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FIRST SEMESTER 2018/2019 B,Sc EXAMINATIONS

BCH 303- Biomembrane and Bioenergetics **Time: 2 hrs**

***Instruction:* Attempt any (3) of the five (5) questions**

1. (a) State the 1st and 2nd Laws of Thermodynamics
   (b) The portion of a system's energy that can perform work is given by this equation:

$$G = H - TS$$

   (i) Define each function in the equation and
   (ii) State the conditions under which the equation is valid.
   (c) Describe the three major types of cellular work requiring the utilization of ATP
   (d) Calculate the $\Delta G^{o'}$ of the reaction,

$$\text{Acetaldehyde} + NADH + H^+ \longrightarrow \text{Ethanol} + NAD^+$$

   Given the following half reactions:

$$\text{Acetaldehyde} + 2H^+ + 2e^- \longrightarrow \text{Ethanol} \qquad E^{o'} = -0.197\ V$$

$$NAD^+ + 2H^+ + 2e^- \longrightarrow NADH \qquad E^{o'} = -0.320\ V$$

   (Faraday's constant, *F*, = 96.5 KJ/V. mol)

2. (a) i What are coupled reactions?
   ii Illustrate with two examples
   iii How important are coupled reactions in cellular metabolism.

   (b) ATP has a large negative standard free energy change ($\Delta G^{o'}$) of hydrolysis:

$$ATP + H_2O \longrightarrow ADP + Pi \quad \Delta G^{o'} = -30.5\ kJ/mol$$

   Discuss the chemical basis for the large, negative free energy change?

   (c) State four (4) other energy molecules with high phosphoryl group transfer potential in cellular metabolism apart from ATP.

3. Describe the Fluid Mosaic Model of membrane structure (the use of a well-labelled diagram will earn additional marks).

4. (a) What is membrane fluidity?
   (b) Why does membrane need to be fluid?
   (c) Describe how membrane fluidity is influenced by:
   (i) Cholesterol
   (ii) Temperature and
   (iii) Fatty *a*cids

5. Diffusion and Osmosis are two forces influencing the movement of water and solutes across plasma membranes. Discuss