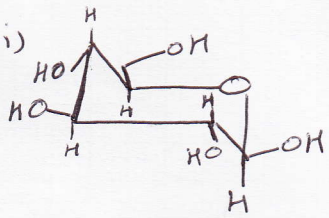
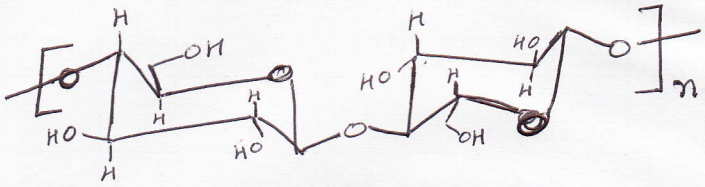
SECTION A

Q1 iii) WHAT IS THE BASIC DIFFERENCE BETWEEN GLUCOSE AND CELLULOSE [STRUCTURE]

ANS iii)



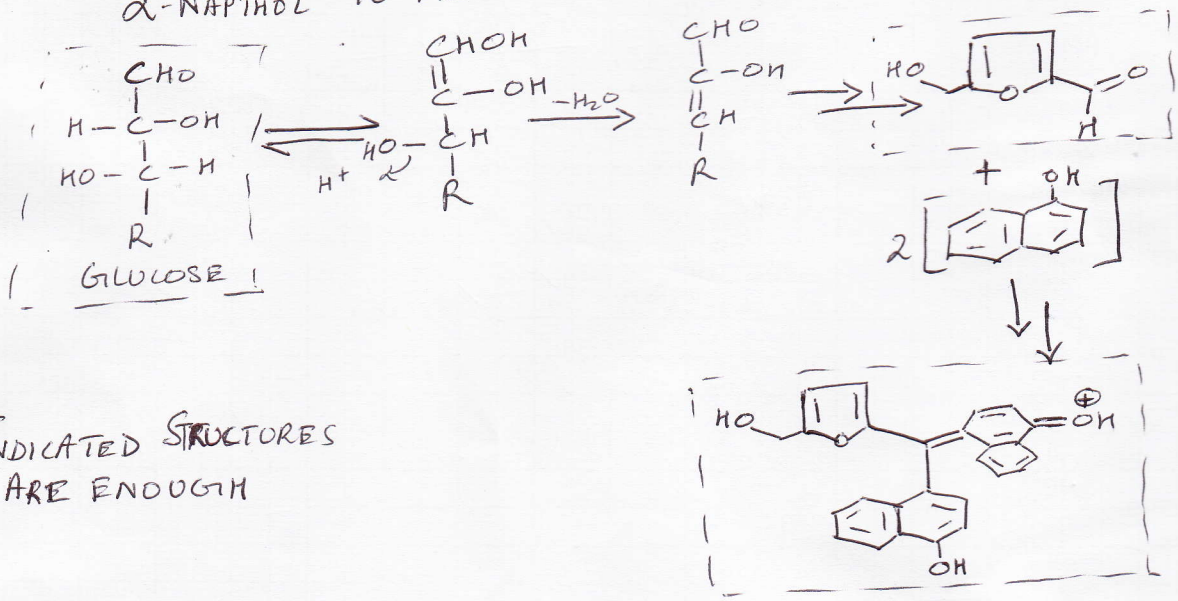
β-D-GLUCOSE
MONOSACCHARIDE



β, 1-4 LINKED D-GLUCOSE
[n = 100 - 10,000]
POLYSACCHARIDE

iv) WHAT IS THE PRINCIPLE OF MOLISCH'S TEST?

ANS iv PRINCIPLE IS BASED ON THE REACTION OF DEHYDRATION PRODUCT OF THE MONOSACCHARIDE/CARBOHYDRATE; WITH α-NAPTHOL TO PRODUCE PURPLE COLOR DYE



★ INDICATED STRUCTURES ARE ENOUGH

Q1. v) WHAT ARE DIFFERENT FORMS OF LIPID? GIVE EXAMPLES.

ANS v) a) TRIGLYCERIDES OR (NEUTRAL FATS).
- i) SATURATED ALKYL CHAIN
- ii) UNSATURATED ALKYL CHAIN
- iii) ONE CABOHYDRATE MOIETY VIA ETHER LINKAGE

b) STEROIDS

c) PHOSPHOLIPIDS

Q1. vi) WHAT IS THE STRUCTURE AND FUNCTION OF ω-3-FATTY ACID?

