Separation Methods Based on Distributions in Discrete Stages (01/26/15)

1. Chemical Separations: The Big Picture

   Classification and comparison of methods

2. Fundamentals of Distribution Separations

3. Separation Methods Based on Distributions in Discrete Stages

   Such as solvent extraction and distillation

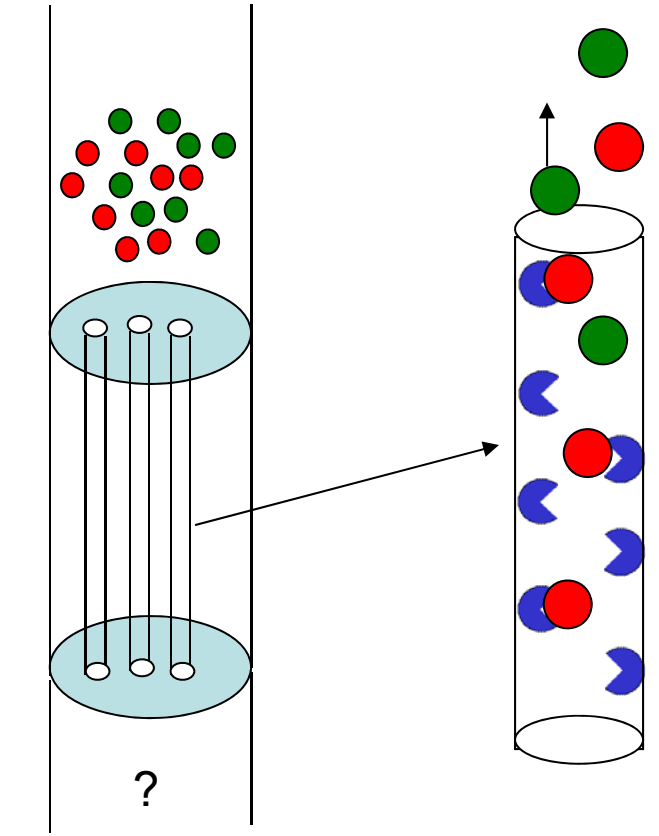
4. Introduction to Distribution Separations in chromatographic

   methods. The plate theory, the rate theory; van Deemter's equation.

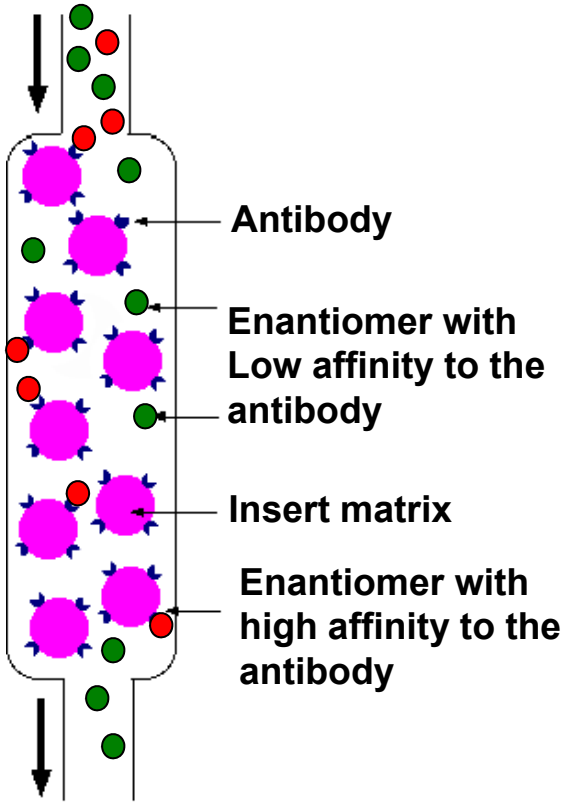
Selectivity of Nanotubes

$$\Delta G^0 = \Delta \bar{H}_i^0 - T\Delta \bar{S}_i^0$$

Enantiomers



nanotube



Non-affinity

$\Delta \bar{H}_i = 0$

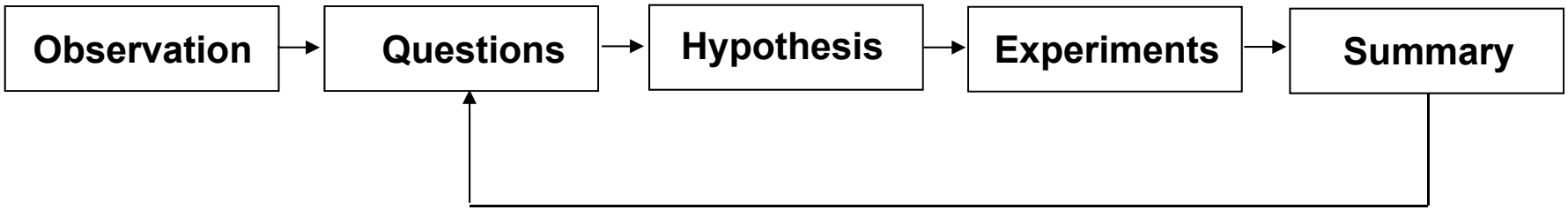
Affinity

$\Delta \bar{H}_i < 0$

Affinity Chromatography

Problem Solving and Research

A scientific research activity:



Problem solving:

