

B.Sc (Sixth semester) Examination, 2013, Chemistry

Paper: CBT-601 (Biomolecules, Polymers and Drugs)

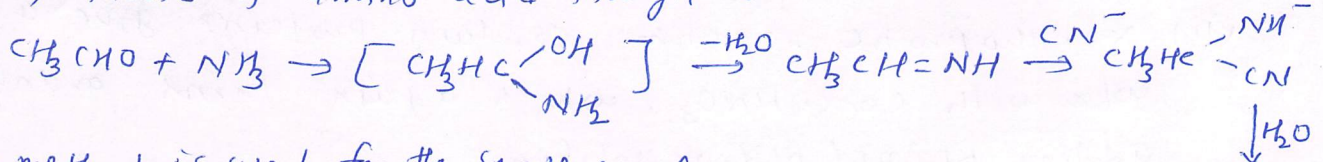
SECTION-A

1. (i) (a) amino acids

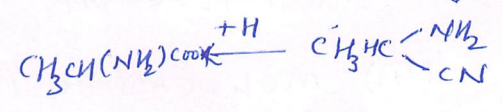
(ii) (a) p-amino benzoic acid

(iii) (b) condensation polymerization

(iv) synthesis of amino acid through stecker method:

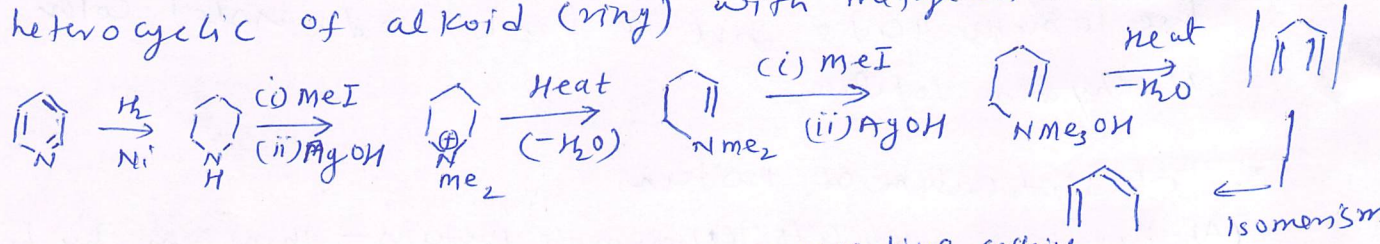


This method is used for the synthesis of  
alanine, glycine, serine, valine, methionine  
leucine, etc.



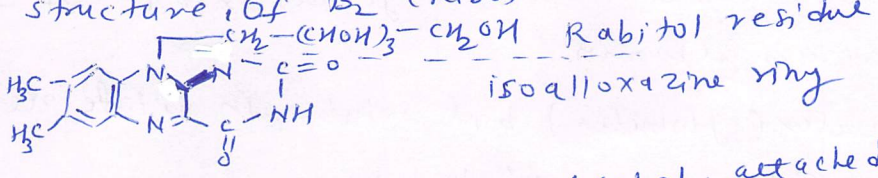
(v) Reaction:  $\text{RCH}(\text{NH}_2)\text{COOH} + \text{HNO}_2 \rightarrow \text{RCHOHCOOH} + \text{N}_2 + \text{H}_2\text{O}$

(vi) Hoffman exhaustive methylation: It is the method of opening heterocyclic of alkoid (ring) with methylation process.



(vii) Name of the alkaloid from leaves: Nicotine, caffeine  
curamin, atropine

(viii) structure of B<sub>2</sub> (Riboflavin)



B<sub>2</sub> consists of a sugar alcohol, attached to a chromogenic isoalloxazine ring.

