Toppersnotes
Unleash the topper in you

CSIR-NET

Council of Scientific & Industrial Research

LIFE SCIENCE

VOLUME – 1

MOLECULES & THEIR INERACTION RELEVANT TO BIOLOGY

SIERRA INNOVATIONS

CONTENT

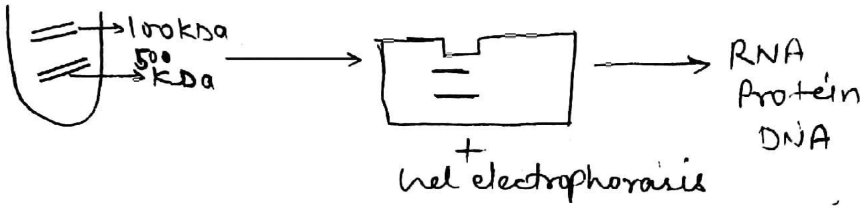
MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY (Tool and Techniques)

FUNDAMENTAL

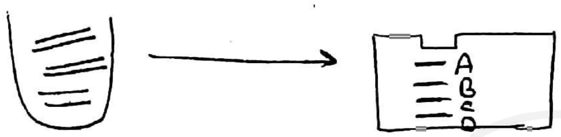
:- Gel electrophorasis greek word which means borne by electricity.

"Gel" – Semisolid ⟶ Porous

Electro+phoresis → movement

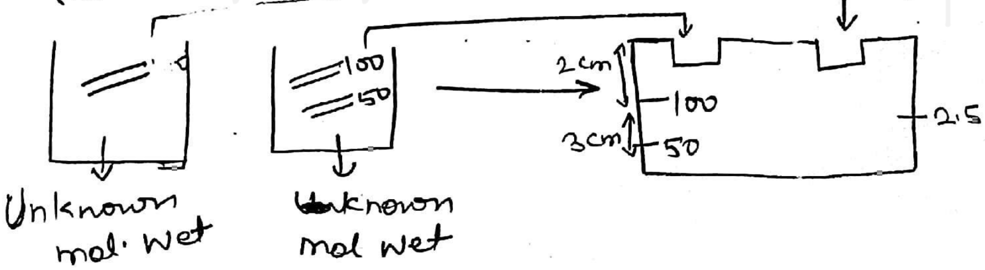


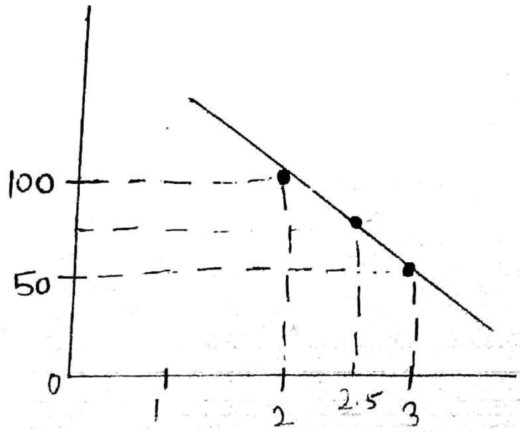
(Not lipid Carbohydrate)
(~~कोई~~ में polar होते हैं न की charge होते हैं)



A (Heavy)
D (light) move Fastly

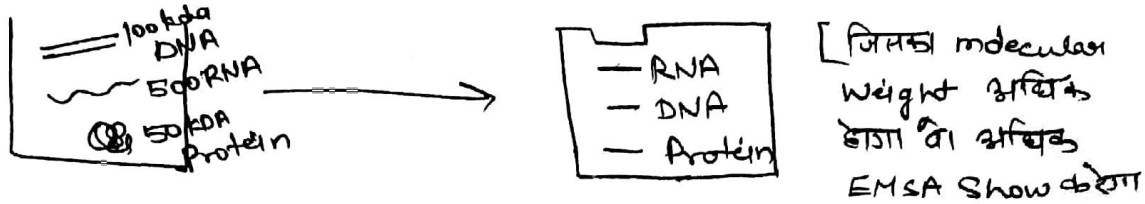
→ Gel electrophorasis is a movement of charge particals Under electricfield. Seprate accn charge & size
→ Gel electrophorasis seprate the molecule.
→ Gel electrophorasis is aplicable only for DNA, RNA & Protein not for carbohydrate & lipic. (cellulose acetate)
DNA migrate to Anode.
→ 2 types –
① Agarose (linear CBH Polymer)
② PAGE (Not solid)





(Molecular weight निकालने के लिए use)

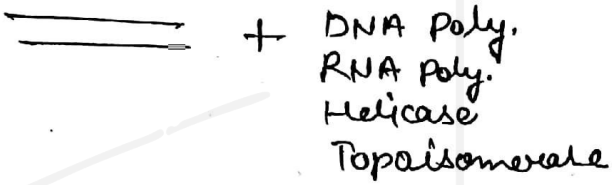
→ Band represent the 'matter'
→ Gel electrophoresis seprate the RNA from DNA, RNA from protein.

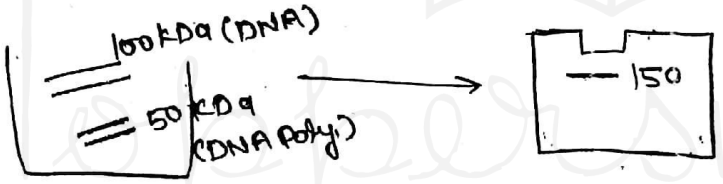


[जिसका molecular weight अधिक होगा वो अधिक EMSA Show करेगा

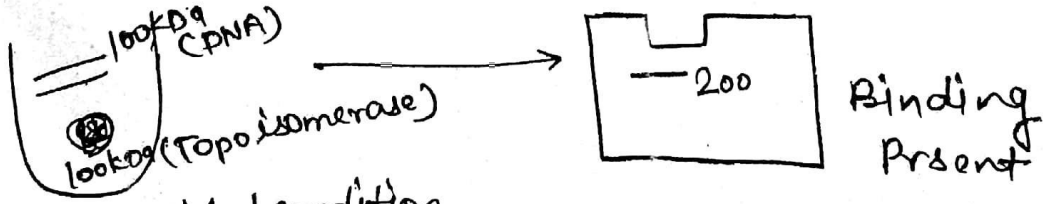
EMSA - Electrophotic mobility shift Assay

