

National Exams December 2014

04-Bio-A6, Anatomy and Physiology

3 hours duration

**NOTES:**

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a CLOSED BOOK EXAM.  
Any non-communicating calculator is permitted.
3. FIVE (5) questions constitute a complete exam paper.  
The first five questions as they appear in the answer book will be marked.
4. Each question is of equal value.
5. Most questions require an answer in essay format. Clarity and organization of the answer are important.

Question 1:

- a) Discuss factors that can affect the resistance to blood flow in the cardiovascular system? Why is the relationship between blood pressure and tissue blood flow non-linear?
- b) What are the quantitative values of the four forces that cause fluid absorption at the arterial and the venous ends of the capillaries? What is the importance of this?
- c) What are the effects of hydrostatic pressures on venous and arterial pressures in the body? Explain the effects of hydrostatic pressure gradients on pulmonary vascular function in both normal and abnormal conditions.

Question 2:

A man was dropped off at the airport. As he was picking up his suitcase from the back of the car, he was struck gently by another vehicle. While shaken, he appeared fine and went on to catch his flight. He arrived safely at his destination, after a relatively short flight but later in the week, became short of breath and ultimately collapsed and died. Given the sequence of events, discuss what possibly may have been the cause of death. What pathological findings would you expect upon autopsy?

Question 3:

- a) Describe the functional anatomy of the kidney.
- b) Approximately what proportion of the glomerular filtrate is normally reabsorbed during the formation of urine?
- c) If the concentration of inulin in the blood is 0.05 g in 100 mL of plasma and a total of 0.02 g of inulin passes into the urine per minute, what is the glomerular filtration rate?
- d) Why is the renin-angiotensin system of importance in allowing a person to conserve water and electrolytes in low blood pressure states while at the same time continuing to excrete waste products?

Question 4:

- a) Explain why minute quantities of carbon monoxide can prevent the transport of oxygen to the tissues.
- b) Draw the oxygen – haemoglobin dissociation curve. Explain how haemoglobin buffers the interstitial blood PO<sub>2</sub> during exercise, in conditions of low atmospheric oxygen and in conditions of high atmospheric oxygen.
- c) What is the normal partial pressure of oxygen in the alveoli. What is the normal carbon dioxide concentration in the alveoli? What factors can increase or decrease this?
- d) Describe the relationship of pulmonary emphysema to smoking, its pathological effects on the lungs and its devastating effects on pulmonary function.

Question 5:

- a) Describe the way in which the organic matrix of bone and the bone salts are structured to provide both compressional strength and tensional strength of the bone.
- b) What is the composition of hydroxyapatite?
- c) During bone calcification, what salts are first laid down in the bone and how are these converted to hydroxyapatite?
- d) Explain the histological mechanisms by which bone is continually being remodelled. What is the value of the continual remodelling of bone?

Question 6:

Give three examples of cartilage based tissues including properties and discuss how their structure function relationships differ.