(ix) sources of vitamin A: citrus fruits (orange, lemon), Pineapple, guavas, tomatoes, melons, vegetables: cabbage, drum stick leaves, spinach leaves, carrot, radish leaves  
Animal Foods: ox liver, cod liver, polar bear, elephant seal, weddel seal



(X) Antipyretics: Are drugs that reduce the fever (agents)

Analgesic: Are drugs/agent that relieve pain

## Section B

### 2. Methods for the detection of proteins

- (i) Biuret test: Adding few drops of conc.  $\text{CuSO}_4$  solution to the alkaline solution of proteins give violet color, which is due to the presence of peptide linkage
- (ii) Xanthoprotic reaction: Certain proteins give a yellow color with conc.  $\text{HNO}_3$ , which again turns orange color adding  $\text{NaOH}/\text{NH}_4\text{OH}$  solution
- (iii) Molisch's test: on adding few drops of alcoholic  $\beta$ -naphthol and conc.  $\text{H}_2\text{SO}_4$  to the protein solution give a violet color ring is produced.
- (iv) Ninhydrin test: Certain proteins which contain a free amino acids give a pink, red, violet color with Ninhydrin solution.

### 3. Classification of proteins

- (A) Based on solubility: (a) simple proteins - those on hydrolysis give  $\alpha$ -amino acids. eg - albumin (egg)
- (a) albumin: soluble in water and large percentage of sulphur  
egg albumin, serum albumin
  - (b) insoluble in water (globulin) but soluble in dilute neutral salt solution. eg - serum globulin
  - (c) Glutelins (wheat): soluble in dilute alkalis
  - (d) Prolamin (wheat): soluble in dilute acids
  - (e) Histones: soluble in water and insoluble in ammonia  
eg - haemoglobin from blood.
  - (f) protamines (soluble in water)
  - (g) Scleroproteins - insoluble in water



(ii) conjugated proteins: These on hydrolysis give  $\alpha$ -amino acids and one of the following products such as carbohydrate, nucleic acid or phosphoric acid

- (a) Nucleoproteins: proteins and nucleic acid
  - (b) Glycoproteins: proteins and carbohydrate. eg - glucosamine
  - (c) Phosphoproteins: proteins + phosphoric acid (Casein milk)
  - (d) Chromoproteins: proteins and metals (Cu, Fe, Mg, Mn, Ca)  
Haemoglobin and Chlorophyll
- (iii) Derived proteins: these are degradation products produced during the hydrolysis of proteins into amino acids.

(B) Based on composition:

- (i) Fibrous proteins: They are long and thread like molecule lie side by side through hydrogen bond.
  - (a) Keratin (b) collagen (c) Myosin (d) Fibronin
- (ii) Globular proteins: Folded or compact structure (spherical)
  - (a) albumin (b) Haemoglobin and fibrinogen
  - (c) enzymes & hormones

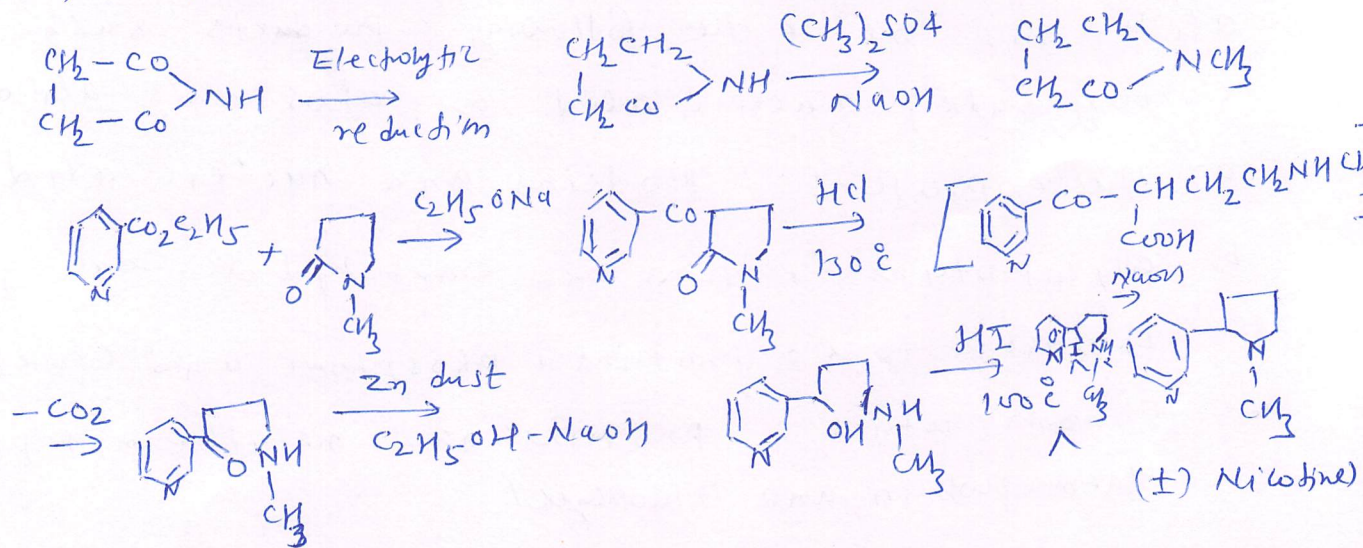
(C) Based on their ~~composition~~ Functions