DNA की Binding following enzyme से हो सकती है।

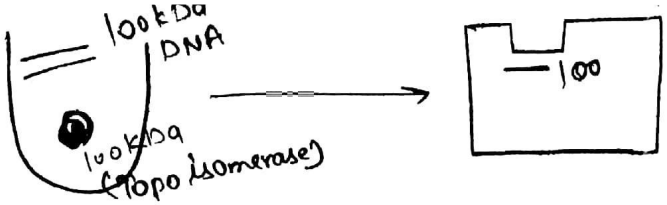




→ यदि DNA व Enzyme को electrophoresis करवाने पर single Band प्राप्त होता है तो उसमें Binding Present होती है। और EMSA High होता है।



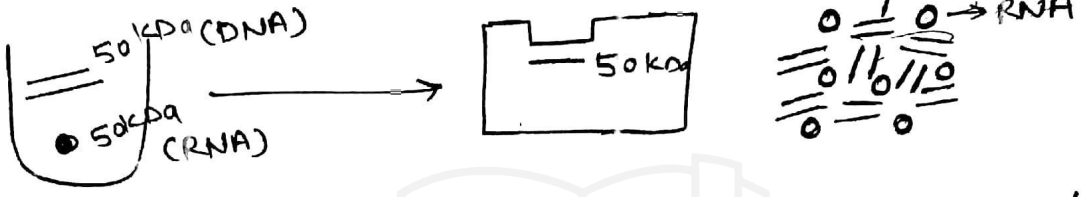
Super coiled condition



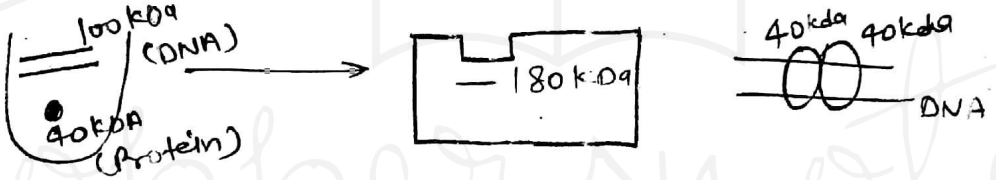
No Binding

Relax condition

→ Topo isomerase Supercoiling में ही Bind होता है।
Relax condition में DNA के साथ Bind नहीं होता।



→ If molecular weight is same of DNA & RNA then it is not differentiated But Binding is absent



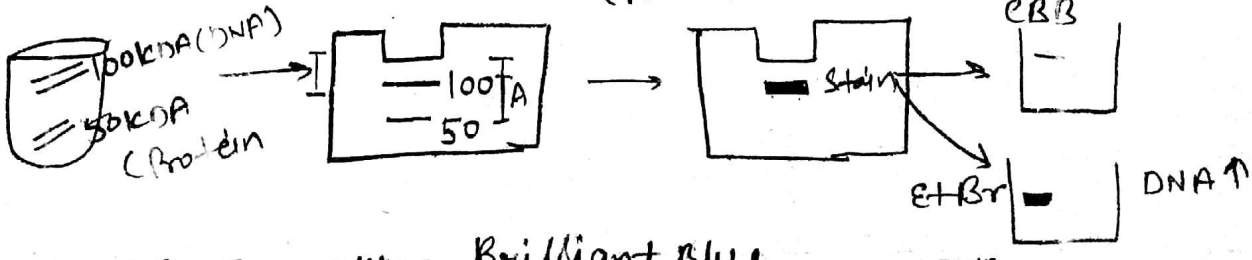
→ In this situation many proteins are binded with DNA.

→ DNA is Helical

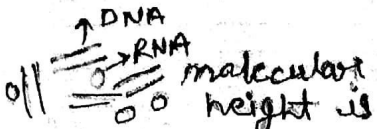
PAGE - Poly acrylamide gel electrophorasis

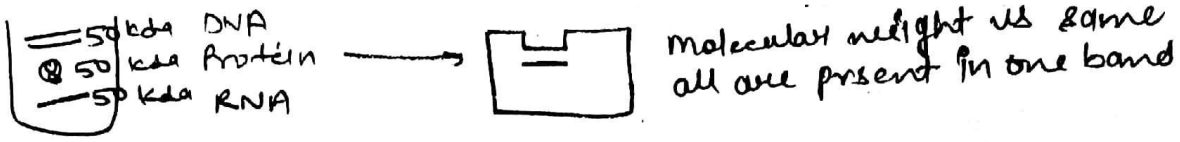
→ Enzymes binds with their substrate.
→ DNA Poly. binds with DNA.
→ RNA Poly. also binds with DNA.

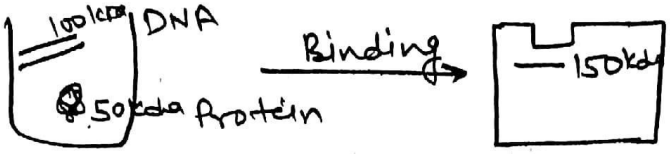
CBB - Blue - Protein EtBr - ~~Red~~ - DNA Orange (Fluorescent dye)

