

Question 1

What is the most important conclusion derived from the **Frye & Edidin** experiment?

- the plasma membrane thickness is 7 nm.
- the plasma membrane is made of 2 layers of phospholipids.
- the plasma membrane is fluid at 37 °C.
- the plasma membrane is a sandwich: phospholipids are between 2 layers of proteins.

Question 2

What is the most important conclusion derived from the **Gorter and Grendel** experiment?

- the plasma membrane thickness is 7 nm.
- the plasma membrane is made of 2 layers of phospholipids.
- the plasma membrane is fluid at 37 °C.
- the plasma membrane is a sandwich: phospholipids are between 2 layers of proteins.

Question 3

In an experiment, a blood sample is drawn from a healthy human being.

1 μL of this blood is found to contain $4 \cdot 10^6$ red blood cells (RBC).

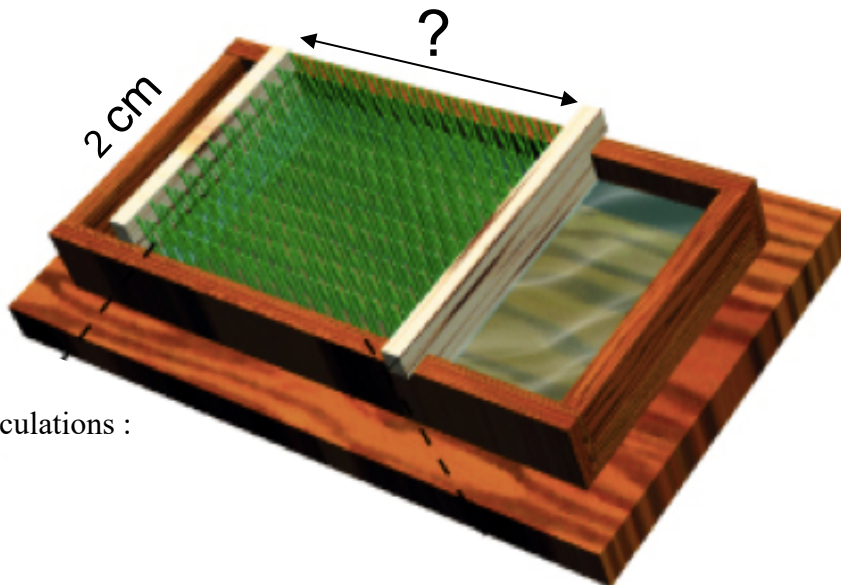
Membrane lipids are extracted for the RBC obtained from 1 μl of blood and then spread on water in a 2-cm-wide Langmuir trough.

What is the distance ℓ between the barriers when the cohesive forces between the lipid molecules signal that a monolayer has been formed?

The surface area of a human red blood cell = $100 \mu^2$.

Lipid extraction yield (efficiency) = 100 %

$$\ell = \text{-----}$$



Calculations :

Question 4

Phospholipids are purified from human Red Blood Cells and then spread as a monolayer in a Langmuir trough.

Phospholipids from how many Red Blood Cells must be purified to obtain a 1 cm^2 monolayer in the Langmuir trough?

(Assume the purification yield is 100% and a human Red Blood Cell has a $100 \mu^2$ surface)

_____ red blood cells

Question 5

Let's consider a U-shaped tube with an phospholipids bilayer separating the tube into 2 parts (L and R). This separation is a synthetic membrane made of phospholipids only, no protein, no cholesterol.

You fill both part of the tube (L and R) with 0.1 L of water. The height of the liquid is identical in the L and the R parts.

Table salt and sugar are available for experiments.

Atomic weight of Na⁺ : 23

Atomic weight of Cl⁻ : 35.5

Molecular weight sucrose : 342

You dissolve 0.585 g of Sodium Chloride in the 0.1 L of water of the L part.

◇ What is the Na⁺Cl⁻ concentration in the L part? _____ mM

◇ what is the osmolality in the L part?

