MODEL ANSWERS

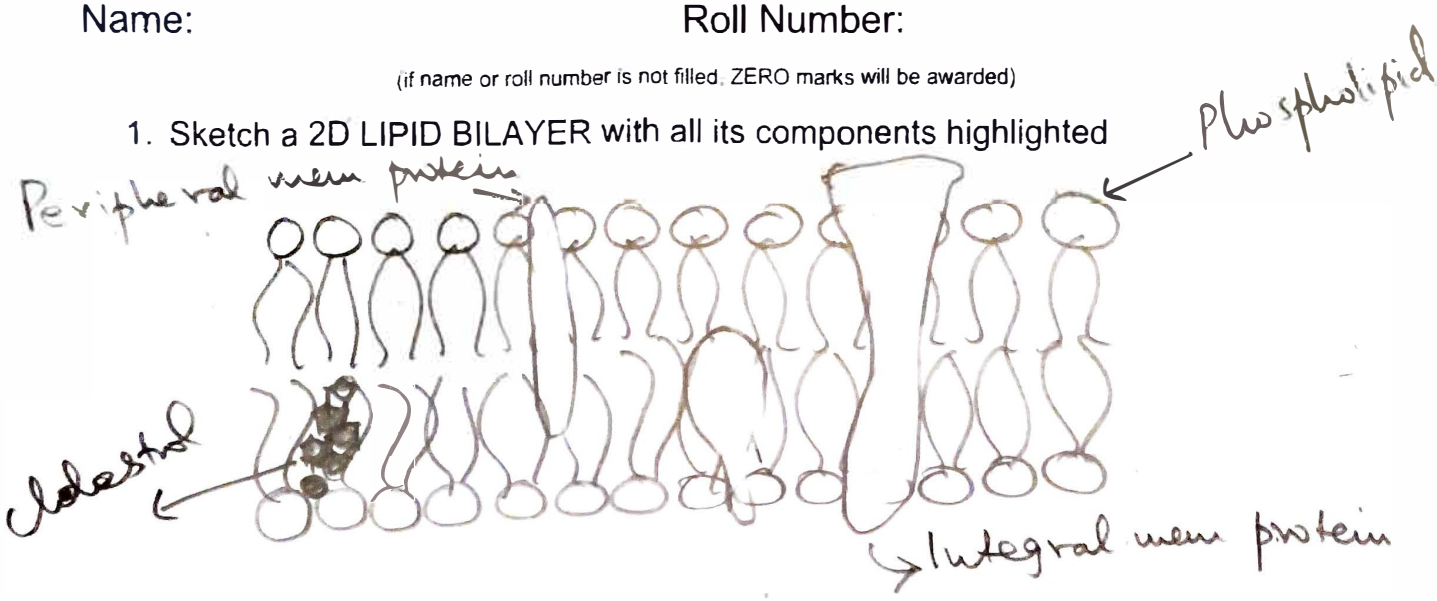
BT 301: Biophysics **QUIZ 1** on 2 Sep 24 Instr: R. Swaminathan

Total marks = 10 Questions carry two marks unless indicated.

Name: Roll Number:

(if name or roll number is not filled, ZERO marks will be awarded)

1. Sketch a 2D LIPID BILAYER with all its components highlighted



2. Arrange the following in increasing order of their PERMEABILITY across lipid bilayer: H_2O; Na^+; Glucose; Cl^-;

$Na^+ < Cl^- < Glucose < H_2O$

3. Describe with diagram the two types of DIFFUSION lipids can undergo in lipid bilayer

Lateral diffusion

Transverse diffusion (flip flop)

4. Calculate the free energy to transport $3Na^+$ OUT of cell and $2K^+$ INSIDE cell, given that: $[Na^+]_{in}$ = 14 mM; $[Na^+]_{out}$ = 143 mM; $[K^+]_{in}$ = 157 mM; $[K^+]_{out}$ = 4 mM; Membrane potential = (—50 mV); T = 310 K; R = 8.314 J/K.mol

For Na^+ ions

$\Delta G = (8.314 \times 10^{-3}\ kJ/mol\cdot K \times 310 \times \ln\left(\frac{143}{14}\right) + (1) \cdot 96.5\ kJ/mol\cdot V \cdot 0.05V) = 10.81\ kJ/mol$

For K^+ ions

$\Delta G = (8.314 \times 10^{-3}\ kJ/mol\cdot K \cdot 310 \times \ln\left(\frac{157}{4}\right) + (1) \cdot 96.5\ kJ/mol \cdot (-0.05V) = 4.63\ kJ/mol$

For transport of 3 Na^+ and 2 K^+

$\Delta G = (3 \times 10.81) + 2(4.63)\ kJ/mol$

$\Delta G = 41.7\ kJ/mol$

5. Explain the difference between LIGAND gated and VOLTAGE gated ion channel in terms of structure and function

Voltage gated ion channels change their conform. to a highly conducting form in response to changes in voltage across membrane. Voltage sensing paddles lie in down position → On mem. depolarization, they shift to UP position, opening the channel.

Ligand gated ion channels have a receptor in extracellular domain to bind the Ligand. Binding of the ligand leads to conformational changes that can open the channel to specific ions.