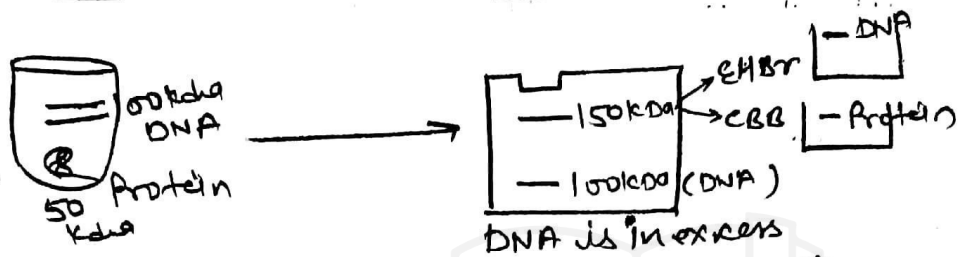


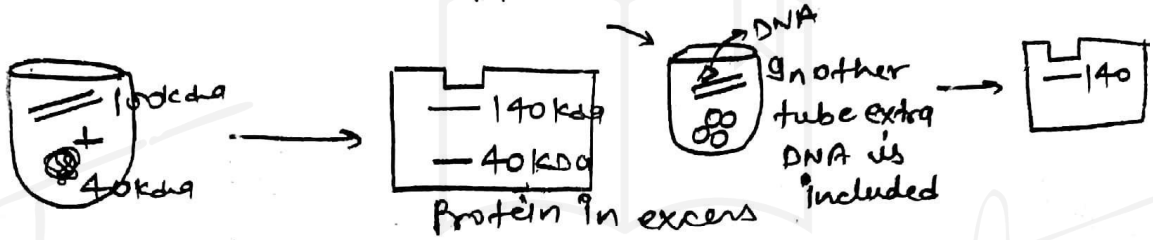
CBB - Coomassiae Brilliant Blue



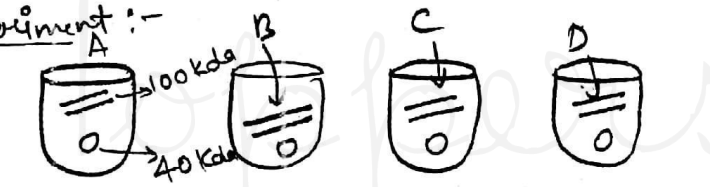


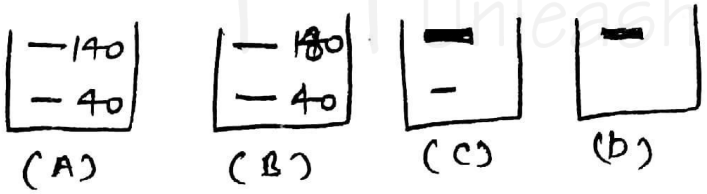


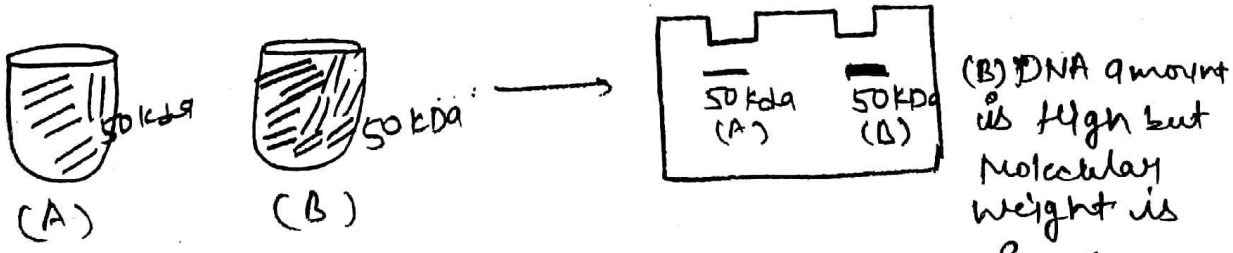




Experiment :-

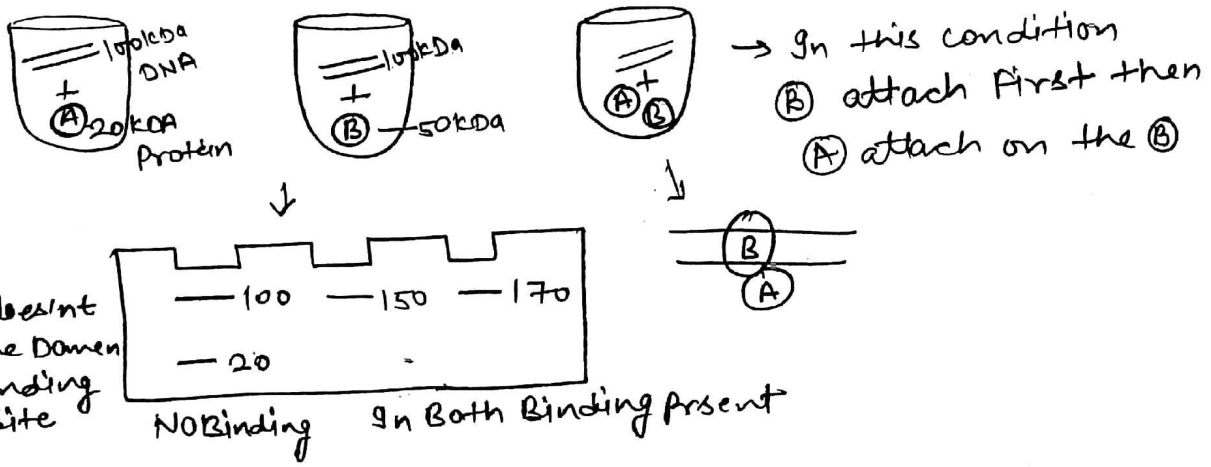




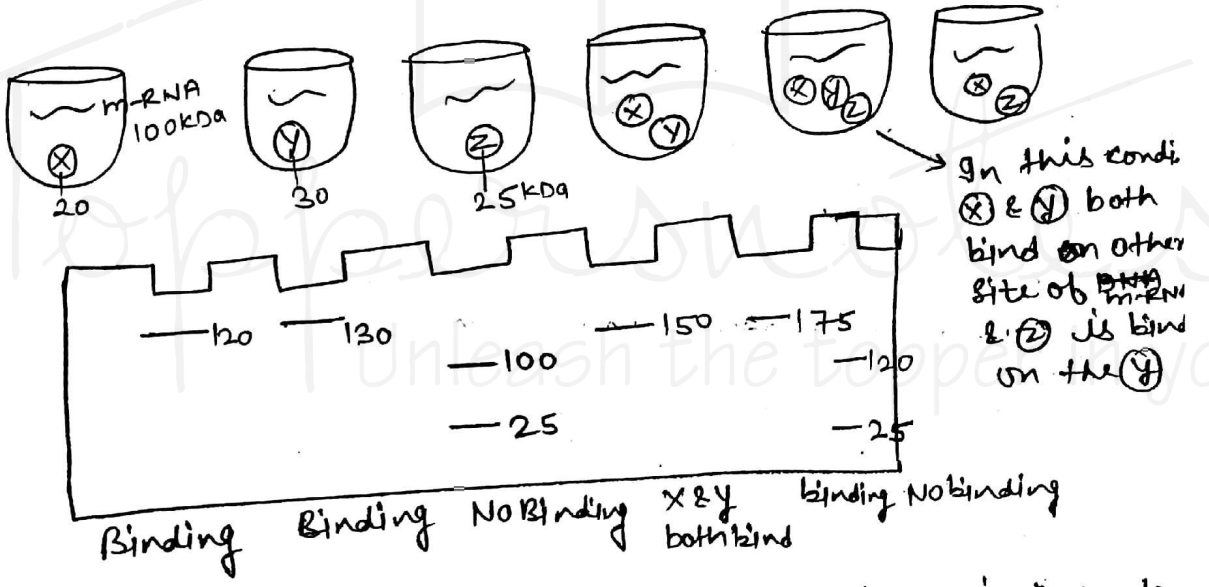


→ In this stage thikness is high

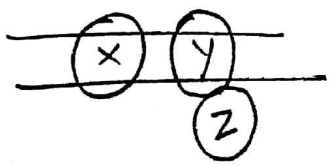
→ Thickness indicate concentration. Shifting of Band indicate binding.



