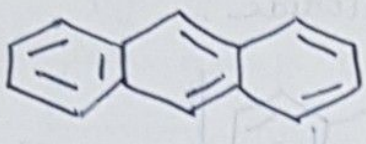
Anthracene



$C_{14}H_{10}$

*[1]

→ obtained from anthracene oil fraction of coal-tar by cool the latter and pressing the solid (which crystallises out) free from Liquid.

↓

crude napthalene anthracene (contains phenanthrene and carbazole)

↓

crude napthalene cake is washed with solvent naptha → releases phenanthrene.

↓

Solid anthracene (free from phenanthrene but contains carbazole)

↓ washed with pyridine dissolves carbazole

anthracene

↓ further purified by sublimation

purified anthracene.

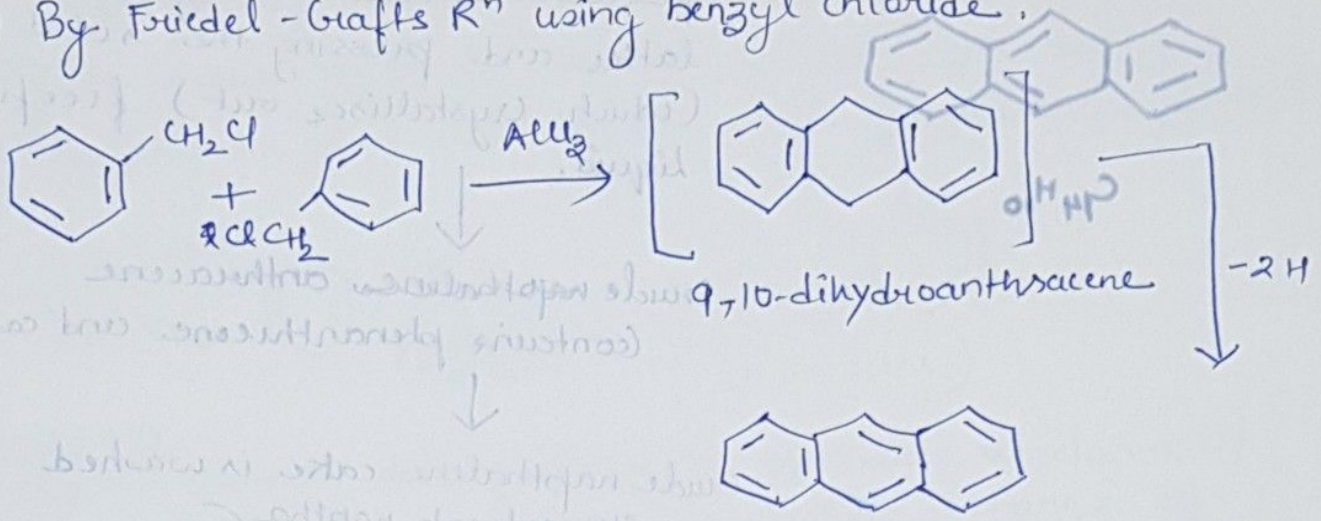
*[2]

crude anthracene from coal-tar (contains impurities of carbazole and phenanthrene) —(removal of phenanthrene)→ mix. of anthracene + carbazole —(air, V_2O_5, 300-500°C)→ anthraquinone (carbazole oxidised to CO_2 etc.)

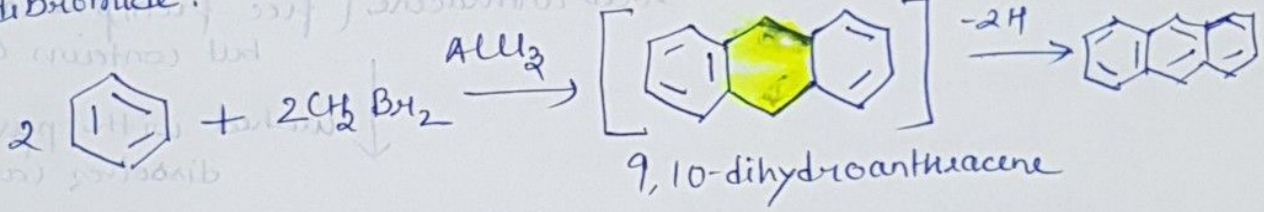
Route no. 2 (above) is more economically as less desired carbazole is completely oxidised and anthracene is converted to anthraquinone which is desirable product for various reactions & synthesis.

