 nm

Question: Calculate λ_{max}



Parent value for Homoannular diene = 253 nm
Two alkyl substituents = 2 × 5 = 10 nm
Two ring residue = 2 × 5 = 10 nm
Total calculated λ_{max} = 253 + 10 + 10 = 273 nm

Question: Calculate λ_{max}



Two alkyl substituents = 2 × 5 = 10 nm
Three ring residue = 3 × 5 = 15 nm
One exocyclic double bond = 5 nm
Total calculated λ_{max} = 214 + 10 + 15 + 5 = 244 nm

Precipitation titration	One product is a precipitated. (Known as Argentometric titration)	• To determine electrode potential • For determination of chloride, cyanide and thiosulphite
	Mohr titration	Titration of sodium chloride with standard silver nitrate in neutral solution giving a precipitate of red silver chromate at the end point. **$Ag^{+} + Cl^{-} \rightarrow AgCl \downarrow$** **$2Ag^{+2} + CrO^{-}_{4}$ (Red colour precipitate)**
	Fajan titration	Involve titration of NaCl with standard of silver nitrate using adsorption indicator. **Adsorption indicator are: Fluorescein, Eosin**
	Volhard's titration	**$AgNo_3 + NH_4SCN \rightarrow AgSCN + NH_4NO_3$** **$NH_4SCN + Fe_2(SO_4)_3(NH_4)SO_4 \rightarrow Fe[Fe(SCN)_6] \downarrow$ (Red colour complex indicate end point)**

DIGESTER –99

INDICATORS FOR ACID BASE TITRATION

INDICATOR	PH RANGE OF	COLOUR ON ACIDIC SIDE	COLOUR ON BASIC SIDE
Methyl Violet	0.0 to 1.6	Yellow	Violet
Bromophenol Blue	3.0 to 4.6	Yellow	Blue
Methyl orange	3.1 to 4.4	Red	Yellow
Methyl red	4.4 to 6.2	Red	Yellow
Phenol red	6.8 t0 8.4	Yellow	Red
Cresol red	7.2 to 8.8	Yellow	Red
Naphtholphthalein	7.3 to 8.7	Yellow	Blue
phenolphthalein	8.3 to 10.0	Colourless	Pink
Alizarin yellow	10.1 to 12.0	Yellow	Red

DIGESTER –100

INDICATORS FOR COMPLEXOMETRIC TITRATION

INDICATOR	PH RANGE	COLOUR CHANGE
Mordant Black II	6 to 7	Red to Blue
Enoehrome Black T	6 to 7	Red to Blue
Solochrome black T	6 to 7	Red to Blue
Murexide	12	Violet to blue
Catechol Violet	8 to 10	Violet to red
Methyl blue	4 to 5	Blue to yellow

Parameter	
Retention time	Difference between point of injection and appearance of peak maxima.
Retention volume	Volume of carrier gas required to elute 50 % of component from the column.
HETP (Height equivalent to theoretical plate)	If HETP is less – column is more efficient If HETP is more – Column is less efficient
Number of theoretical plate	If number of theoretical plate is high than column is highly efficient If number of theoretical plate is less than column is less efficient

Van Deemter Equation $H = A + \frac{B}{\mu} + C\mu$

Where, H = Height of theoretical plate,

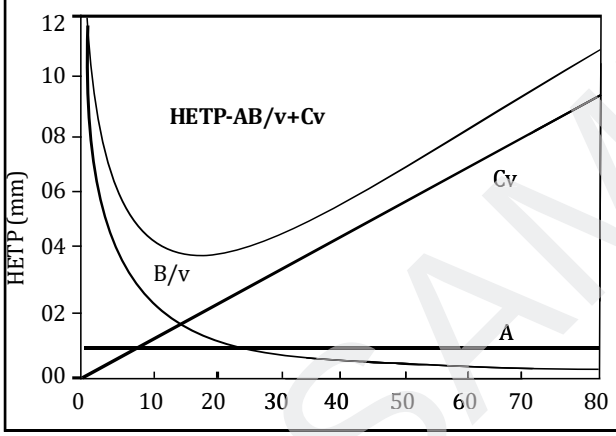
= Average liner velocity of mobile phase

A = Eddy diffusion

B = Longitudinal or ordinary diffusion term

C = Non equilibrium or resistance to mass transfer

Van Deemeter plots



- The term 'A' is independent of flow of the mobile phase
- The term B/u decrease drastically in the beginning with increase in the flow rate of mobile phase. Increase in the flow rate beyond particulars value , leads to slow decrease value in the value of B/u
- The term Cu increase with increase in the rate

DIGESTER –116

CHIRAL CHROMATOGRAPHY

Chiral chromatography - Separation of particular isomer from enantionmeric mixture involves formation of Diastereomers	
Stationary Phase	Naphthyl Alanine, Naphthyl Leucine, Dinitro benzoyl phenyl glycine, β-Cyclodextrin
Mobile phase	Non polar solvents

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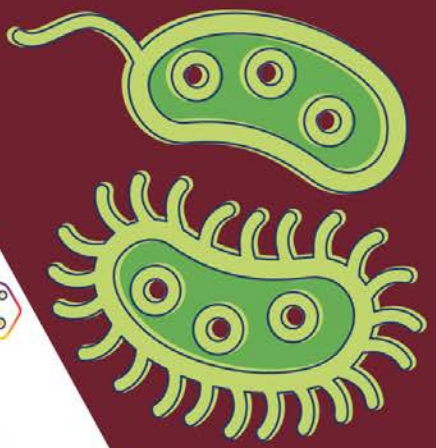
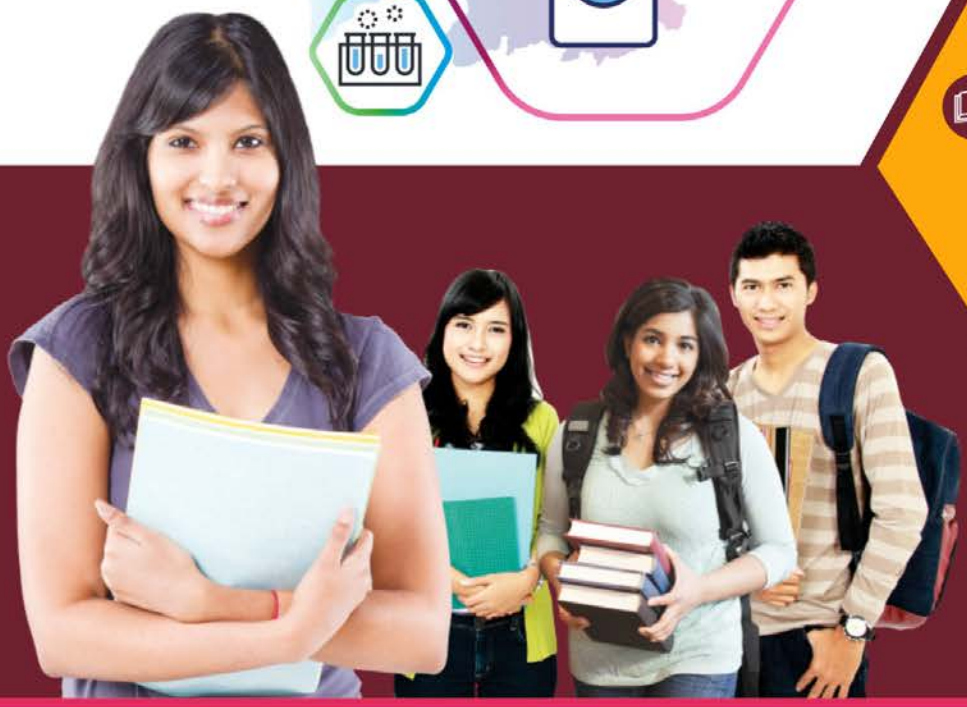
DIGESTER

MODULE 2

Rapid Revision Notes



- Biochemistry
- Biotechnology
- Microbiology
- Pharmacognosy



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Rapid Revision Notes

MODULE - 2

YOUR GATEWAY TO SUCCESS

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Pentose phosphate pathway (HMP shunt)	Alternative pathway to glycolysis and TCA cycle for oxidation of glucose	Glucose 6-phosphate Dehydrogenase	Cytosol
Urea cycle	Formation of urea from protein metabolism	Carbamoyl phosphate synthetase	Liver
Uronic acid pathway	Conversion of Glucose → Glucuronic acid	UDP-Glucose 6-dehydrogenase (UGDH)	Liver

DIGESTER –8

TEST FOR CARBOHYDRATES

S. NO.	TEST	OBSERVATION	INFERENCE
1.	**Barfoed's test: -** Neutral copper acetate in acetic acid and boil on water bath	Red precipitate at bottom of the test tube	Distinguish between monosaccharide form disaccharide
2.	**Benedict's test: -** $CuSO_4$ + Sodium carbonate + Sod. Citrate + boil for 2 minutes.	Orange red or brick red precipitate	Reducing sugar
3.	**Fehling's test: -** Fehling solution A + Fehling solution B and boil for 2 min.	Yellow red precipitate	Reducing sugar
4.	**Molisch test: -** α-naphthol + C_2H_5OH	Purple red ring at junction of two liquid	For all carbohydrate
5.	**Seliwanoff's test: -** Resorcinol in HCl	Red colored complex	Distinguish between ketose and aldose form
6.	**Tommers test: -** Tommers reagent and boil for 2 min.	Yellow or red precipitate	Reducing sugar
7.	**Osazone test: - Phenyl hydrazine + Sodium Acetate + Acetic acid + Water + Heat for 20 min.**	Greenish yellow needle/ Broomstick shape crystal	Test for glucose, Fructose, Mannose
		Pincushion with pins/Hedgehog crystal appears like ball of prickles	Test for lactose
		Sun flower Plate like crystals appear like sun flower	Test for maltose
8.	**Iodine test: - Suspension or solution of polysaccharides + 1-2 drop of iodine**	Deep blue colour	Starch present
		Brown wine colour	Glycogen present

DIGESTER –14

NUTRITIONAL CLASSIFICATION OF AMINO ACID

ESSENTIAL AA	NON-ESSENTIAL AA	SEMI-ESSENTIAL AA
The amino acids which cannot be synthesized by the body and need to be supplied through diet.	The amino acids which can be synthesized by human body and not essential to include in our diet.	Can be synthesized by adults but not synthesized by growing children.
Examples	**Examples**	**Examples**
TRICK – **VIP HALL** for **MTT** **V - Valine** **I - Isoleucine** **P - Phenylalanine** **H - Histidine** **A - Arginine** **L - Leucine** **L - Lysine** **M - Methionine** **T - Threonine** **T - Tryptophan**	TRICK – **CATAPAS GGG** **C - Cysteine** **A - Alanine** **T - Tyrosine** **A - Asparagine** **P - Proline** **A - Aspartic acid** **S - Serine** **G - Glycine** **G - Glutamine** **G - Glutamic acid**	**A - Arginine** **H - Histidine**