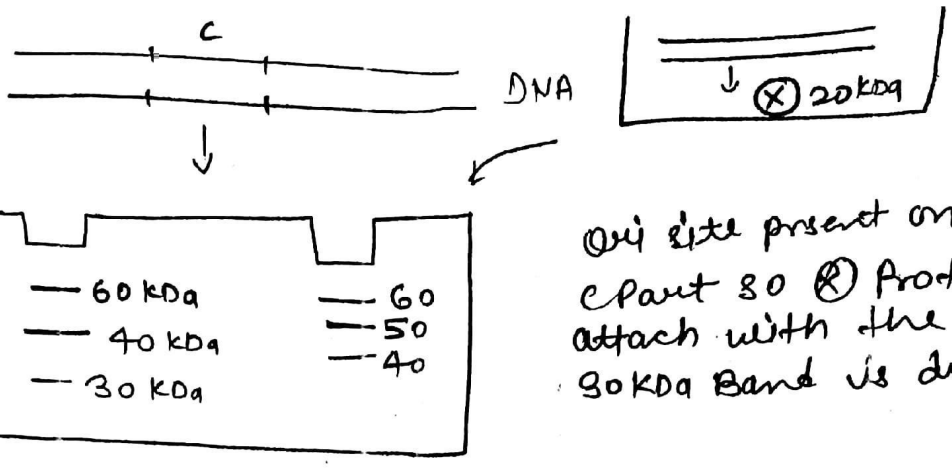
→ DNA, DNA Not Bind together
→ Hexokinase also Not Bind with other Hexokinase
→ all Hexokinase Not interact together.



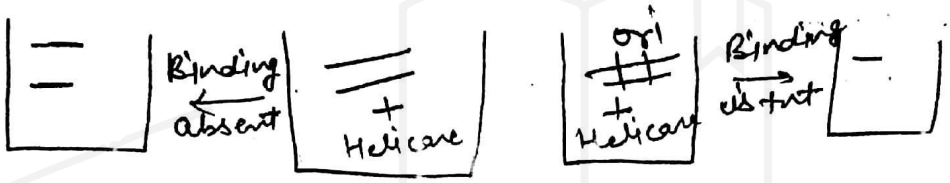
→ Molecular weight is diff and domen site is present then it's bind different site of m-RNA

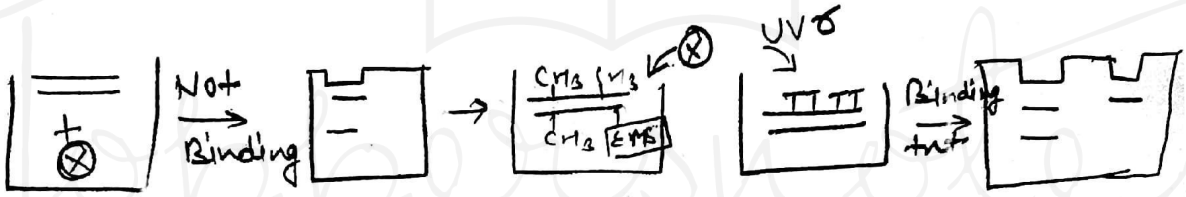


→ DNA, RNA have always Negative charge (-ve) & Proteins are amphalytes (so +ve, -ve both)



Ori site present on the C part so ⊗ Protein attach with the C. 30KDa Band is disappear