Synthesis of Anthracene :-

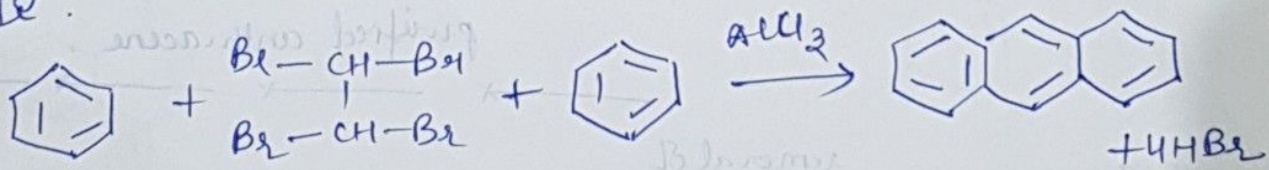
(1) By Friedel-Crafts R^n using benzyl chloride.



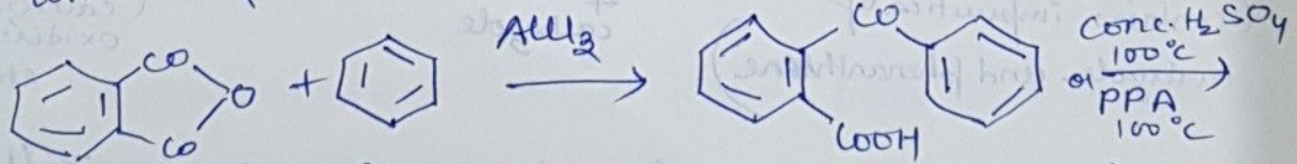
(2) Friedel Crafts condensation between benzene and methylene dibromide.



(3) By Friedel Crafts R^n b/w benzene and acetylene tetrabromide.



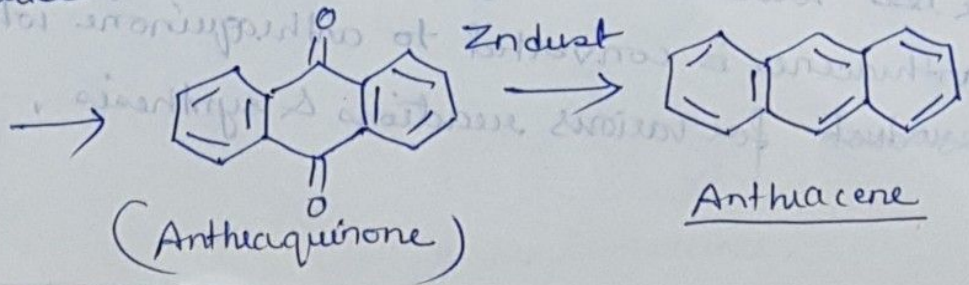
(4) By R^n b/w solution of phthalic anhydride in benzene with $AlCl_3$.



Phthalic anhydride

Benzene

(O-benzoylbenzoic acid)



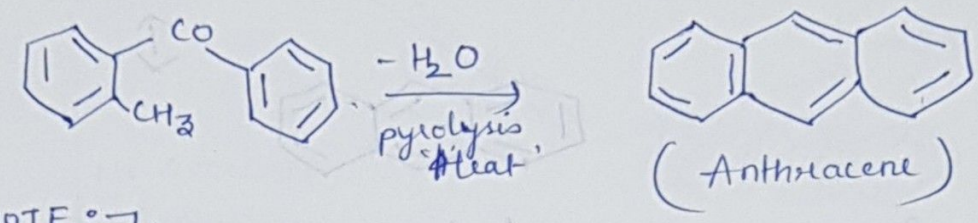
(Anthraquinone)

