

TANNINS:-

The name tannin is derived from French tanin (tanning substance) and is used for a range of natural polyphenol.

- Tannins are complex organic, non-hydrogenous plant products, which generally have astringent properties.
- Tannins are substances which are detected by a tanning test due to its absorption on standard hide powder. The test is known as Goldbeater's skin test.

* Characteristic of Tannins:-

1. Non crystalline substance.
2. Tannins are colloidal solution with water.
3. Soluble in water (exception of some high molecular weight structure), alcohol, dilute alkali & glycerine.
4. Sparingly soluble in ethyl acetate.
5. Sparingly soluble in ethyl acetate.
5. Insoluble in organic solvents except acetone.
6. mol. wt. ranging from 500 to > 20,000.
7. Oligomeric compounds with multiple structure units with free phenolic groups.
8. Can bind with protein and form insoluble or soluble tannin-protein complexes.

* Chemical Tests:-

① Phenazone Test:- To 5 ml of aqueous solution of tannin containing drug, add 0.5 gm of sodium acid phosphate. Warm the solution, cool and filterate. All tannins cause precipitation of gelatin from solution.

② Gelatin Test:- To a 1% gelatin solution, add little 10% sodium chloride. If a 1% solution of tannin is added to the gelatin solution tannin causes precipitation of gelatin from solution.

(Test for Catechin)



Date _____

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3) Matchstick Test :- Catechin test is the modification of the well known phloroglucinol test for lignin. Matchstick contain lignin. Dip a matchstick in the dilute extract of the drug, dry, moisten it with concentrated HCl and warm it near a flame. Catechin in the presence of acid produce phloroglucinol which stain the lignified wood pink or red.

4) Test for Chlorogenic acid :- A dilute solution of chlorogenic acid containing extract, if treated with aqueous ammonia and exposed to air, slowly turn green indicating the presence of chlorogenic acid.

5) Vanillin-HCl test :- Drugs shows pink or red colours with a mixture of vanillin : alcohol : dil. HCl in the ratio 1:10:10. The reaction produce phloroglucinol which along with vanillin gives pink or red colour.

6) Gold beater's skin test :

* CATECHU :- Black catechu :-

* Synonyms : Cutch, Kattha

* Biological sources :- Black catechu is the dried aqueous extract prepared from the heartwood of *Acacia catechu* belonging to family, Leguminosae.

* Geographical source :- It is found in drier regions of peninsula such as M.A., Bihar, Maharashtra, Gujarat, Rajasthan & Tamil Nadu.

* Morphology :-

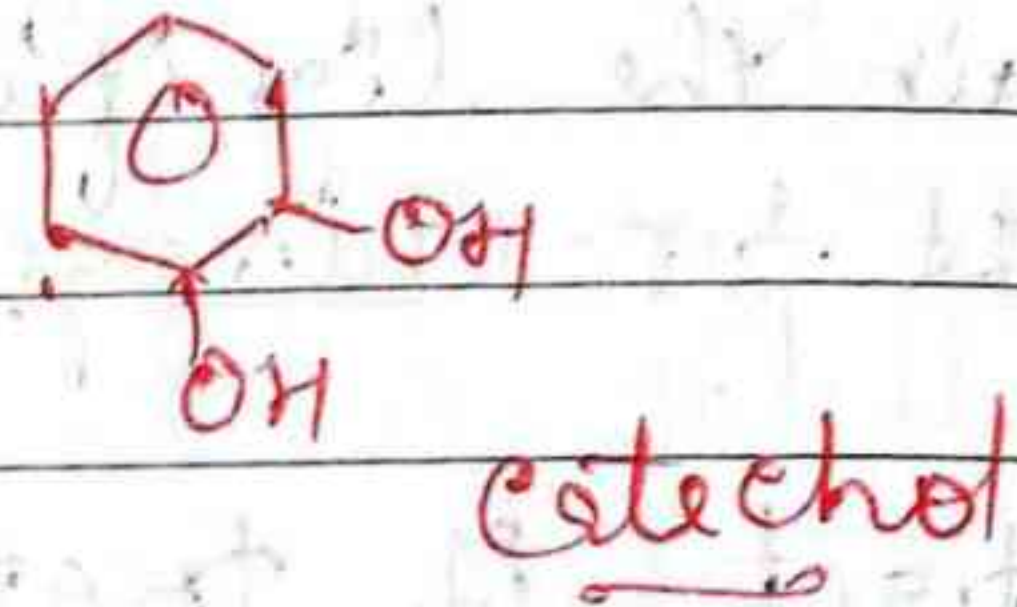
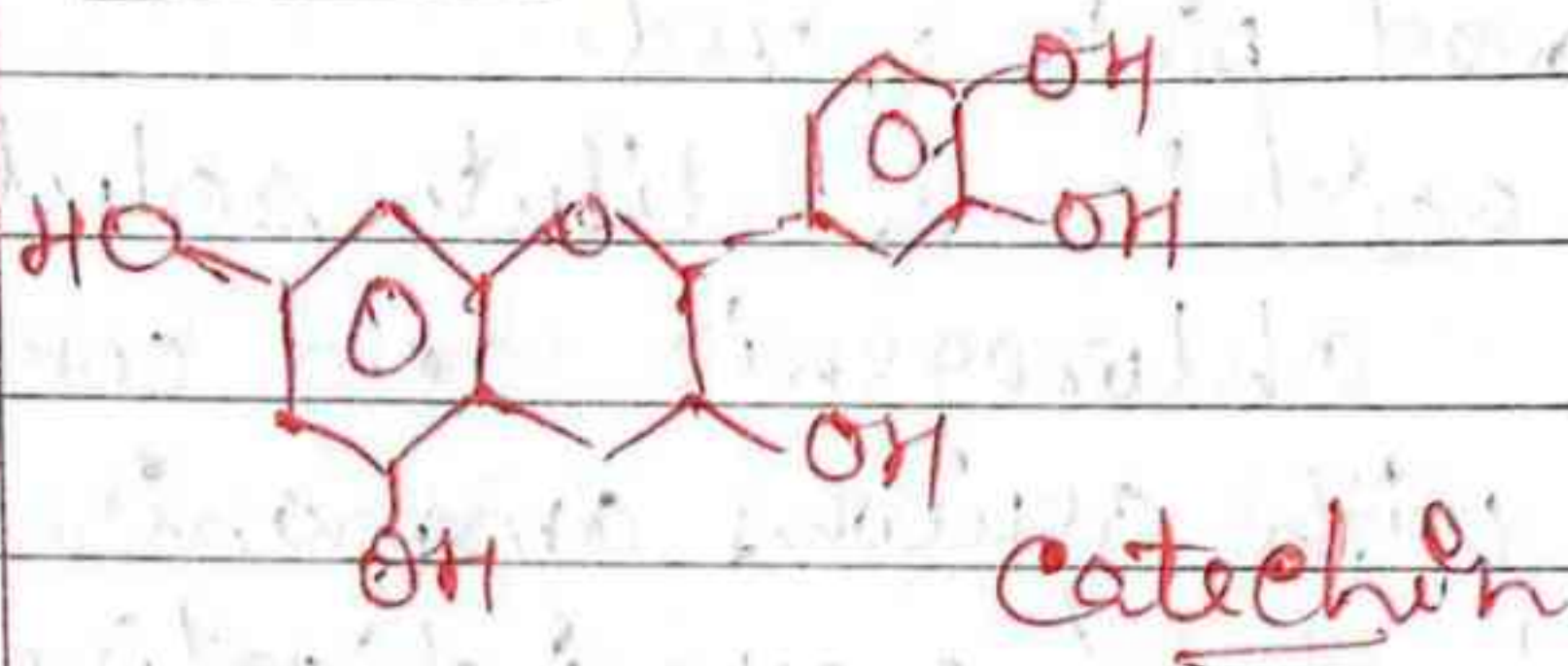
Colour - Black or Brownish black mass.

Odour - Odourless.

Taste - Astringent and subsequently sweet test.

Size - Irregular mass.

* Chemical constituent :-



* Chemical test :-

1. Because of the presence of catechin, black catechu gives pink or red colour with vanillin and HCl.

2. Lime water when added to aqueous extract of black catechu gives brown colour, which turn to red precipitate on standing for some time.

3. Green colour is produced when ferric ammonium sulphate is added to dilute solution of black catechu. By the addition of sodium hydroxide the green colour turns to purple.

* Use :- It is used as Astringent.

- It cure troubles of mouth, disease of the throat and diarrhoea.

- It is also increase appetite.

- In India and eastern countries, it is used in betel leaves for chewing.

- In dyeing industries.

* PTEROCARPUS :-

* Synonyms :- Bijasal, Indian kino tree, Malabar kino.

* Biological source :- It consists of dried juice obtained by making vertical incisions to the stem bark of the plant *Pterocarpus marsupium* belonging to family Leguminosae.

* Geographical distribution :- It is found in hilly regions of Gujarat, Madhya Pradesh, U.P, Bihar, Orissa. It is also found in forest of Karnal, Kerala, West Bengal and Assam.

* Morphology :-

- Colour - Ruby-red

- Odour - Odourless.

Taste - Astringent

Shape - Angular grains.

Size - 3 to 5 to 10 mm granule.

Solubility - Partially soluble in H_2O (80-90%), completely soluble in alcohol.

* Chemical constituent :-

70-80% of kero-tannic acid, catechol, resin & gallic acid.

* Chemical test :- (1) When solution of drug is treated with ferrous sulphate, green colour is produced.

2. With alkali (KOH) violet colour is produced.

3. With mineral acid a precipitate is obtained.

* Uses :- It is used as powerful Astringent and also in the treatment of diarrhoea and dysentery, haemorrhage, toothache & diabetes.

- In dyeing, tanning & printing.

* RESINS: - The term resin is applied to more or less solid amorphous products of complex chemical nature.

- On heating they soften and finally melt.
- They are insoluble in water and usually insoluble in petroleum spirit, but dissolve more or less completely in alcohol, chloroform and ether.
- Chemically, resins are complex mixture of resin acids, resin alcohols (resinols), resin phenol (resinotannols), ester and chemically inert compounds known as resenes.

Classification:

1. Resin acid
2. Resin ester
3. Resin alcohol
4. Resin phenol
5. Gluco-resin
6. Resenes
7. Oleoresin
8. Gum resin
9. Oleogum resin
10. Balsam

<u>Drugs Name</u>	<u>Biological source</u>	<u>Chemical constituent</u>	<u>Uses</u>
Benzoin	- Balsamic resin	- Coniferyl alcohol	- Expectorant
Loban	- <i>Styrea benzoin</i> - <i>Syraceae</i>	- Coniferyl benzoin - Benzoic acid - Cinnamic acid	- Carminative - Diuretic - Antiseptic & Protective
Guggul	- Incision of the bark of	- 2-guggulsteron	- Expectorant
Gum guggul	- Commiphora mukul - Burseraceae	- 5-guggulsteron - β -sitosterol - cholesterol	- Astringent - Antiseptic - Emulsaent
Ginger	- Root rhizome of	- Gingerols	- Carminative
Zingiber	- <i>Zingiber officinale</i> - Zingiberaceae	- Shogaols - Zingerone	- flavoring agent - dyspepsia - Anticancer



- Asafoetida: Oleogum resin obtained - fœtidin. - Carminative
 Devil's dung from rhizome and root of - Asafoetida - Expectovent
 hing - Ferula asafoetida, F. foetida - Umbellifer acid - Antispasmodic
 - Apiaceae - Ferullic acid - Laxative, cholera
- Myrrh - stem of
 Gum myrrh - Commiphora molle - resin, gum & volatile oil. - Carminative
 - Burseraceae - Eugenol, cineol, pinene - Perfume
 - Limonene - Antiseptic
- Colophony - Oleoresin obtained from - Pimaric acid - stiffening agent in
 Rosin - Pinus palustris - Abietic acid - ointment, plaster.
 yellow resin - family - Pinaceae - Stimulant in veterinary

* BENZOIN :- Synonyms:- Sumatra benzoin, Loban
Biological Source:- Benzoin is a balsamic resin obtained from *Styrax benzoin* or *Styrax paralleloneurus* Perkins and other species of *Styrax* known as Sumatra Benzoin.