1. Understanding concepts and formulas
2. Logical Analysis

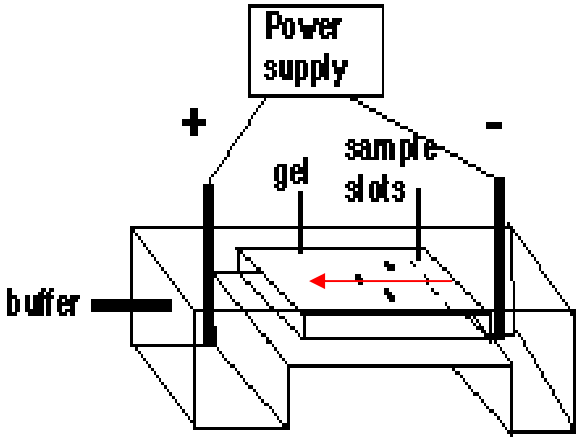
Formal logic laws: (a) A event is determined by many parameters; (b) All the parameters have some sort of connection between each other.

Basic method for problem solving:

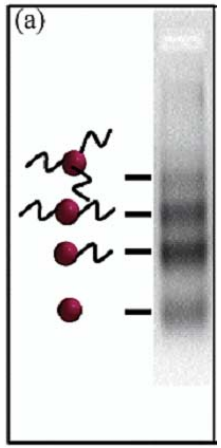
1. Understanding the question.
2. Lay out the parameters regarding this question.
3. Try to use concepts and formulas to find the connections.
4. Solving the question.

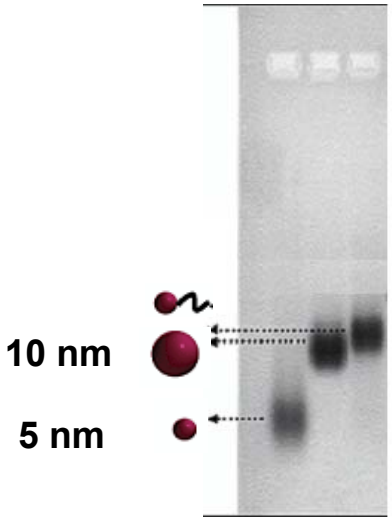
Gel Electrophoresis

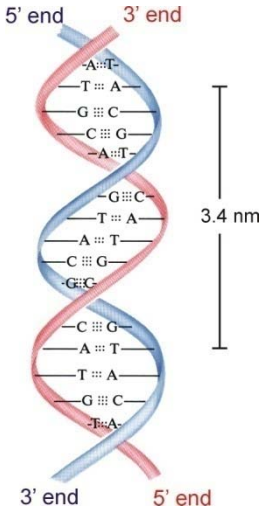
Nanoparticles: the model system for understanding protein separation
Assign the components on the Gel bands without TEM