Anthracene

(5) **By Elbs Reaction (1884)**

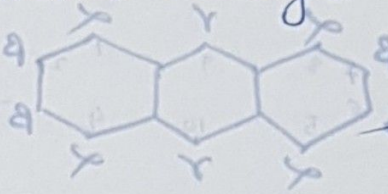
(2)

Pyrolysis of diaryl ketone containing methyl or methylene group ortho to carbonyl group (e.g. o-methyl-benzophenone gives anthracene) yields polynuclear hydrocarbon.

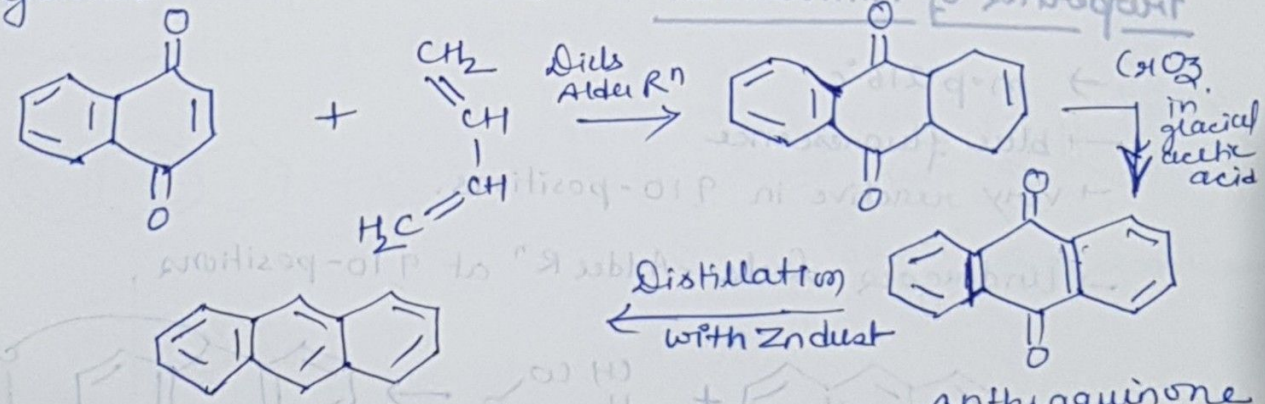


(Anthracene)

NOTE :-
Pyrolysis - thermal decomposition of materials at elevated temp. in an inert atmosphere. It involves a change of chemical composition.
(pyro = fire
lysis = separating)

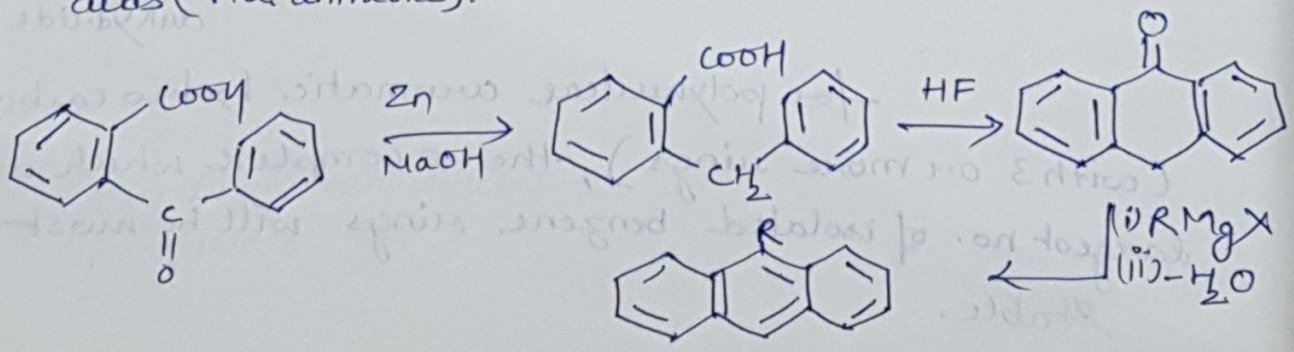


(6) **By Diels Alder Reaction :-** Involving 1,4-napthaquinone and butadiene followed by oxidation of product with chromium trioxide in glacial acetic acid and then distillation with Zn dust.