* Geographical Source:- Sumatra benzoin is produced from trees grown in South Eastern Asia, chiefly Sumatra. Siam benzoin obtained from trees grown in Thailand & Vietnam.

Morphology :- Sumatra benzoin:-

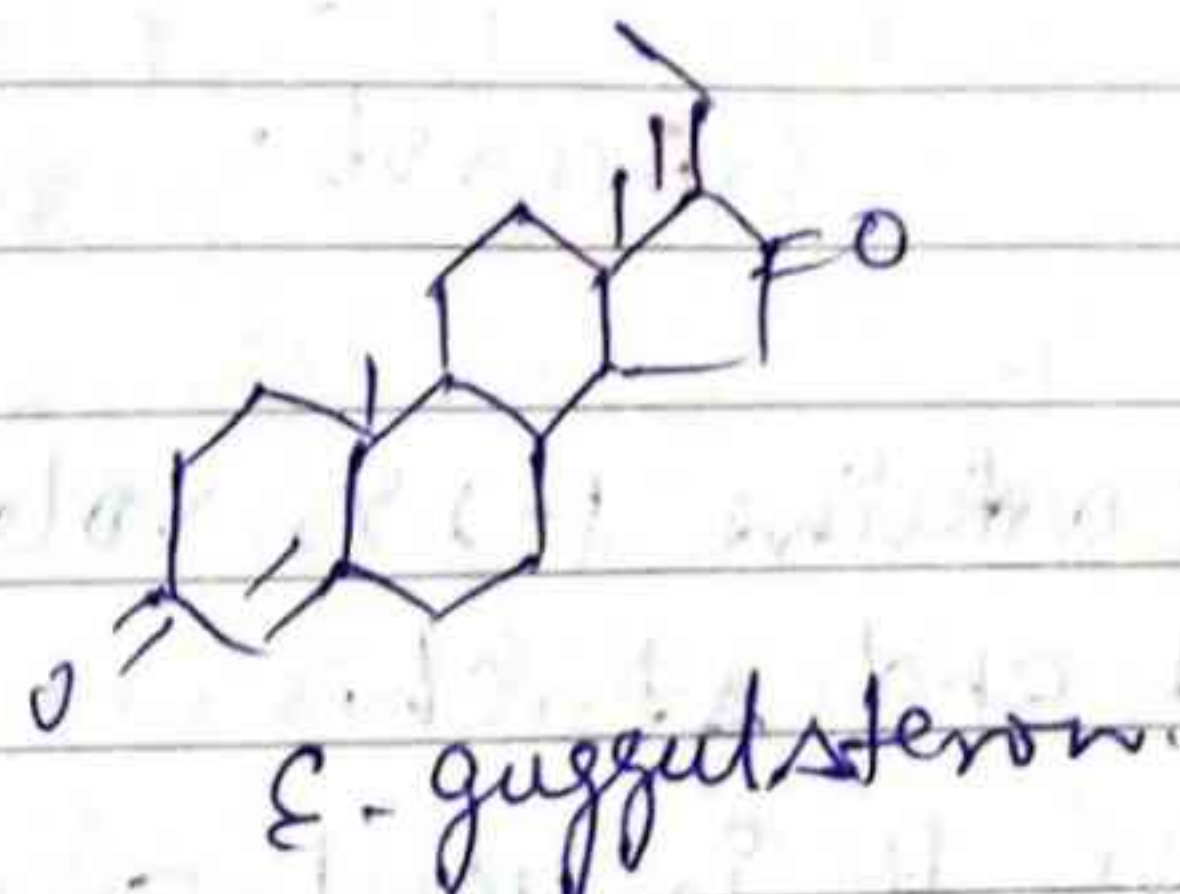
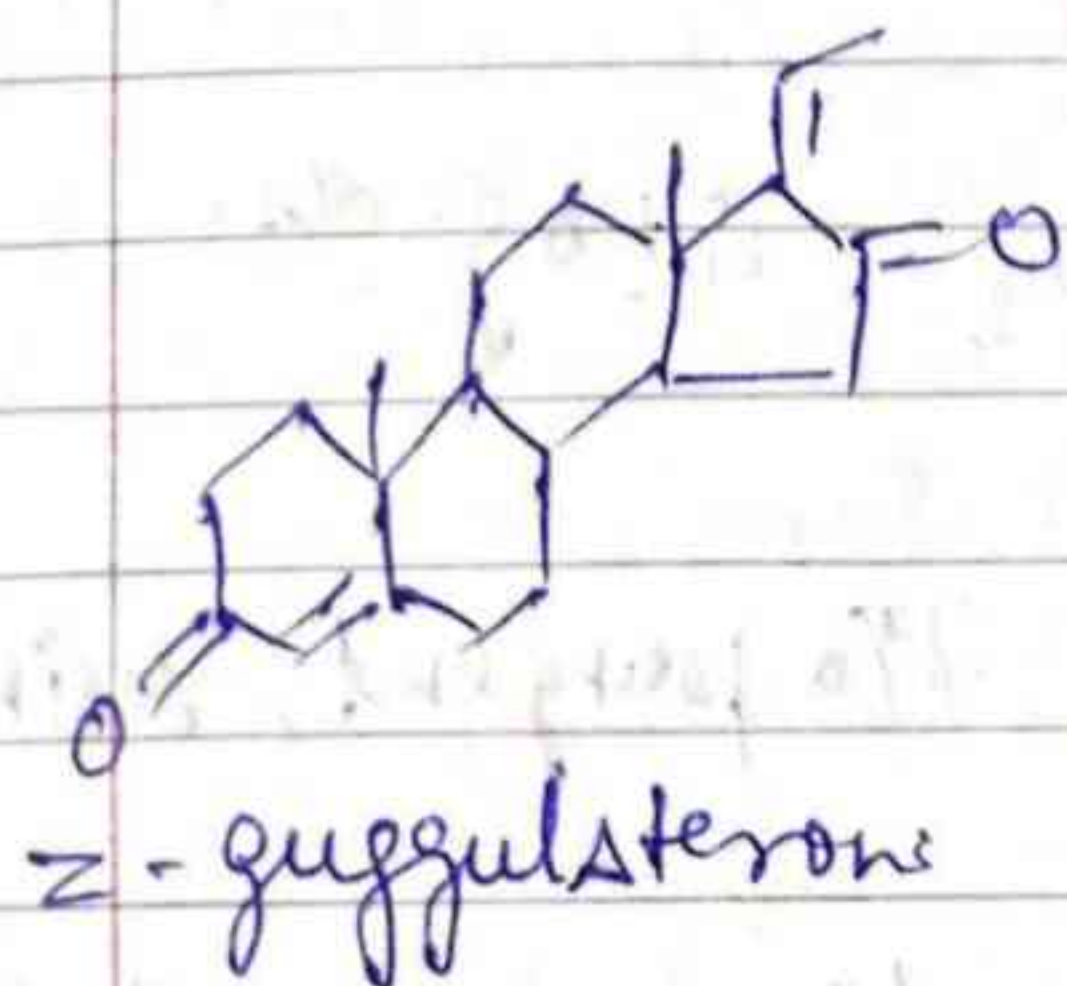
Colour - greyish brown or grey
 Odour - Aromatic and characteristic
 Taste - Sweetish and slightly acid

* Siam Benzoin:-

Colour - Yellowish brown
 Odour - Agreeable and vanilla like
 Taste - Sweetish and slightly acid

* Chemical Constituents:- Guggul contains gum (32%), essential oil (1.45%) sterol.

- β -sterol, cholesterol, Δ^2 and Δ^5 guggulsterone, guggul amino acid, α -camphorene, cambran, allylcambrol.



- * Use:- Gum is Astringent, antirheumatic, antiseptic, expectorant, aphrodisiac, demulcent.
- The resin is used in the form of a lotion for eczematous ulcers and as a gargle in tooth disorders, tonsillitis, pharyngitis and ulcerated throat.

* GINGER:- Synonyms:- Rhizoma zingiberis, Zingiber

* Biological sources:- Ginger consists of the dried rhizome of the *Zingiber officinale* belonging to family Zingiberaceae.

Geographical source:- It is mainly cultivated in West Indies, Nigeria, Jamaica, Japan, Africa & India.

* Macroscopic Character

Colour - Externally, it is buff coloured.

Odour - Agreeable and aromatic.

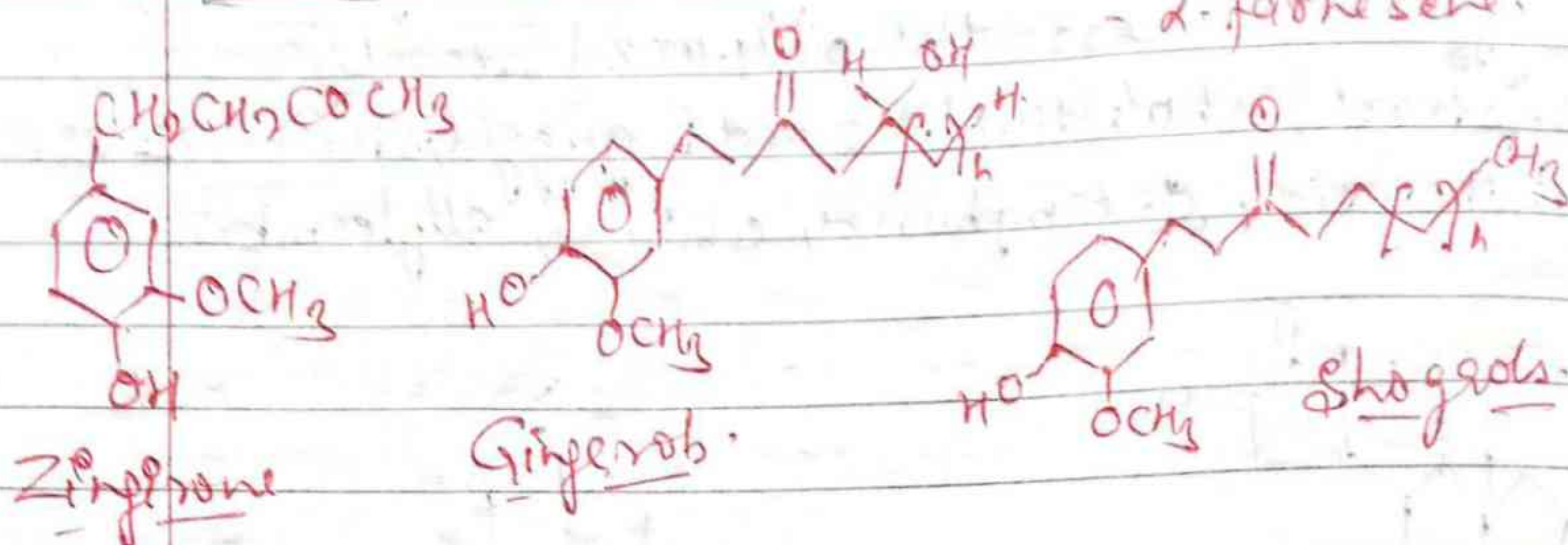
Taste - Agreeable and pungent.

Size - Rhizomes of ginger are about 5-15 x 15-65 cm.

Shape - The rhizomes are laterally compressed, bearing short flat, ovate

* Chemical constituents:-

- α -bisabolene
- α -farnesene



- It contains 1-2% volatile oil, 5-8% pungent, resins, mms and starch.

* Uses:- It is used as an antiemetic, spasmolytic, aromatic stimulant, carminative, condiment and flavouring agent.

- It is prescribed in dyspepsia, vomiting spasm, for painful affections of the stomach, cold, cough and asthma.

* ASAFOETIDA:-

* Synonyms:- Devil's dung, food of the Gods, asafots, asant, hiry.

* Biological source:- Asafoetida is an oleogum resin obtained as an exudation by incision of the decapitated rhizome and roots of *Ferula asafoetida*, *F. foetida*, *F. subrepens*. belonging to family Apiaceae.

* Geographical sources:- The plant grows in Iran, Afghanistan & Turkmenistan.