- (i) structural protein: collagen
- (ii) contractile protein: myosin & actin
- (iii) Hormones: insulin
- (iv) Blood protein: fibrinogen, albumin
- (v) Enzymes

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#### 4. Preparation steps for Nicotine:



#### 5. Importance of vitamins

vitamins are organic compounds that are necessary to maintain normal health, growth and nutrition are called vitamins. vitamins are broadly classified into two types - water soluble and fat soluble. vitamins A, D, E and K are fat soluble whereas B and C are water soluble. some of the functions of vitamins (A, B<sub>2</sub> and C is summarized)

- (i) vitamin A is necessary for a variety of functions such as vision, proper growth and differentiation, reproduction and maintenance of epithelial cells.
- (ii) vitamin A guards against cancer by protecting cell walls from undesirable oxidation and scavenging the products of oxidation.
- (iii) important factor in tooth formation (vitamin A)
- (iv) vitamin B<sub>1</sub> (riboflavin) plays a significant role in phototropic curvature of various plant organs.
- (v) Riboflavin is essential for growth and tissue respiration.
- (vi) They have shown to participate in the enzymatic oxidation of glucose, fatty acids, amino acids →



(vii) vitamin c (ascorbic acid) functions in a number of enzymatic activities. major function is the formation of tissue collagen

(viii) Ascorbic acid plays important role in ~~synth~~ metabolism of tyrosine

(ix) the stress or illness in body can be reduced by vitamin C

(x) Ascorbic acid plays an important role in germination, growth, metabolism and flowering of plants.

Importance of Hormones:

Hormone is secretion of gland which are called as endocrine glands - eg: thyroid, pituitary, adrenal and pancreas. The probable function of hormone is to control biological process in body. these are also called as chemical messenger -

- (i) Thyroxine is hormone produced from thyroid gland that are responsible for regulation and metabolism.
- (ii) Thyroxine also plays role in controlling basal metabolic rate (BMR), energy production, cardiovascular system, reproductive system, growth and development
- (iii) Necessary for neural development and normal cellular metabolism.
- (iv) Estone is another hormone produced from adrenal gland and is necessary for <sup>sexual</sup> development of men and women.
- (v) Estrogen is required for women during menopause



## 6. sources of ascorbic acid (Vitamin C)

Fruits: Amla (600-700 mg/100g), Guava (200-300 mg), Lime (65 mg), Papaya (55-60 mg), orange (30 mg),  
Vegetables: Drumstick leaves (200-250 mg), Radish leaves (80 mg), Spinach (30 mg)

## Deficiency of ascorbic acid (Diseases)

The deficiency of ascorbic acid leads to scurvy at any stage. The main symptoms are listed below:

- (i) Tender bones: There is tenderness in the leg of infants. The leg is assumed the typical "frog like position", in which the hips and knees are semiflexed.
- (ii) Petechial hemorrhage: The capillary become brittle and burst giving rise to red and purple spots over the body.
- (iii) Bleeding gums: changes in the gums, most noticeable when teeth are erupted characterized by bluish spongy swelling of the mucous membrane.
- (iv) Other symptoms: delayed wound healing, anemia and pyrexia

