

## 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 °C.
- 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 °C.
- 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  $\mu\text{L}$  of this blood is found to contain  $4 \cdot 10^6$  red blood cells (RBC).

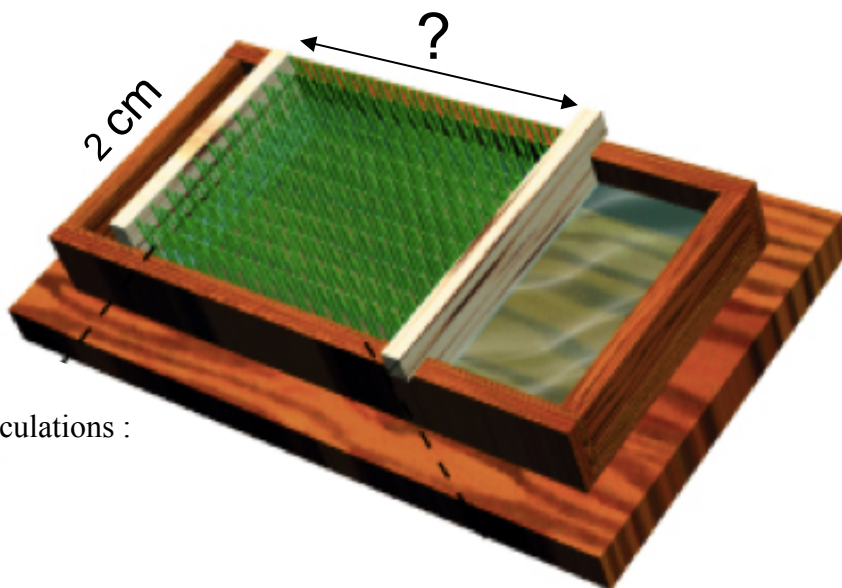
Membrane lipids are extracted for the RBC obtained from 1  $\mu\text{L}$  of blood and then spread on water in a 2-cm-wide Langmuir trough.

What is the distance  $\ell$  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 %

$\ell =$  \_\_\_\_\_



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  $1 \text{ cm}^2$  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  $\text{Na}^+$  : 23

Atomic weight of  $\text{Cl}^-$  : 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  $\text{Na}^+\text{Cl}^-$  concentration in the L part? \_\_\_\_\_ mM

◇ what is the osmolality in the L part?

After 4 hours, you observe that

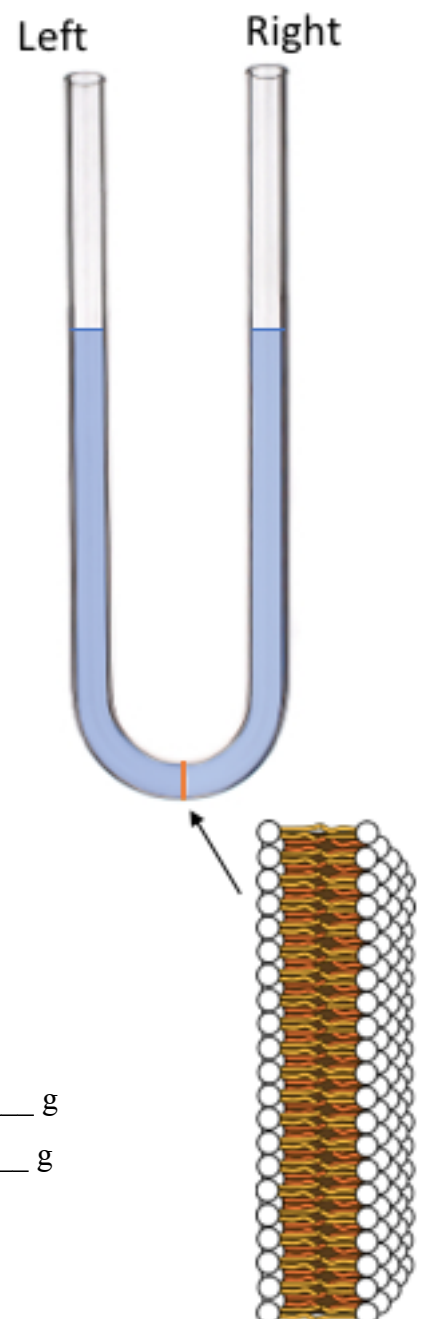
- a. nothing has change, same water level in the L and R part.
- a. water molecules have moved from the R part to the L part
- a. water molecules have moved from the L part to the R part

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

To achieve that,

- how much  $\text{Na}^+\text{Cl}^-$  should you add to the water in the R part? \_\_\_\_\_ g

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



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 ? \_\_\_\_\_

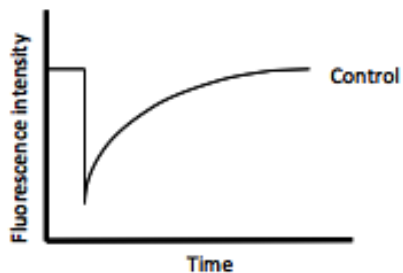
How does this osmolality compare with the osmolality of the human plasma ?



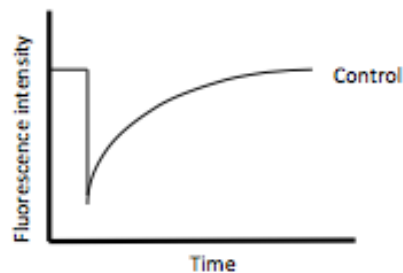
### Question 7

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**

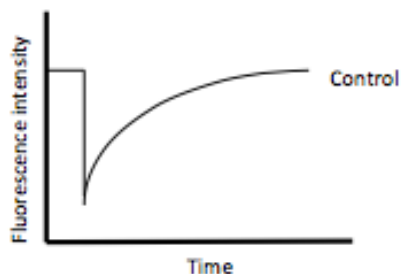
A. You add an enzyme which saturates lipid hydrocarbon chains.



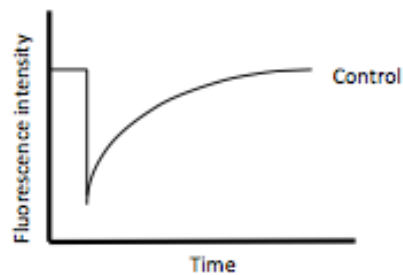
B. You raise the temperature.



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

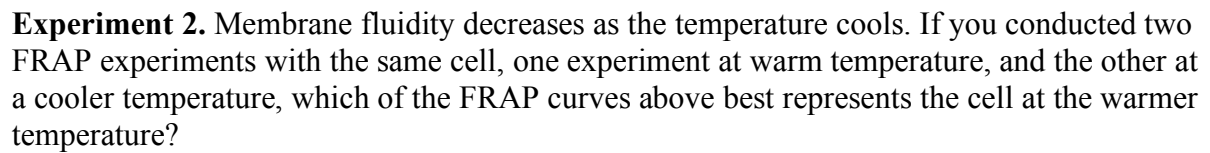


D. You add an enzyme that makes lipid hydrocarbon chains 10 carbon atoms longer



**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?

B



B