* Description:-

Colour - Yellowish white, changing to reddish brown

Odour - Intense, persistent, penetrating

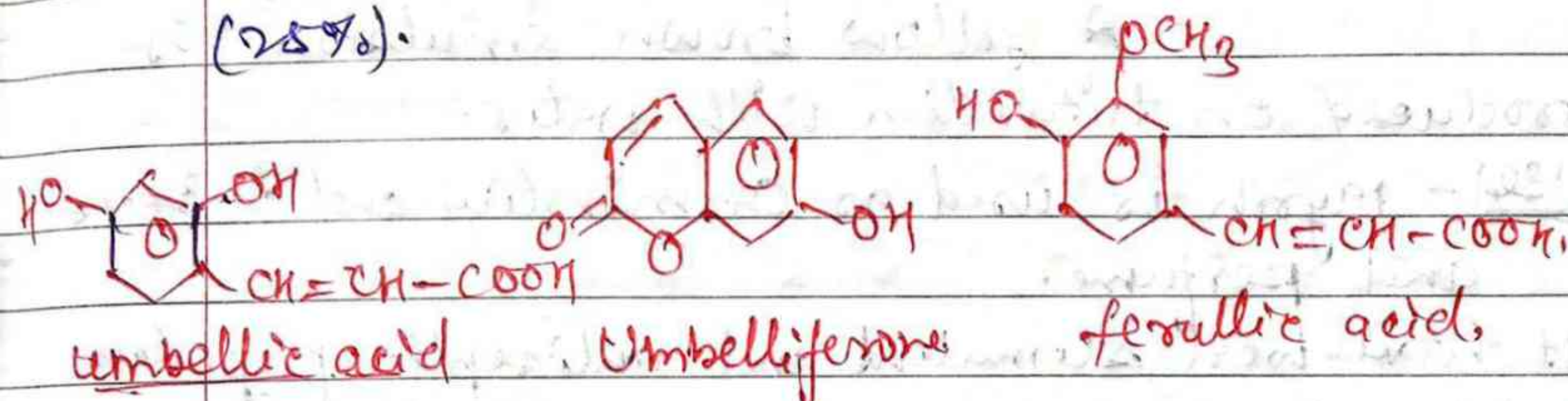
Taste - Bitter, alliaceous and acid

Size - 0.5-3 cm in diameter

Shape - It occurs in two different forms i.e. tears & masses.

- * Identification test:-
1. Fractured surface of the drug if treated with H_2SO_4 forms red or reddish brown colour
 2. When treated with 50% HNO_3 , the drug gives green colour
 3. When triturated with water, it forms yellowish ~~orange~~ orange suspension

* Chemical constituent:- Asafoetida contains volatile oil (4-20%), resin (40-65%) and gum (25%).



* Uses:- Carminative, Expectorant, antispasmodic and laxative.

M.

* MYRRH:-

* Synonyms:- Gum Myrrh, Arabian or Somali Myrrh

* Biological source:- Myrrh is an oleo gum-resin obtained from the stem of *Commiphora molmol*, belonging to family - Burseraceae.

* Geographical sources:- It grows in Arabian peninsula, Ethiopia, Nubia and Somaliland.

* Morphology :-

Colour - Externally, it is reddish brown, Internally brown
 Odour & Taste - Aromatic and agreeable.

Size - About 1.5 to 3.0 cm in diameter

Shape - It is found in the form of rounded

* Chemical constituent :- Myrrh contains resin (25-40%), gum (57-61%) and volatile oil (7-17%).

- α , β & γ -camphoric acids, resenes, cuminic aldehyde, Eugenol, cresol, pinene, limonene, dipentene

* Chemical test :-

A yellow brown emulsion is produced on trituration with water.

* Uses :- Myrrh is used as Carmine and in incense and perfume.

- It has local stimulant and antiseptic properties
 - Astringent & anti-inflammatory properties.

* Colophony :-

Synonyms :- Rosin, yellow resin, coloponium.

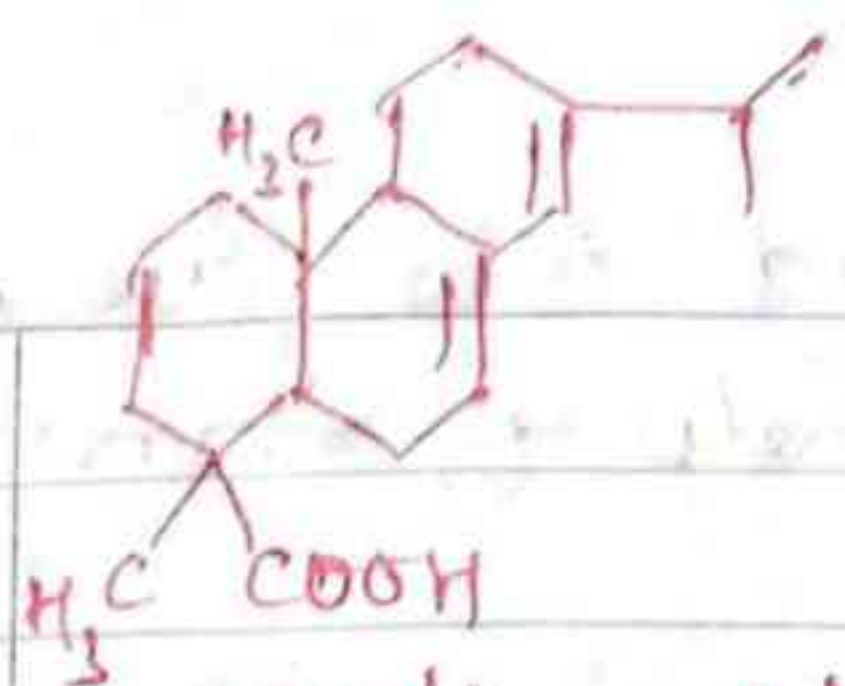
* Biological sources :-

Colophony is a solid residue left after distilling off the volatile oil from the oleoresin obtained from *Pinus palustris* belonging to family - Pinaceae.

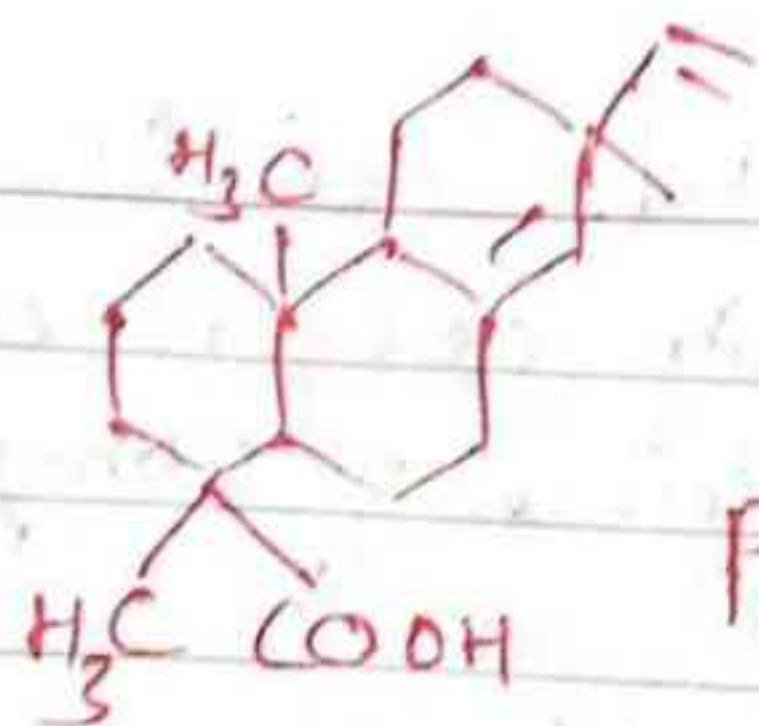
* Geographical sources :-

The genus *Pinus* is widely found in US, France, Italy, Spain, Portugal, Greece, New Zealand, China, India, Pakistan.

* Chemical test :- Colophony contains resin acid (90%) α , β & γ -abietic acid, pimaric acid.



Abietic acid



Pimaric acid

* Chemical test! - To solution of powdered resin (0.1g) in acetic acid (10ml) one drop of conc. H_2SO_4 is added in a dry test tube. A purple colour readily changing to violet is formed.

(2) Alcoholic solution of colophony turns blue litmus to red due to the presence of diterpenic acids.

* Uses! - Colophony is used as stiffening agent in ointments, adhesives, plasters and as a diuretic in veterinary medicine.

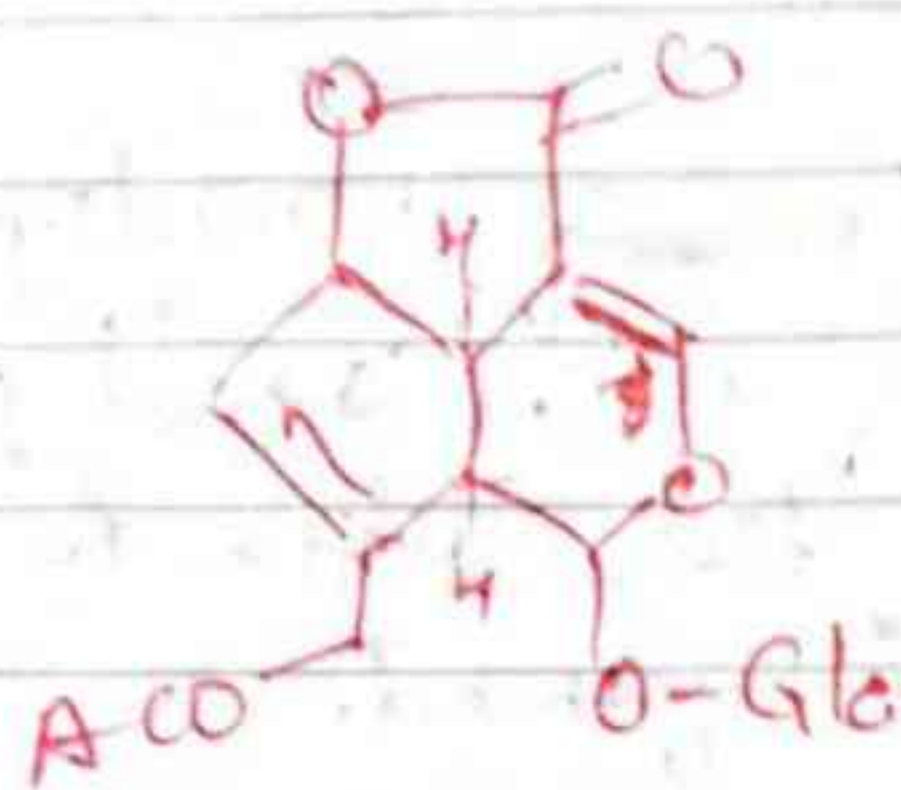
- Commercially it is used to manufacture varnishes, printing inks, cements, soap, sealing wax, wood polish, floor covering, paper, plastic, framework etc.
- Abietic acids show antimicrobial, antitumor & C.V activity.