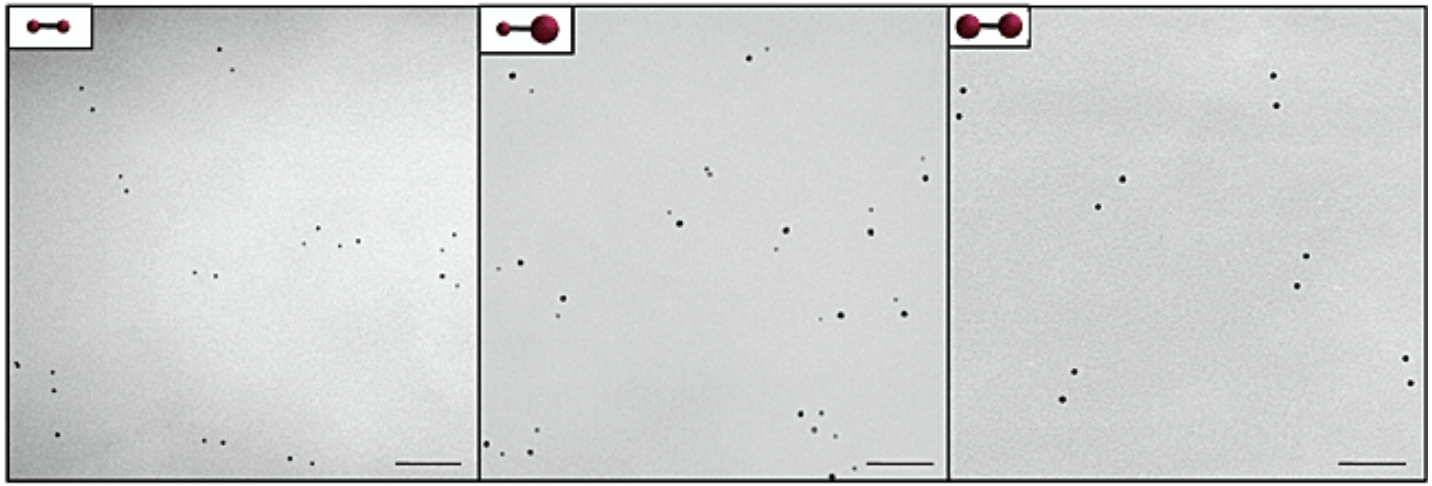


3% agarose gel



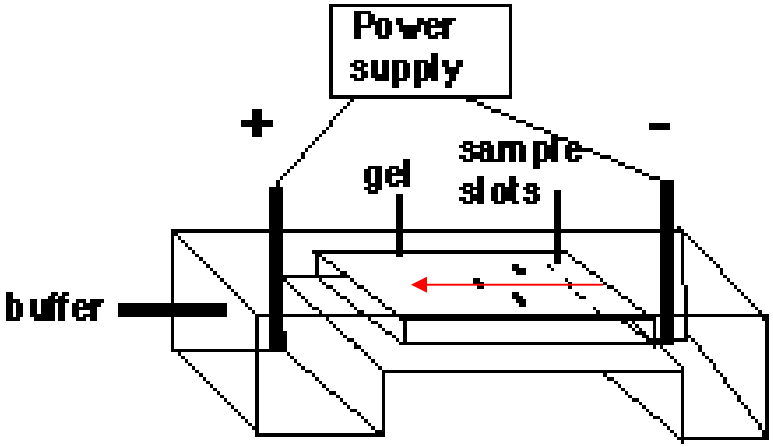


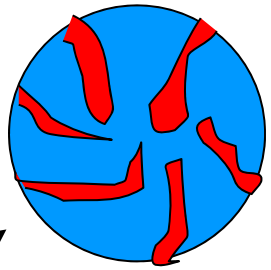




Zanchet, D.; et al. J. Phys. Chem. B. ; 2002, *106*(45); 11758-11763 **1. Understanding the question.**