ANS vi

α-LINOLEIC ACID.

PRESENCE OF DOUBLE BOND 3rd FROM ω CONSTITUTES an EXAMPLE ω-3 FATTY ACID

ESSENTIAL FOR SMOOTH FUNCTIONING NEUROLOGICAL PROCESSES.

Q1 vii) WHAT IS THE BASIS OF MICHAELIS MENTEN KINETICS? [GIVE THE FUNDAMENTAL EQUATION USED]

ANS vii) THE PROGRESS OF A REACTION CATALYZED BY AN ENZYME CAN BE REPRESENTED BY THE FOLLOWING EQUATION

$$V_o = \frac{V_{MAX}[S]}{K_m + [S]}$$

WHERE [S] IS SUBSTRATE CONCENTRATION
V_{MAX} – REACTION AT THE HIGHEST ENZYME SUBSTRATE CONCENTRATION.
K_M = MICHAELIS CONSTANT
V_o = INITIAL RATE

$$A + E \underset{K_{-1}}{\overset{K_1}{\rightleftharpoons}} B \xrightarrow{K_2} C + E$$

SECTION A

Q1 viii) WHAT DO YOU MEA BY ENZYME SPECIFICITY?

Ans viii) THE ACTIVE SITE OF AN ENZYME HAS A UNIQUE GEOMETRIC SHAPE THAT IS COMPLEMENTARY TO THE GEOMETRIC SHAPE OF A SUBSTRATE MOLECULE, SIMILAR TO PUZZLE PIECES. THIS MEANS THAT ENZYMES REACT WITH ONE OR A VERY FEW SIMILAR COMPOUNDS

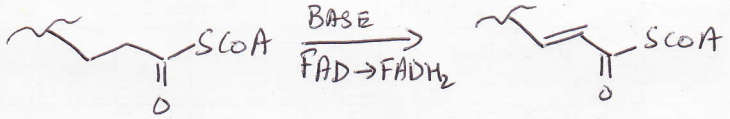
ix) GIVE AN EXAMPLE OF REACTIVE OXYGEN SPECIES AND HOW ARE THEY FORMED?

Ans ix) $O_2 \xrightarrow{e^-} O_2^- \xrightarrow{e^-} H_2O_2 \xrightarrow{2e^-} OH^- \xrightarrow{e^-} H_2O$

SUPER OXIDE — HYDROGEN PEROXIDE — HYDROXYL RADICAL

x) WHAT IS THE IMPORTANCE OF CONJUGATION REACTION IN LIPID METABOLISM?

Ans x) DUE TO CONJUGATION REACTION RESULTS THE FORMATION OF AN UNSATURATED FATTY ACYL-CoA WITH THE DOUBLE BOND BETWEEN α AND β CARBON ATOMS



WHICH PROVIDES THE SUBSTRATE FOR CONJUGATE ADDITION FOLLOWED BY OXIDATION AND CLEAVAGE OF A 2 CARBON FRAGMENT ACETYL CO-ENZYME A

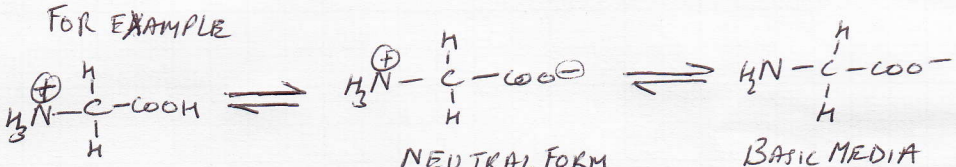
SECTION B

Q2 WHAT IS ISOELECTRIC POINT? IDENTIFY THE ISOELECTRIC POINT FOR THE FOLLOWING AMINOACIDS a) GLUTAMIC ACID b) GLYCINE & c) LYSINE

GIVEN (GLUTAMIC ACID $pKa_1 = 2.10$ $pKa_2 = 9.47$, $pKa_3 = 4.07$; GLYCINE $pKa_1 = 2.34$ $pKa_2 = 9.6$ AND LYSINE $pKa_1 = 2.18$ pKa_2 8.95 $pKa_3 = 10.53$)

ANS 2. ISOELECTRIC POINT FOR A GIVEN AMINO ACID IS SIMPLY THE pH AT WHICH IT WILL NOT MIGRATE IN AN ELECTRIC FIELD.