DIGESTER –15

CLASSIFICATION OF AMINO ACID BASED ON METABOLIC FATE

Ketogenic Amino Acid A ketogenic amino acid is an amino acid that can be degraded directly into **acetyl-CoA**, which is the **precursor of ketone bodies** and **myelin**.		**Glucogenic (Glucogenic) Amino Acid** A glucogenic amino acid is an amino acid that can be converted into **glucose** through **gluconeogenesis**.
S. NO.	**TYPE**	**EXAMPLES**
1.	**Ketogenic Amino Acid**	Leucine, Lysine
2.	**Glucogenic (Glycogenic) Amino Acid**	Arginine, Glutamate, Glutamine, Histidine, Proline, Valine, Methionine, Aspartate, Alanine, Serine, Cysteine, Hydroxyproline, Threonine and Glycine
3.	**Glucogenic and Ketogenic Amino Acid**	Isoleucine, Phenylalanine, Tyrosine, Tryptophan

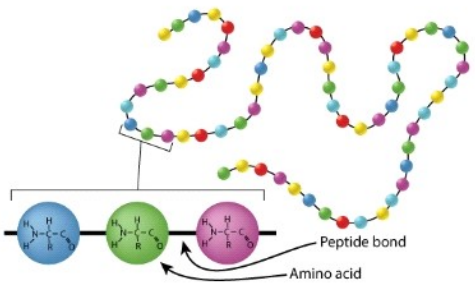
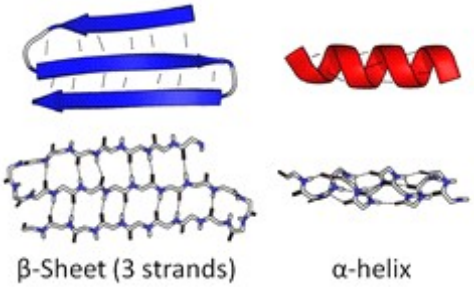
DIGESTER –16

CLASSIFICATION OF PROTEINS

- **PROTEINS**
  - **SIMPLE PROTEINS**
    - **Globular Proteins**
      - Albumins
      - Globins
      - Globulins
      - Histones
      - Prolamines
      - Protamines
    - **Scleroproteins**
      - Collagens
      - Elastins
      - Keratins
  - **CONJUGATED PROTEINS**
    - Chromoproteins
    - Glycoproteins
    - Lipoproteins
    - Metalloproteins
    - Nucleoproteins
    - Phosphoproteins
  - **DERIVED PROTEINS**
    - **Primary**
      - Coagulated proteins
      - Metaproteins
      - Proteans
    - **Secondary**
      - Peptones
      - Polypeptides
      - Proteoses
      - Peptides

DIGESTER –17

STRUCTURE OF PROTEINS

STRUCTURE	CHARACTERISTIC	DIAGRAM
Primary Structure	• Simple (linear) amino acid sequence. • Amino acids are joined covalently by peptide bond • Protein biosynthesis Start form N-termination amino acid. • Determination of amino acid sequence is by **Sanger's and Edman's reagent.** • **E.g.-** Insulin	
Secondary Structure	• Spatial arrangement of protein by twisting of polypeptide chain. • Consist of **α-helix and β pleated sheet.** • Stabilized by hydrogen and electrostatic bonding. • **E.g.- α-helical -** Leucine, Glutamate and Alanine **β-pleated sheet -** Threonine, Histidine, Tyrosine and Isoleucine	

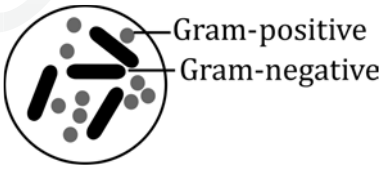
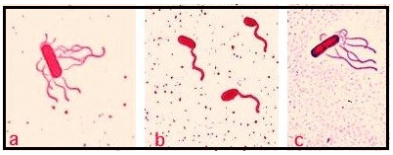
DIGESTER –46

ENZYMES INVOLVED IN DNA REPLICATION

S. NO.	ENZYME	FUNCTION
1.	**DNA Helicase**	Involved in **unwinding** the double-helical structure of DNA allowing DNA replication to commence
2.	**DNA ligase**	**Seals** the gaps between the **Okazaki fragments** to create one continuous DNA strand
3.	**DNA polymerase: -**	DNA polymerases are enzymes used for the **synthesis of DNA** by adding nucleotide one by one to the growing DNA chain. The enzyme incorporates complementary amino acids to the template strand.
	(a) DNA polymerase I	Exonuclease activity **removes RNA primer** and replaces with **newly synthesized DNA**
	(b) DNA polymerase II	**Repair** function
	(c) DNA polymerase III	Main enzyme that **adds nucleotides** in the **5'-3' direction**
4.	**DNA primase**	**Synthesizes RNA primers** needed to start replication
5.	**Exonuclease**	Exonucleases are a broad class of enzymes that **cleave off nucleotides** one at a time from the 3' or 5' ends of DNA and RNA chains
6.	**DNA Gyrase**	Catalyzes **negative supercoiling** of plasmid and chromosomal DNA
7.	**Single Stranded Binding Proteins (SSB)**	**Binds to single-stranded DNA** to avoid DNA rewinding back
8.	**Sliding Clamp**	Helps to **hold the DNA polymerase** in place when nucleotides are being added
9.	**Topoisomerase**	Helps **relieve the stress on DNA** when unwinding by causing breaks and then **resealing** the DNA

DIGESTER –55

BACTERIAL STAINING METHODS

S.NO	STAINING TECHNIQUES	REAGENTS/ OBSERVATION	RESULT/USED
1.	**BASIC STAINING**	**Stain acidic part i.e. cytoplasm** because of nucleic acid present in the bacteria. **Example:** Crystal violet, Methyl violet, Gentian violet.	Demonstrate Polysaccharide capsule in the bacteria.
2.	**ACIDIC STAINING**	Acidic stain cannot stain bacterial cell due to repulsion of same charge. Acidic stain is used to stain the positively charged components such as **background staining**. **Examples:** Eosin, Nigrosine.	Used for background staining.
3.	**GRAM STAINING**	**Procedure:** (i) Add Primary dye (**Crystal violet, Methylene blue**) (ii) Add **Mordant** such as **Gram iodine** (iodine-bond strongly primary dye) wait 1 min. (iii) Add decolorizer (**Acetone, Alcohol**) (iv) Add Counter stain (**safranin**) **Observation: gram positive give purple colour** and **gram-negative give pink/red colour** 	The gram staining is used for the distinguish between gram positive and gram-negative bacteria.
4.	**FLAGELLA STAINING**	Flagella stains employs **a mordant (silver colloidal suspension of tannic acid & stain basic fuchsin)** to coat the flagella with stain until they are thick enough to be seen. 	Determination of bacteria containing flagella.

DIGESTER –64

STERILIZATION TECHNIQUES

S. NO.	METHODS OF STERILIZATION	TYPES				CONDITIONS
	Physical Methods	**I. Dry Heat sterilization**				160 °C for 1 hour (Hot air oven)
		II. Moist Heat Sterilization	A.Below 100 °C	Pasteuri-zation	1. Holder Method	60 °C for 30 minutes
					2. Flash Method	72 °C for 15-20 seconds and then quick colling at 13 °C
				Inspissation		85 °C for 30 minutes for 3 days
			B. At 100 °C	Tyndallization		100 °C for 20 minutes for 3 successive days
			C. Above 100 °C	Autoclaving		115-118 °C for 30 minutes 121-124 °C for 15 minutes 126-129 °C for 10 minutes 134-138 °C for 3 minutes
		III. Radiation	A. Non-ionizing (Hot sterilization)			The optimal radiation dose depends on the desired sterility assurance level (SAL), the probability that a microorganism will survive the sterilization procedure. i.e. Dose of gamma radiation used is about 25 KGy (2.5 mrads)
			B. Ionizing (Cold sterilization)			
	Chemical Method	I. Gaseous				8 hours exposure (0.5 ppm) i.e. Ethylene oxide, Ozone, etc.
		II. Disinfectant (Surface Sterilization)				Wash the object with sterile water before treating with disinfectant. Ex.- Alcohol, iodine, etc.
	Mechanical Method	I. Filtration	A. Membrane Filters			Filter through medium of nominal pore size of 0.22 µm or less

8.	Oriental sore (Delhi boils)	Leishmania tropica	Sand fly Bed bug	• Affects dermal tissue • Rashes develops in skin
9.	Aggravation of Pyorrhea	Entamoeba gingivalis Trichomonas buccalis	Lip kissing	• Bleeding of gums

6.	**ANTICANCER**	Vinca, Podopyllum, Camptotheca, Taxus
7.	**ANTIRHEUMATOIDS**	Aconite, Colchicine, Guggul
8.	**ANTHELMINTICS**	Quassia, Male fern, Vidang
9.	**IMMUNOMODULATORY**	Ashwagandha, Tulsi, Ginseng, Asparagus, Picrorhhiza, Kurroa
10.	**ASTRINGENT**	Myrobalan, Black catechu
11.	**ANTIMALARIAL**	Cinchona, Artemisia
12.	**LOCAL ANAESTHETICS**	Coca

DIGESTER –105

CLASSIFICATION BASED ON THE FAMLIY

S. NO.	FAMILY	DRUGS
1.	Leguminosae or Fabaceae	Acacia, Guar Gam, Locust bean gum, Tragacanth, Balsam of peru, Tolu balsam, Alexandrian senna, Indian senna, Senna pods, Yasti, Psoralea, Derris, Tonka bean, Arachis oil, Ashoka bark, Black catechu, Pterocarpus, Kavach
2.	Liliaceace	Aloe, European squill, Indian squill, Safed musali, Shatavari, Garlic, Colchicum, Veratrum, Gloriosa, Sabadilla
3.	Umbelliferae	Jalbrahmi, Visnaga, Ajowan, Anise, Caraway, Celery, Coriander, Cummin, Dill, Fennel, Hemlock, Ammi, Asafoetida
4.	Graminae	Starch, Corn oil, Rice bran oil, Wheat germ oil, Citronella oil, Lemon grass oil, Palmarosa oil, Vetiver oil, Ergot, Malt extract
5.	Solanaceae	Starch of potato, Solanum, Belladonna herb, Capsicum, Capsicum oleoresin, Datura, Duboisia, Hyoscyamus, Stramonium, Ashwagandha, Tobacco, Kantkari
6.	Combretaceae	Gum ghatti, Arjuna, Bahera, Myrobalan.
7.	Rutaceae	Bael, Pectin, Pilocarpus, Citrus fruits, Bitter orange peel, Lemon peel, Rue
8.	Apidae	Honey, Bees Wax,
9.	Oleaceae	Manna olive oil,
10.	Plantaginaceae	Isapgol
11.	Compositae or Asteraceae	Inulin, Echinacea, Safflower oil, Arnica, Artemisia, Kalijiri, Insect flower, Artemisia annua, Feverfew, Saussurea, Davana oil, Bhringraj, Stevia, Milk Thistle,
12.	Phaeophyceae	Algin
13.	Rhodophyceae	Carrageenan
14.	Sterculiaceae	Gum Karaya, Cocoa butter, Cocoa (cocoa beans), Kola
15.	Rhamnaceae	Cascara
16.	Hypericaceae	Hypericum
17.	Polygonaceae	Rhubarb, Buck wheat
18.	Scrophulariaceae	Brahmi, Digitalis, Digitalis lanata, Picrorrhiza
19.	Apocynaceae	Ouobain, Strophanthus, Thevetia, Sarpagandha, Vinca, Kurchi

