Question 1
What is the most important conclusion derived from the **Frye & Edidin** experiment?

a. the plasma membrane thickness is 7 nm.

b. the plasma membrane is made of 2 layers of phospholipids.

c. the plasma membrane is fluid at 37 ºC.

d 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?

a. the plasma membrane thickness is 7 nm.

b. the plasma membrane is made of 2 layers of phospholipids.

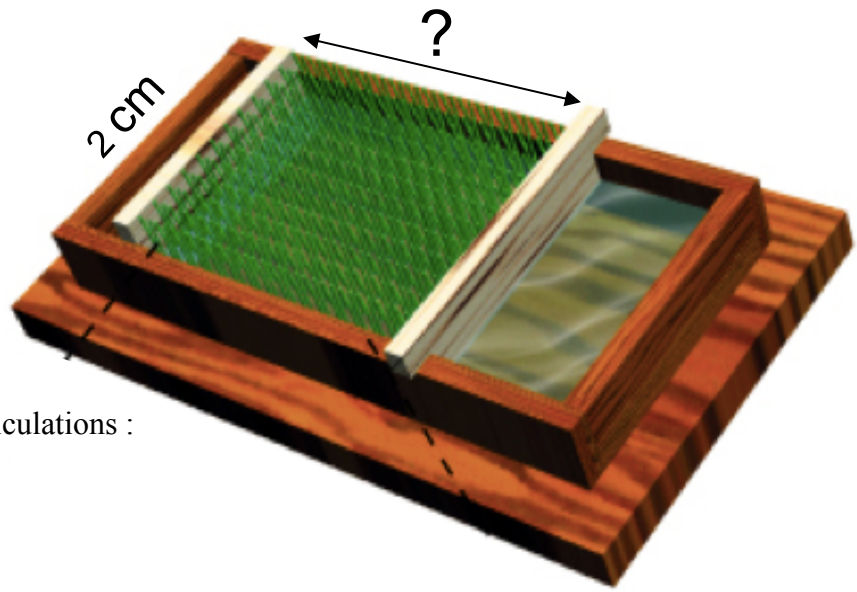
c. the plasma membrane is fluid at 37 ºC.

d 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 through.
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 μ^2.
Lipid extraction yield (efficiency) = 100 %

ℓ = _____

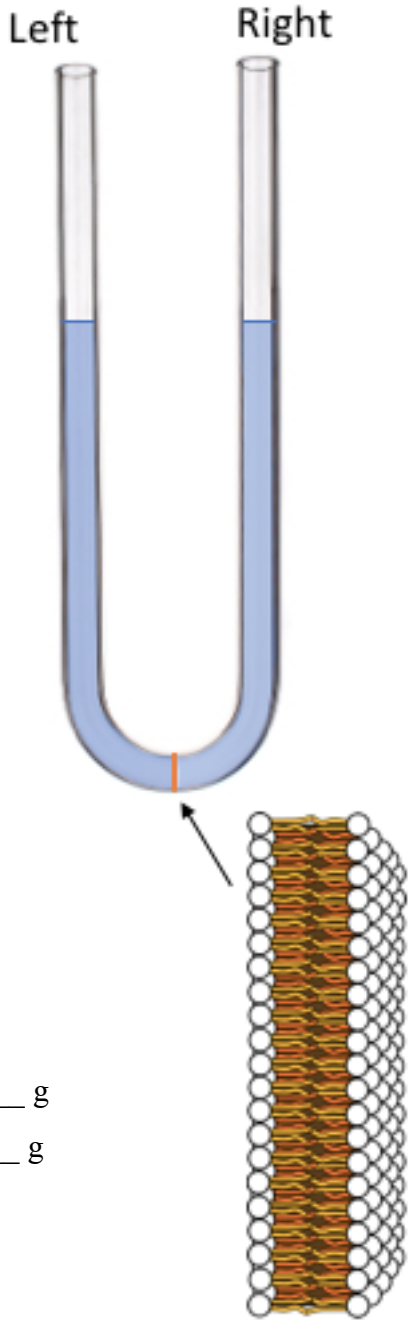


Calculations :

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 μ^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

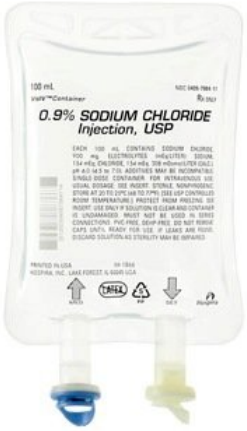
You would like to bring back the water levels were they were initially.

