NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

MASTER OF SCIENCE IN SPORT SCIENCE AND COACHING

DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

THEORY: PHYSIOLOGY SBB 5102

DECEMBER 2001

3 HOURS (100 marks)

INSTRUCTIONS

Answer TWO Questions from Section One and One Question from Section Two. Where a question contains subdivisions, the mark value for each subdivision is given in brackets.

SECTION ONE

1. What mechanisms and structural organizations make the lung the most efficient gas exchange area in the body and what parameters affect gas transport to and from target tissues. (30 marks)

   What volume of oxygen per minute is taken by the lungs of somebody whose inspired volume of ventilation is 6200mls per minute, the concentration of oxygen in inspired air is 1200ml and the expired volume of ventilation is 6200mls and the concentration of oxygen in expired air is 1000mls. (5 marks)

2. Membranes are able to conduct an action potential as well as permit movement of molecules and ions across them. Describe the mechanisms by which these functions are achieved. (30 marks)

   Determine the membrane potential of a cell whose inside Na^{+} concentration is 5mM and the outside is 140mM at a temperature of 25°C, whose ionic charge is 1 and the gas constant is 1.987 cal K^{-1} mol^{-1} and Faradays constant is 23.06 K cal V^{-1} mol^{-1}. (5 marks)

3. Describe the digestive and motility function of the human alimentary canal. (30 marks)

   Determine the initial diffusion rate across a 0.25µm thick membrane, by a solute whose concentration is 50mM outside and 25mM inside and the area under consideration is 0.10cm^2 and the time in which the readings in concentrations were taken is 5 seconds. (5 marks)

4. Describe sequentially the electrical and muscular activity involved in the heart when it pumps blood in regular and systematic fashion and then explain how systemic blood pressure is normally regulated. (30 marks)

   What work is done by the heart per beat if the mean arterial pressure is 125mm Hg and the stroke volume is 125mls. (5 marks)

SECTION TWO

5. Compare and contrast the sequence of events in the contraction mechanism when a person is lifting 2g envelope and when they are lifting a 20kg load using the same appendage. (30 marks)

6. Using epinephrine as an example, describe the role of cyclic AMP as a second messenger in hormonal action. (30 marks)

END OF QUESTION PAPER

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