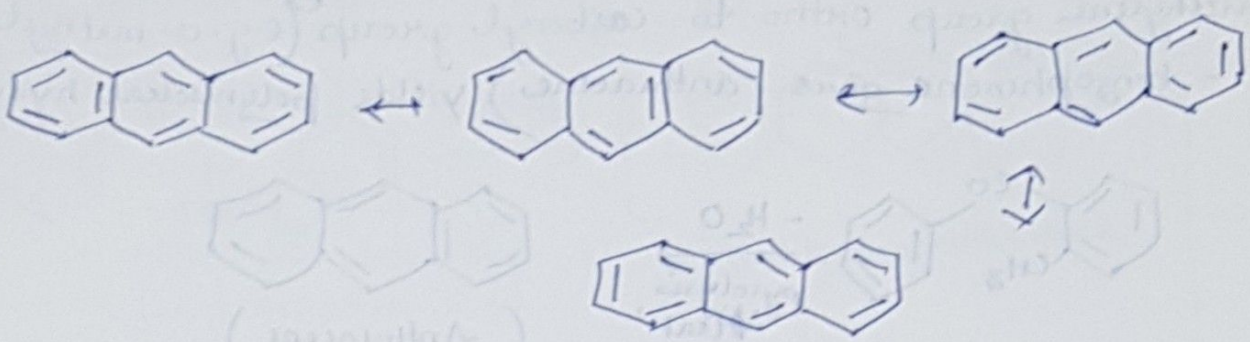
anthraquinone

(7) 9-Alkylanthracenes can be prepared from-o-benzoylbenzoic acids (via anthrone):-

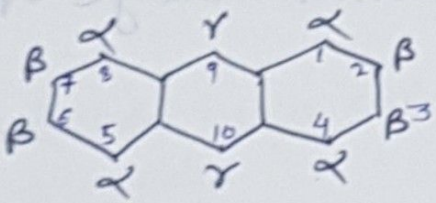


9-Alkylanthracenes.

Resonating structures of Anthracene:-



Resonance energy of Anthracene is 351.5 KJmol⁻¹



→ 3-possible mono substitution products
1 or α; 2 or β and γ (or meso-)

→ 15 possible disubstitution products are possible if both substituents are identical

→ If substituents are diff. no. of isomers are larger.

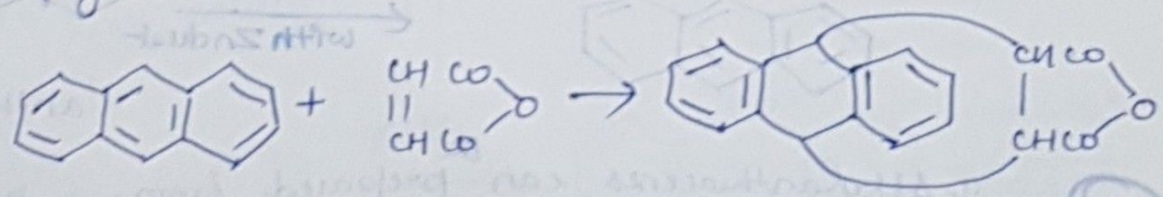
Properties of Anthracene:-

→ m.p 216°C

→ blue fluorescence

→ very reactive in 9,10-positions.

→ Undergoes Diels-Alder R^n at 9,10-positions.