* IRIDOIDS! - (monoterpene) Ants of *Iridomyrmex* genus

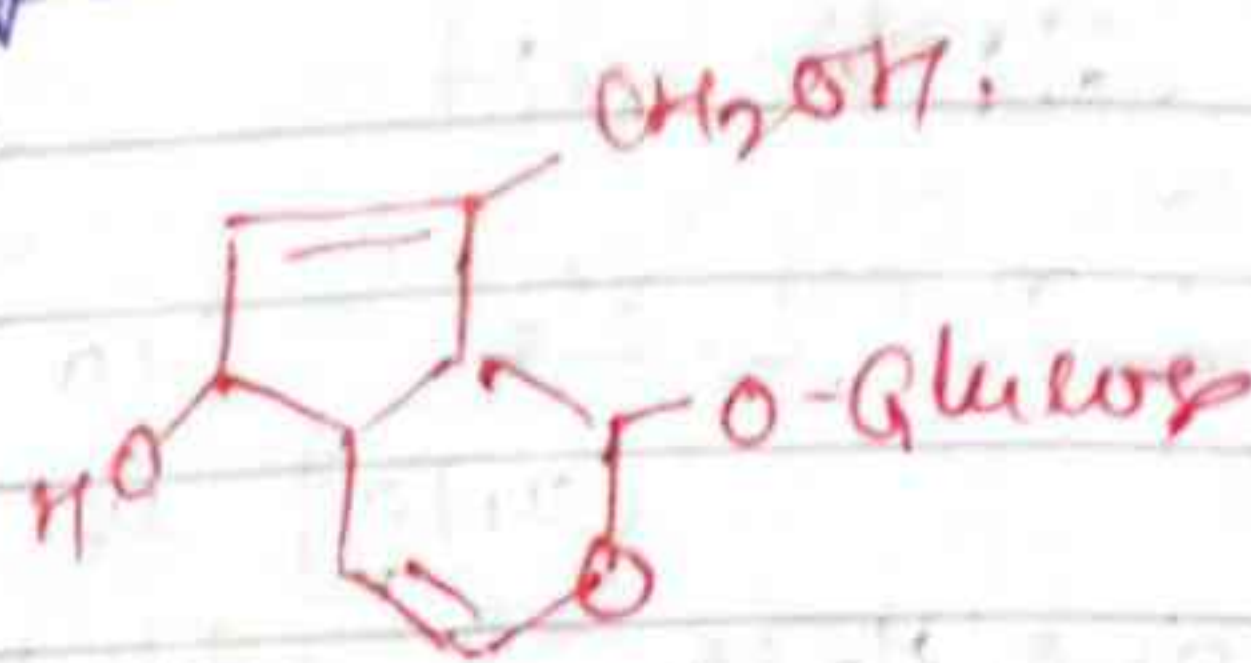
Iridoids in broadest sense are highly characteristic metabolites which occur mainly in a number of assumed phylogenetically related dicotyledonous plant families.

- The detection of iridoids in Callitrichaceae, Eucymniaceae, Fouquieriaceae, Hippuridaceae, part of Lamiaceae, Liquidambar, part of Loasaceae, Theligonaceae and other often mono- or oligotypic taxa made a considerable contribution to their appropriate classification.
- The production of iridoids in plant has conformed some recent changes in classification on morphology basis only.

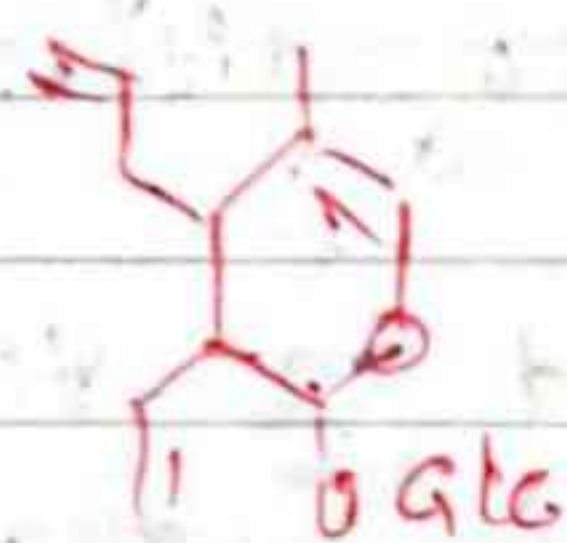
- These compounds can be divided into four structural types and their occurrence can help to characterize the different tribes of Compositae.



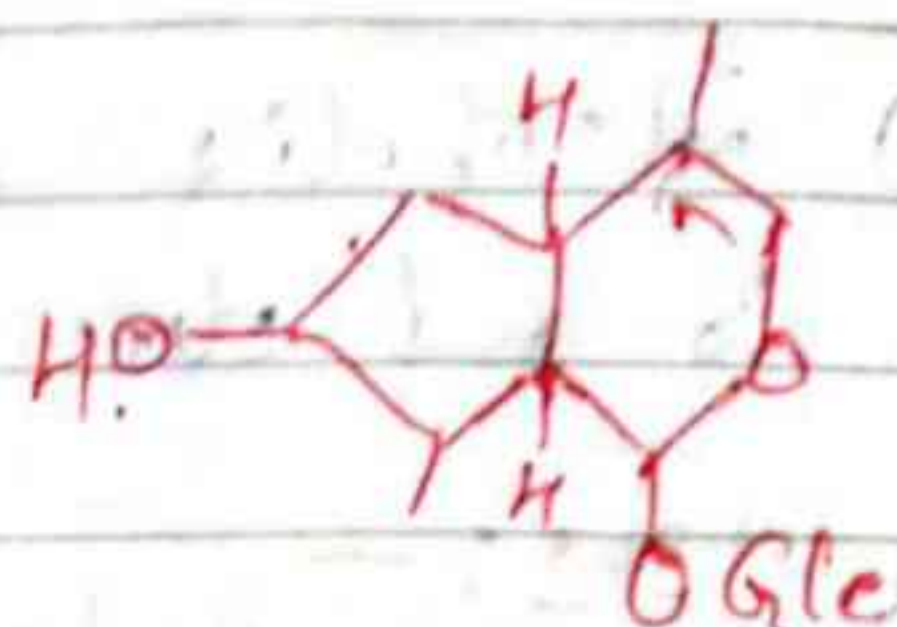
Asperuloside (bri'doidin)



Aucubin



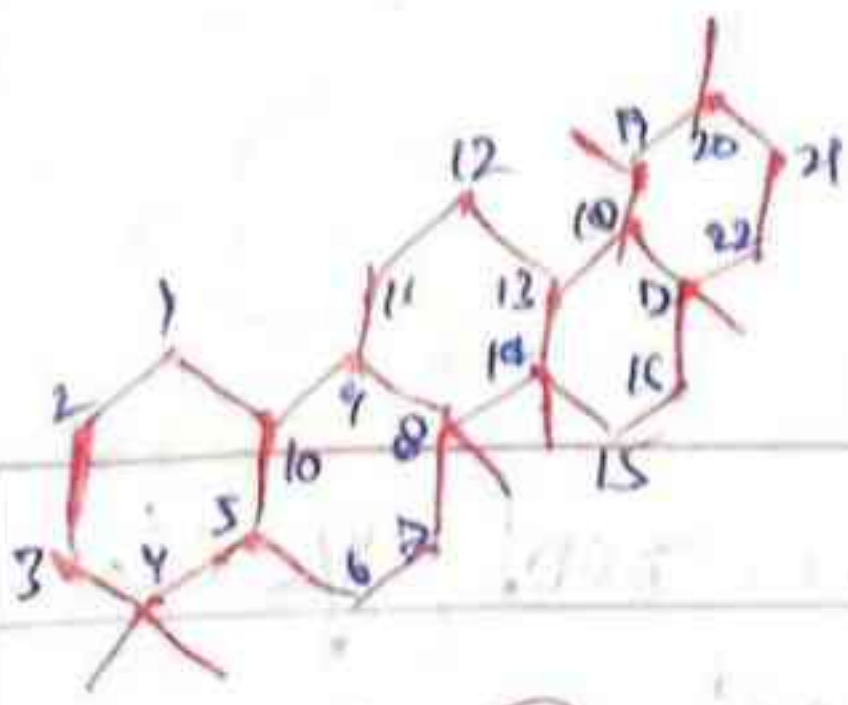
Seeclogenin



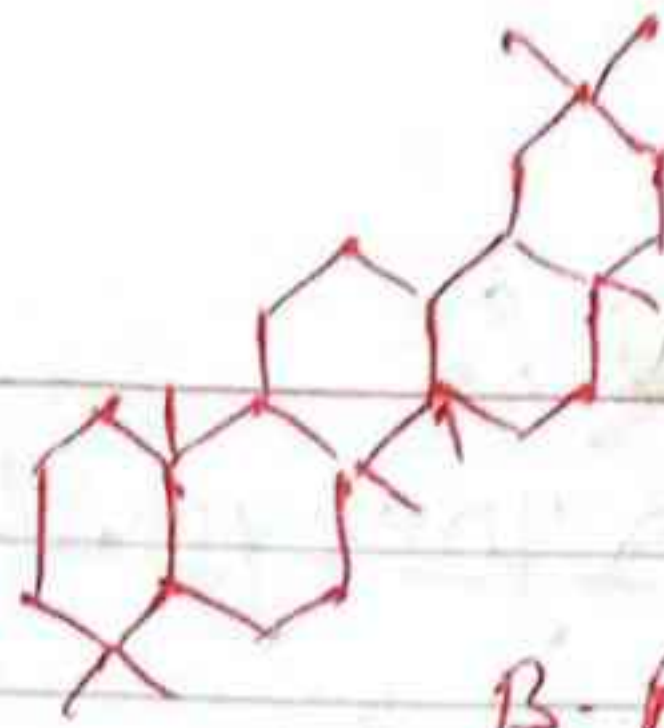
Loganin

Isolates in Chemotaxonomy

- * TRITERPENOID SAPONIN**:- Triterpene saponins are usually β -amyrine derivatives and some are also α -amyrine and lupeol derivatives.
- ⇒ Triterpenoid saponins have been isolated from different plant species and some of the examples are *Aesculus hippocastanum* (aescin), *Aralia japonica* (aralin); *Cyclamen* (primulasaponin), *Glycyrrhiza glabra* (glycyrrhizin), *Primula elatior* (Hell saponin), *Hedera helix* (hederacoside A), *Bupleurum falcatum* (sarsapogenin), *Platycodon grandiflorum* (platycodin A), *Polygonum tenuifolium* (tenuifolin) (tenuifolin). Saponin are used as expectorant.

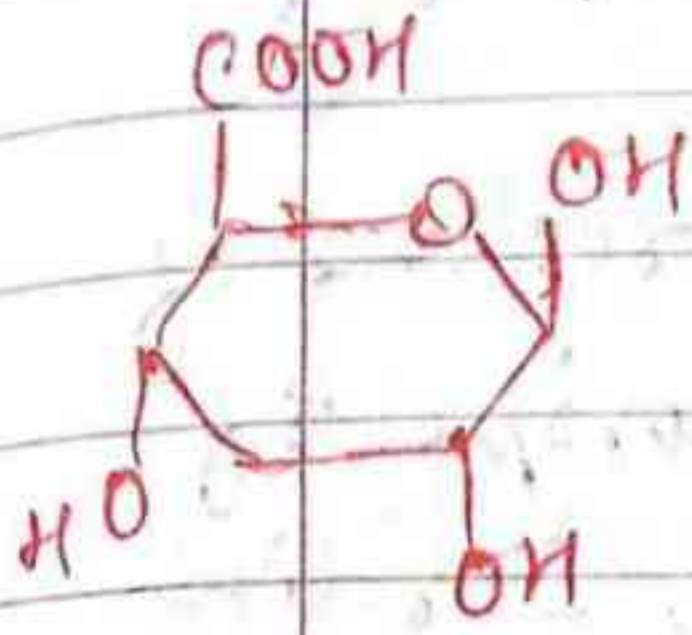


α -Amyrine Type Saponin

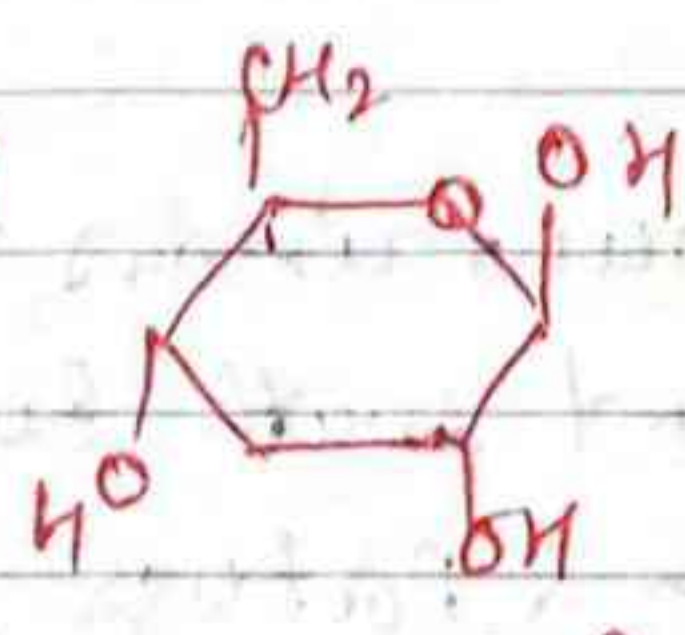


β -Amyrine Type Saponin

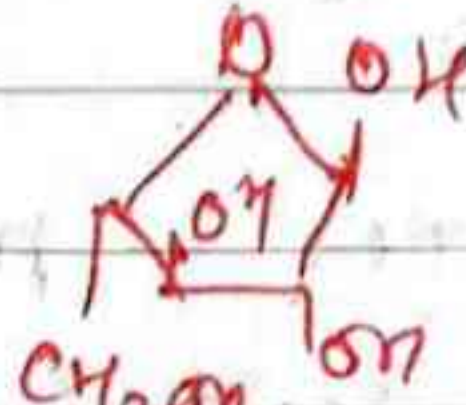
Some of the sugars associated with the above saponins are given below.