Gel Electrophoresis

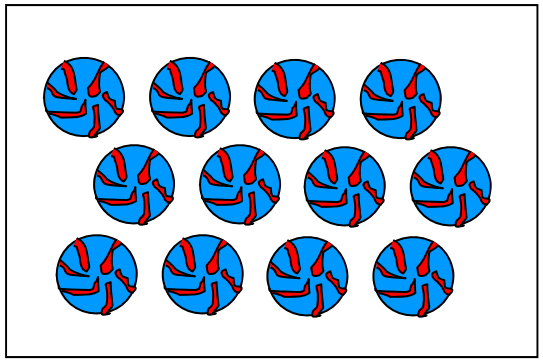


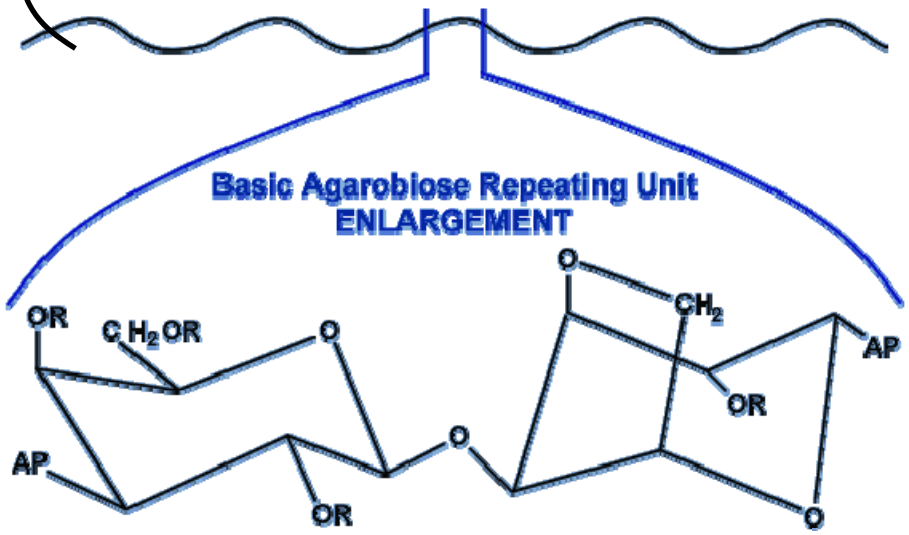


Agarose: polysaccharide

Agarose molecule: approx. 120,000 dalton MW

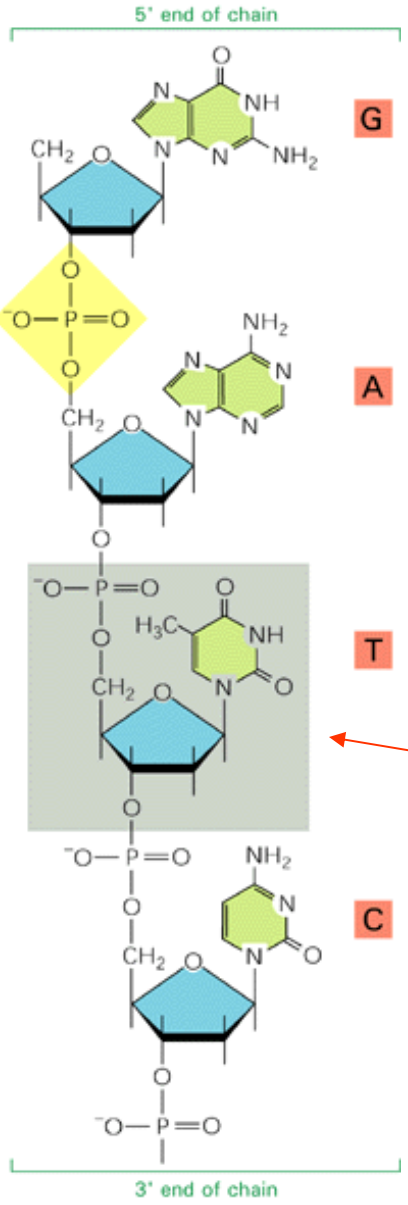
Agarose Gel

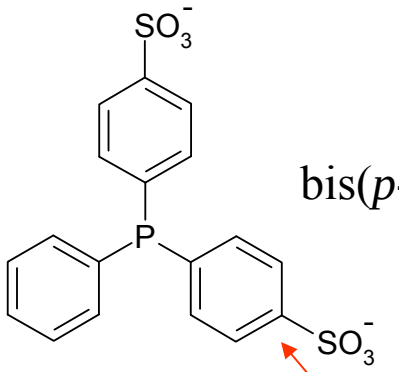




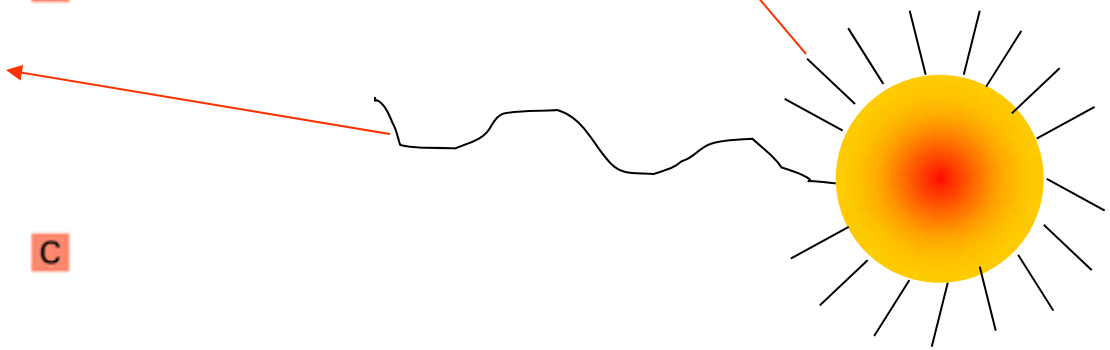
2. Lay out the parameters regarding this question.

Surface of Nanoparticles





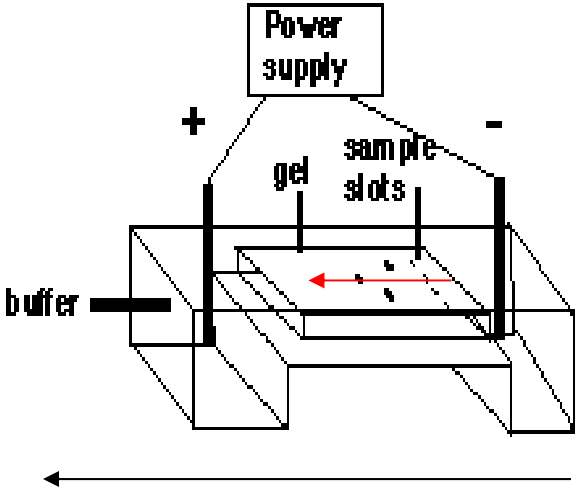
bis(*p*-sulfonatophenyl)phenylphosphine

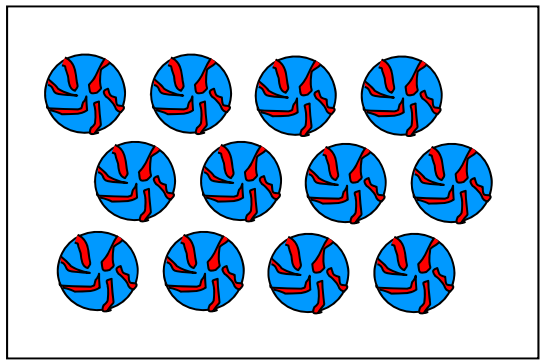


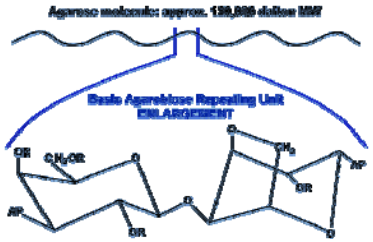
2. Lay out the parameters regarding this question.