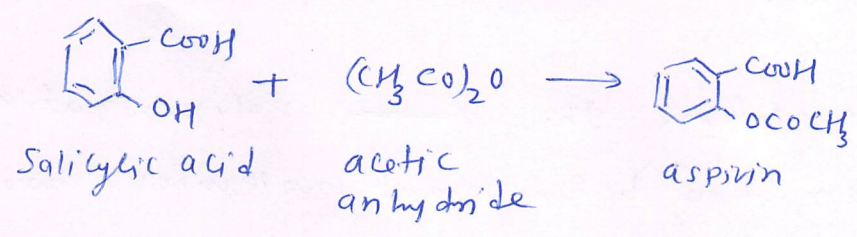
Sources of riboflavin: milk, cheese, eggs, liver, kidney, heart and brewers yeast, cows milk. Fruits and vegetables contain moderate amount. Cereals and meat.

## Deficiency diseases:

1. cheilosis: Fissuring at the corner of the mouth and lips, which is covered by yellow crust develops in the angle of the mouth.
2. Glossitis: The tongue is smooth and loss of papillary structure occurs
3. Keratitis, conjunctivitis, photophobia, lacrimation, corneal vascularization (bloodshot eye) are other symptoms of Vitamin B<sub>2</sub>
4. Pellagra and Beriberi's patient also suffered from B<sub>3</sub> Vitamin



7. Synthesis of aspirin: aspirin is also called as ~~synthetic~~ <sup>pain reliever agent</sup> ~~acid~~, which is synthesized by the acetylation reaction of salicylic acid and acetic anhydride



Mechanism of action: Aspirin is medicine and it has two main actions in the body:

1. An anti-prostaglandin (anti-inflammation, fever reducing, pain reliever)
2. Anti-platelet (blood thinner) agent

Both of these actions are the result of the effect of aspirin on an enzyme in the body called cyclooxygenase (COX)

(i) When ~~the~~ the body is injured, inflammation occurs, facilitated by number of enzymes mediator and different cells, such as white blood cells (WBC). one enzyme involved is COX. COX is responsible for the formation of a group of inflammatory mediator known as prostaglandins. Aspirin inhibits COX and stopping the formation of prostaglandins, hence aspirin acts as an anti-inflammatory agent in this process.

(ii) COX plays a role in cessation of bleeding. Blood clotting is result of complex mechanism which involves many different cells, including platelets. when blood vessels are damaged, plates are clump together over the vessel to facilitate repair. COX activates a chemical known as thromboxane A<sub>2</sub> that causes platelets to



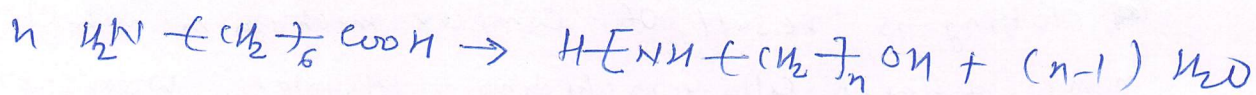
stick together to form a 'plug' over the damaged area. Aspirin inhibits COX and reducing the ability of platelets to aggregate. Thus aspirin is known as 'blood thinner' or antiplatelet agent.

8. Condensation polymerization: This ~~cond~~ polymerization takes place between two bifunctional molecules (two monomer units or more) to produce one larger polyfunctional molecule. The bifunctional molecules (monomers) usually condense with one another and in so doing repeatedly eliminate small molecules such as  $H_2O$ ,  $NH_3$  and  $HCl$ . This polymerization takes place by series of steps. The type of end product resulting from a condensation polymerization is dependent on the number of functional end groups of the monomer which can react.

Linear polymers are created (formed) by the monomers with two reactive end groups and monomers with more than two end groups give three dimensional polymers, which are cross linked.

- Main characteristics: (i) these monomers have functional grp such as alcohol, amine or carboxylic acid grp  
(ii) these monomers have two reactive sites, some functional monomers have more than two.

Self condensation: when the monomers have two reactive groups, then chance of self condensation. Eg -



more characteristics of polymerization: -

- (i) They have one or two functional groups and proceed react a step-wise



(ii) Hydrogen bonding gives crystalline structure and have melting point

(iii) they are thermosets as once molded, they can not be remolded.

Eg:

