



FACULTY OF MEDICINE, UNIVERSITY OF RUHUNA  
SECOND EXAMINATION FOR MEDICAL DEGREES  
PHYSIOLOGY PAPER II – May 2023

Answer all five questions  
Answer each question in a separate book  
Use diagrams where necessary

22<sup>nd</sup> May 2023  
2.00 – 5.00 p.m. (3 hours)

1. Digoxin is given to patients with systolic heart failure to increase myocardial contractility.
- 1.1 Define systolic heart failure. (05 marks)
- 1.2 Define myocardial contractility. (05 marks)
- 1.3 Draw a labeled diagram to show the phases of cardiac action potential. (20 marks)
- 1.4 Describe the movement of ions across the membrane in different phases of cardiac action potential. (20 marks)
- 1.5 Explain how electrical activation of a myocyte increases  $Ca^{+2}$  concentration in the sarcolemma of the myocyte. (20 marks)
- 1.6 Explain how digoxin increases myocardial contractility. (30 marks)
- 2
- 2.1 A 50-year-old patient has following respiratory indices.
- |                                  |              |
|----------------------------------|--------------|
| Tidal volume                     | : 420 mL     |
| Dead space                       | : 120 mL     |
| Peak expiratory flow rate (PEFR) | : 350 L/min. |
| Respiratory rate                 | : 12 /min    |
- 2.1.1 Define tidal volume. (05 marks)
- 2.1.2 Define PEFR. (05 marks)
- 2.1.3 List **three** factors that are used to determine the predicted PEFR. (05 marks)
- 2.1.4 Calculate the minute alveolar ventilation. (15 marks)
- 2.1.5 After inhalation of a beta 2 agonist (salbutamol), PEFR increases to 400L/min. Explain the mechanism that led to the increased PEFR. (20 marks)
- 2.2
- 2.2.1 List **three** motility types of the gastrointestinal tract. (10 marks)
- 2.2.2 Describe briefly the locations and functions of the above mentioned motility types. (25 marks)
- 2.2.3 Describe briefly **two** motility disorders of the gastrointestinal tract. (15 marks)

- 3.
- 3.1 Explain the role of the following in determining the volume of urine:
- 3.1.1 Countercurrent mechanism (20 marks)
  - 3.1.2 ADH (20 marks)
  - 3.1.3 Renal sympathetic nerves (20 marks)
- 3.2 A full blood count report of an adult male with a **renal tumour** is given below. (Normal ranges are given within brackets)
- |                 |                                     |      |                     |
|-----------------|-------------------------------------|------|---------------------|
| Red cell count: | 6.2 x 10 <sup>12</sup> /L (4.7-6.1) | MCV  | : 86 fL (80 - 100)  |
| Hb              | : 18.5 g/dL (13-17)                 | MCH  | : 29.8 pg (27-31)   |
| PCV             | : 55% (35-50)                       | MCHC | : 33.6 g/dL (32-36) |
- 3.2.1 State the diagnosis based on the full blood count report. (10 marks)
  - 3.2.2 Explain the physiological basis for the Hb concentration in this patient. (20 marks)
  - 3.2.3 Explain briefly the physiological basis for the cardiovascular risks this patient has if he is left untreated. (10 marks)
4. A 40-year-old female was recently diagnosed with Cushing syndrome.
- 4.1 What is Cushing syndrome? (10 marks)
  - 4.2 Explain the hypothalamo-pituitary-adrenal axis. (20 marks)
  - 4.3 List **two** causes for Cushing syndrome. (10 marks)
  - 4.4 Explain how above two causes will affect the hypothalamo-pituitary-adrenal axis. (20 marks)
  - 4.2 Explain the physiological basis for the following complications of Cushing syndrome.
    - 4.2.1 Hypertension (20 marks)
    - 4.2.2 Diabetes (10 marks)
    - 4.2.3 Muscle weakness (10 marks)
5. A 70-year-old man working in the garden with his son in bright sunlight for several hours goes into a storeroom as he is sweating and tired. His son shouts "do not go in", but he does not hear it. Only after few minutes he recognizes the objects around him. After seeing an object resembling a snake on the ground, he experiences palpitations.
- 5.1 What is the name of the physiological phenomenon that allowed him to see the objects in less well illuminated room after few minutes. (10 marks)
  - 5.2 Explain the physiological mechanism behind the above phenomenon. (20 marks)
  - 5.3 What is the most possible cause of hearing defect in old age? (05 marks)
  - 5.4 What is palpitation? (10 marks)
  - 5.5 Explain the mechanism of development of palpitations in this person. (30 marks)
  - 5.6 Explain why he developed sweating when working in hot sun. (25 marks)
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