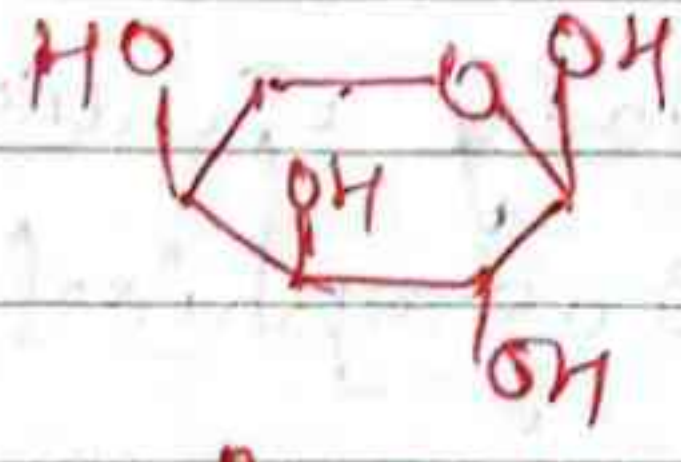
β -D-Glucuronic acid



β -D-glucose (arabinose)



furanose

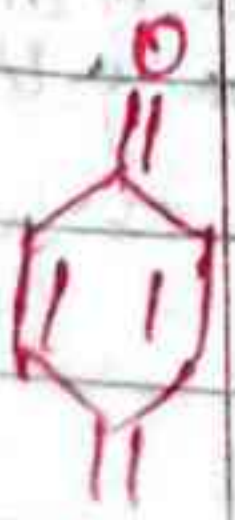


Pyranose (L-Arabinose)

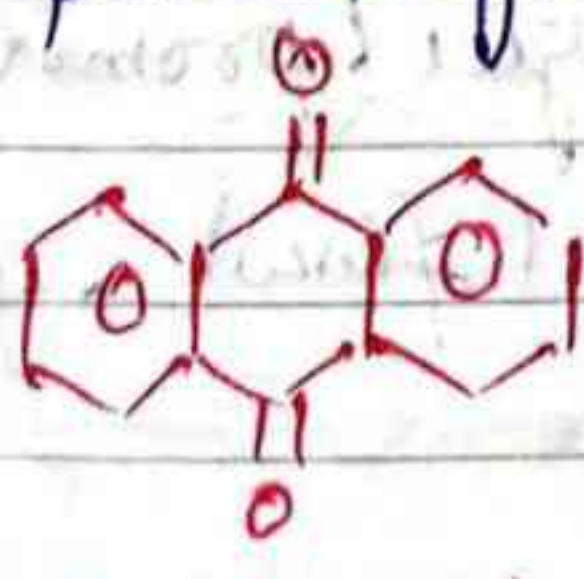
* NAPHTHAQUINONES:-

The glycoside formation involving hydroxyanthra-quinone is frequent, hydroxybenzoquinone (eg- 2,6-dimethoxyquinone from Adonis vernalis, Ranunculaceae) and hydroxynaphthoquinone (plumbagin)

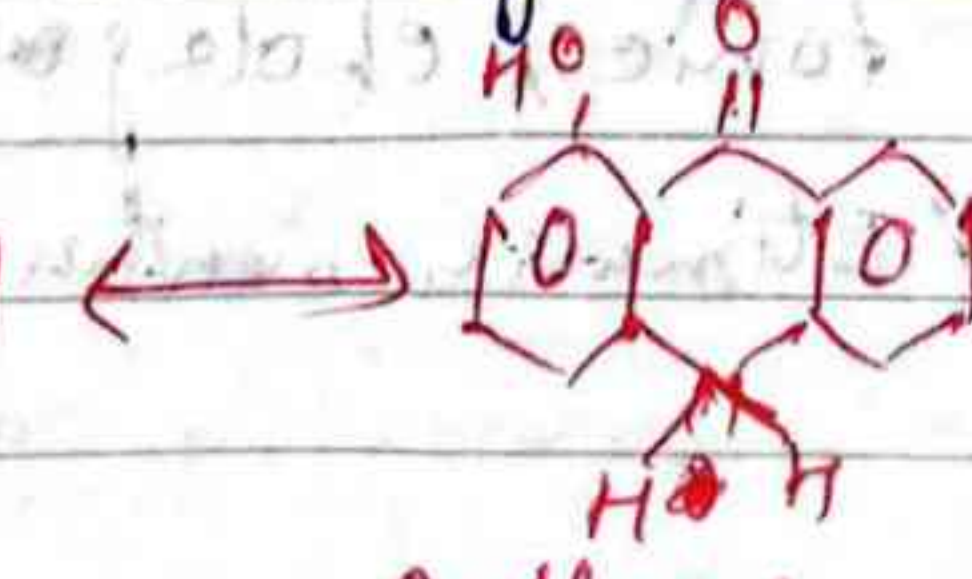
- A number of benzoquinones, naphthoquinones and anthraquinones have a restricted distribution hence their presence can be potentially useful in plant taxonomy
- In dicotyledons the polyprenylated benzoquinones such as embelin are good taxonomic markers for Myrsinaceae, while primitive with shorter side chain occurs in related Primulaceae
- Acetate malonate pathways by which quinones are biosynthesized seems to be more primitive than the pathways involving shikimic acid



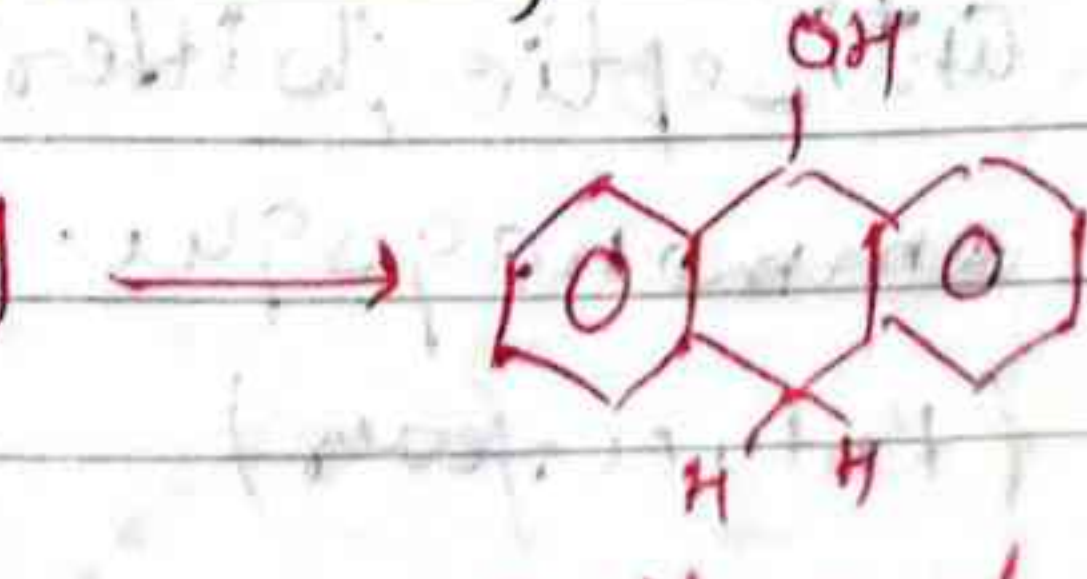
Benzoquinone



Anthraquinone



Anthrone



Anthranol

* GENTIAN:-

* Synonyms:- Gentian root, yellow gentian root.

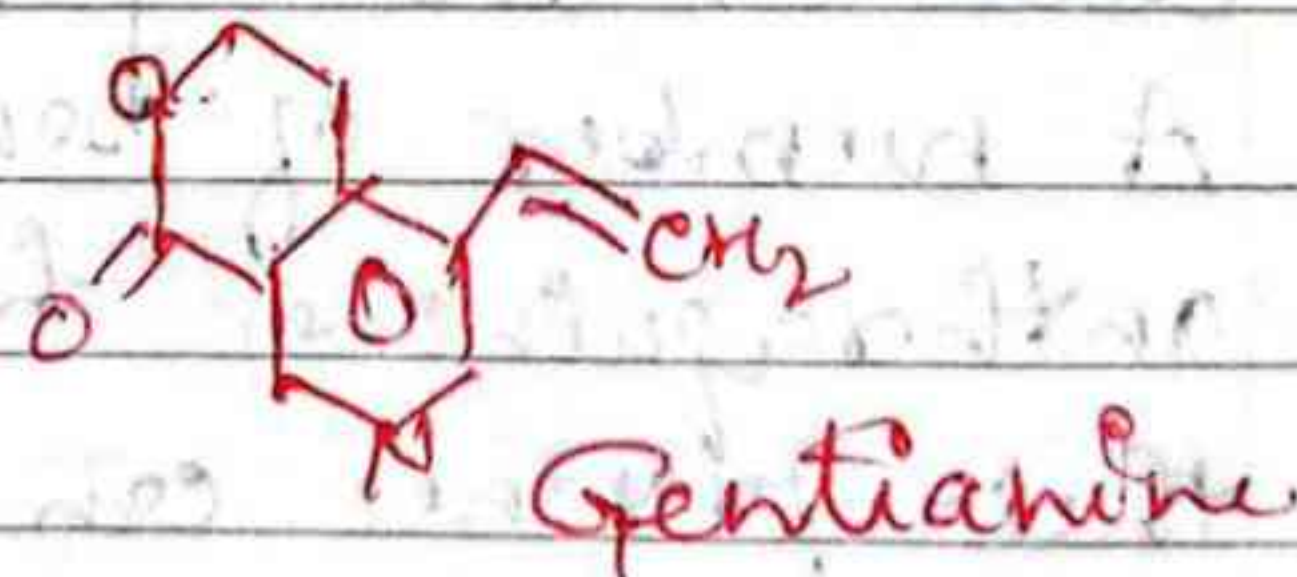
* Biological sources:-

Gentian consists of dried unfermented rhizomes and roots of *Gentiana lutea* belonging to family *Gentianaceae*.

* Geographical sources:- mountainous regions of central and south Europe of France and Switzerland, Spain & Portugal, Sardinia, Corsica, The black forest and throughout the chain of the Alps as far as Boemia and the Balkan State.

* Chemical constituent:- Gentian contains bitter glycosides. The dried gentian root contains gentinin and gentiamarin, bitter glycoside, together with gentianic acid (gentisin), the latter being physiologically inactive.

- Gentiopicrosin, Gentinin,



* Chemical test:-

Under UV-radiation gentian extract shows light blue fluorescence.

* Uses:- It is used in the treatment of digestive disorders.

- It is also used as anthelmintic, anti-inflammatory, antiseptic, bitter tonic, cholagogue (promote flow of bile from gall bladder), emmenagogue (stimulate menstrual flow), febrifuge (Reduce fever).

* ARTEMISIA :- Synonyms :- Santonica, Worm seeds

* Biological sources :- These are unexpanded flower head of *Artemisia cina* Berg, *Artemisia brevifolia* Wall, *Artemisia maritima* belonging to family Compositae. It should contain not more than 2% of stem and not less than 0.75% of Santonin

* Geographical Sources :- It is found growing wild in the Karoon Valley in Pakistan, Turkey and from Kashmir to Kumaon in Himalayas as well as Tibet. It is found in U.P., Punjab & Hongkong.

