

**UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY**

DURATION: 3 HOURS

TOTAL MARKS: 150

**External Examiner: Dr K Pillay
Internal Examiner: Mrs J Galliers**

**NOTE: THIS PAPER CONSISTS OF TWELVE (12) PAGES.
PLEASE SEE THAT YOU HAVE THEM ALL.**

INSTRUCTIONS:

- **Write your student number on all answer books.**
- **Do not write in pencil -it will not be marked.**
- **Write legibly- if it cannot be read it will not be marked.**
- **Leave enough space open so that you can answer questions in their correct sequence i.e. 3 followed by 4 etc.**
- **Section 1 is compulsory- please answer all questions**
- **Section 2- please choose 4 out of the 6 questions**

**UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY**

SECTION 1

[50 MARKS]

THIS SECTION IS COMPULSORY.

THERE ARE 50 QUESTIONS, EACH WORTH ONE (1) MARK.

HAND IN BOTH THE QUESTION PAPER AND THE ANSWER SHEET WITH YOUR EXAM BOOKLET.

A. MULTIPLE CHOICE QUESTIONS

[20 MARKS]

CHOOSE THE MOST CORRECT ANSWER. ANSWER ALL QUESTIONS ON THE ANSWER SHEET PROVIDED AND WRITE YOUR CHOSEN LETTER NEXT TO THE CORRESPONDING QUESTION NUMBER.

NEGATIVE MARKING APPLIES, WITH MINUS ½ MARK FOR EVERY INCORRECT ANSWER.

1. A transverse section divides the body into:
 - a) Anterior and posterior portions
 - b) Dorsal and ventral portions
 - c) Superior and inferior portions
 - d) Right and left portions

2. Which of the following is not a function of the hypothalamus?
 - a) Control of thirst and urine output
 - b) Control of food intake
 - c) Control of respiration and circulatory function
 - d) Control of body temperature

- 3) The homeostatic mechanism that monitors changes in the internal and external environment is/are the:
 - a) set point
 - b) receptors
 - c) effector organs
 - d) integration system

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY

- 4) The stalk of neurons connecting the hypothalamus and the pituitary gland is the:
- a) pineal body
 - b) posterior commissure
 - c) corpus callosum
 - d) infundibulum
- 5) The sympathetic nervous system performs the following function:
- a) innervates structures in the head
 - b) innervates smooth muscles of the arteries
 - c) slows the heart rate
 - d) stimulates digestive organs
- 6) Which pancreatic cells produce insulin?
- a) beta
 - b) alpha
 - c) F cells
 - d) delta
- 7) Pulmonary surfactant:
- a) Is composed of only lipids
 - b) Reduces surface tension
 - c) Channels the movement of nitrogen
 - d) Ensures the alveoli stick together
- 8) The “U”-shaped loop of Henle has:
- a) descending and ascending limbs
 - b) descending limbs only
 - c) descending and lateral limbs
 - d) ascending limbs only
- 9) Nociceptors detect:
- a) mechanical stimuli
 - b) chemical concentrations
 - c) pain
 - d) temperature

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY

10) Which layer of the skin epidermis synthesises keratin?

- a) stratum granulosum
- b) stratum corneum
- c) stratum spinosum
- d) stratum basale

11) The innermost layer of the meninges is the:

- a) duramater
- b) pia mater
- c) choroid plexus
- d) arachnoid

12) The cornea of the eye:

- a) controls the amount of light entering the eye
- b) focuses the light rays that enter the eye
- c) gives the eye its colour
- d) sends impulses along the optic nerve to the brain

13) The volume of air entering/leaving the lungs during a single breath is the:

- a) tidal volume
- b) forced vital capacity
- c) residual volume
- d) functional residual capacity

14) During expiration:

- a) intrathoracic volume decreases
- b) intrathoracic volume increases
- c) lung pressure is less than air pressure
- d) lung volume increases

15) Which of the following is considered to be a trophic hormone?

- a) FSH
- b) Thyroid hormone
- c) Aldosterone
- d) Parathyroid hormone

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPhys 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY

16) The two pigments responsible for the range of skin colours in humans are:

- a) melanin and keratin
- b) melanin and carotene
- c) melanin and sebum
- d) melanin and eleidin

17) Activation of the target cell by the hormone-receptor complex depends on:

- a) Number of available receptors for that specific hormone
- b) Blood levels of the hormone
- c) Strength of the bond between the hormone and the receptor
- d) all of the above

18) The release of aldosterone is determined by the:

- a) level of sodium in the blood
- b) level of calcium in the blood
- c) level of cortisol in the blood
- d) level of catecholamines in the blood

19) The majority of water is reabsorbed in the:

- a) distal convoluted tubule
- b) proximal convoluted tubule
- c) collecting ducts
- d) peritubular capillaries

20) For the sense of touch, stimuli are detected by the:

- a) mechanoreceptors
- b) thermoreceptors
- c) nociceptors
- d) all of the above

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY

B. TRUE OR FALSE QUESTIONS

[20 MARKS]

USE THE ANSWER SHEET PROVIDED TO WRITE YOUR CHOSEN ANSWER, TRUE (T) OR FALSE (F), NEXT TO THE CORRESPONDING QUESTION NUMBER.