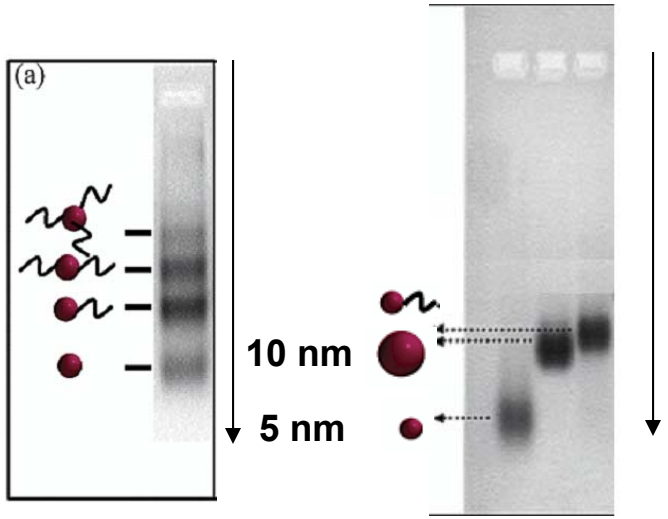
Gel Electrophoresis

Assign the components on the Gel bands without TEM







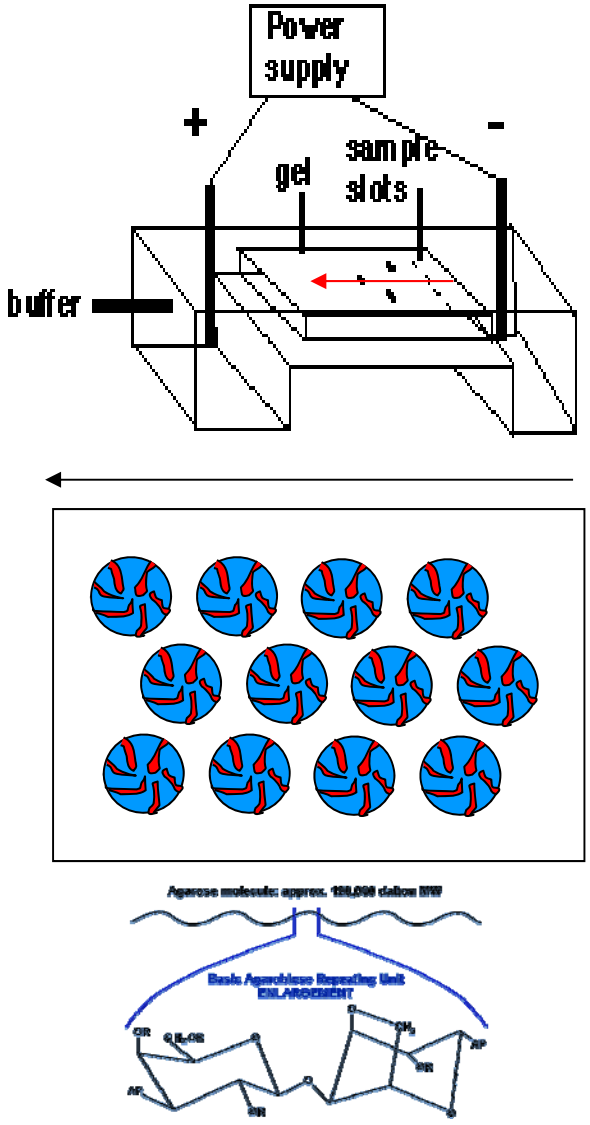


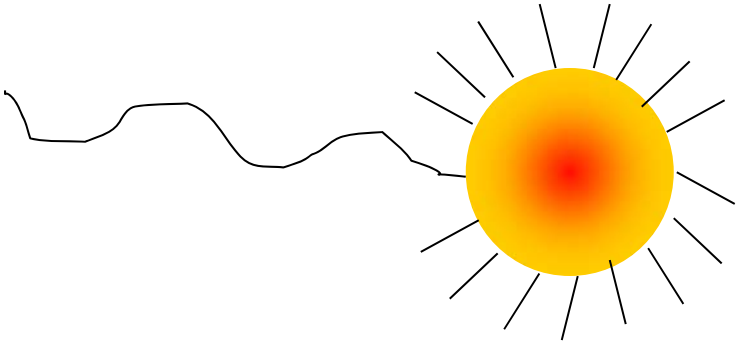
$$K = \exp\left(\frac{-\Delta\mu_i^0 - \Delta\mu_i^{ext}}{RT}\right)$$

$$\Delta\mu_i^0 = \Delta\bar{H}_i^0 - T\Delta\bar{S}_i^0$$

2. Lay out the parameters regarding this question.

3. Try to use concepts and formulas to find the connections.





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$$\Delta\mu_i^0 = \Delta\bar{H}_i^0 - T\Delta\bar{S}_i^0$$

Columbic force: external electric field

F=q*E, q the amount of charges on a particle, E: Intensity of field

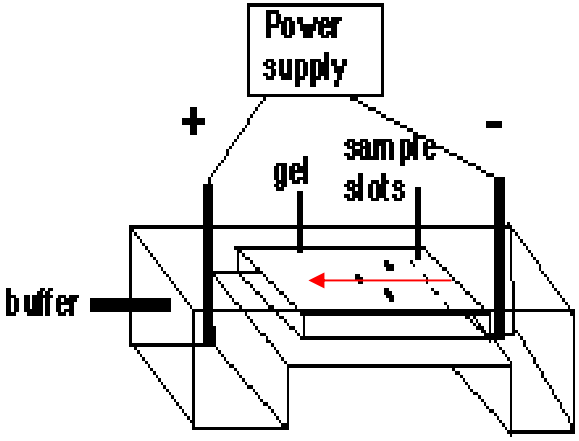
Intermolecular interactions (friction force)

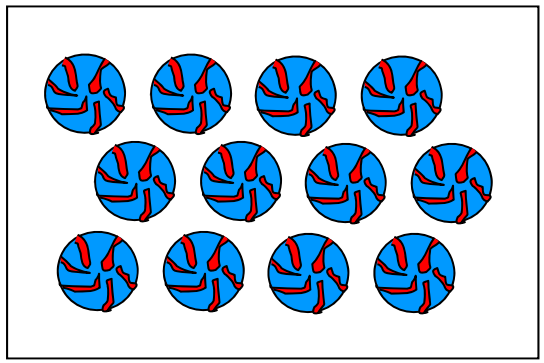
Entropy effect

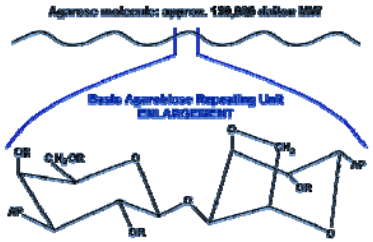
2. Lay out the parameters regarding this question. 3. Try to use concepts and formulas to find the connections.