After 4 hours, you observe that

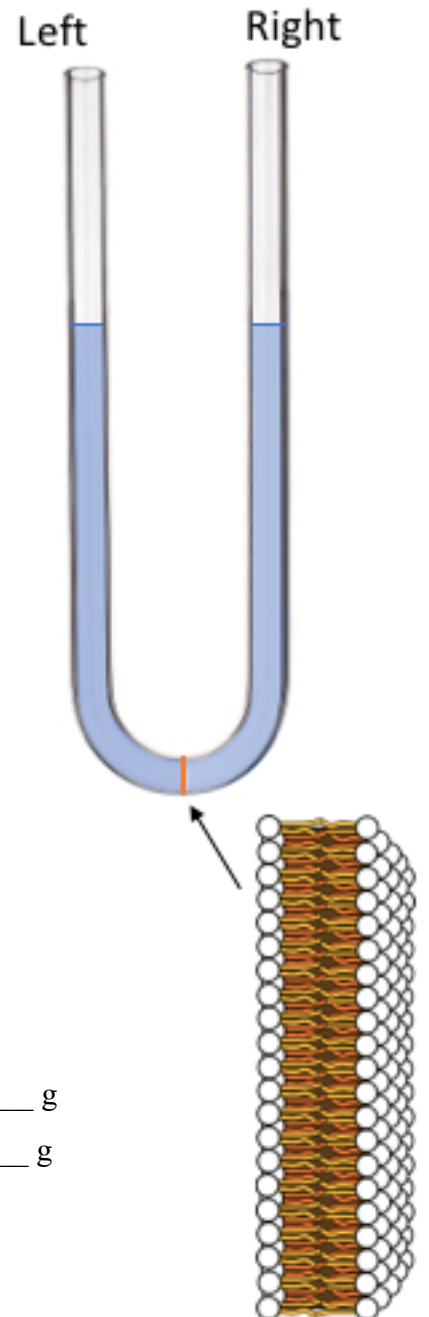
- a. nothing has change, same water level in the L and R part.
- a. water molecules have moved from the R part to the L part
- a. water molecules have moved from the L part to the R part

You would like to bring back the water levels were they were initially.

To achieve that,

- how much Na⁺Cl⁻ should you add to the water in the R part? _____ g

- how much table sugar (sucrose) should you add to the R part? _____ g



Question 6

On the site of an accident, a intra-venous (i.v.) line is frequently given to patients. The infused liquid is 0.9 % sodium chloride.

What is the osmolality of 0.9 % sodium chloride ? _____

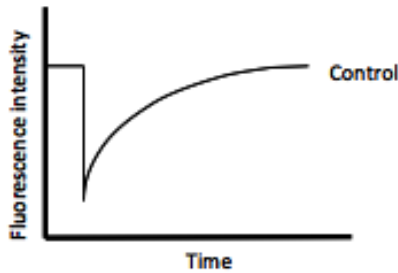
How does this osmolality compare with the osmolality of the human plasma ?



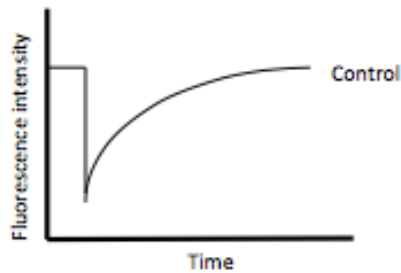
Question 7

You wish to study how membrane composition affects fluidity using Fluorescence Recovery After Photobleaching (FRAP). On the following graphs, a control FRAP curve has been drawn. Please draw how you predict the **FRAP curve would change for each of the following experiments**

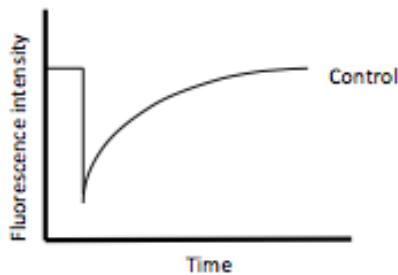
A. You add an enzyme which saturates lipid hydrocarbon chains.



B. You raise the temperature.



C. You add a drug that prevents 25% of the lipids from diffusing



D. You add an enzyme that makes lipid hydrocarbon chains 10 carbon atoms longer