FOR EXAMPLE



ACIDIC MEDIA pH IS LOW — NEUTRAL FORM — BASIC MEDIA pH IS HIGH

DEPENDING UPON THE CLASSIFICATION OF THE AMINO ACID pI (ISOELECTRIC POINT) OF AN AMINO ACID CAN BE EVALUATED FROM THE pKa_x VALUES.

ACIDIC – GLUTAMIC ACID

$$pI = \frac{1}{2}(pKa_1 + pKa_3) = \frac{(2.10 + 4.07)}{2} = \boxed{3.085}$$

NEUTRAL – GLYCINE

$$pI = \frac{1}{2}(pKa_1 + pKa_2) = \frac{(2.34 + 9.6)}{2} = \boxed{5.97}$$

BASIC – LYSINE

$$pI = \frac{1}{2}(pKa_2 + pKa_3) = \frac{(8.95 + 10.53)}{2} = \boxed{9.74}$$

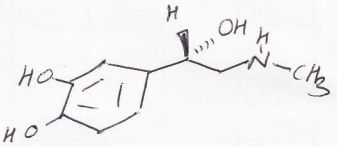
SECTION B

Q3. IDENTIFY THE FOLLOWING WITH RESPECT TO GLYCOGEN METABOLISM:

a) DIFFERENT HORMONES
b) ROLE OF GLYCOGEN PHOSPHORYLASE AND PHOSPHOGLUCOMUTASE.

ANS 3 a) DIFFERENT HORMONES INVOLVED IN GLYCOGEN METABOLISM

EPINEPHRINE (IN MUSCLE)



AND

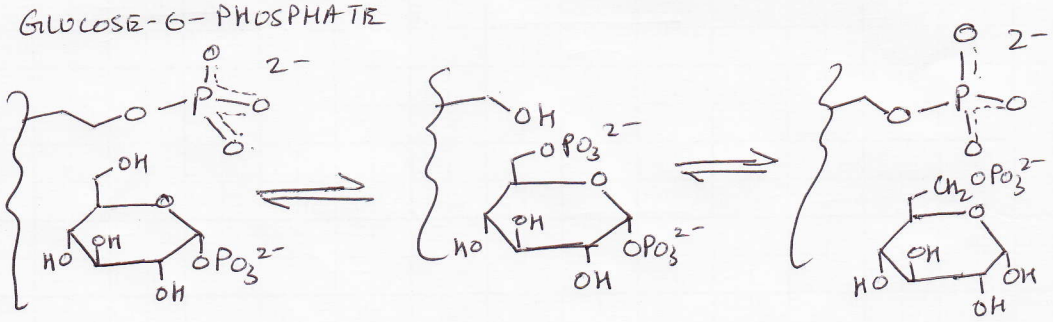
GLUCAGON (LIVER) PEPTIDE CONSISTING OF 29 AMINOACID

IT IS RESPONSIBLE FOR TRIGGERING GLYCOGEN BREAKDOWN AND SYNTHESIS

b) ROLE OF PHOSPHORYLASE - i) IT HAS A FULLY ACTIVE FORM AND AN INACTIVE FORM. ii) THE RATE OF GLYCOGEN BREAKDOWN IS DUE TO PHOSPHORYLASE a/b INTERCONVERSION WHICH IS IN TURN CONTROLLED BY HORMONES (WITH INTERMEDIATE STEPS)

iii) PHOSPHORYLASE KINASE ACTIVATES GLYCOGEN PHOSPHORYLASE AND PHOSPHORYLASE PHOSPHATASE DEACTIVATES PHOSPHORYLASE.
WITH RESPECT TO GLYCOGEN - PHOSPHORYLASE IS RESPONSIBLE FOR SHORTENING OF GLYCOGEN (CHAINS) [$\alpha 1 \rightarrow 4$]
IT IS AN EXOGLUCOSIDASE AND DEGRADES GLYCOGEN CHAINS AT THEIR REDUCING ENDS. UNTIL FOUR GLUCOSYL UNITS REMAIN ON EACH CHAIN BEFORE EACH BRANCH POINT.