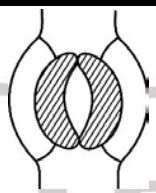
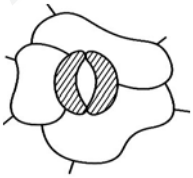
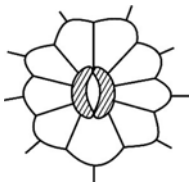
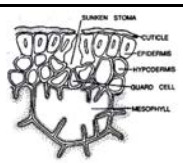
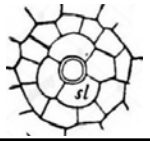
Types of soil and its composition

S NO.	TEXTURE GROUP	RELATIVE PROPORTION OF DIFFERENT SIZED MINERAL PARTICLES
1.	SANDY SOIL	85% SAND + 15 % CLAY OR SLIT OR BOTH
2.	Loamy Sand	70% + 30 % clay or slit or both
3.	Loam soil	50% sand + 50% clay or slit or both
4.	Slit	90% slit + 10% sand

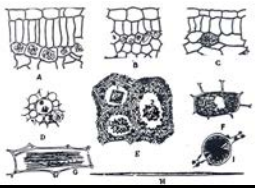
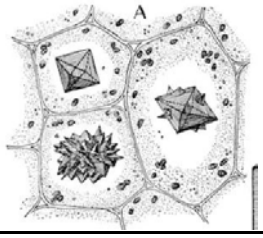
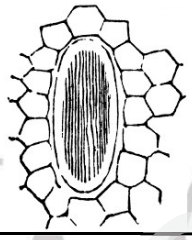
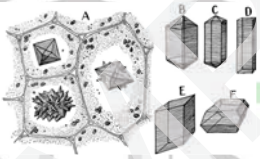
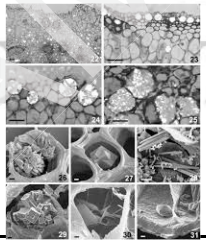
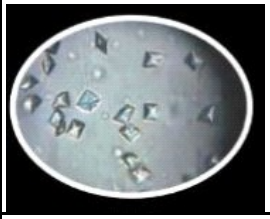
DIGESTER –107

QUALITY CONTROL AND EVALUATION OF PLANTS

1. Microscopic evaluation

S NO.	TYPES OF STOMATA	STRUCTURE	CHARACTERISTIC	EXAMPLE
1.	Paracytic / Rubiaceae/ Parallel		Two guard cell covered by the two subsidiary cell which are parallel	Senna, Coca
2.	Diacytic/ Caryophyllaceous / Cross celled stomata		Guard cell covered by the two subsidiary cell long axis of which are right angle to that of stomata	Thyme, Spearmint, Peppermint, vasaka
3.	Anomocytic / Ranuculaceous / Irregular celled stomata		Stomata covered by varying number of subsidiary cell	Buchu, Digitalis, Lobelia, Clove, Fennel, Opium
4.	Anisocytic / Cruciferous / Unequal celled stomata		Guards cell are two but subsidiary cell three and one is small	Vinca, Belladonna, Henbane, Datura
5.	Actinocytic / Radiate celled stomata		Two guard cell are covered by circle radiating subsidiary cell	
6.	Sunken stomata			Ephedra
7.	Circular stomata			Colchicum, Squill

Types of Calcium oxalate crystal and their example

S NO.	CALCIUM OXALATE	STRUCTURE	EXAMPLE
1.	**Prismatic or Cubic crystal**		Senna, Glycerrhiza, Hyocyamus, Coriander, Rauwolfia, Cascara, Wild Cherry, Quaillaia, Cardamom
2.	**Rosette or Cluster crystal**		Cascara, clove, Arjuna, Fennel, Rhubarb, Eucalyptus, Stramonium, Senna
3.	**Raphid or Acicular crystal**		Cinnamon, Squill, Gentain, Andrographis, Ipecac, Aloe, Rauwolfia.
4.	**Microsphenoidal or sandly crystal**		Tobacco, Henbane, Cinchona, Duboisa, Datura and belladonna
5.	**Tetragonal crystal**		Hyocyamus, Onion
6.	**Monoclinic crystal**		Veratrum, Oak galls, Quillaia.
7.	**Rhombic or Diamond crystal**		Kurchi, mimosa pudica
8.	**Needle shape crystal**		Comptotheca

10.	**Senega**	• Externally contain elongated tapering root and bearing tufed crown • Contain a band of enlarged phloem giving rise to keel • Root stock show central parenchymatous pitch
11.	**Visnaga**	• A large lacuna is present in primary ridges on the outerside of vascular bundle is the characteristic features of the drug.

DIGESTER –142

SYNONYMS OF GLYCOSIDAL PLANTS

S NO.	PLANTS	SYNONYMS
1	Aloe	Musabar, Kumari
2	Brahmi	Bacopa
3	Bitter almond	Amygdala, Amera
4	Cascara	Sacread bark, Chittam bark
5	Chirata	East indian, Balmony
6	Catharides	Spanish file
7	Cochineal	Red scale insect
8	Digitalis	Fox glove leaves
9	Dioscorea	Yam, rheumatism root
10	Ginseng	Ninja, Pannag, Panax
11	Gokhru	Puncture
12	Garcinica	Vilayti lamli
13	Gudmar	Madhu nashini, gymnema
14	Guduchi	Gulvel, Giloe, Amrita
15	Jalbrahmi	Manduk parni
16	Kalmegh	Andrographis
17	Momordica	Bitter guard, karela
18	Manjistha	Rakta pushpin
19	Mylabris	Chinese cantharis
20	Mustard seed	Black musterd
21	Milk thistle	Our lady thistle
22	Liquorice	Yasti, glycyrrhiza, mulethi
23	Psorelea	Bavchi
24	Picrorrhiza	India gentian, kutki
25	Quassia	Bitter wood
26	Quillaria	Soap bark
27	Satavari	Satavari
28	Stropanthus	Arrow poison
29	Senna	Thinevelly
30	Thevetia	Lucky nut tree, Trumpet flower
31	Visnaga	Pick toth fruit
32	Vanilla	Builha
33	Wild cherry	Cotex pruni
34	Hyperium	St. john wort
35	Rhubarb	Ravadchini
36	Bearberry	Uva-ursi
37	Henna	Low sonia

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Rapid Revision Notes

MODULE - 3

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DIGESTER –4

MULTIFUNCTIONAL EXCIPIENTS

CO-PROCESSED EXCIPIENTS	COMPONENTS	CLAIMED BENEFITS
StarCap1500®	Maize Starch, Pregelatinized Starch	Better flow and low compression force.
PanExcea™ MC200G®	MCC-89% Hydroxypropyl methyl cellulose-2%, Crospovidone- 9%	Enable direct compression with high speed tableting.
Pharmatose® DCL40	ß-Lactose- 95%, Lactitol- 5%	High compressibility, Low lubricant sensitivity.
Ludiflash	Mannitol-90% , Kollidon CL-SF- 5%, Kollicoat SR 30D- 5%	Rapidly disintegrating, mechanically stable tablets.
Pharmaburst 500™	Mannitol, Sorbitol, crospovidone, silica, aspartame and magnesium stearate.	Rapidly disintegrating with superior organoleptic properties.
Avicel® Ce15	MCC- 85%, Guar- 15%	Less grittiness, improved tablet palatability.

DIGESTER –5

COMPRESSIBILITY AND FLOWABILITY OF PHARMACEUTICAL EXCIPIENTS

S. NO.	MATERIAL	% COMPRESSIBILITY	FLOWABILITY
1.	Celutab	11	Excellent
2.	Emcompress	15	Excellent
3.	Star X-1500	19	Fair-passable
4.	Lactose monohydrate	19	Fair-passable
5.	Maize starch	26-27	Poor
6.	Dicalcium phosphate dehydrate (coarse)	27	Poor
7.	Magnesium stearate	31	Poor
8.	Titanium dioxide	34	Very poor
9.	Dicalcium phosphate, dehydrate (fine)	41	Very, Very poor
10.	Talc	49	Very, Very poor

DIGESTER –21

HLB RANGE OF SOME AMPHIPHILIC AGENTS

S. NO	SUBSTANCE	HLB VALUE
1.	Oleic acid	1
2.	Polyoxyethylene sorbitol beeswax derivative	2.0
3.	Sorbitan tristearate	2.1
4.	Glyceryl monostearate	3.8
5	Sorbitan mono-oleate (Span 80)	4.3
6	Diethylene glycol monostearate	4.7
7	Glyceryl monostearate, self-emulsifying (Tegin)	5.5
8	Diethylene glycol monolaurate	6.1
9	Sorbitan monolaurate (Span 20)	8.6
10	Polyethylene lauryl ether (Brij 30)	9.5
11	Gelatin (Pharmagel B)	9.8
12	Methyl cellulose	10.5
13	Polyoxyethylene lauryl ether	10.8
14	Polyoxyethylene monostearate (Myrj 45)	11.1
15	Triethanolamineoleate	12.0
16	Polyoxyethylene alkyl phenol	12.8
17	Polyethylene glycol 400 monolaurate	13.1
18	Tragacanth	13.2
19	Polyoxyethylene sorbitan mono-oleate (Tween 80)	15.0
20	Polyoxyethylene sorbitan monolaurate (Tween 20)	16.7
21	Polyoxyethylene lauryl ether (Brij 35)	16.9
22	Sodium oleate	18.0
23	Potassium oleate	20
24.	Sodium lauryl sulfate	40

DIGESTER –22

DIFFERENCE BETWEEN O/W AND W/O EMULSION

S.NO.	O/W	W/O
1.	Non greasy and easily removable from the skin Surface	More greasy and not washable with water
2.	Generally for internal use as bitter taste of oil an be masked	Generally for external use like creams
3.	Externally applied emulsion e.g. vanishing cream provide cooling effect	Externally applied emulsion prevent evaporation of moisture from the surface of skin
4.	Water soluble drug are more quickly released from O/W emulsion	Oil soluble drug are more quickly released from W/O emulsion
5.	Show a +ve conductivity test	Show a –ve conductivity test
6.	Example –Vanishing cream	Example – Cold cream

DIGESTER –27

IMPORTANT NON-IONIC SURFACTANTS

NON-IONIC SURFACTANT	CHEMICAL NAME
Span 20	Sorbitan monolaurate
Span 40	Sorbitan monopalmitate
Span 60	Sorbitan monostearate
Span 80	Sorbitan monooleate
Tween 20	Polyoxyethylene sorbitan monolaurate
Tween 40	Polyoxyethylene sorbitan monopalmitate
Tween 60	Polyoxyethylene sorbitan monostearate
Tween 80	Polyoxyethylene sorbitan monooleate
MYRJ 45	Polyoxylethylene monostearate
BRIJ 30	Polyethylene lauryl ether
BRIJ 35	Polyoxylethylene lauryl ether
PLURONICS	Combination of polyoxyethylene and polypropylene
Promulgens D	Ceteryl alcohol and ceteareth 20
Promulgens G	Stearyl alcohol and ceteareth 20

DIGESTER –28

TYPES OF SUSPENSION

FLOCCULATED SUSPENSION	DEFLOCCULATED SUSPENSION
Settles as flocs	Particles settles as a separately due to low particle size
Supernatant liquid is clear	Supernatant liquid is cloudy
Suspending agent settles down rapidly	Suspending agent remains suspended for long time
Uniform dose distribution, hence pharmaceutically acceptable, but not recommended for parenterals.	Non-uniform dose distribution, hence pharmaceutically unacceptable, but used is in parenteral preparations.
Exhibits plastic or pseudoplastic flow.	In low concentration it exhibits Newtonian flow, where as in high concentration it exhibits dilatant behavior.