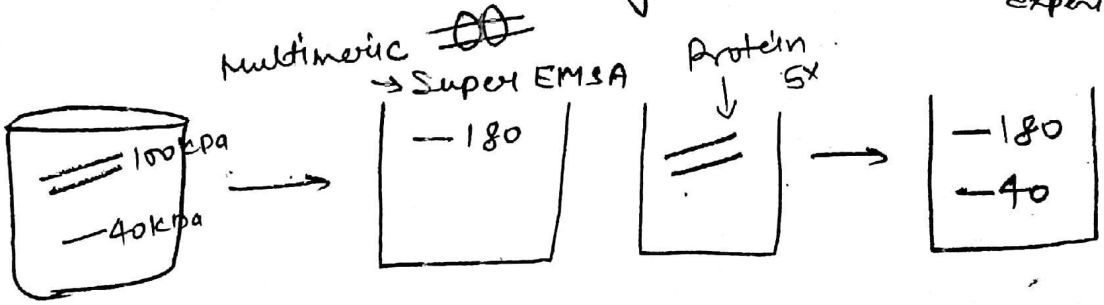


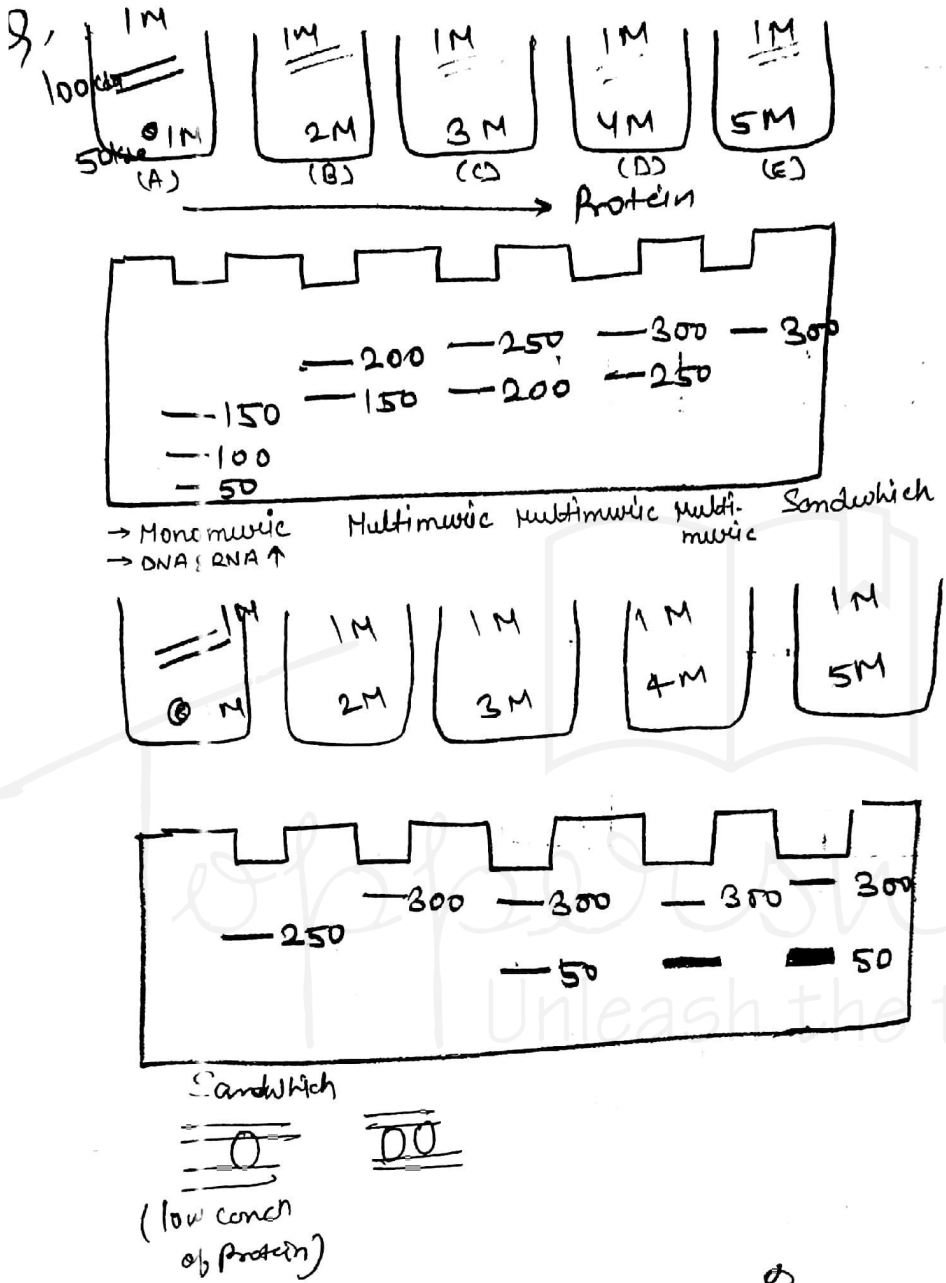


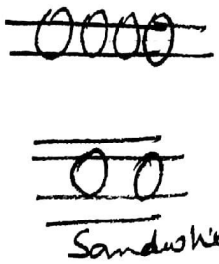
EMS-Ethyl Methyl Sulphonate

→ There ⊗ protein Bind with Thymin dimer

→ The molecular weight of molecule must be known to us before ~~mw~~ performing EMSA or before EMSA Experiment





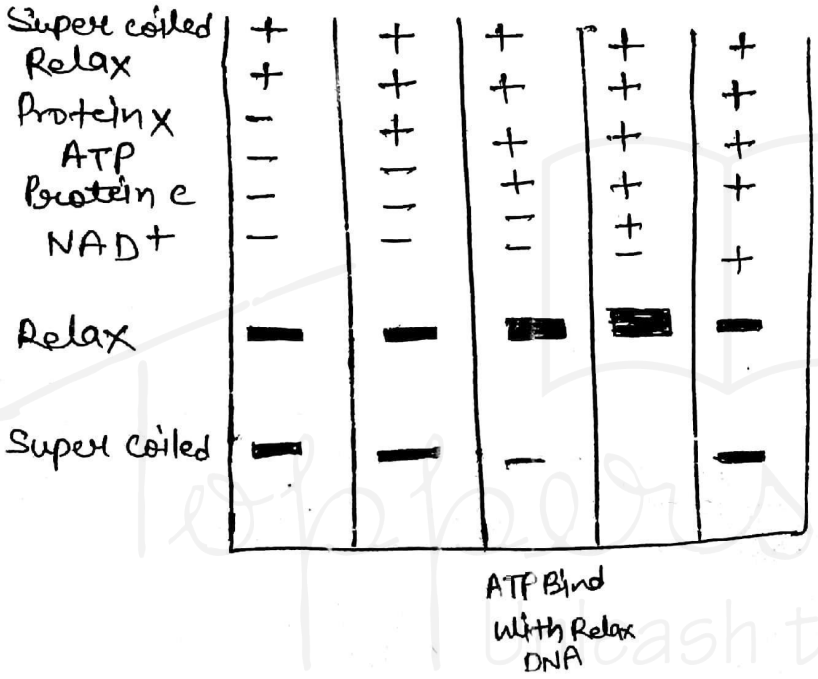


→ जब Protein concentration कम हो तब excess amount में DNA के साथ Bind होते हैं sandwich binding कहलाती है।

→ All gel based questions can be solved by remembering two questiones in mind.

① Concentration

② Position of band



NAD+ – Inhibitor

Protein c – Activator

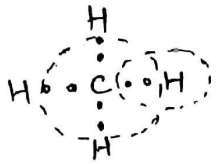
→ Topoisomerase change the topology of DNA

→ Supercoiled form of DNA is converted into relax DNA.