PHOSPHOGLUCOMUTASE: CONVERSION OF GLUCOSE-1-PHOSPHATE TO GLUCOSE-6-PHOSPHATE



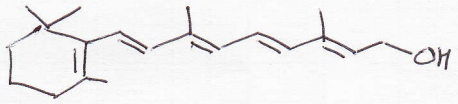
SECTION B

AS-2814

Q4. WHAT IS THE BASIS FOR CLASSIFICATION OF VITAMINS? GIVE TWO EXAMPLES FOR EACH CLASSIFICATION ALONG WITH THEIR STRUCTURE AND ROLE?

ANS 4 CLASSIFICATION IS PRIMARILY BASED ON SOLUBILITY

FAT SOLUBLE

a) 

RETINOL (VITAMIN A).

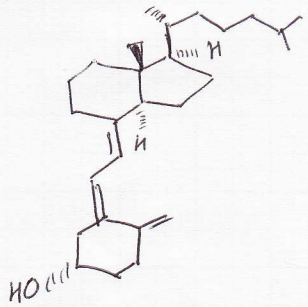
THE VITAMERS ARE ASSOCIATED WITH VISION (RETNAL) PROTEIN SYNTHESIS AND CELL DIFFERENCIATION SUPPORTS IMMUNITY (RETINOIC ACID)

b) VITAMIN D

THE VITAMERS D_2 – ERGOCALCIFEROL

D_3 – CHOLECALCIFEROL

ARE ASSOCIATED WITH CALCIUM AND PHOSPHATE ABSORPTION AND MOBILIZATION FORMATION OF HORMONES.

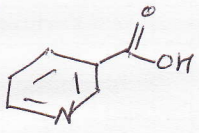


CHOLECALCIFEROL

WATER SOLUBLE

b) VITAMIN B AND ITS VITAMER

PART OF ENZYME INVOLVED IN ENERGY METABOLISM VITAMIN B_1 (THAMINE)

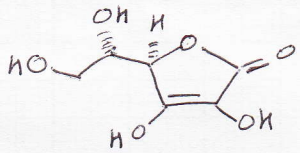


NIACIN

b) VITAMIC : C

ASCORBIC ACID

COLLAGEN SYNTHESIS, WOUND HEALING, BONE AND TEETH FORMATION, IMPROVING IMMUNE SYSTEM.

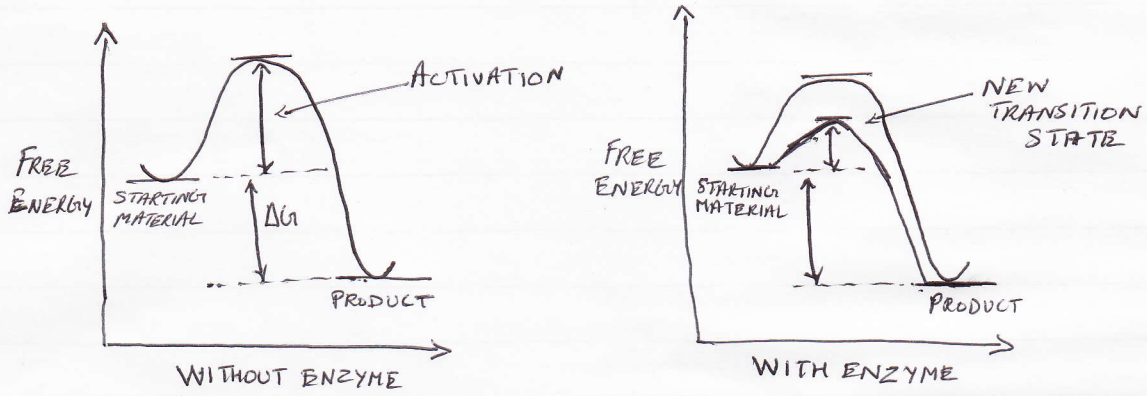


SECTION B

AS-2814

Q5 BASED ON THE CONCEPT OF STABILIZATION OF A REACTION'S TRANSITION STATE EXPLAIN THE ROLE OF ENZYMES [USE AN ENERGY DIAGRAM WITH CLEAR IDENTIFICATION OF THE VARIABLES]

ANS 5



$$\Delta G = -RT \ln K$$

ENERGY DIFFERENCE

K IS THE EQUILIBRIUM CONSTANT $= \frac{[\text{PRODUCT}]}{[\text{REACTANTS}]}$

R IS THE GAS CONSTANT ($8.314\ J\ mol^{-1} K^{-1}$).