DIGESTER –29

TYPES OF SUSPENSION BASED ON SIZE OF SOLID PARTICLES

SUSPENSION	PARTICLE SIZE
Colloidal suspension	< 1 μm
Coarse suspension	> 1 μm
Nano suspension	10 nm

DIGESTER –65

DISINTEGRATION TIME OF DIFFERENT TABLETS

TYPES OF TABLET/CAPSULE	DISINTEGRATION MEDIA	DISINTEGRATION TIME (MIN)	
		IP	USP
Dispersible tablet	Water (24-26°C)	3 or less	3 or less
Effervescent tablet	Water (250 ml at 20-30°C)	5 or less	5 or less
Uncoated tablet	Water	15 or less	30 or less
Film coated tablet	Water or 0.1 N HCL	30 or less	30 or less
Vaginal tablet	Water	30 or less	30 or less
Sugar coated tablet	Water	60 or less	60 or less
Enteric coated tablet	0.1 N HCL	120 or less	60 or less
	Phosphated buffer	60 or less	120 or less
Hard gelatin capsule	Water	15 or less	15 or less
Soft gelatin capsule	Water	60 or less	60 or less

DIGESTER –66

TYPES OF DISSOLUTION APPARATUS

APPARATUS TYPE	IP	USP	B.P
TYPE I	Paddle Apparatus	Basket Apparatus	Basket Apparatus
TYPE II	Basket Apparatus	Paddle Apparatus	Paddle Apparatus
TYPE III		Reciprocating Cylinder	Flow Through Cell
TYPE IV		Flow Through Cell	
TYPE V		Paddle Over Disc	
TYPE VI		Rotating Cylinder	
TYPE VII		Reciprocating Disc	

DIGESTER –67

TYPES OF DISSOLUTION APPARATUS AND THEIR APPLICATIONS

USP APPARATUS	TYPE	DRUG FORMULATION TESTED
Apparatus I	Rotating Basket apparatus	Conventional tablet, Chewable tablet, Controlled release formulation
Apparatus II	Rotating Paddle apparatus	Orally disintegrating tablet, Chewable tablet, Capsule, Suspension, Controlled release formulation
Apparatus III	Reciprocating Cylinder apparatus	Controlled release formulation, Chewable tablets
Apparatus IV	Flow Through Cell apparatus	Poorly soulbe drugs, Powder, granules , Microparticles, Implants
Apparatus V	Paddle Over Disc apparatus	Transdermal patch
Apparatus VI	Cylinder apparatus	Transdermal patch
Apparatus VII	Reciprocating disc apparatus	Controlled release formulation(non-disintegrating oral formulation and transdermal formulation)

DIGESTER –124

DIFFERENCE BETWEEN MATRIX AND RESERVIOR SYSTEM

MATRIX SYSTEM	RESERVIOR SYSTEM
Achievement of zero order is difficult	Achievement of zero order is easy
Suitable for both degradable and non-degradable systems	Degradable reservoir systems may be difficult to design
No danger of dose dumping	Rupture can result in dangerous dose dumping
Not all drugs can be blended with a given polymeric matrix	Drug inactivation by contact with the polymeric matrix can be avoided
Can deliver high mol. Wt. compounds	Difficult to deliver high mol. Wt. compounds

DIGESTER –125

RETARDANTS USED IN MATRIX TABLET FORMULATION

S. NO.	MATRIX CHARACTERISTICS	MATERIAL
1.	Insoluble, Inert	Polyethylene
		Polyvinyl chloride
		Methylacrylate-methacrylate copolymer
		Ethyl cellulose
2.	Insoluble, Erodible	Carnauba wax
		Stearyl alcohol
		Stearic acid
		Polyethylene Glycol
		Castor wax
		Polyethylene glycol monostearate
		Triglycerides

DIGESTER –126

CLASSIFICATION OF NOVEL DRUG DELIVERY SYSTEM

S. No.	DRUG DELIVERY STSTEM	DEFINITION
1.	**Liposomes**	Liposomes are small vesicles in bilayer form composed of phospholipids, especially phosphatidylcholine, but may also include other lipids, such as egg phosphatidylethanolamine, so long as they are compatible with lipid bilayer structure.
2.	**Niosome**	Niosomes are promising vehicle for drug delivery and being non-ionic. Niosome have better stability than liposome. Their physical properties are similar to liposomes.

DIGESTER –137

DIFFERENT ACTS AND SECTIONS

Acts	Chapters	Sections
Pharmacy act	5	46
Drug and Cosmetic Act	5	38
Narcotic Drug and Psychotics Subs.	6	83
Drug Price Control Order		32
Medicinal & Toilet Preparation Act	9	143
Patent Act	23	163
Factories Act	11	120
Trade and Merchandise Act	11	136
Industries Act	6	31
Medical Termination & Pregnancy Act		8
Insecticide Act		38
Minimum Wages Act		31

DIGESTER –138

OFFENCES AND PENALTIES OF DIFFERENT ACTS

S.No.	Offence	First conviction	Second conviction
I	**Pharmacy Act**		
1.	Penalty for falsely claiming to be registered pharmacist	6M /500	
2.	Dispensing by unregistered persons	6M /1000	
3.	Falling to surrender certificate of registration	50	
II.	**Drugs and Cosmetics Act and Rules**		
A.	**Manufacture and sale of drugs**		
1.	Any adulterated or spurious drug	5Y/ 10000	10Y /20000
2.	Adulterated drug but not containing toxic substances	1-3Y/5000	2-4Y/ 10000
3.	Without licence	------,,-------	------,,-------
4.	Spurious drugs but not manufactured under the name of any other drug	3-5Y/ 5000	6-10Y/10000
5.	Any other contravention of this act	1-2Y /fine	2-4Y/ 5000
6.	Not disclosing name of manufacture or place of manufacture	3 Y/ 1000	
7.	Not keeping records of manufacture or sale of drugs	------,,-------	
8.	Using report of Government Analyst for advertising drug	500	10 Y
B.	**Manufacture and sale of Cosmetics**		
1.	Any adulterated or spurious cosmetic	3 Y	
2.	Any other contravention of this act	1 Y/ 1000	
3.	Not disclosing name of manufacture or place of manufacture	------,,-------	

DIGESTER –145

LIST OF DIFFERENT SCHEDULES OF DRUG AND COSMETIC ACT

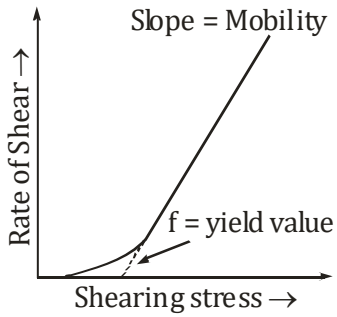
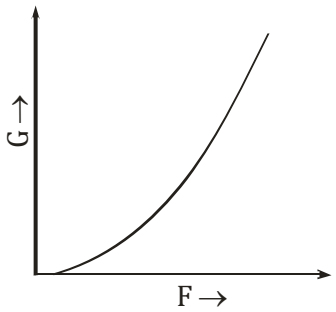
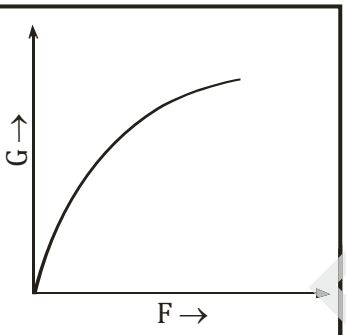
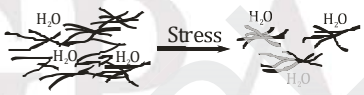
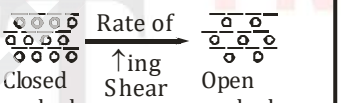
SCHEDULE	SCHEDULE RELATED WITH THE INFORMATION	
A	**Preforma** for the application for getting licenses, issue and renewal of licenses or sending memoranda under the act. Preforma for **forms no. 1 to 50** (Application, issue, renewal, etc.)	
B	**Rate of fee for test or analysis** by the Central Drugs Laboratory or the Government Analyst.	
C	List of **biological and other special products (Injectable)** whose import, sale, distribution and manufacture are governed by special provisions. Ex. Sera, Vaccines. Penicillin, etc.	
C_1	List of **other special products (non-parenteral)** whose import, sale, distribution and manufacture are governed by special provisions. Ex. Digitalis, Hormones, Ergot.	
D	List of drugs that are exempted from the provisions of **import**.	
E_1	List of poisonous substances under the **Ayurvedic, Siddha and Unani systems of the medicine.**	
F	Part XII B-**Requirement for the functioning and operation of blood bank** and/ or for the preparation of blood bank or Provisions applicable to blood **Licence to operate "Blood Bank" is granted by Drug Licencing Authority of state	
F_1	Part-I	Provision applicable to the production of **bacterial and viral vaccine**.
	Part-II	Provision applicable to the production of **all sera from living animals.**
	Part-III	Provision applicable to the manufacture and standardization of **diagnostic agents (bacterial origin).**
F_2	Standards for **Surgical dressings.**	
F_3	Standards for **Sterilized umbilical tapes.**	
FF	Standards for **Ophthalmic preparations.**	
G	List of substances that are required to be used **only under medical supervision** and which are labelled accordingly.	
H	**List of prescription drugs** which are sold by retail and only on prescription of registered Medical Practitioner.	
J	List of **diseases and ailments** which a drug may not purport to prevent or **cure** Ex. Cancer, AIDS, Cataract, Diabetes, etc.	
K	List of drugs that are **exempted** from certain provisions regarding manufacture.	
M	Requirements of manufacturing premises, GMP requirements of factory premises, plants and equipments.	
Part -I	GMP for premises and material : Specific requirement for manufacturing of	
	A	**Sterile products**, **parenteral preparations** (Small volume injectable and large volume parenteral) and sterile ophthalmic preparations.
	B	**Oral solid dosage forms** (tablets and capsule).
	C	**Oral liquids** (Syrup, elixirs, emulsion, suspension).
	D	**Topical** (external) products (creams, ointments, pastes, emulsions, solutions, dusting powders and identical products).
	E	**Metered dose inhalators** (MDI).