21. In positive feedback mechanisms, the result increases the production of the original triggering substance.
22. The integumentary system contains the human body's largest organ.
23. In the brain the outermost layer is made up of white matter and the innermost layer is grey matter, while the reverse is true for the spinal cord.
24. Growth hormone deficiency may be caused by a pituitary defect.
25. The parasympathetic nervous system prepares the body for stress situations by being responsible for the "fight-or-flight" mechanism.
26. Oxygen concentration has the greatest effect on alveolar ventilation rate.
27. The majority of carbon dioxide in the blood is transported in the form of bicarbonate ions.
28. Efferent fibres carry impulses into the CNS and afferent fibres carry outgoing signals.
29. The vertebral column in the spinal cord is equal in length to the spinal cord.
30. The epidermal layer of the skin has a rich blood supply.
31. The kidney is an example of a homeostatic organ.
33. The ascending loop of Henle is impermeable to water.

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY

34. Parathyroid hormone is responsible for maintaining the concentration of potassium in the blood.
35. The medical term “femoral’ refers to the lower arm
36. Microglia cells are responsible for the formation of the myelin sheath.
37. The diencephalon is composed of the hypothalamus and pons.
38. The adrenal gland produces steroid hormones.
39. In a healthy adult the level of blood glucose is controlled by negative feedback.
40. Touch originates from the top layer of the skin, due to the presence of nerve endings.

**UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY**

C. MEDICAL TERMINOLOGY QUESTIONS

[10 MARKS]

GIVE BRIEF DEFINITIONS OF THE FOLLOWING TERMS. WRITE YOUR ANSWER ON THE ANSWER SHEET PROVIDED.

WORD	DEFINITION
Glycosuria	
Pneumothorax	
Pyelonephritis	
Hydrocephalus	
Dermatitis	
Neuralgia	
Appendectomy	
Subcutaneous	
Anoxia	

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY

SECTION 2 **[100 MARKS]**
ANSWER FOUR (4) OF THE FOLLOWING SIX (6) QUESTIONS

QUESTION 1 **[25 MARKS]**

- 1.1 What is homeostasis? [3]
- 1.2 Using the three (3) components of a feedback system, briefly explain how homeostasis is maintained. [10]
- 1.3 What is the difference between positive and negative feedback? Include an example of each. [4]
- 1.4 Smell is one of the five senses. Describe the process of detecting and interpreting an odour. [8]

QUESTION 2 **[25 MARKS]**

- 2.1 Briefly explain what neurotransmitters are and how they exert their effect? [7]
- 2.2 Name the four (4) different lobes of the brain. [4]
- 2.3 Where is cerebrospinal fluid produced, and what is its function? [4]
- 2.4 State the three (3) components of the Glasgow Coma Scale. [3]
- 2.5 Briefly describe the anatomy of the spine. [7]

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY

QUESTION 3

[25 MARKS]

- 3.1 List the differences between protein and steroid hormones. [8]
- 3.2 Name the three (3) hormones produced by the thyroid gland. [3]
- 3.3 What role does insulin play, and what effect does an insulin deficiency have on the body? [12]
- 3.4 Where is antidiuretic hormone produced, and where is it secreted from? [2]

QUESTION 4

[25 MARKS]

- 4.1 Describe the mechanism of breathing. [10]
- 4.2 An experiment was carried out on an athlete in which the volume of air taken in at each breath and the number of breaths per minute were measured at rest and during exercise.

	Volume of air/breath	Breaths/minute
At rest	450cm ³	20
During exercise	1000cm ³	38

- i) What is the volume of air breathed in per minute while at rest? [2]
- ii) Explain why the amount of oxygen taken up into the blood needs to increase during exercise. [2]
- iii) The volume of air exhaled would be the same as the volume of air inhaled. What substance would replace the oxygen taken into the blood? [1]
- 4.3 Describe the oxygen-haemoglobin dissociation curve. Show what would happen if there was:
- i) a change in pH
- ii) a change in temperature [10]

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY

QUESTION 5

[25 MARKS]

5.1 Describe in detail the three (3) different regions within the kidney. [16 x ½ =8]

5.2 The diagram below shows a kidney nephron and its blood supply.
Name the parts labelled 1-4, and the fluids X and Y in your answer book. [6]

5.3 What properties allow substances to pass through the walls of the glomerulus and Bowman's capsule? [2]

5.4 The filtrate in the ascending part of the loop of Henle has a lower osmolality than the filtrate in the descending part of the loop of Henle. Explain why this is. [9]

UNIVERSITY OF KWAZULU-NATAL
SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES
DIETETICS AND HUMAN NUTRITION
EXAMINATION: JUNE 2014
SUBJECT, COURSE, CODE: MPHYS 200 P1
INTRODUCTION TO MAMMALIAN PHYSIOLOGY

QUESTION 6

[25 MARKS]

- 6.1 Using your detailed knowledge of the tissue comprising the integumentary system, name and briefly describe the layers of the epidermis. [5]
- 6.2 Describe the structure of the dermis. [4]
- 6.3 When the external temperature is cold, the heat-promoting centre within the hypothalamus is activated. It triggers mechanisms to maintain, or increase, core body temperature. Discuss these heat-promoting mechanisms in detail. [16]