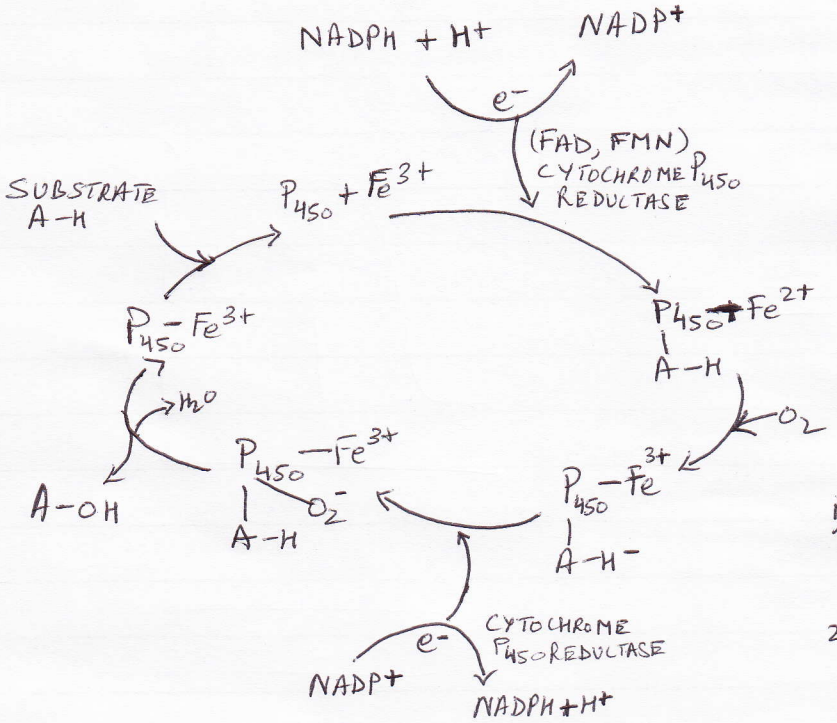
T IS THE TEMPERATURE

SECTION B

AS-2814

Q6 EXPLAIN WITH MECHANISM THE CYTOCHROME P-450 MONOXYGENASE SYSTEM.

ANS 6

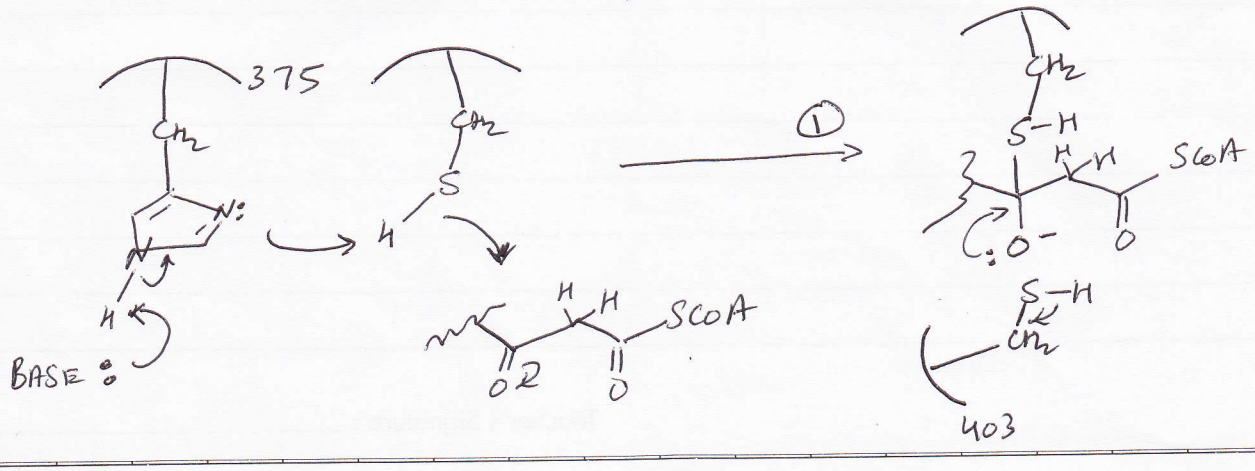


1) ONE MOLECULE OF FAD, FMN IS PRESENT CONTAINING A HEME COFACTOR.