DIGESTER –148

FORMS (1 TO 50) IN D & C ACT AND RULES

For retail & wholesale of drugs	• For drugs **other than** those specified in **schedules c, c(1) and x:** 19, **20, 20b, 20bb** (sale on motor vehicle), 19a, **20a** • For drugs specified in **schedules x:** 19c, **20f, 20g** • For **homeopathic drugs:** 19b, **20c, 20d,** 20e • For drugs specified in **schedules c and c(1): 21, 21a, 21b, 21bb** (sale on motor vehicle), 21c, 21cc
For manufacturing of blood products	• For **blood bank:** 27c, **28c**, 26g • For **large volume parenterals/ sera and vaccine / recombinant DNA** (r-DNA) **derived drugs:** 27d, **28d**, 26h, 27da, **28da**, 26j • For **blood products:** 27e, **28e**, 26i • For **umbilical cord:** 27f, **28f**, 26-j
For Drug Inspector	• 1 (Memorandum to CDL) • 1a (Memorandum to PLIM) • 18 (Memorandum to GA) • 18a (Intimation to person from whom sample is taken) • 15 (Order to a person not to dispose of stock in his possession) • 16 (Receipt for stock of object seized) • 35 (inspection book)
For manufacturing of drugs	• For manufacturing of allopathic drugs: 24, **25**, 26, 24a, **25a**, 26a, • For repacking of drugs: 24b, **25b**, 26b • For manufacturing of homeopathic drugs: 24c, **25c**, 26c • For manufacturing of ayurvedic/siddha or unani drugs: 24d, **25d**, 26d, 24e, **25e**, 26e, 26e1 • For manufacturing of schedule x drugs: 24f, **25f**, 26f • For manufacturing of schedules c and c (1) drugs: 27, **28**, 27a, **28a** • For manufacturing of schedules c, c (1) and x drugs: 27b, 28b • For manufacturing of drugs for purposes of examination, test or analysis: 30, 29 • For manufacturing of cosmetics: 31, **32**, 33, 31a, **32a**, 33a • For manufacturing of new drug and raw material (new bulk drug): **46, 46a**
For import of drugs	• For undertaking to accompany import: 9 • For import of drugs except schedule x: 8, **10**, • For import of drugs specified in schedule x: 8a, 10a, • For import drugs for purpose of **examination, test or analysis:** 12, **11** • For import drugs for **treatment of patients** by a government hospital or autonomous medical institution: **11a** • For import drugs **for personal use:** 12a, **12b** • For import **new drugs** for **treatment of patients** by a government hospital or autonomous medical institution 12aa, • For import or manufacture a new drug or to undertake clinical trial: 44 • For import of finished formulation of a new drug: **45** • For import of raw material (new bulk drug substance): **45a** • For import of **drugs:** 40, **41**, • For import of **cosmetics:** 42, **43**

211.196	Distribution records
211.198	Complaint files
Subpart K- Returned and salvaged drug product	
211.204	Returned drug product
211.208	Drug product salvaging

4			
5	Equ^{n} → $U = \frac{F-f}{G}$ U = Plastic viscosity f = Yield value [N/m^2] G = Rate of shear [S] F = Shear stress [N/m^2]	Equ^{n} → $F^N = \eta' G$ N = 1 (Newtonian flow) N > 1 (Non-newtonian flow)	Equ^{n} → $F^N = \eta' G$ N<1 = degree of dilatency ↑ses N=1 = Newtonian flow N>1 = Non-newtonian
6	Known as Bingham bodies	SHEAR THINNING SYSTEM	SHEAR THICKENING SYSTEM
7	It doesn't flow until shearing stress is extended as yield value		 Minimum void volume Low consistency Maximum void volume High consistency
8	Viscosity is linearly increase with increase in rate of shear	Viscosity of pseudoplastic substance decrease with increase rate of shear	Viscosity of dilatant substance increases with increase in stress
9	**Eg :** Flocculated particles in concentrated suspension	**Eg :** Liquid dispersion of natural and synthetics gums (tragacanth, Sodium alginate, Methyl cellulose, Sodium carboxy methyl cellulose)	**Eg:** • Suspension containing high concentration of solids, • Suspension of starch in water, • Inorganic pigments in water, kaolin in water, zinc oxide in water

DIGESTER –188

TYPE OF FLOW

TYPE OF FLOW	EXAMPLE
Newtonian	Water, Glycerin, Benzene, Alcohol, Syrup solution, Very dilute colloid solution
Plastic (Bingham body)	Suspension of ZnO_2 in mineral oil point, Printing inks and Firm jellies Flocculated suspension (1.10% solid content)
Pseudoplastic	Natural and synthetic gums, Polymers such as MC, CMC, Tragacanth, Sodium alginate, gelatin
Dilatant	De Flocculated suspension (more than 50% solid content) e.g. Concentrated titanium dioxide suspension

BIOPHARMACEUTICS

DIGESTER –253

MECHANISM OF ABSORPTION

<table>
<tr><th colspan="4">1. Transcellular / intracellular – Most common pathway for drug transport</th></tr>
<tr><td rowspan="4">Passive transport</td><td>Passive diffusion</td><td colspan="2">• Non saturable
Follow first order kinetic
Expressed by: Fick's law of diffusion
$\frac{dQ}{dt} = \frac{DAK_{o/w}}{h}(C_{GIT} - C)$</td></tr>
<tr><td>Pore transport</td><td colspan="2">Also known as connective transport, bulk flow, and filtration.
Suitable for low molecular weight.</td></tr>
<tr><td>Ion-pair transport</td><td colspan="2">Based the charge of membrane.
Unionised > anions > cations</td></tr>
<tr><td>Carrier mediated diffusion</td><td colspan="2">Structure specific carrier (lock-key arrangement)
Saturated transport
Mixed order kinetics</td></tr>
<tr><td rowspan="4">Active transport</td><td rowspan="2">Primary active</td><td>Ion transport</td><td>Responsible for transportiong ions in or out.</td></tr>
<tr><td>ABC transport</td><td>ATP binding cassette
Transport small foreign molecules</td></tr>
<tr><td rowspan="2">Secondary active</td><td>Symport (Co-transport)</td><td>Involve movement of both the molecule in the same direction.
Example: Na^+ glucose symporter</td></tr>
<tr><td>Antiport (Counter-transport)</td><td>Involve moment of molecule in the opposite direction. Example: Expulsion of H^+ ions using the Na^+ gradient in the kidney</td></tr>
<tr><th colspan="4">2. Para cellular/ intercellular</th></tr>
<tr><td colspan="2">Permeation through tight junction of epithelial cells</td><td colspan="2">Basically through an openings.
Example: Insulin and cardiac glycoside taken by this mechanism.</td></tr>
<tr><td colspan="2">Persorption</td><td colspan="2">Permeation of drug through temporary opening cell into lumen.</td></tr>
<tr><th colspan="4">3. Vesicular transport - Energy dependent process</th></tr>
<tr><td colspan="2">Pinocytosis</td><td colspan="2">Uptake of fluids. Example: Sabin polio vaccine, Botulism toxin</td></tr>
<tr><td colspan="2">Phagocytosis</td><td colspan="2">Absorption uptake of solids
Example: Vitamin A, D, E, K, insulin</td></tr>
</table>

DIGESTER –264

BIOTRANSFORMATION REACTION

Phase – I reaction	
Oxidative reaction	• Most abundant & most common metabolic reaction • For oxidation reaction require molecular oxygen (O_2), reducing agent NADPH (mixed function oxidases) & Cyt.P450 • Mixed function oxidases – located in ER of hepatic cells, it is composed of electron transport chain consisting of components 1. A heme protein-k/a Cytochrome P450(terminal oxidase) 2. Flavoprotein k/a Cytochrome P450 reductase (electron carrier) 3. Phosphatidylcholine -heat stable → Mg ion also required for maximal activity of mixed function oxidases
Reductive reaction	➢ Reductive reactions generate metabolites with polar functional group which undergo further conjugation or biotransformation. ➢ These are reversible reactions leading to conversion of inactive metabolite to active drug removal and hence results in prolongation of action
Hydrolytic reaction	In this the functional groups like esters, ethers, amides, hydrazides are hydrolyzed and results in loss in large fragments of molecules
Phase – II reaction	
❖ Phase-II reaction involve transfer of glucuronic acid, sulfate, glycine to drugs or metabolite of phase-I reaction to form polar, rapidly excretable pharmacologically inert conjugates. ❖ Real drug detoxification pathways ❖ The moieties transferred are simple, endogenous molecules with large molecular size. ❖ Strongly polar or ionic in nature and make the substrate water soluble. ❖ Conjugation reactions are capacity limited. ❖ Capacities of important conjugation • **Glucuronidation >Amino Acid Conjugation > Sulfation >Glutathione Conjugation**	
Conjugation with Glucuronic acid	• Most common & most important phase-II reaction • Conjugating moiety-D-glucuronic acid (derived from D-glucose)
Conjugation with Sulphate moiety	• Sulfation is conjugated by non-microsomal enzymes • It is a saturable process
Conjugation with α-amino acid	• Conjugation with α-amino acids like glycine, glutamine and less extent to aspartic acid, taurine, serine are observed • Extensively occurs in liver mitochondria • Reaction can be used in estimation of liver function

Renal clearance ratio	$\mathbf{Q = \frac{Cl_d}{Cl_{cr}}}$ CI_d = Renal clearance of drug Cl_{cr} = Renal clearance of creatinine
	Question: What is the renal clearance ratio of a drug if its renal clearance value is 300? Given: Renal clearance of creatinine = 150 ml/min) **Solution:** $Q = \frac{Cl_d}{Cl_{cr}} = \frac{300}{150}$ So renal clearance ratio was 2.
Renal clearance	$\mathbf{cl_r = \frac{R_f + R_s - R_r}{C}}$ R_f = Rate of filtration R_s = Rate of secretion R_r = Rate of reabsorption C = Total plasma drug concentration
	Question: The rate of filtration of paracetamol is 10 mg/ml the rate of secretion is 8 mg/ml and rate of reabsorption is 6 mg/ml. What will be renal clearance of paracetmol if its plasma concentration is 2 mg/ml. **Solution:** $\mathbf{cl_r = \frac{R_f + R_s - R_r}{C} = \frac{10 + 8 - 6}{2}} = 12$ so renal clearance is 12 ml/min.
Dosing interval in renal failure	$\mathbf{DI = \frac{NI}{RF}}$ NI = Normal interval in hours RF = Renal function
	Question: Calculate the dosing interval in renal failure patient normal dosing Interval is 3 hours and renal function value is 0.70. **Solution:** $DI = \frac{NI}{RF} = \frac{3}{0.70} = 4.28$ So dosing interval in renal failure patient is 4.28 hours.
Dialysis clearance	$\mathbf{Cl_d = \frac{Q(C_{in} - C_{out})}{C_{in}}}$ Q = Blood flow to dialyzer C_{in} = Concentration of drug in blood entering the dialyzer C_{out} = Concentration of drug in blood leaving the dialyzer
	Question: What is the dialysis clearance when the blood flow rate to the dialyzer is 20 ml/min and concentration of drug entering and leaving the dialyzer is 60 µg/ml and 10 µg/ml respectively? **Solution:** $\mathbf{Cl_d = \frac{Q(C_{in} - C_{out})}{C_{in}}} = \frac{20(60-10)}{60} = 16.66$ So dialysis clearance is 16.66 ml/min.