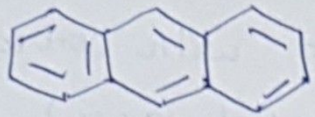


endo anthracenemaleic anhydride.

for polynuclear aromatic hydrocarbons (with 3 or more rings), the σ complex which contain largest no. of isolated benzene rings will be most stable.

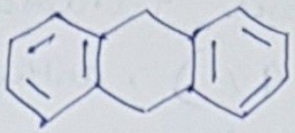
Reactions of Anthracene

(1)



Anthracene

Na, isopentanol

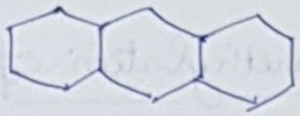


(9,10-dihydroanthracene)
m.p. 107°C
fluorescent.

conc. H_2SO_4 & Heating –2H

Ni, 200-250°C (Reduction)

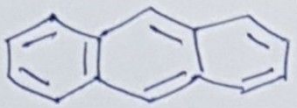
(mix of tetra, hexa- and octahydroanthracene)



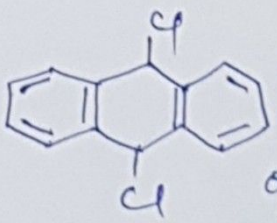
(perhydroanthracene)
complete hydrogenation of ring.

(2) Halogenation of Anthracene :–

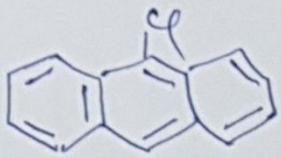
When Cl_2 is passed into a cold soln of anthracene in CS_2 anthracene dichloride is formed.



$+ Cl_2 \longrightarrow$

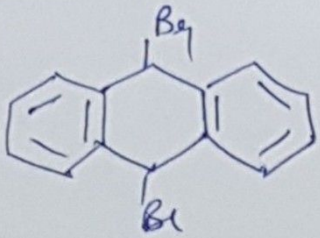


$\xrightarrow[\text{Heat}]{-HCl}$ or alkali



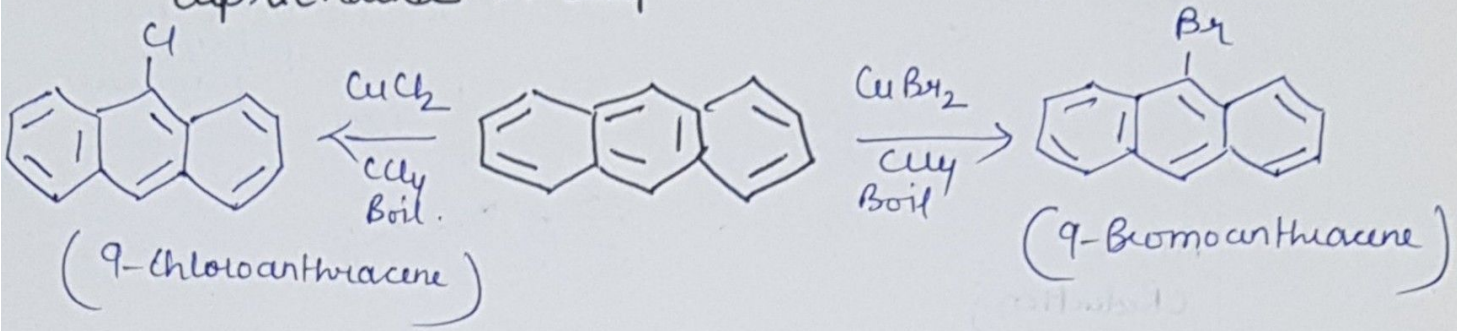
9-chloroanthracene

boiling $Br_2 + CCl_4$



9,10-Dibromoanthracene
(yield 83-88%)

To prepare 9-chloro or 9-bromoanthracene exclusively (98-99%), anthracene is heated with corresponding cuprichalide in CCl_4 soln (Nonhebel, 1963).



(9-Chloroanthracene)

(9-Bromoanthracene)

(3) Chloromethylation of Anthracene:-