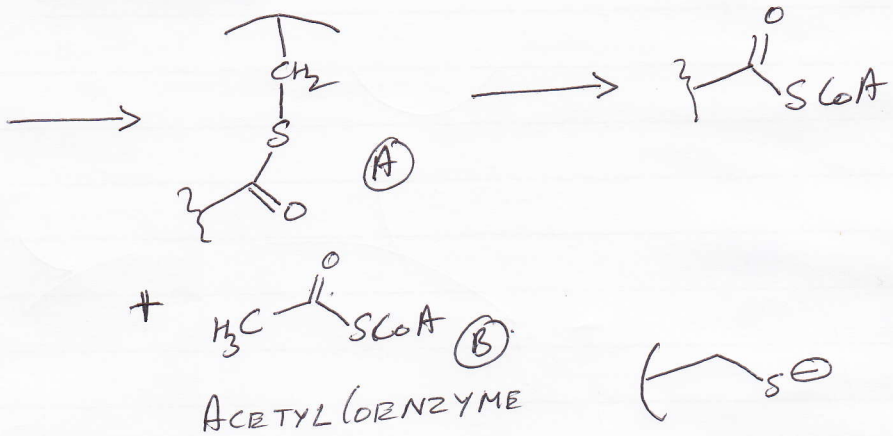
2) NADPH IS REQUIRED FOR HEME DEPENDENT ENZYMES TO REDUCE FLAVIN COENZYME USED FOR TRANSFER OF ELECTRONS TO THE HEME AND HEME OXYGEN COMPLEX

Q7. GIVE THE MECHANSM OF ACTION FOR β-KETOACYL-CoA THIOLASE ENZYME IN THE LIPID METABOLISM.

ANS 7. FOLLOWING THE FORMATION OF β-KETOFATTY ACYL CoA THE REACTION WITH β-KETOACYL-CoA THIOLASE



ANS 7 CONTINUED



ACETYL COENZYME

Q8. DEFINE GLYCOLYSIS PROCESS AND WRITE DOWN THE BIOCHEMICAL REACTION STEPS FOR THE FORMATION OF PYRUVATE FROM GLUCOSE IN THIS PROCESS

ANS 8. PROCESS OF BREAKDOWN OF GLUCOSE BY ENZYMES, RELEASING ENERGY AND PYRUVIC ACID.

THE STEPS ARE SUMMARIZED AS FOLLOWS

STEP-1 1-GLUCOSE ⟶ 2-GLYCERALDEHYDE-3-PHOSPHATE

STEP I FIVE REACTIONS.

STEP-2 2-GLYCERALDEHYDE-3-PHOSPHATE ⟶ 2-PYRUVATE

STEP II FIVE REACTIONS

As-2814

SECTION B

Ans 8. CONTINUED

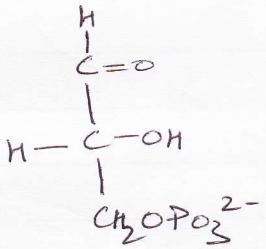
STEP I ⇒

GLUCOSE —(ATP → ADP, ①)→ GLUCOSE-6-PHOSPHATE

—(② FRU)→ FRUCTOSE-6-PHOSPHATE

—(③ ATP → ADP)→ FRUCTOSE-1,6-BIPHOSPHATE

—(④ FRUCTOSE BIPHOSPHATE ALDOLASE; ⑤ TRIOSE PHOSPHATE ISOMERASE)→



GLYCERALDEHYDE-3-PHOSPHATE

STEP II ⇒

GLYCERALDEHYDE-3-PHOSPHATE —(① DEHYDROGENASE; NAD+ → NADH + H+)→ 1,3-BISPHOSPHOGLYCERATE

—(② ADP → ATP; PHOSPHO GLYCERATE KINASE)→ 3-PHOSPHOGLYCERATE

—(③ PHOSPHOGLYCERATE MUTASE)→ 2-PHOSPHOGLYCERATE

—(④ $-H_2O$; ENOLASE)→ PHOSPHOENOL PYRUVATE

—(⑤)→ PYRUVIC ACID