

THE OPEN UNIVERSITY OF SRI LANKA  
 BACHELOR OF SCIENCE DEGREE PROGRAMME - LEVEL 05  
 FINAL EXAMINATIONS 2006/2007



PHU 3152/PHE 5152 – BIO PHYSICS

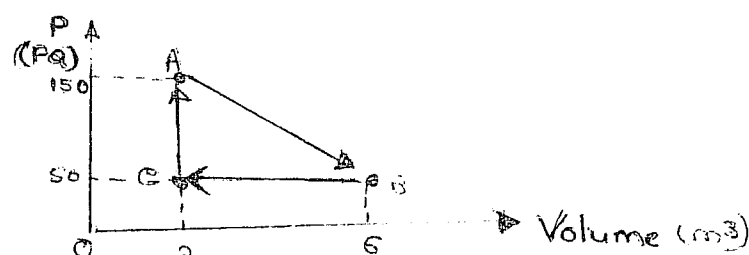
TIME ALLOWED : TWO AND A HALF (02 ½) HOURS

Date : 07<sup>th</sup> June 2007

Time : 10.00 a.m. – 12.30 p.m.

Answer four questions.

01. a) Discuss the differences between reversible process and irreversible process, giving an example in each case.
- b) State the first law and the second law of thermodynamics.
- c) A thermodynamic process is shown in P-V diagram. In usual notation. If  $U_A = 10\text{J}$   $U_B = 20\text{J}$  and Heat absorbed in the process  $B \rightarrow C$  is  $40\text{J}$ .



Find

- i.  $U_C$                       ii.  $Q_{A \rightarrow B}$   
 iii.  $Q_{C \rightarrow A}$                 iii.  $W_{ABCA}$

- d) A bullet of mass  $100\text{g}$  traveling with speed  $42\text{ ms}^{-1}$  strikes a target. The heat generated is completely absorbed by the bullet. What is the rise in temperature at the bullet. Specific heat of bullet is  $0.1\text{ J}^{-1}\text{Kg}^{-1}\text{C}^{-1}$ .
02. a) Explain the constructive interference and destructive interference. Give requirement to observe the above interference pattern.
- b) In a young's double slit experiment the distance between slits is  $2 \times 10^{-3}$  and that between slits and screen is  $2.5\text{m}$ . Slits are illuminated by a light contain wavelengths from  $2000\text{ \AA}$  to  $8000\text{ \AA}$ . Find all the wavelengths in the visible region which have intensity maxima at a distance of  $10^{-3}\text{ m}$  from the central fringe.

- c) Explain the term "Diffraction".  
What are the main differences between Fraunhofer diffraction and Fresnel diffraction.
- d) Parallel beam of light of wavelength 540nm incident normally on a slit of width 0.20mm.

A diffraction pattern is observed on a screen 4m away.

Calculate the width of the central maxima.

03. a) Discuss energies involved in rotational and vibrational motion of an atom. How these energies are compared with the electronic energy of a molecule. If a molecule absorbs a photon with energy in the ultraviolet region.

What possible excitations would occur in the molecule?

- b) A solution of biological molecules absorbs wavelength of 300nm light and fluoresces strongly at 625nm. What is the amount of energy lost in this process?
- c) A sample of length 1.0cm has concentration  $2.0 \text{ mol m}^{-3}$ . At certain wavelength the sample absorbs 60% of the incident light. What is the absorptivity of this sample.

04. a) State Bragg's Law & explain the rules that can be used to determine Miller indices.  
Draw planes with Miller indices  $(\bar{1}, 0, 0)$ ,  $(0, 2, 0)$ ,  $(\bar{1}, 1, 1)$  for a simple cubic structure.
- b) Discuss the x-ray diffraction phenomena briefly.  
A continuous X-ray beam containing wavelengths from  $0.9 \text{ \AA} - 2.0 \text{ \AA}$ . Strikes a set of parallel planes with spacing 0.4nm of a protein crystal at an incident angle of  $30^\circ$ .
- c) What wavelengths will be reflected from this set of planes.
- d) At what angle with the reflected x-rays emerge from the crystal relative to the transmitted beam.

05. a) Discuss the major difference among the three main nonbonding interaction.  
dipole dipole,  
Vandervál and hydrogen bonding
- b) Explain the
- i. Solubility of non ionic compounds.
  - ii. Dissolving of NaCl in waken
- c) Discuss the structure of water and ice. Explain why water is a good solvent for ionic compounds.
- d) Two sphere of the same size, but made with different material have terminal velocities in water in the ratio of 9 to 1. If the slower of sphere has a density of  $2.0 \times 10^3 \text{ Kg m}^{-3}$ , calculate the density of the faster sphere.
06. i. Discuss how an enzyme speeds up a biological reaction.
- ii. What factors affect enzyme reactions? Discuss then briefly.
- iii. The hydrolysis of pyrophosphate to orthophosphate is important in driving forward biosynthetic reactions such as the synthesis of D.N.A. Assume that such a reactions at room temperature of  $35^0$  has a Michealis constant of  $0.50 \text{ mol l}^{-1}$ . The reaction occurs at a rate of  $5.0 \times 10^{-2} \text{ mol l}^{-1}$  per minute. If the substrate present at a concentration of  $0.100 \text{ mol l}^{-1}$ .
- Find the maximum rate of this enzyme catalyzed hydrolysis reaction.

- Copyrights reserved -