* Macroscopic Character

Colour - flowers are yellow in colour, while other parts are whitish grey.

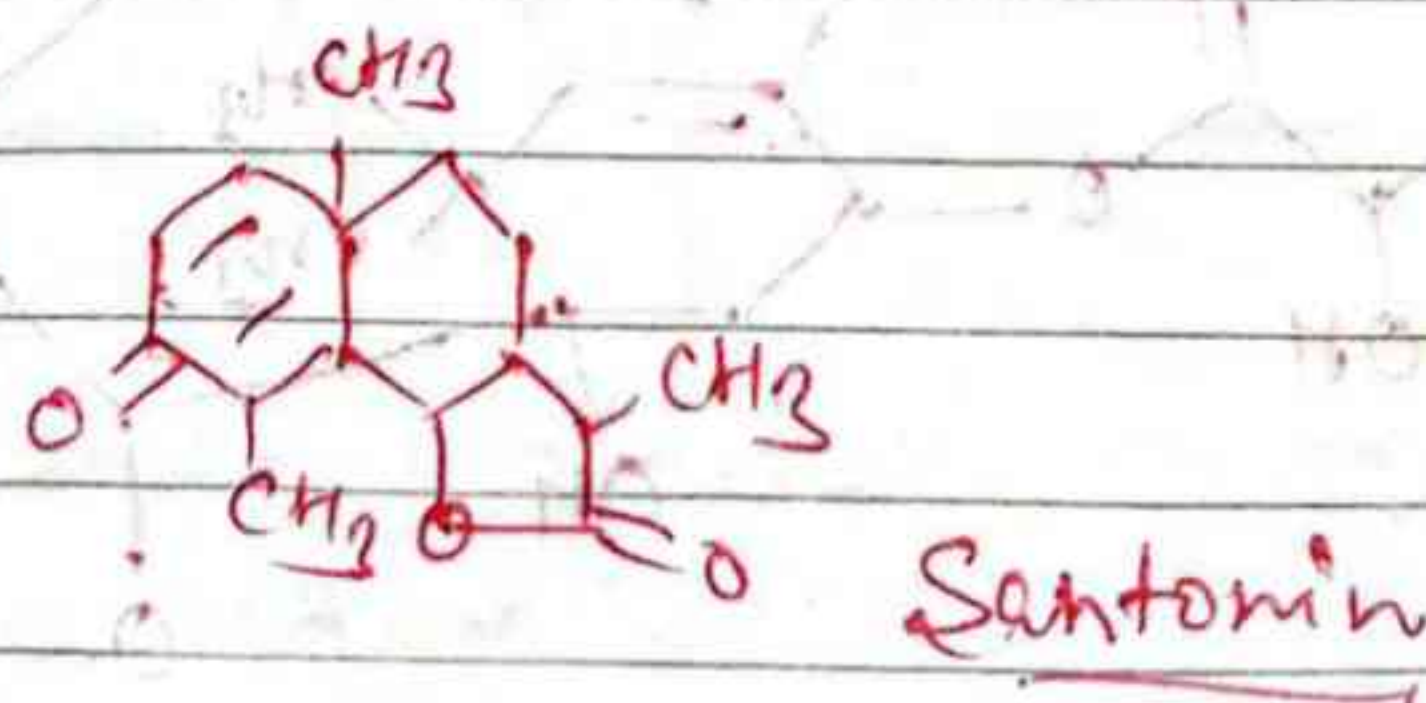
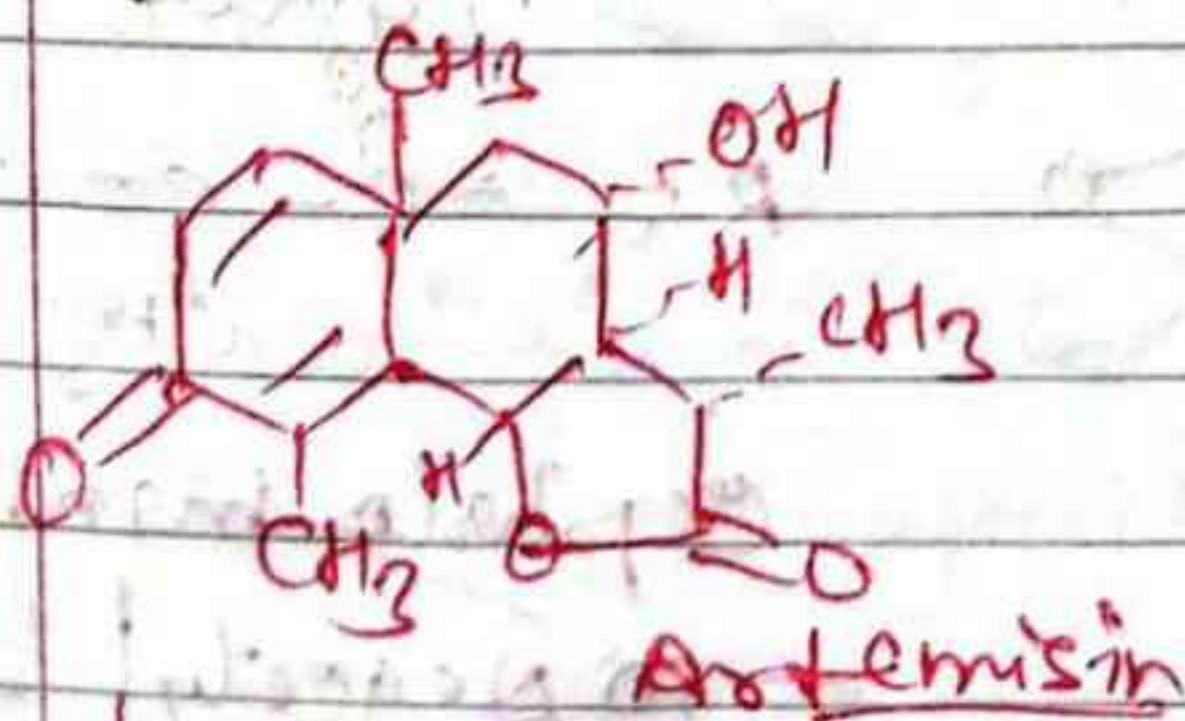
Odour - Aromatic and Sweet.

Taste - Bitter and camphoraceous

Shape - oval.

* Chemical test :- Boil 1 gm finely powdered drug with 10 ml alcohol and filter. To the filtrate, add NaOH and heat again. The liquid develops red colour.

* Chemical Constituents :-



* Uses :- Santonica is used as a strong anthelmintic - Antimalarial effect.

* TAXUS :- Synonyms :- Yew, Tallapatra, Himalayan yew.

* Biological Sources :- This consists of dried leaves, bark and roots of various species of Taxus, belonging to family - Pinaceae. The four important species with parts used as under -

- ① Taxus baccata (English or European Yew) leaves.
- ② Taxus brevifolia (Pacific yew) stem bark
- ③ Taxus canadensis (American yew) leaves and roots.
- ④ Taxus cuspidata (Japanese yew) leaves

* Geographical Sources :- It is very slow growing evergreen gymnospermous tree found India, Canada, America.

* Morphological Characters :-

Leaf colour - Dark green.

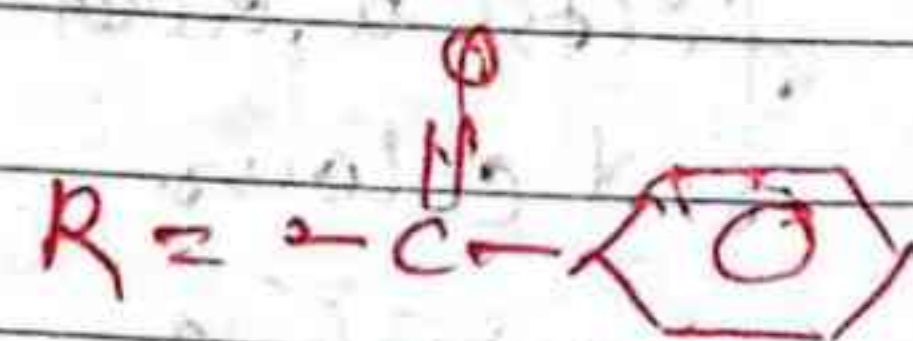
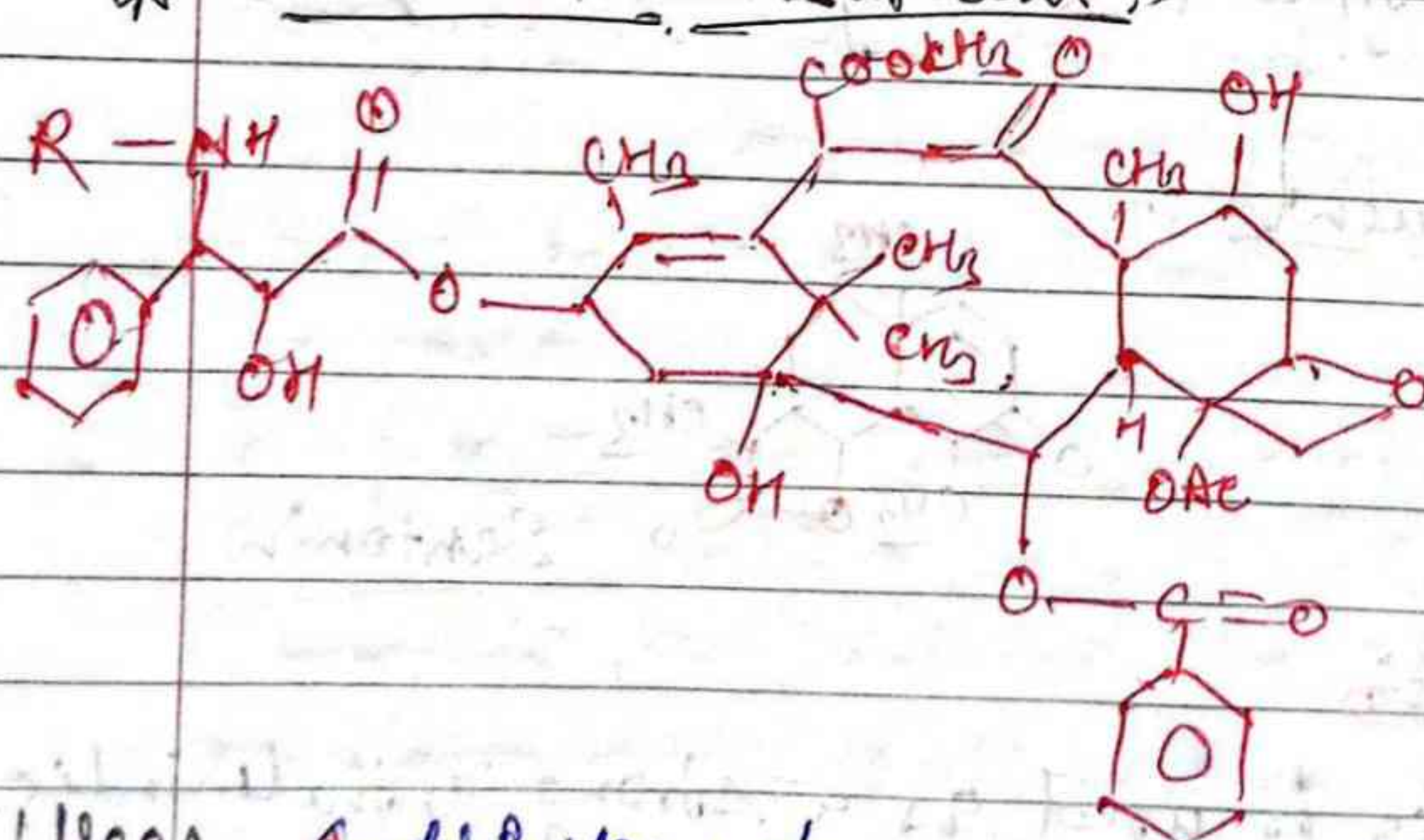
Taste - Bitter.