BONDING

Binding

Covalent



Non-covalent ⇒ weak interaction 1-5 kcal/mol energy req.

1. Electrostatic = Ionic
2. Hydrogen bonding
3. Hydrophobic
4. Wander walls

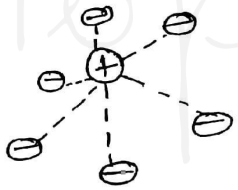
→ Present between two atom
→ Strong bonding (Stable in nature)
→ Form in High temp, Enzyme use

→ Covalent bonding is sharing of electron.
→ Atoms form the molecule (2 type polar & Non-polar)

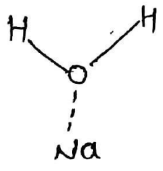
Non-covalent bonding

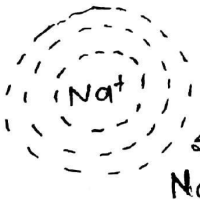
1. Electrostatic :- (Temporary

→ $F = \frac{Kq_1q_2}{r^2}$

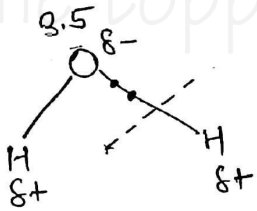


K^+ की size Na^+ से ज्यादा होती है But hydration shell Na^+ से ज्यादा बनता है।

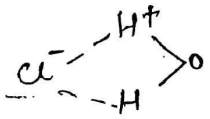




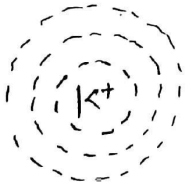
Hydration shell
Na^+ Hydration shell is large

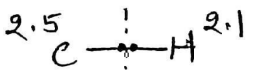


Polar bond (O & H के बीच e⁻ की distance अलग होती है)



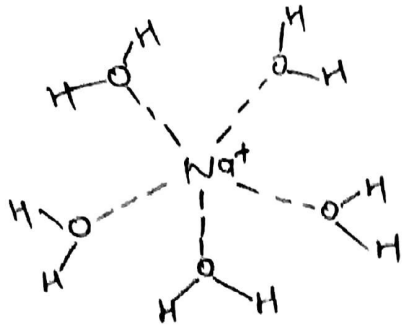
$Na^+ < Mg^+$





Non-polar (e⁻ बीच में)

Hydration shell :- It is a shell of water molecule that surrounds the ions.
→ It is a cage of water molecule.



Hydration shell

→ DNA, RNA, ATP, etc are no stage. All are molecules
↓
GTP, TTP, CTP

$6O{=}C{=}O + 6H_2O \longrightarrow$  non covalent bonding

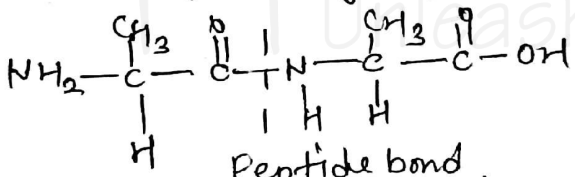
Glucose

G-G-G-G-Glucose (Non-covalent bonding)

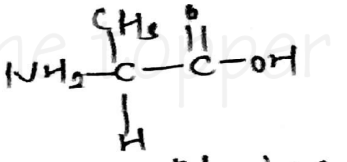
No stage

Glucose — Fructose ⟶ Sucrose

↓
covalent bonding
(glycosidic bond)

→ 

Peptide bond
Covalent bond



Alanine

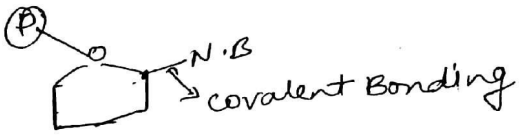
→ Purin, Pyrimidine, Nucleotide & Nucleoside all are no stage

→ All are molecule and molecules form matter

→ Virus are no any stage. Many virus form a crystal.

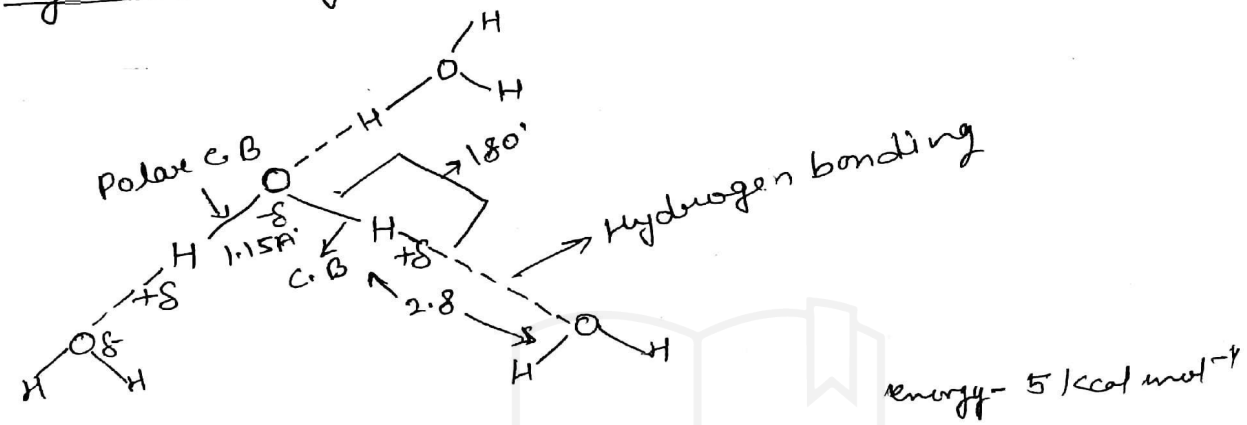
→ According to inter molecular Distance various forms are found Solid, liquid, has.