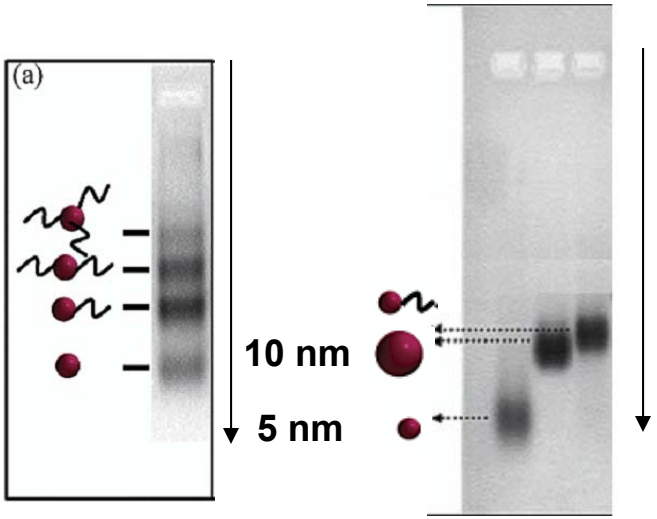
Gel Electrophoresis

Assign the components on the Gel bands without TEM









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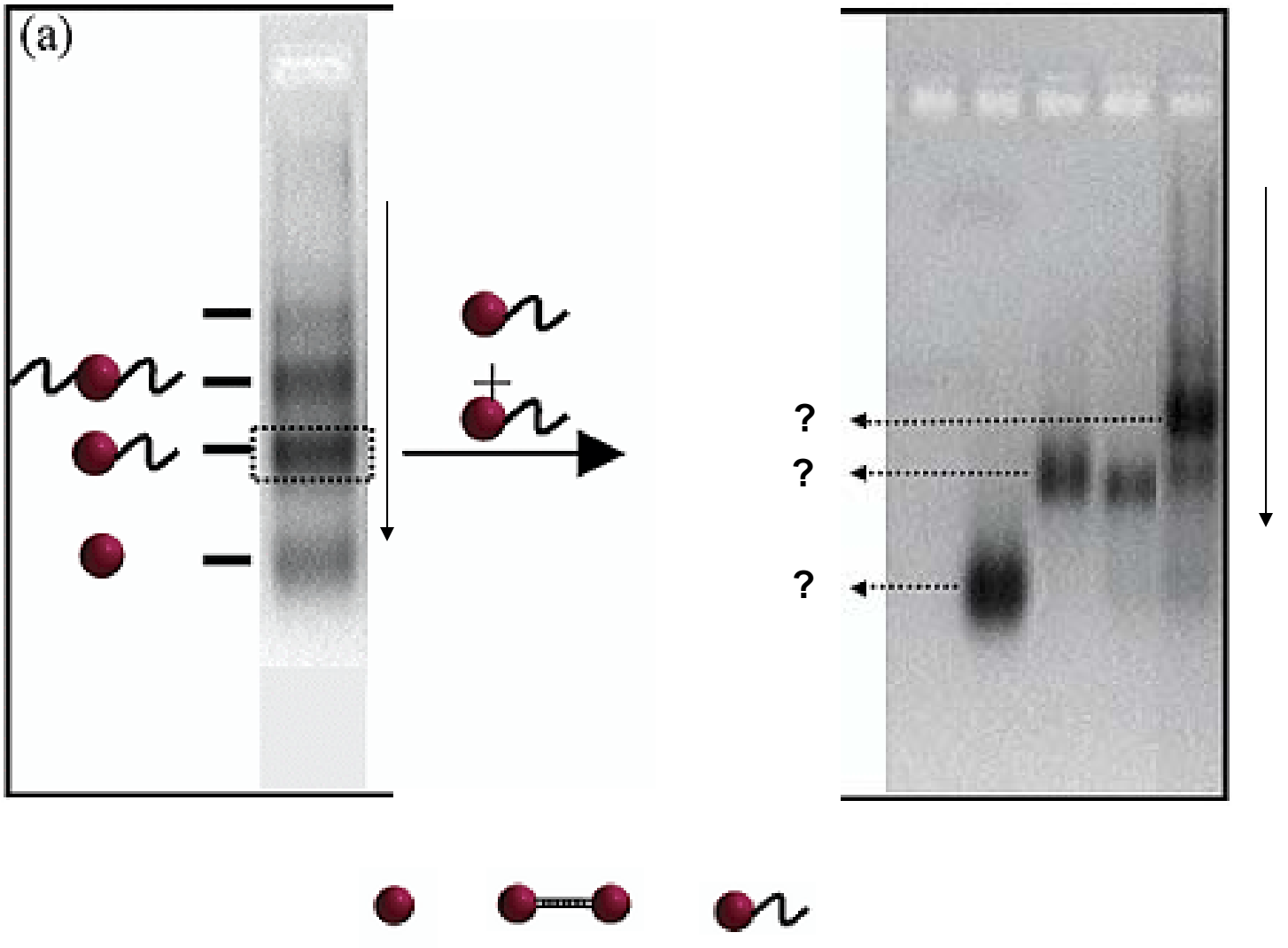
Analyze the question