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.

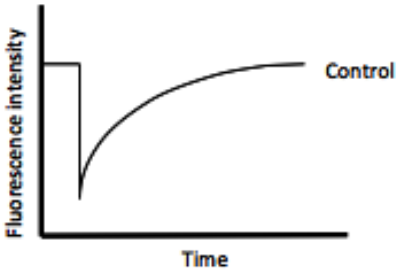
What is the osmolality of 0.9 % sodium chloride ? _____

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

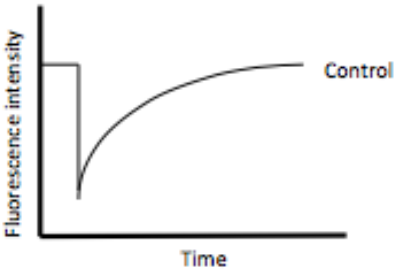
Question 7

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**

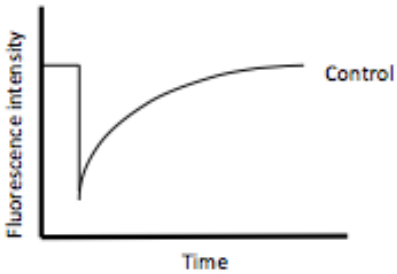
A. You add an enzyme which saturates lipid hydrocarbon chains.



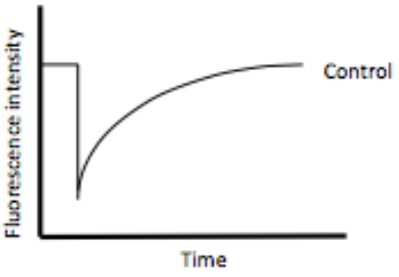
B. You raise the temperature.



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



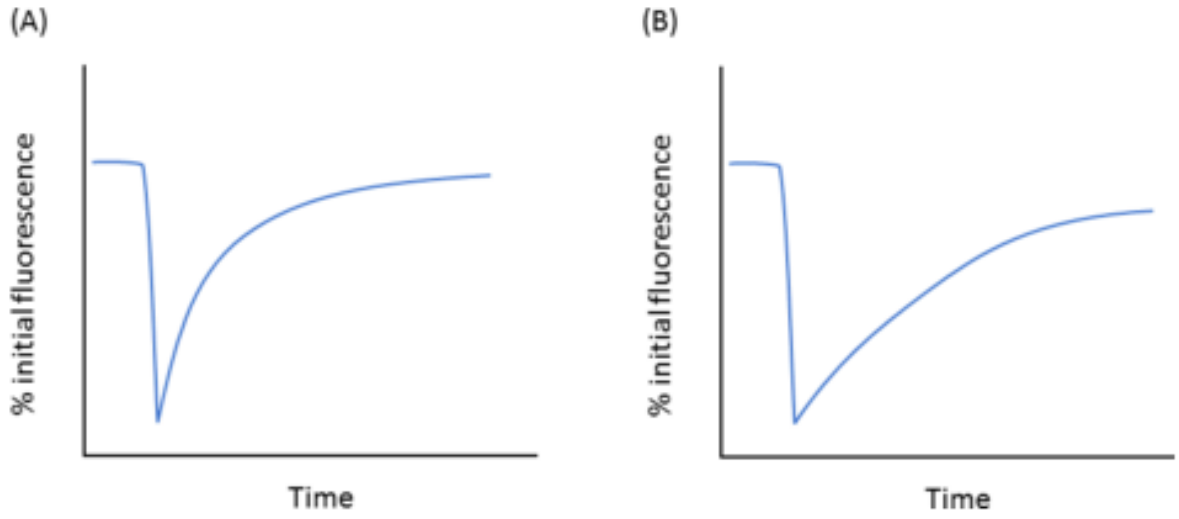
D. You add an enzyme that makes lipid hydrocarbon chains 10 carbon atoms longer



Question 8

Experiment 1. Two sets of cells are subjected to a FRAP experiment. One cell has a lipid bilayer that includes cholesterol, which makes it less fluid; and the other cell has a membrane made purely of phospholipids. The results are shown below. Which curve, A or B, was obtained from cells with a membrane that includes cholesterol?

A B



Experiment 2. Membrane fluidity decreases as the temperature cools. If you conducted two FRAP experiments with the same cell, one experiment at warm temperature, and the other at a cooler temperature, which of the FRAP curves above best represents the cell at the warmer temperature?

A B