$99_1 - 99_2 - 99_3 - 99_4$ – Peptide



② Hydrogen bonding :-

X — H ··· Y



→ Conditions -

1> H is must

2> FON
4 3.5 3.0
H-F H-O H-N
Polar bond

3> Hydrogen must be Prsent b/w two highly electro-negative Atoms

4> O — H - - - O
180°

5 O — H - - - O
←2.8→

C ≡ C 2.812 Å A = T Normal bonding
2.84 Å

C = T A ≡ C Abnormal bonding
180° Å

2.8 Å

1 Turn = 10 bp = 360
1 bp = 36°

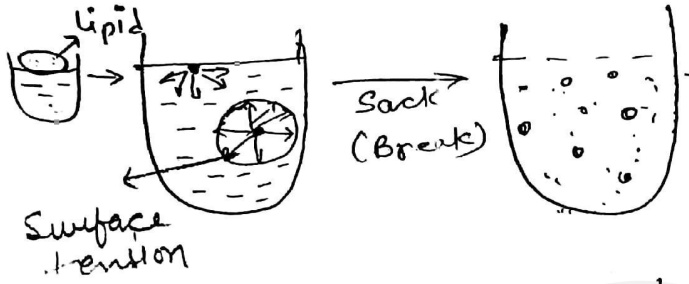
1 Turn - 12 bp = 360°
1 bp = 30

A = C The angle and distance is major by X-ray crystalography

3) Hydrophobic Interaction :-

→ Carbohydrate is a polar molecule becoz Polyhydroxy aldehyde & Ketone is present

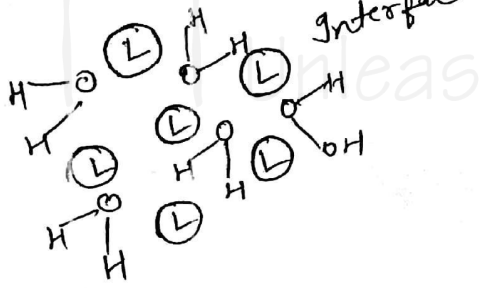
→ Lipid is Non-polar.

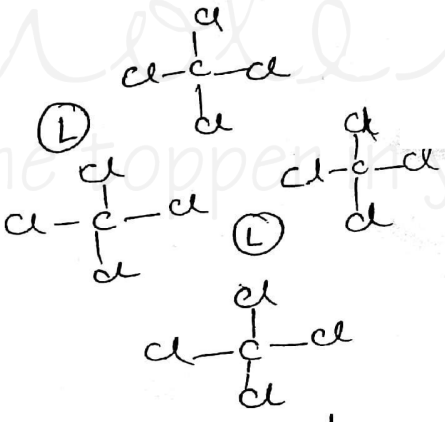


→ In air & oil drops not bind.

→ In water & oil drops are bind.

→ Water is must for hydrophobic force.





→ The water molecules are randomly oriented around the lipid droplet,

→ Hydrophobic force is tendency of water molecule to form bigger cage.

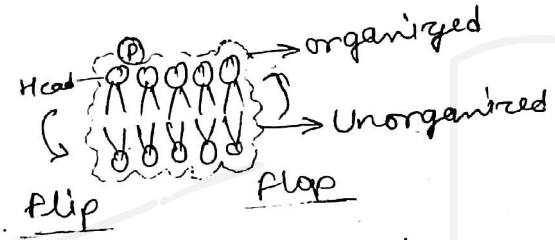
→ The water molecule which are present at the interphase (2 lipid) they come out on surface in order to form perfect H-bonding with other water molecules becoz

of this outword movement of water a vaccum is genrated and becoz of the vaccume molecules/ matter come close to each other.

→ Watermolecule that not exist b/w lipid lipid layer & lipid molecule.

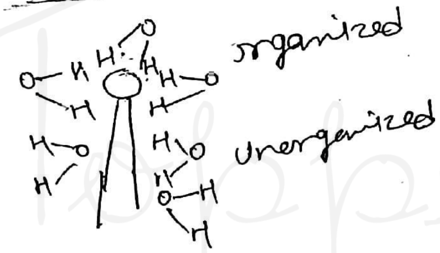
→ Nitogenousbase, Glucose-6-PO_4 & Phospholipid का gelelectrophoresis भी हो सकता है। PO_4 के कारण

→ H_2O prsent the bothside of plasmamembrane.



→ H_2O lipid bilayer को cross नहीं कर सकता।

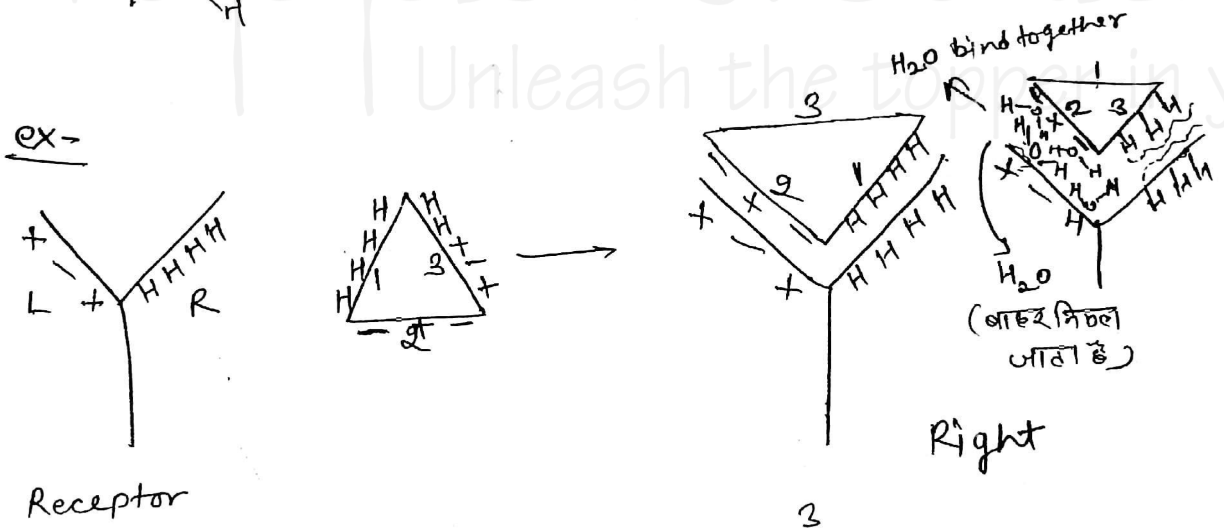
→ O_2 & CO_2 is soluble in lipid



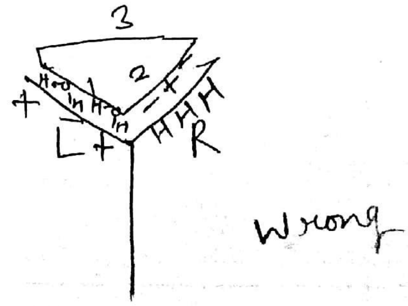
→ Alcohol also cross the lipid bilayer.