Size - 1-3 cm ~~by~~ 1-2 cm

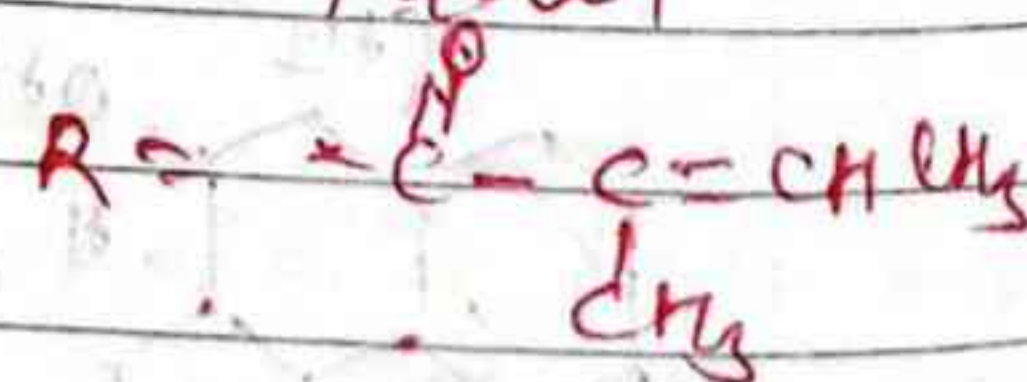
Shape - Lanceolate, flat.

Bark - Thin and deeply brown

* Chemical constituent :-



Taxol



Cephalomannine

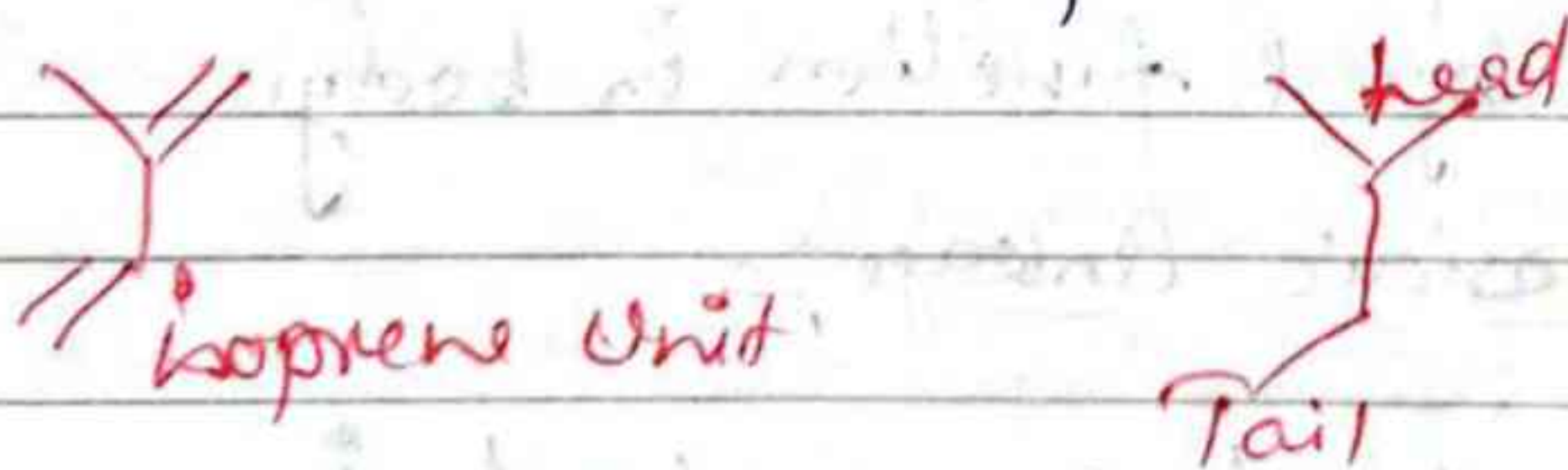
- 10 Deacetyl baccatin

* Uses :- Anti-inflammatory, Antipyretic, Anticonvulsant, Analgesic, Anticancer.

* TETRA TERPENOIDS & CAROTENOIDS :

- They are C₄₀ compounds of terpenoid groups and biosynthetically prepared by tail-to-tail condensation of geranyl geranyl. They contain long sequence of conjugated double bonds.
- Carotenoids are a prominent group of natural colouring matter exhibiting purple, red, yellow or orange colour.
- They are present both plants and animals. In plants they act as photosynthetic accessory pigment and in animals as a source of vitamin A and also as antioxidants.

* Isoprene Rule :- Thermal decomposition of terpenoid gives isoprene as one of the product. Otto Wallach pointed out that terpenoids can be built up of isoprene unit. Isoprene rule states that the terpenoid molecule are constructed from two or more isoprene unit.

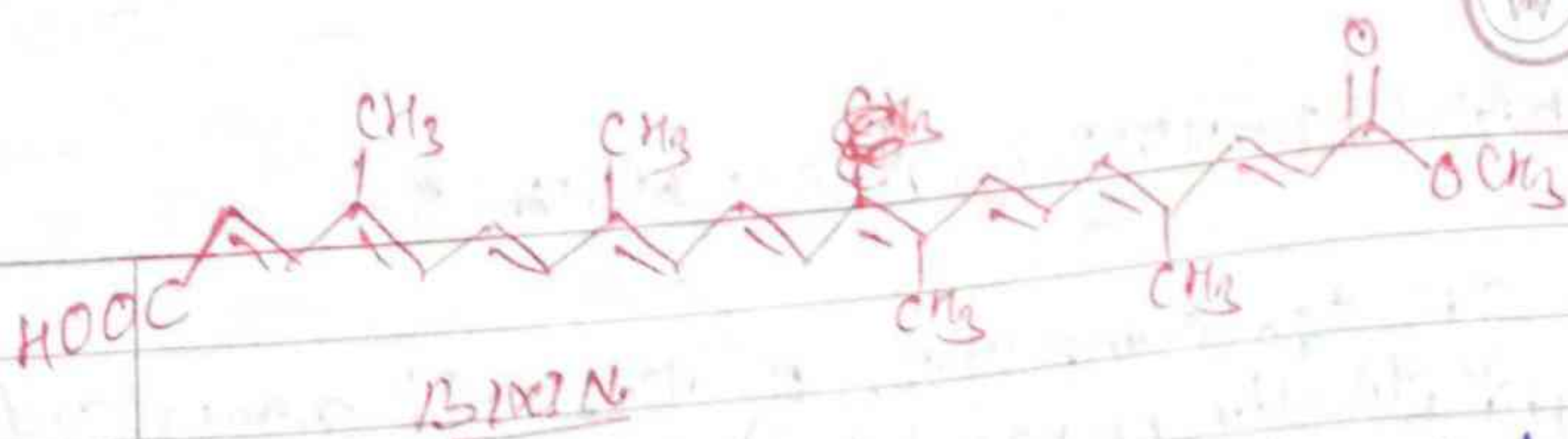


* ANNATTO :- Synonyms :- Annatto, Annatto, Lipstick pods.

* Biological source :- This consists of dried seeds of the plant *Bixa orellana* family - Bixaceae.

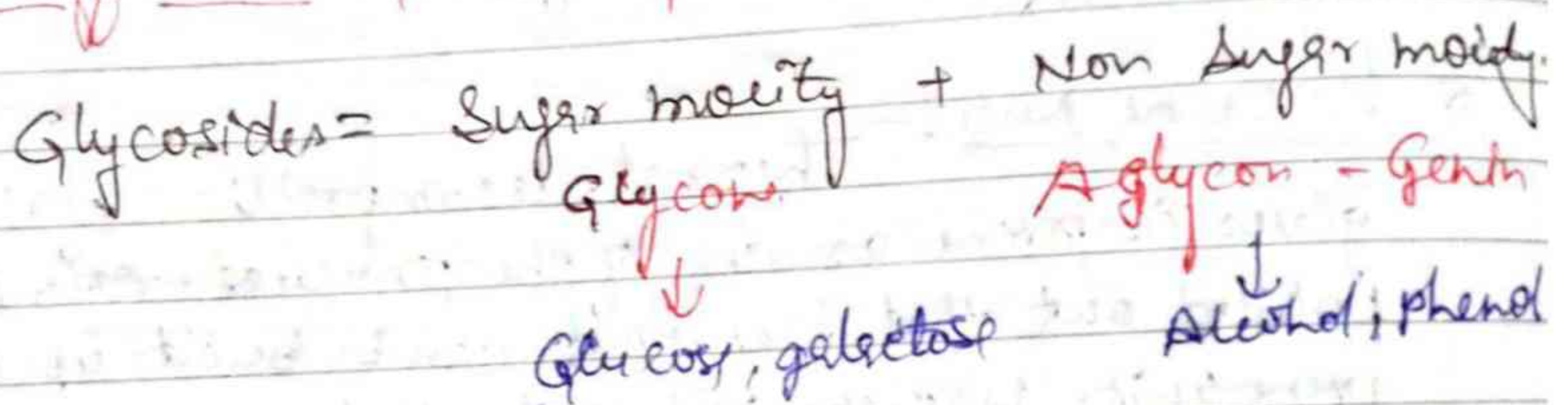
* Geographical sources :- The plant is cultivated in Peru, Jamaica, Mexico, Kenya, India.

* Chemical constituent :- Bixin. Bixin



- * Uses:- Bixin is antioxidant and protects against U.V light. It also have liver protective property.
- It is also used as colouring agent for foods, cosmetics, alcoholic and non-alcoholic beverages, dairy desserts, fats and oils and in margarine.

* Difference b/n O-Glycoside & C-glycoside:-



- They play important function in plant life and also exhibit physiological function in body.

* Basic Glycosidic Linkage:-

① O-Glycosides:- Sugar molecule is combined with phenol or -OH group of aglycone for example. Amygdalin, indesine, arbutin, salicin, cordice glycoside like sennoside.

② C-glycosides:- Sugar molecule directly attached with C-atom of aglycone eg. Anthraquinone glycoside like aloin, barbaloin, cascuboside & flavon.

③ N-glycosides:- Sugar molecule is combined with N of the -NH₂ (amino group) of aglycone for eg. - ~~strychnine~~ nuxloside

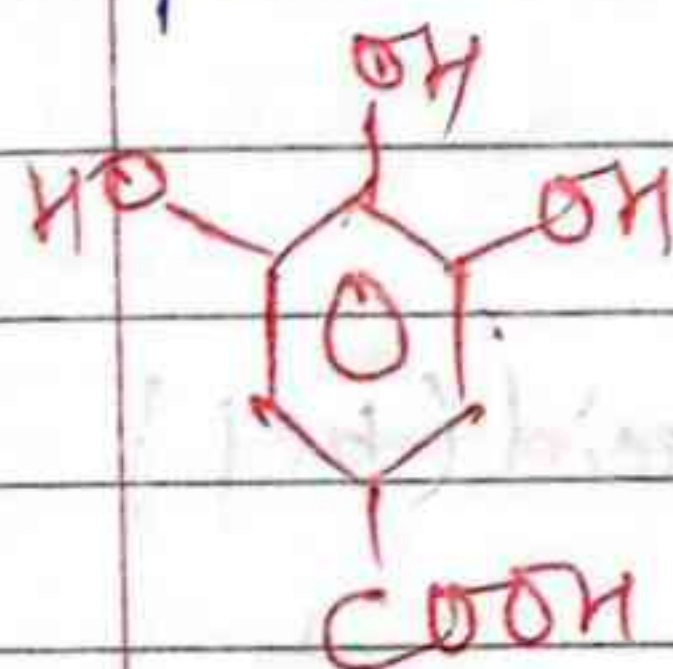
④ S-glycosides:- Sugar molecule is combined with S or SH (thiol group) of aglycone eg. Silybin