DIGESTER –292

PHARMACOGNOSY

%Total ash value	**%Total ash Value** $= \frac{W_a}{W_d} \times 100$ W_a = Weight of ash W_d = Weight of drug
	Question: when 200 gm crude drug was incinerated, 90 gm ash was produced. What is %Total ash value? **Solution:** $= \frac{W_a}{W_d} \times 100 = \frac{90}{200} \times 100 = 45\%$
% Soluble extractive	**% soluble extractive** $= \frac{W_e}{W_d} \times 100$ W_e = Weight of extractive W_d = Weight of drug
Stomatal index	**S.I.** $= \left(\frac{S}{E+S}\right) \times 100$ S = Number of stomata per unit area E = Number of epidermal cells in the same unit area
	Question: If number of stomata per cm is 20 and number of epidermal cells per cm is 31 of a leaf, then what is the Stomatal Index of that leaf? **Solution:** $\left(\frac{S}{E+S}\right) \times 100 = \left(\frac{20}{20+31}\right) \times 100 = 39.21$
Lycopodium spore method	**% Purity of drug** $= \left\{\frac{N \times W \times 94000 \times 100}{S \times M \times P}\right\}$ N = Number of characteristic structures in 26 fields W = Weight in mg of lycopodium taken S = Number of lycopodium spores in the same 25 fields M = Weight in mg of the sample dried at 105°C P = 286000 in case of ginger starch grains powder
	Question: When 1 gm lycopodium was taken; 2400 lycopodium spores were observed in 25 fields. When 2 gm ginger starch grain powder was taken; 600 characteristic structures were observed in same 25 fields. What is the % purity of ginger starch grain powder sample? **Solution:** % Purity of drug $= \left\{\frac{600 \times 1000 \times 94000 \times 100}{2400 \times 1000 \times 28600}\right\} = 82\ \%$
Foaming index	**Foming index** $= \frac{1000}{a}$ Where, a = Volume in ml of the decoction in the test tube showing 1 cm foam height

Modified Noyes and whitney equation	$\frac{dC}{dt} = \frac{D.S}{V.h}(C_s - C)$ Where, D = Diffusion coefficient S = Surface area of exposed solid V = Volume of solution h = Thickness of diffusion layer C = Solubility of solid drug C = Solubility of the drug at time 't'
Hixon and Crowell's root law of dissolution	$W_0^{1/3} - W_t^{1/3} = K \times t$ Where, W_0 = Original mass of the drug W = Mass of the drug remaining to dissolve at K = Dissolution rate constant
Danckwert's model	$V.\frac{dC}{dt} = A(C_s - C_b).\sqrt{\gamma.D}$ $\frac{dC}{dt}$ = Dissolution rate of the drug Where, A = Surface area of solid γ= Constant (Cs - C) = Concentration gradient V = Volume of diffusion medium D = Diffusion Coefficient
Interfacial barrier model of dissolution	$G = K_i(C_s - C_b)$ Where, G = Dissolution rate per unit area K_i = Effective interfacial transport constant (Cs-Cb) = Concentration gradient
Darcy's law	$V = \frac{KA\Delta P}{\eta l}$ Where, V = volume K = Permeability coefficient ΔP= Pressure difference η= Viscosity of the liquid l = thickness of filter cake
Rate of evaporation in drying	$\frac{dW}{d\theta} = \frac{q}{\tau}$ Where, q = Overall rate of heat transfer t = Latent heat of vaporization of water

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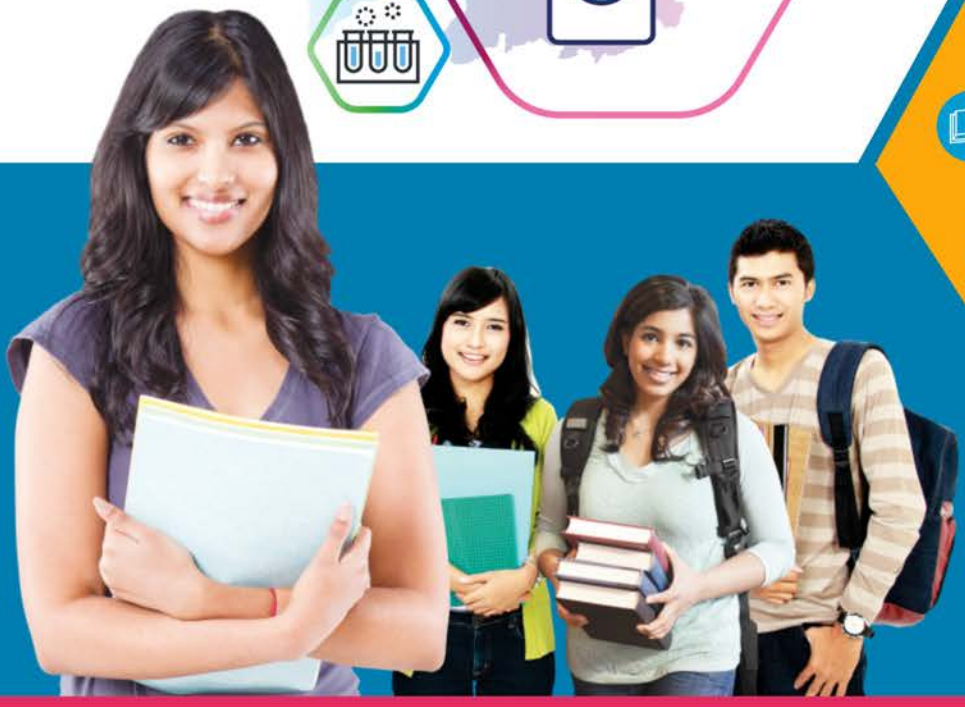
GDC PUBLICATION

DIGESTER

MODULE 4

Rapid Revision Notes

- Pathology
- Pharmacology
- Human Anatomy & Physiology
- Pharmaceutical Management
- Hospital Pharmacy



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DIGESTER

Rapid Revision Notes

MODULE - 4

YOUR GATEWAY TO SUCCESS

GPAT DISCUSSION CENTER

GPAT I NIPER I DRUG INSPECTOR I PHARMACIST

DIGESTER –11

COMBINED EFFECT OF DRUGS

NON- COMPETITIVE INHIBITORS	
EXAMPLES OF DRUGS	**NON- COMPETITIVE INHIBITOR**
Acetazolamide	Carbonic anhydrase
Aspirin, indomethacin	Cyclooxygenase
Disulfiram	Aldehyde dehydrogenase
Nialamide	Monoamine oxidase
Digoxin	Na^+ K^+ ATPase
Theophylline	Phosphodiesterase
Propylthiouracil	Peroxidase in thyroid
Omeprazole	H^+K^+ ATPase
ADDITIVE	
EXAMPLES OF DRUGS	**USES**
Aspirin + paracetamol (Benorylate)	Analgesic /antipyretic
Nitrous oxide + Ether	General anaesthetic
Ephedrine + Theophylline	Bronchodilator
Sulfadiazine + Sulfamerazine + Sulfamethazime	Antibacterial
SUPRAADDITIVE (POTENTIATION) Effect of drug A+B > Effect of drug A+ effect of drug B	
EXAMPLES OF DRUG	**MECHANISM**
Acetylcholine + Physostigmine	Inhibition of breakdown
Levodopa + Carbidopa/Benserazide	Inhibition of peripheral metabolism
Adrenaline + Cocaine / Desipramine	Inhibition of uptake
Sulfonamide + Trimethoprim	Sequential blockade
Captopril + Diuretics	Tackling two contributing factors
Tyramine + MAO inhibitors	Increasing releasable Catecholamines store

DIGESTER –12

DRUG OF CHOICE AGAINST DISEASE

S NO.	CONDITION/DISEASE	DRUG OF CHOICE
1.	Atropine poisoning	Physostigmine
2.	Acute Pulmonary edema	Furosemide (Loop diuretic)
3.	Acute gout	NSAIDs (except aspirin)
4.	Alzheimer's disease	Rivastigmine/ Gallantamine/Donepezil
5.	Anaesthetic in shock	Ketamine
6.	Anaesthetics for neurosurgery	Isoflurane
7.	Anaphylactic shock	Adrenaline
8.	Atrial fibrillation /Atrial flutter (to maintain sinus rhythm)	Ibutilide, flecainide
9.	Atrial fibrillation /Atrial flutter (to control ventricular rate)	β-blockers
10.	Av block Sinus bradycardia	Atropine

DIGESTER –17

PRODRUG AND ACTIVE FORM

S NO.	PRODRUGS	ACTIVE FROM
1	**Acyclovir**	Acyclovir triphosphate
2	**α-methyldopa**	α-methylnorepinephrine
3	**Benazepril**	Benazeprilat
4	**Bacampacillin**	Ampicillin
5	**Bambuterol**	Salbutamol
6	**Cyclophosphamide**	4-hydroxycyclophosphamide
7	**Chloramphenicol palmitate**	Chloramphenicol
8	**Clindamycin palmitate**	Clindamycin
9	**Carbecillin**	Carbenicillin
10	**Diethyl dithioisophthalate**	Ethyl mercaptan
11	**Dipivefrine**	Epinephrine
12	**Estrogen propionate**	Estrogen
13	**Estramustine**	17α-estradiol
14	**Enalapril**	Enalaprillat
15	**Fosinopril**	Fosinoprilat
16	**Fluorouracil**	Fluorouracil monophosphate
17	**Levodopa**	Dopamine
18	**Nadolol diacetate ester**	Nadolol
19	**Mercaptopurine**	Methylmercaptopurine ribonucleotide
20	**Proguanil**	Cycloguanil
21	**Prednisone**	Prednisolone
22	**Quinalapril**	Quinalaprilat
23	**Ramipril**	Ramiprilat
24	**Sulfisoxazole acetyl**	Sulfisoxazole
25	**sodium succinate**	Corticosteroids
26	**Sulindac**	Sulphide metabolite
27	**Sulfasalazine**	5-asa +sulfa pyridine/5-aminosalicylic acid
28	**Testosterone propionate**	Testosterone
29	**Testosterone phosphate ester**	Testosterone
30	**Triamcinolone diacetate**	Triamcinolone

S. NO.	ACTIVE DRUG	ACTIVE METABOLITE
1	**Spironolactone**	Canrenone
2	**Phenacetin**	Paracetamol
3	**Morphine**	Codeine
4	**Digitoxin**	Digoxin
5	**Trimethadione**	Dimethadione
6	**Primidone**	Phenobarbitone
7	**Imipramine**	Desipramine
8	**Chloral hydrate**	Trichloroethanol
9	**Amitriptyline**	Nortriptyline
10	**Phenylbutazone**	Oxyphenbutazone
11	**Azathioprine**	6-mercaptopurine
12	**Carbamazepine**	Carbamazepine-9,10-epoxide

DIGESTER –25

ADRENERGIC AGONIST AND THEIR RECEPTOR ACTION AND THERAPEUTIC USES

ADRENERGIC AGONIST	RECEPTOR ACTION	THERAPEUTIC USES
1. Directly acting		
Adrenaline	α_1, α_2 β_1, β_2, and β_3 agonist	• Anaphylactic shock, Bronchial asthma (acute) • Cardiac arrest, • To prolong the duration of local anaesthetic, • To control epistaxis and other capillary oozing.
Non Adrenaline	α_1, α_2 and β_1 agonist	Hypotensive state
Isoprenaline	β_1 and β_2,	• Heart block, • Cardiac arrest
Dobutamine	Relatively β_1 selective agonist	• Cardiogenic shock due to acute myocardial infraction, • Congestive Heart failure or Cardiac surgery
Salbutamol **Terbutaline** **Salmeterol** **Formeterol**	Selective β_1 agonist	• Bronchial asthma, • To suppress premature labour (as a uterine relaxant)
Ritodrine **Isoxsuprine**	Selective β_2 agonist with main action on uterus	Uterine relaxant
Phenylephrine **Methoxamine** **Mephentermine**	Selective α_1 agonist	• Vasopressor agent, • Nasal decongestant, as Mydriasis(Phenylephrine), • Allergic or vasomotor rhinitis
Naphazoline **Oxymetazoline** **Xylometazoline**	α_1 and α_2 agonist	Nasal decongestant ($\alpha_1$stimulation), Structural damage can occur due to intense vasoconstriction ($\alpha_2$stimulation)
Clonidine, α methyldopa	α_2 -agonist	Hypertension
Apraclonidine **Brimonidine**	α_2- agonist	Glaucoma
2. Indirect acting		
Amphetamine **Methamphetamine** **Methylphenidate**	They are release NA in the periphery, NA, DA and 5-hydroxytryptamine (5-HT) centrally	Narcolepsy, attention-deficit hyperkinetic disorder (ADHD)
3. Mixed acting		
Ephedrine	α_1, α_2 β_1, β_2, (direct action) + release NA (indirect action)	Intravenous ephedrine is used for treatment of hypotension due to spinal anaesthetic
Dopamine	α_1, α_2 β_1 and D_1 + release NA	Cardiogenic shock, CCF with oliguria

4.	**ALIPHATIC CARBOXYLIC ACID**	Valproate, Divalproex	• Prolongation of **sodium channel inactivation** • Enhance release of inhibitory transmitter GABA due to inhibition of its degradation(by **GABA-transaminase)** • Inhibition of **T types of Ca^+ current** • Blockage of excitatory **NMDA** glutamate receptor.
4.	**ALIPHATIC CARBOXYLIC ACID**	Valproate, Divalproex	• Prolongation of **sodium channel inactivation** • Enhance release of inhibitory transmitter GABA due to inhibition of its degradation(by **GABA-transaminase)** • Inhibition of **T types of Ca^+ current** • Blockage of excitatory **NMDA** glutamate receptor.
5.	**BARBITURATE**	Diazepam, Lorazepam, Clobazam, Clonazepam	Facilitation of **GABA mediated Cl^- channel** opening
6.	**BENZODIAZEPINES**	Phenobarbitone, Pentobarbitone	Facilitation of **$GABA_A$ mediated Cl^-channel** opening
7.	**CYCLIC GABA ANALOGUE**	Gabapentin, Pregabaline	It is the GABA derivative cross to the brain and **enhance the GABA release** but does not act as agonist at $GABA_A$ receptor.
8.	**SUCCINIMIDES**	Ethosuximide	Inhibition of **T types Ca^+current**
9.	**NEWER DRUGS**	Levetiractam	Synaptically release the **GABA/ glutamate by binding with SV_2A.**
		Topiramide	• Prolongation of sodium channel inactivation • Antagonism of certain glutamate receptor and neuronal hyperpolarization through certain K^+ channel. • GABA potentiation by postsynaptically effect.
		Zonisamide	• Prolongation of **sodium channel inactivation** • Inhibition of **T types of Ca^+current**
		Lacosamide	Prolongation of **sodium channel inactivation**
		Vigabatrin	It is the inhibitor of **GABA-transaminase**, the enzyme which degrades GABA.
		Tiagabine	GABA neuronal inhibition by **blocking GABA transporter GAT-1** which removes synaptically release GABA into neurons and glial cells.
		Topiramate	Prolongation of **sodium channel inactivation**

DIGESTER –88

DISORDERS OF HEART

Tachycardia	Increased rate of heart beat
Bradycardia	Decreased rate of heart beat
Arrhythmia	It is irregular heartbeat
Coronary thrombosis	Formation of clot in coronary artery
Atherosclerosis	Thickening of walls of blood vessels due to deposition of fat including cholesterol
Myocardial Ischaemia	Inadequate flow of blood to a part of heart
Arteriosclerosis	Hardening or loss of elasticity of arteries

DIGESTER –89

DIFFERENT PHASES OF CARDIAC ARRHYTHMIAS

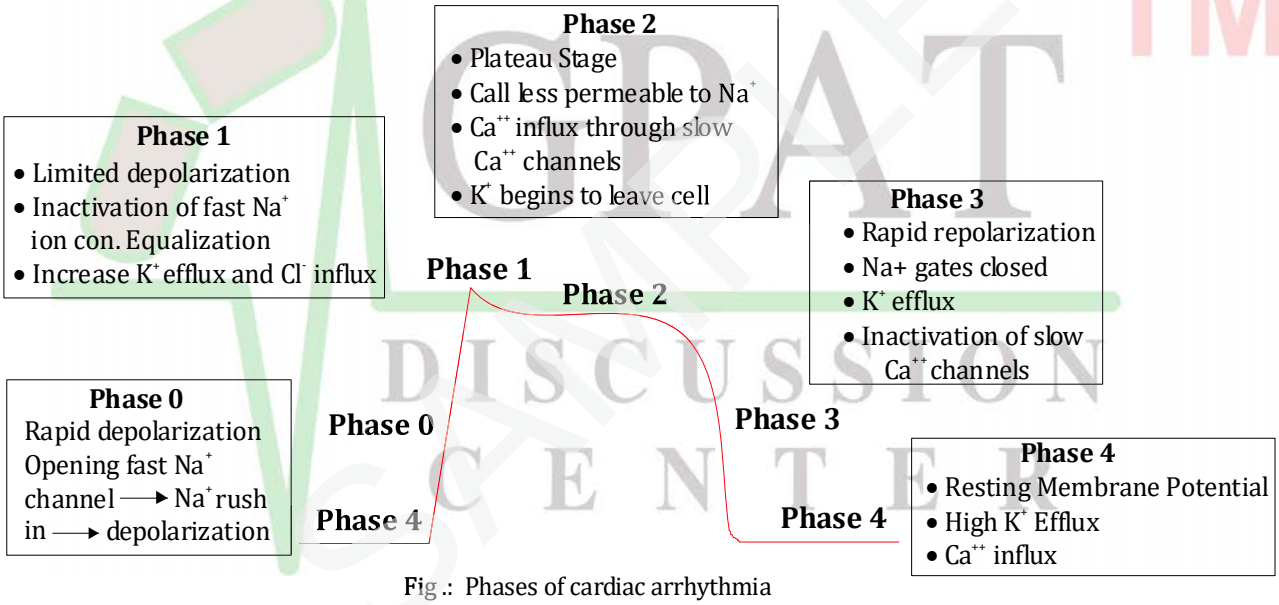


Fig.: Phases of cardiac arrhythmia

Phase 4:	It is **resting membrane potential** (when the cell is not being stimulate), This phase is associated with diastole.
Phase 0:	**Rapid depolarization** phase occurs **due to fast inflow of Na^+ ions.**
Phase 1:	**Rapid repolarization** occurs due to **stoppage of inward flow of Na^+ and start of K^+ and Cl^- outflow from the cell.**
Phase 2:	**Plateau phase,** during this phase, **Ca^{+2} enters and K^+ moves out,** This leads to contraction.
Phase 3	**Second phase of rapid repolarization** occurs due **Ca+ close and to fast outflow of the K^+ ions.**
Phase 4	The **membrane potential returns to the resting value.** Fully repolarized stage.

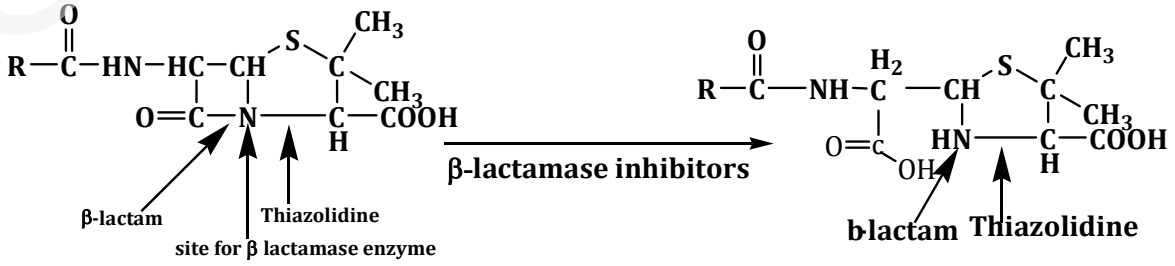
DIGESTER –111

MECHANISM OF ACTION OF β-LACTAM ANTIBIOTICS

DRUG	CLASSIFICATION	MECHANISM OF ACTION
Penicillin	**Natural penicillin:** Penicillin G **Modified penicillin: Benzathine penicillin** **Semisynthetic penicillin:** **Acid-resistant :**Phenoxymethy penicillin, Penicillin V **Penicillinase resistance penicillin's:** Methicillin, Cloxacillin, Dicloxacillin **Extended spectrum penicillin:** **Amino penicillin's**: Ampicillin, Bacampicillin, Amoxicillin. **Carboxy penicillin:** Carbenicillin, Ticarcillin **Ureido-penicillin's:** Piperacillin, Mezlocillin	**β-lactam antibiotics** inhibit the **transpeptidase** so that cross linking (which contain the close-knit structure of the cell wall) does not take place and these enzyme constituents located on the bacterial cell wall.
Cephalosporins	**First generation:** **Parenteral:**Cefazolin. **Oral:** Cephalexin, Cefadroxil **Second generation:** **Parenteral:**Cefuroxime, Cefaxitin **Oral:**Cefaclor, Cefprozil, Cefuroxime **Third generation:** **Parenteral**: Cefotaxime, Ceftizoxime, Ceftriaxone, Ceftazidime, Cefoperazone. **Oral:**Cefixime, Cefpodoxime, Cefdinir, Ceftibuten. **Fourth generation:** **Parenteral**: Cefepime, Cefpirome. **Fifth generation:** **Parenteral**: Ceftaroline fosamil, Ceftabiprole medocaril	
Monobactams	Aztreonams	
Carbapenems	Imipenem, Meropenem, Feropenem, Doripenem, Ertapenem	

Beta-lactamase inhibitor: Clavulanic acid, Sulbactam, Tazobactam

Mechanism of action: β- lactamases enzyme produced by bacteria that inactivate β -lactam antibiotics by opening the β -lactam ring.



2.	**PLATINUM COORDINATION COMPLEX**	Cisplatin, Carboplatin, Oxaliplatin	It hydrolyzed intracellularly to produce a highly reactive moiety which cause cross linking of DNA at site N^7 of guanine residue, and it can react with the –SH group of cytoplasmic and nuclear protein.
3.	**ANTIMETABOLITES**	**Folate antagonist:** Methotrexate	Dihydrofolic acid (DHFRase) Dihydrofolate reductase (DHFR) ← Methotrexate ↓ Tetrahydrofolic acid ↓ Synthesis of purines & thymidines ↓ DNA & RNA synthesis
		Purine antagonist: Mercaptopurine, Thioguanine Azathioprine	They inhibit the conversion of inosine monophosphate to adenine and guanine nucleotide that are building block for RNA and DNA.
		Fludarabine	It is inhibits DNA polymerase and ribonucleotide reductase interfere with DNA repair and incorporated to form dysfunctional DNA.
		Pyrimidine antagonist: Fluorouracil, Capecitabine,	In body 5-FU ↓ 5-Fluro-2-deoxycridine → Deoxyuridilic acid ↓ Inhibit thymidylate synthatase → Deoxythymidylic acid ↓ Failure of DNA synthesis due to non availability of thymidylate Fdump= Fluorodeoxyuridine monophosphate TMP= Thymidylate monophosphate
		Cytarabine	The triphosphate of Cytarabine is an inhibitor of DNA polymerase and block the production of cytidylic acid.
4.	**VINCA ALKALOIDS**	Vincristine, Vinblastine	These are mitotic inhibitors, bind to β-tubulin and **prevent the polymerization** and assembly of microtubules cause the disruption of mitotic spindle and interfere with cytoskeleton function.
5.	**TAXANES**	Paclitaxel, Docetaxel, Estramustine	They bind to β-tubulin and **enhance its polymerization**
6.	**EPIPODOPHYLLOTOXIN**	Etoposide, Teniposide	It react with topoisomerase II and arrest the G2 phase cause DNA breaks.
7.	**COMPTOTHECIN**	Topotecan, Irinotecan	They inhibit the resealing of DNA fragments by binding to topoisomerase I and DNA break.