→ All str are 3d

ex-

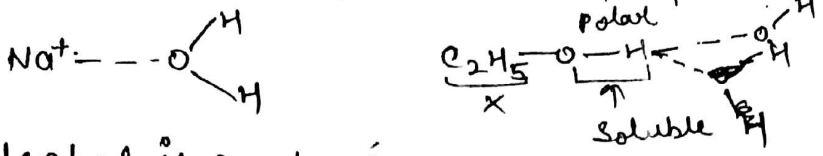


(Kcl is not diff. into ions in H_2O becoz Kcl lattice energy is very high)

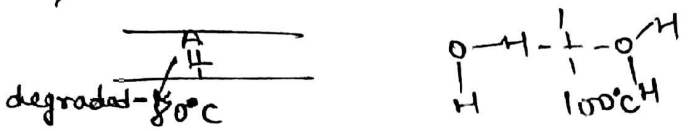


✡ Solubility :—

→ Alcohol is soluble in H_2O .. Formeldehye also.

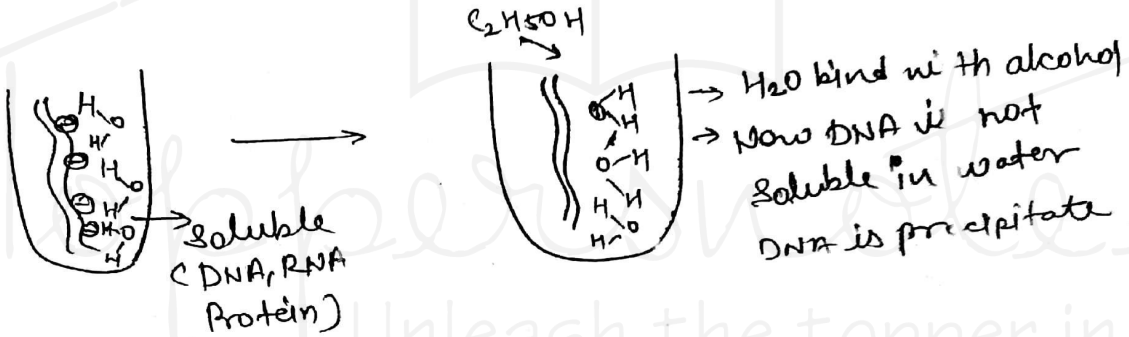


→ Alcohol is good solvent.



50 ml + 70 ml ⟶ 97 ml (3 ml reduce)
Alcohol H_2O

500 ml + 700 ml ⟶ 970 ml

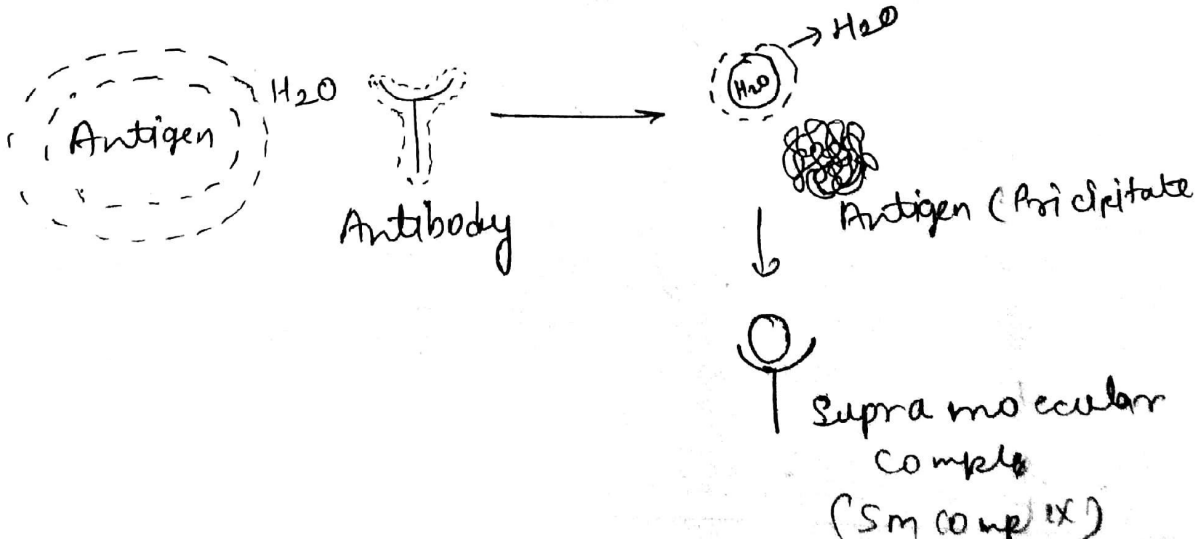


→ DNA more soluble & RNA is less soluble.

→ Solubility = Interaction with water

→ Alcohol form perfect H-bonding with water.
(All conditions are true)

→



→ Antigen के चारों ओर water होता है व Antibody के चारों ओर भी water होता है। जिसमें H_2O बाहर निकालकर Antigen & ~~Anti~~ Antibody Supramolecular complex बनाते हैं।

→ DNA, RNA, Protein, CBH, Lipid is macromolecule one & molecule bind with another macromolecule & form SM complex.

→ SDS PAGE

Protein

→ Disulphidebonding
→ H.B
→ electrostatic
→ Hydrophobic

(BME, Urea, Dithiothretol) is use

BME
Bmercepto ethanol

(BME denature the protein and break the disulphide bond
→ Heat is also use for denature process)

Denaturation SH SH

SDS
⊖ ions

(SDS Uniform -ve Mask the +ve)

(SDS - Sodium dodecyl Sulphate)

→ Denaturing SDS PAGE

— Yolk

NO SDS
NO BME

→ Native PAGE

— Yolk

Protein

→ Direct use the SDS before denature the protein then Heat is use

Heat
SDS

Folding

lessfolding