

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**FACULTY OF MEDICINE**

**MEDICAL SCHOOL**

**BACHELOR OF MEDICINE AND BACHELOR OF SURGERY DEGREE**  
**PART I EXAMINATIONS**

**(MHO 1101)** : PHYSICS & PHYSIOLOGICAL MEASUREMENTS  
**DATE** : **DECEMBER 2005**  
**TIME** : 3 HOURS

**Instructions to Candidates**

Answer **all** questions

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**SECTION A**

1. Describe the buffering capacity of the bicarbonate/carbonic acid system as it applies to metabolic alkalosis/acidosis and respiratory alkalosis/acidosis. (20)
2.
  - a) List four types of radiation detectors. (2)
  - b) Compare and contrast the properties of  $\alpha$ ,  $\beta$  and  $\gamma$  rays. (10)
  - c) What are the biological effects of radiation on DNA? (3)
3. Show that kinetic energy ( $E_k$ ) =  $\frac{1}{2} mv^2$  and that potential energy ( $E_p$ ) =  $mgh$ , where  $m$  is the mass,  $g$  is the acceleration due to gravity,  $v$  is the velocity and  $h$  is the height. (4)
4.
  - a) State Snell's Law (1)
  - b) Describe the principle by which a surgeon is able to view the operation site using a fibre optic cable. (5)

- c) List four common refractive disorders of the eye, and for each state the type of lens that must be used to correct the defect. (4)
5. Briefly explain the following terms:
- a) endocytosis (2)
  - b) exocytosis (2)
  - c) osmosis (2)
  - d) facilitated transport (2)
  - e) active transport. (2)
6. a) Discuss the generation and maintenance of the resting membrane potential. (5)
- b) Briefly, outline the changes in membrane conductance of  $\text{Na}^+$  and  $\text{K}^+$  that occur during the action potential. (5)
- c) Explain the roles of cAMP and  $\text{Ca}^{2+}$  as second messengers for hormones. (8)
7. a) Define homeostasis. (1)
- b) Describe the Renin-Angiotensin – Aldosterone system. (5)
- c) Briefly, explain the term "glomerular filtration rate". (5)
8. a) List four categories of hypoxia. (2)
- b) Illustrate the normal oxygen/haemoglobin dissociation curve at a temperature of  $38^\circ\text{C}$  and pH 7.4. (3)
- c) What **three** conditions affect the oxygen /haemoglobin dissociation curve? (3)
- d) What is the Bohr effect and what is its basis? (3)
9. List any **four** causes of dehydration and any **four** symptoms or signs. (4)