Assign the components on the Gel bands without TEM



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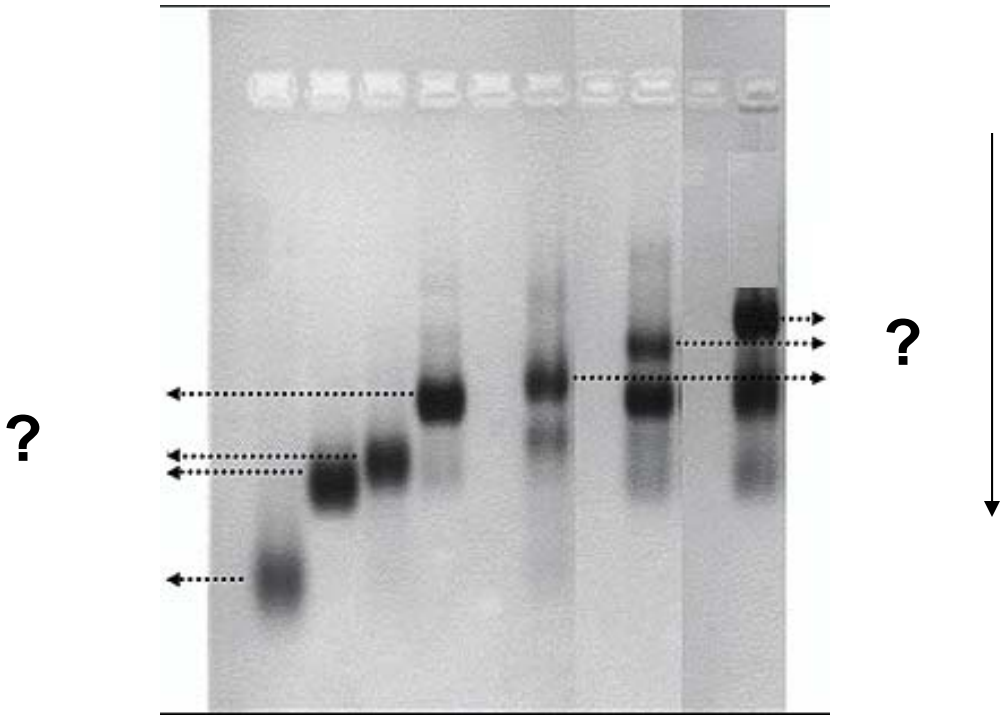
4. Answer the question

Assign the components on the Gel bands without TEM



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4. Answer the question

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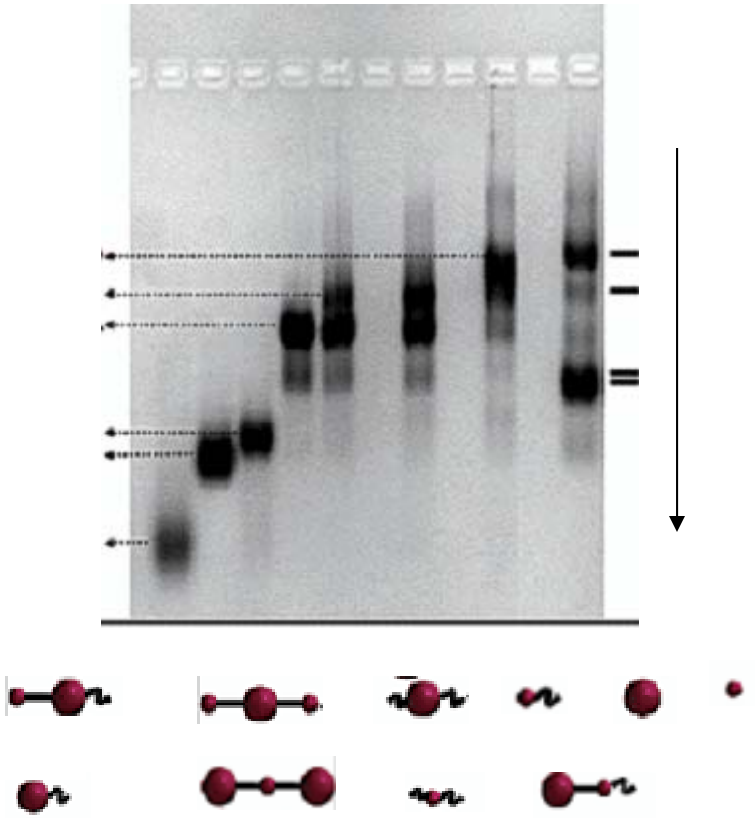

