

**RAJARATA UNIVERSITY OF SRI LANKA**  
**FACULTY OF APPLIED SCIENCES**

Bachelor of Science in Applied Sciences  
 Fourth Year Semester II Examination – Jan / Feb 2023

**PHY 4201 – BIOPHYSICS**

**Answer All Questions**

**Time: Two (02) hours**

01. "It is all but inconceivable that the complex structural organization and chemistry of living systems could exist in other than an aqueous medium."

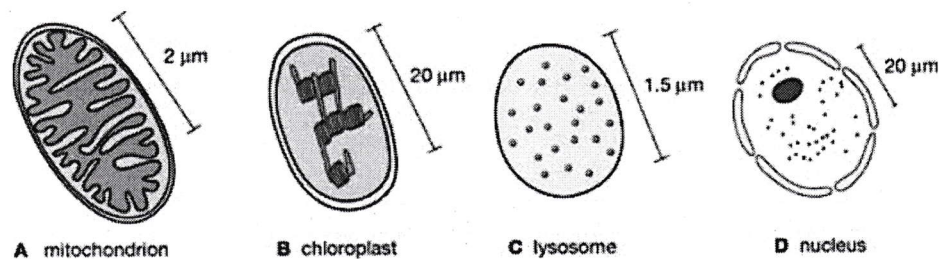
- a) What are the essential properties of water that distinguish it from other molecules and make it the critical compound of life? (5 marks)
- b) Draw the structure of ice at  $0 - 4^{\circ}\text{C}$  (5 marks)
- c) Discuss what will happen to pond water near the surface as it cools but before it freezes. (5 marks)
- d) *Water is said to readily ionize. Provide the equilibrium chemical equation.* (5 marks)
- e) What is the biological importance of a high Dielectric constant of water? (5 marks)

02. Answer the following questions.

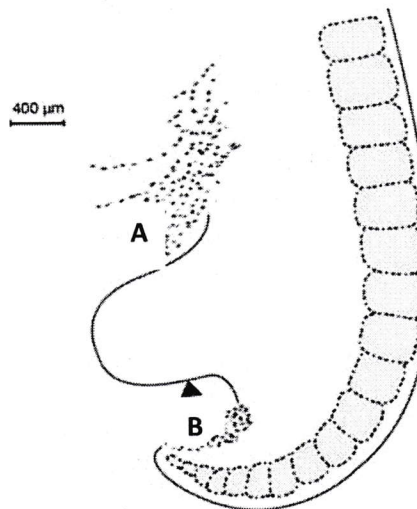
- a) What are protein aggregates? (4 marks)
- b) State four characteristics of aggregates of globular proteins (8 marks)
- c) Briefly discuss the functions of polysaccharides. (8 marks)
- d) What are biological composites? (5 marks)

03. The structure of proteins can be localized in the protein data bank (PDB) files.

- Name a stand-alone application that can use to view the protein structure using a PDB file? (3 marks)
- Which data is used to create PDB files? (2 marks)
- What is the difference between magnification and resolution? (5 marks)
- Below are four diagrams of different organelles in the animal cell. Each drawing has been made the same size. Study the diagrams and the information given and state which drawing has been most magnified. (5 marks)

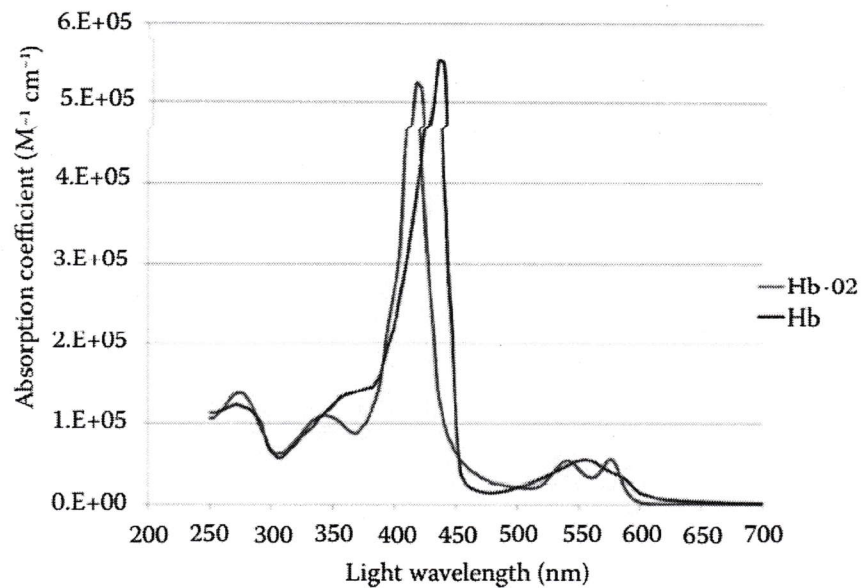


- The figure below shows the leg bud of a chick embryo at about four days of incubation.



- Calculate the magnification of the image. (5 marks)
- Calculate the actual size of the limb bud from A to B. Give your answer in  $\mu\text{m}$ . (5 marks)

04. The absorption spectra of oxy-Hb and deoxy-Hb is provided below.



- What wavelengths is absorbed most strongly by oxy-Hb? (4 marks)
- What determines the apparent color of hemoglobin? (7 marks)
- What determines the apparent color of blood coming from a cut in your finger. (7 marks)
- Sizing chromatography is a type of chromatography that separates molecules according to molecular size or molecular mass. Assume that a chromatography material consists of  $200 \mu\text{m}$  diameter beads of a resin permeated with small (submicron diameter) tunnels. Sephadex *G* – 50 is one such material, suitable for the separation of molecules of mass  $> 30 \text{ kDa}$  from molecules  $< 1.5 \text{ kDa}$ . Estimate the mean diameter of the tunnels in the medium. (7 marks)

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