Amines	**Noradrenaline**	Postganglionic adrenergic sympathetic nerve ending, cerebral cortex, hypothalamus, basal ganglia, brainstem, locus ceruleus and spinal cord	Excitatory and Inhibitory
	Adrenaline	Hypothalamus, thalamus and spinal cord	Excitatory and Inhibitory
	Dopamine	Basal ganglia, hypothalamus, limbic system, neocortex, retina and sympathetic ganglia	Inhibitory
	Serotonin	Hypothalamus, limbic system, cerebellum, spinal cord, retina, GI tract, lungs and platelets	Inhibitory
	Histamine	Hypothalamus, cerebral cortex, GI tract and mast cells	Excitatory
	Nitric oxide	Many parts of CNS, neuromuscular junction and GI tract	Excitatory
Others	**Acetylcholine**	Preganglionic parasympathetic nerve endings Postganglionic parasympathetic nerve endings Preganglionic sympathetic nerve endings Postganglionic sympathetic cholinergic nerve endings Neuromuscular junction, cerebral cortex, hypothalamus, basal ganglia, thalamus, hippocampus and amacrine cells of retina	Excitatory

DIGESTER –153

CRANIAL NERVES

S.NO.	NAME	NATURE	FUNCTION
I.	Olfactory	Sensory	Smell
II.	Optic	Sensory	Sight
III.	Oculomotor	Motor	Movement of eyeball
IV.	Pathetic or Trochlear	Motor	Rotation of eyeball
V.	Trigeminal (I) Ophthalmic (ii) Maxillary (iii) Mandibular	Mixed Sensory Sensory Mixed	Sensations of touch and taste
VI.	Abducens	Motor	Rotation of eyeball
VII.	Facial	Mixed	Taste, mastication, facial expression, saliva secretion, neck movement.
VIII.	Auditory or Vestibulocochlear nerve	sensory	Hearing, equilibrium
IX.	Glossopharyngeal	Mixed	Taste, pharyngeal contractions, saliva secretion.

PARTS	LOCATION	FUNCTION
Left Ventricle	The bottom chamber on the left side of heart	To pump oxygenated blood to the aorta to go around the body and to the brain
Right Ventricle	The bottom Chamber on the right side of heart	Pumps deoxygenated blood to the pulmonary vein
Left Atrium	The top chamber on the left side of heart	Collect the oxygenated blood from the pulmonary vein and push it through to the left ventricle
Right Atrium	The top chamber on the right side of heart	Collect the deoxygenated blood from the vena cava and push it through to the right ventricle
Aorta	Tube on top of the left side of the heart	Pump the oxygenated blood to the brain and the rest of the body from the left ventricle
Pulmonary Vein	Tube on the far left on top of the heart	Take the **freshly oxygenated blood from the lung** to the left atrium
Pulmonary Artery	Tube on right of the aorta	Take deoxygenated blood from the right ventricle to the lung to get oxygen
Vena cava	Tube on the far right on top of the heart	Give deoxygenated blood back to the heart from the around the body and the brain
Valves	In between the ventricles and the atriums	Make sure blood only floe in one direction
Coronary Artery	On the surface of the heart	**Carry nutrients and oxygen to the heart muscle**
Septum	Muscle wall separating the right and left side of the heart	Separate the right and left chambers on the heart
Valves of Heart	**Bicuspid valve or initial valve -** Present in between the left atrium and left ventricle **Tricuspid valves -** Consist of three flaps or cusps and present between the right atrium and right ventricle **Semilunar valves -** (pulmonary valve and aortic valve) are present where artery leaves the heart.	
Pericardium	The double membrane sac by which heart is covered.	

PATHOPHYSIOLOGY

DIGESTER –174

IMPORTANT TERMS

S. NO.	TERMINOLOGY	COMMENTS
1.	**Anaplasia**	Morphological and functional alteration of normal cell
2.	**Azotemia**	Abnormal elevation of blood
3.	**Aneurysm**	Permanent abnormal dilatation of blood vessel
4.	**Apnoea**	A potentially serious sleep disorder in which breathing repeatedly stop and start
5.	**Amenorrhoea**	Absence of period
6.	**Acromegaly**	Over secretion of Growth Hormone in adults
7.	**Agranulocytosis**	Decrease WBCs
8.	**Atrophy**	Decrease in cell size and tissue mass
9.	**Apoptosis**	A controlled, preprogrammed cell death occur with aging
10.	**Granulocytopenia**	Decrease blood peripheral granulocytes
11.	**Anaphylaxis**	A severe potentially life threating allergic reactions
12.	**Aplastic anaemia**	Depression in synthesis of cells blood
13.	**Agranulocytosis**	Lack of neutrophils (less than 100 micro liter)
14.	**Anisocytosis**	Abnormal variation of RBC in size
15.	**Angiogenesis**	Formation of new blood vessels
16.	**Bartter's syndrome**	Kidney disorder (i.e. inability to reabsorb salts, Na^+, K^+, Cl^-)
17.	**Brucellosis**	Infection spread from animal to humans
18.	**Bronchitis**	Inflammation of the bronchi
19.	**Candidiasis**	Fungal infection caused by candida
20.	**Cholestasis**	Rise in bilirubin level
21.	**Chemotaxis**	Movement of a motile cell or organism in a direction corresponding to gradient of increase or decrease concentration of particular substance
22.	**Chorio-carcinoma**	Fast growing cancer that occur in women's uterus
23.	**Catalepsy**	Loss of consciousness with rigidity of muscle that keeps limbs in fixed condition
24.	**Cyanosis**	Bluish discoloration of the skin and mucous
25.	**Dyspnoea**	Shortness of breath

DIGESTER –194

LIVER TEST DURING VARIOUS CONDITION

S.NO.	TEST/EXAMINATION	CONDITIONS
1.	**Aminotransferases (AST, ALT)**	Hepatocellular injury (ethanol, hepatitis, ischemic injury, NAFLD), celiac disease, skeletal muscle disease
2.	**Alkaline phosphatase**	Cholestasis, Canalicular injury, children during bone growth, bone disease, pregnancy (placenta origin)
3.	**GGT**	Cholestasis, ethanol, rarely anorexia nervosa, hyperthyroidism, mystonic dystrophy
4.	**Bilirubin**	Any acute or chronic liver disease, congenital disorder of bilirubin metabolism

DIGESTER –77

SOME COMMON DEFINITIONS

S. NO.	TERM	DEFINITION
1	**Administration**	It is the **management** of an **office, business**, or **organization**. It involves the efficient organization of people, information, and other resources to achieve organizational objectives.
2	**Advertisement**	**Advertising** refers to any **paid form of communication** designed to create interest in or stimulate **sales** of products or **services**.
3	**Ambulatory Surgery Centers**	**Ambulatory surgery centers** (ASCs) are health care facilities which offer patients the opportunity to have selected **surgical** and procedural services performed outside the hospital setting.
4	**Balance sheet**	A ***balance sheet*** is a ***financial statement*** that reports a company's **assets, liabilities and shareholders'** equity at a specific point in time.
5	**Channels of distribution**	In marketing, it refers to **exchange of ownership** of product until it reaches the end user.
6	**Consumer**	**A consumer** is a person that buys goods and services
7	**DIS (Drug Information Service)**	**Drug information service** is a dedicated and specialized **service** provided by pharmacists to enhance knowledge of **medicines** use, promote rational prescribing among prescribers, and reduce **medication** errors.
8	**Documentation**	It is a method of preparing a **written material**, which describes the process in terms of **specifications, instructions** etc.
9	**Forecasting**	**Forecasting** is the process of **projecting past sales demand** into the future.
10	**GLP (Good Laboratory Practices)**	GLP is a quality system of **management controls** for **research laboratories** and **organizations** to ensure the **uniformity**, **consistency, reliability, reproducibility, quality**, and **integrity** of products in development for **human or animal health** (including pharmaceuticals) through **non-clinical safety tests**; from **physio-chemical properties** through **acute** to **chronic toxicity tests**.
11	**GMP (Good Manufacturing Practices)**	Good manufacturing practices (GMP) are the **practices** required in order to conform to the guidelines recommended by agencies that control the **authorization** and **licensing** of the manufacture and sale of **food** and **beverages**, **cosmetics**, **pharmaceutical products**, **dietary supplements**, and **medical devices.**
12	**Hospital pharmacy**	**Hospital pharmacy** is the health care service, which comprises the art, practice, and profession of choosing, preparing, storing, **compounding,** and **dispensing** medicines and medical devices, advising healthcare professionals and patients on their safe, effective and efficient use

13	**Human Resource Development (HRD)**	*Human Resource Development* (*HRD*) is the framework for helping employees **develop their personal and organizational skills, knowledge, and abilities**.
14	**Human Resource Management (HRM)**	It is defined as a management function that helps managers to **recruit, select, train, develop, maintain and compensate** the **human resources** for accomplishing the **individual, organizational and social objectives**.
15	**Human resource Planning (HRP)**	**Human resource planning** (**HRP**) is the continuous process of systematic planning ahead to achieve optimum use of an organization's most **valuable asset—quality employees**.
16	**Industrial Relation Management (IRM)**	It implies the concern about the employees' **grievances**, their **settlement**, **unionization** etc.
17	**In-patient**	An **in-patient** is someone who stays in hospital while they receive their treatment.
18	**Intellectual property rights (IPR)**	**Intellectual property rights** are the **rights** given to persons over the creations of their minds. **Intellectual property rights** refer to the general term for the assignment of property rights through **patents**, **copyrights, trademarks and trade secrets**. These property rights allow the holder to exercise a **monopoly** on the use of the item for a specified period.
19	**Inventory management**	**Inventory management** refers to the process of ordering, storing and using a company's inventory. This includes the **management of raw materials, components and finished products**, as well as warehousing and processing such items.
20	**Ledger Balance**	It is a **complete record** of financial transaction over life of a company. It holds account information that is needed to prepare finance statement and **includes accounts for assets, owner's quality, liabilities, revenues and expense**.
21	**Manufacturer**	A **manufacturer is** a person or company that produces finished goods from raw materials by using various tools, equipment, and processes, and then sells the goods to consumers.
22	**Market**	A set up where two or more parties engage in **exchange of goods**, **services** and **information** is called a **market**. The two parties involved in a transaction are called **seller** and **buyer**.
23	**Organization**	An **organization** is a group of people with a defined relationship in which they work together to achieve the goals of that **organization**.
24	**Out-patient**	A **patient** who is **not hospitalized** overnight but who visits a hospital, clinic, or associated facility for diagnosis or treatment.
25	**Personal management**	**Personnel management** is the **planning, organizing, compensation, integration** and **maintenance** of people for the purpose of contributing to organizational, individual and societal goals.

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