⇒ Hydrolysable & Non-Hydrolysable or Condensed Tannins

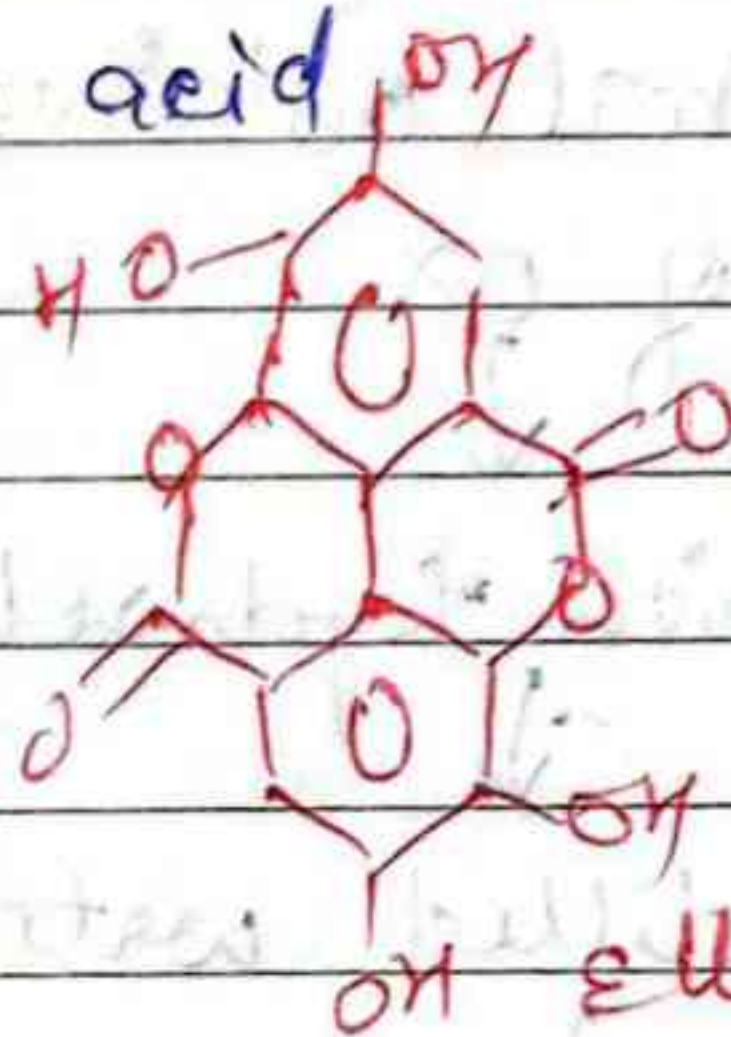
① Hydrolysable Tannins

These tannins are hydrolysable by mineral acids or enzymes such as tannase. Their structures involve several molecules of polyphenolic acid such as gallic hexahydrodiphenic or ellagic acids, bonded through ester linkage to a central glucose molecule.

- On the basis of the phenolic acid produced after the hydrolysis, they are categorized under gallotannins composed of gallic acid or ellagitannins which contain hexahydrodiphenic acid which after interesterification produce ellagic acid.



Gallic acid



Ellagic acid

* NonHydrolysable or Condensed Tannins

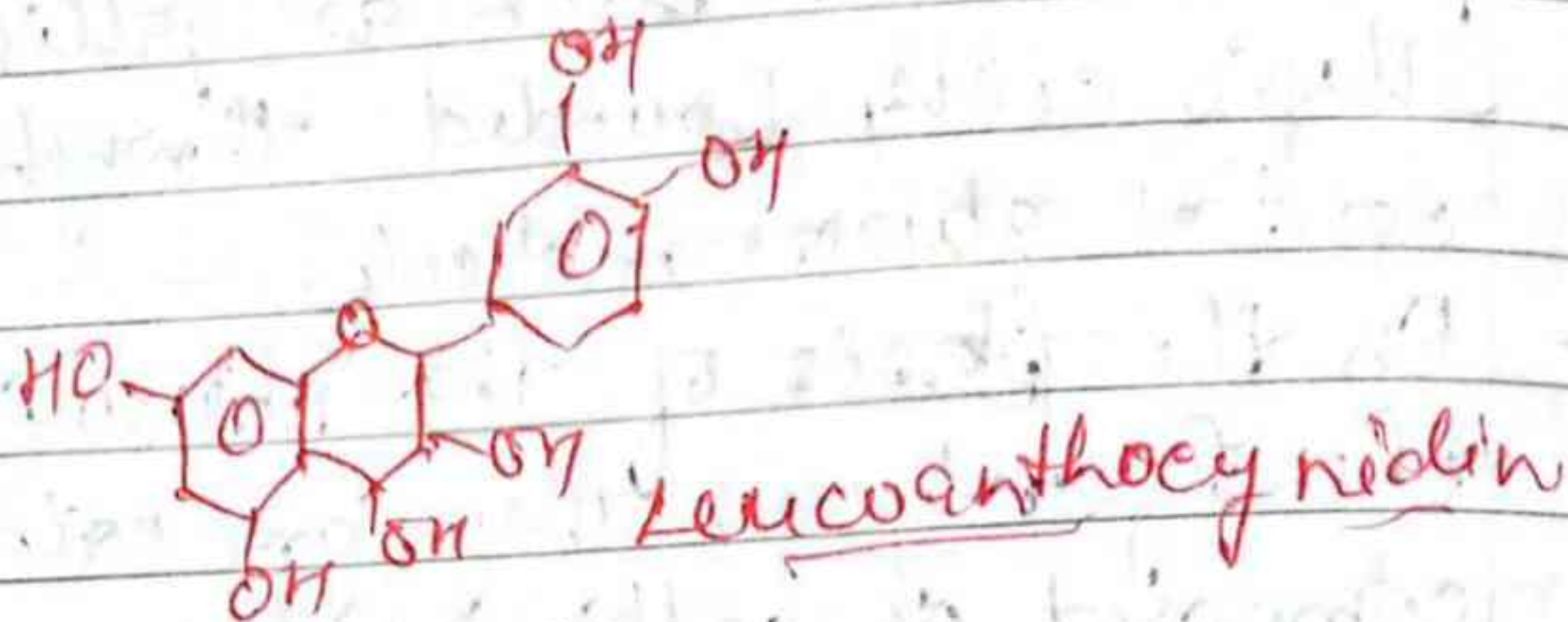
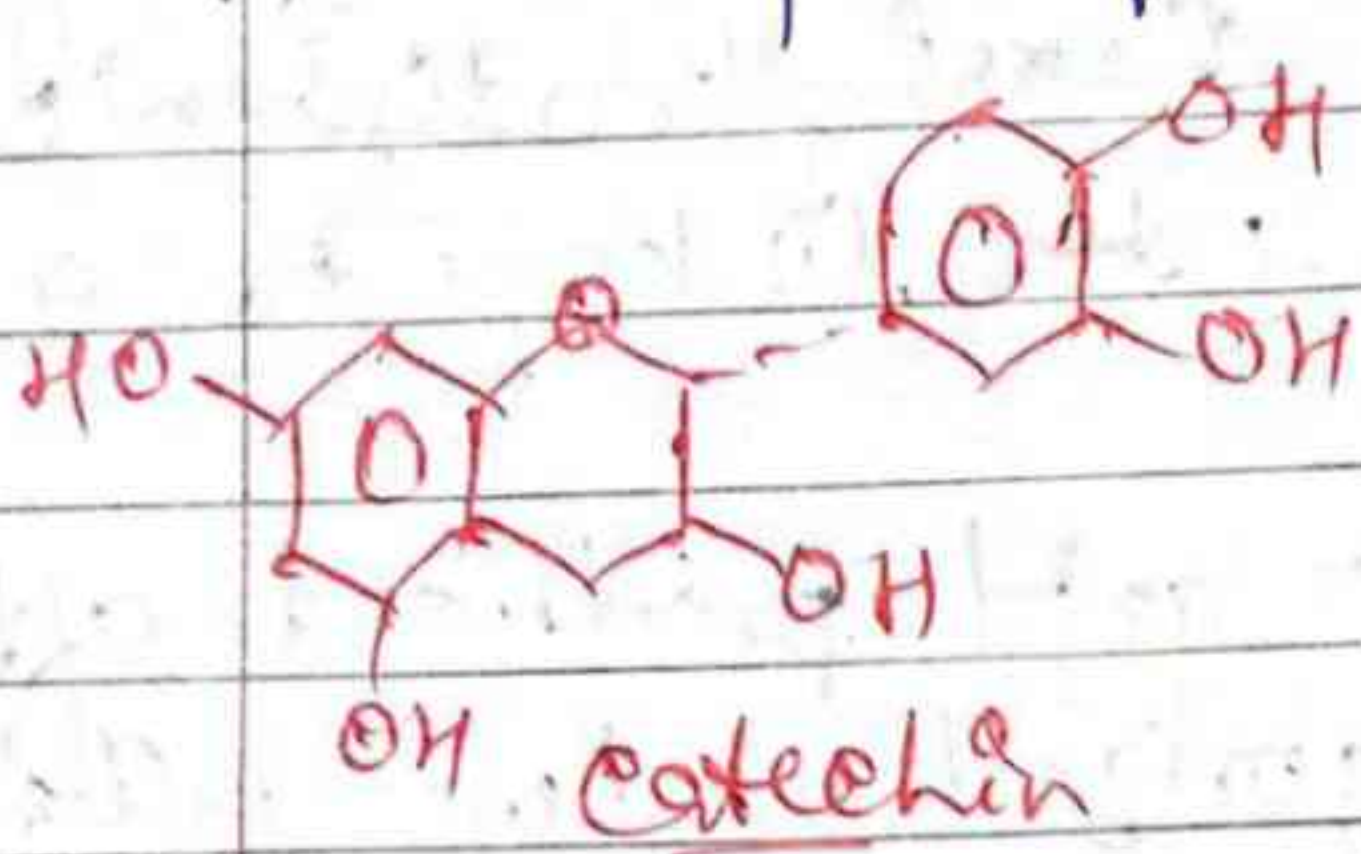
They are not readily hydrolysable to simpler molecules with mineral acids and enzymes, thus they are also referred as nonhydrolysable tannins.

⇒ The term proanthocyanidins is sometimes alternatively used for these tannins. The compound containing condensed tannins contains only phenolic nuclei which are biosynthetically related to flavonoids.

⇒ Catechin which is found in tannins is flavan-3-ol, whereas leucoanthocyanidins are flavan-3,4-diol structures.

- These phenolics are frequently linked to carbohydrates or protein molecules to produce more complex tannin compounds.

- When treated with acids or enzymes, they tend to polymerize yielding insoluble red coloured products known as phlobaphenes.
- The phlobaphenes give characteristic red colour to many drugs such as cinchona and wild cherry bark.



* Gold beater skin test! - (Tannin)
 Fresh skin of animal obtained as a membrane from the intestine of ox.

↓
 Membrane treated with hydrochloric acid (HCl)

↓
 Rinsed with distilled water

↓
 Placed in tannin solution for 5 min.

↓
 Washing with distilled water

↓
 Putting in ferrous sulphate solution

↓
 Brown or black colour developed on skin due to tannin

Isopren (C₅H₈)

No. of carbons

Molecular



Date
Page

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Terpene	No. of Isoprene unit	Formula	Exm
Monoterpene	2	C ₁₀	Acyelic - myrcene, linal, geraniol. monocyclic - limonene, menthol, phellandrene
sesquiterpene	3	C ₁₅	monocyclic - zingiberene, bicyclic - santalene, santalol
diterpene	4	C ₂₀	Acyelic - phytol, monocyclic - vit A, bicyclic - menadiol tricyclic - podocarpic acid
triterpene	6	C ₃₀	Acyelic - squalene, tetracyclic - lanosterol
tetraterpene	8	C ₄₀	tetracyclic - urosolic acid, Asiatic acid. lycopene, crocin, p-carotene, beta xanthophyll
polyterpene	n	...	Rubber

~~Borntrager's~~ Borntrager's Test for Anthraquinone glycoside

3ml extract + Dil. H₂SO₄



Boil & filter

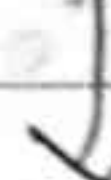


To cold filtrate



Add Benzene / CHCl₃ & shake

Separate the organic layer



Add NH₃

Ammoniac layer turn pink / red