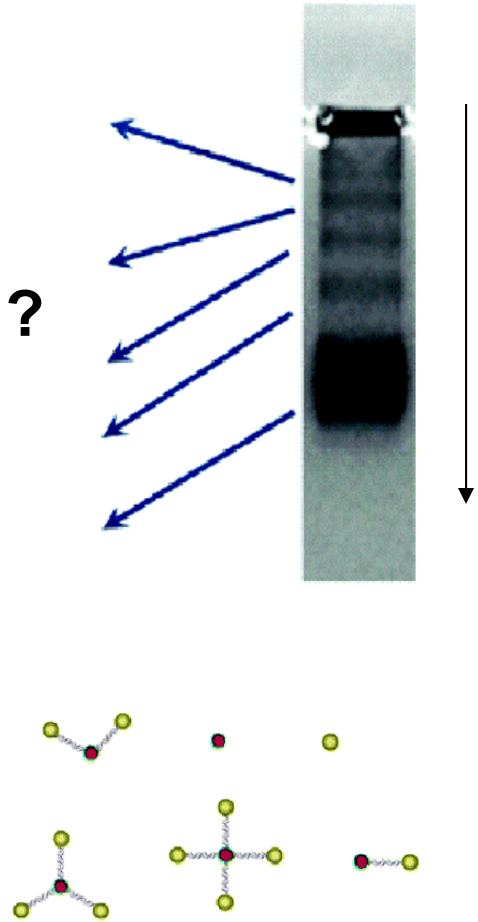

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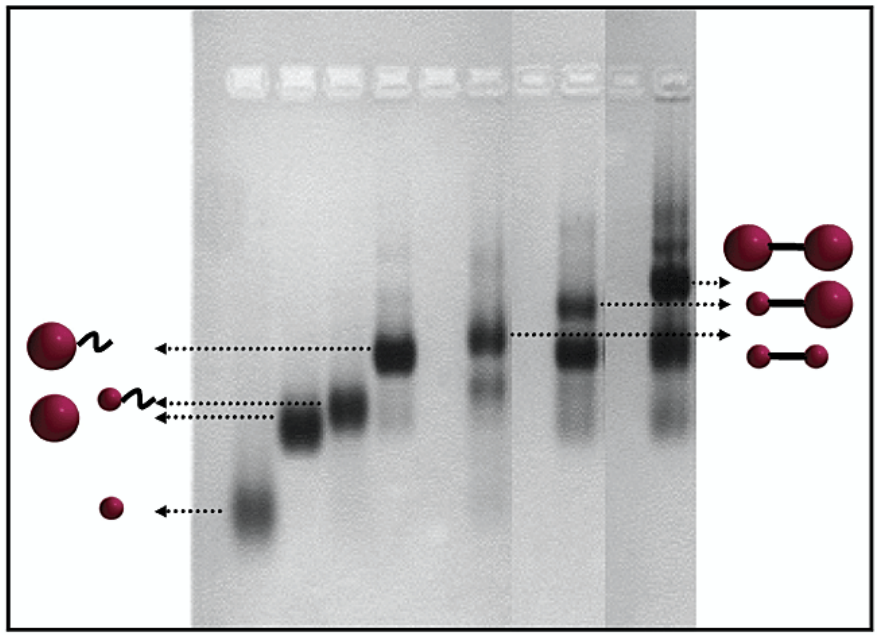
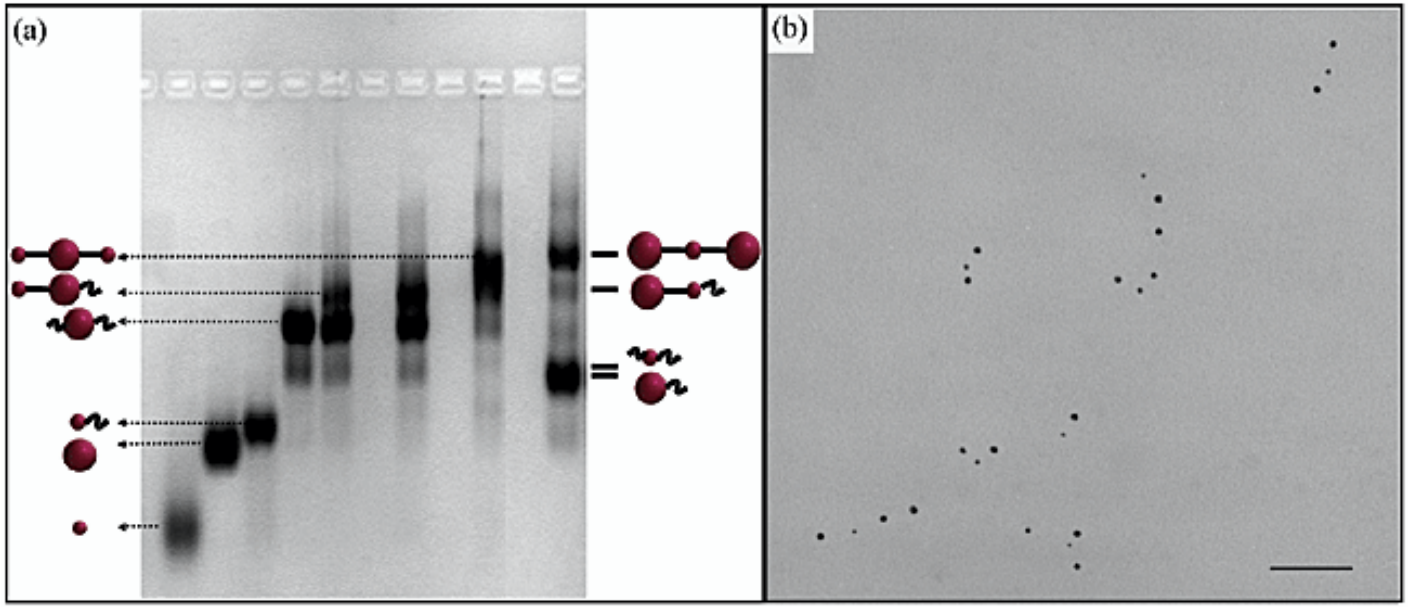
J. Am. Chem. Soc.; **2004**; *126*(35); 10832-10833




(a)
(b)