



# TECHNICAL UNIVERSITY OF MOMBASA

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Faculty of applied and health sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

## UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MEDICAL ENGINEERING (DME 16S)

AAB 2250 HUMAN ANATOMY AND PHYSIOLOGY

## END OF SEMESTER EXAMINATION

**SERIES:DEC 2016** PAPER-A

**TIME:2HOURS**

**DATE:December 2016**

### Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions.

Answer Question ONE (compulsory) and any other TWO Questions.

**Do not write on the question paper.**

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### QUESTION ONE

- a) Name the function the of the following;
- (i) Capsule 1 mark
  - (ii) Cell wall 1 mark
  - (iii) Plasma membrane 1 mark
  - (iv) Mesosome 1 mark
- b) State FOUR primary functions of epithelial cells 4 marks
- c) (i) State TWO functions of blood 2 marks
- (ii) Name TWO causes of chronic bronchitis 2 marks
- d) (i) Name TWO clinical disorder which leads to overproduction of leucocytes 2 marks
- (ii) Name bones of auxiliary skeleton 2 marks
- (e) (i) Outline the parts of human respiratory system pathway 2 marks
- (ii) List FOUR functions of connective tissues 2 marks
- (f) (i) State two functions of the skeleton 2 marks
- (ii) List FOUR breathing patterns 2 marks
- (g) Classify human bones 4 marks
- (h) Name TWO causes of osteoporosis 2 marks

### QUESTION TWO

- (a) Explain the expiration process 8 marks

(b) Describe characteristics of epithelial tissues 7 marks

**Question THREE**

(a) Describe muscle contraction initiation 7 marks

(b) Explain pulmonary circulation 8 marks

**Question FOUR**

(a) Draw a well labeled diagram of a human heart 7 marks

(b) Explain the mechanism of inspiration 8 marks

**Question FIVE**

(a) Explain the causes of pulmonary tuberculosis 7 marks

(b) Describe the transport of proteins in a cell 8 marks

MARKING SCHEME PAPER –A

QUESTION ONE

a) (i) Capsule - outer sticky protective layer

(ii) Cell Wall - rigid structure which helps the bacterium maintain its shape

(iii) Plasma membrane - separates the cell from the environment

(iv) Mesosome - infolding of plasma membrane to aid in compartmentalization

b) The primary functions of epithelial tissues are:

- To protect the tissues that lie beneath it from radiation, desiccation, toxins,

- Regulation and exchange of chemicals between the underlying tissues and a body cavity;

- Secretion of hormones into the blood vascular system,

- To provide sensation

c) (i) Blood distributes nutrients, oxygen, hormones, antibodies and collects nitrogenous wastes and carbon dioxide from them

(ii) often caused by constant irritation of bronchi, as in smoking, causing degeneration, loss of cilia,

- increases susceptibility to other respiratory infections.

d) (i) Overproduction of WBCs

- Leukemia – cancer of leukocytes

- Mononucleosis – viral disease (Epstein-Barr virus)

(ii) skull, sternum, ribs, vertebral column, sacrum,

(e) The Pathway

- Air enters the nostrils

- passes through the nasopharynx,

- the oral pharynx

- through the glottis

- into the trachea

- into the right and left bronchi, which branches and rebranches into

- bronchioles, each of which terminates in a cluster of alveoli

(ii) Function

- Storage of energy

- Protection of organs

- Provision of structural framework for the body

- Connection of body tissues

- Connection of epithelial tissues to muscle fiber.

- Supply of hormones all over the body

- Nutritional support to epithelium

- Site of defense reactions

(f) (i) it provides the shape and form for our bodies

- in addition to supporting, protecting, allowing bodily movement, producing [blood](#) for the body, and storing minerals.

(ii) Patterns of Breathing

Apnea – temporary cessation of breathing (one or more skipped breaths)

Dyspnea – labored, gasping breathing; shortness of breath

Eupnea – Normal, relaxed, quiet breathing

Hyperpnea – increased rate and depth of breathing in response to exercise, pain, or other conditions

Hyperventilation – increased pulmonary ventilation in excess of metabolic demand

(g) long bones, short bones, flat bones, irregular bones, and sesamoid bones.

(h) When too much calcium is dissolved from bones or not enough replaced, bones lose density and are easily fractured.

- Estrogen, the female sex hormone, helps maintain proper calcium levels in bones.
- Once the ovaries stop producing the hormone, women are at higher risk of developing osteoporosis.

#### Question TWO

(a)-Expiration, or exhalation – a passive process that takes advantage of the recoil properties of elastic fibers

- Air is forced out of the lungs when the thoracic pressure rises above atmospheric pressure.
- The diaphragm and expiratory muscles relax.
- The elasticity of the lungs and the thoracic cage allows them to return to their normal size and shape.
- To exhale more than usual, internal (expiratory) intercostals muscles and other muscles can be stimulated.

(b) -Epithelial tissue covers surfaces with an uninterrupted layer of cells

- Epithelial cells are attached to one another.
- Intercellular spaces in epithelium are small.
- Epithelial cells are polarized.
- Epithelial cells are separated from the underlying tissue by a basement membrane.

#### Question THREE

muscle contraction

- In mammals, when a muscle contracts, a series of reactions occur.
- Muscle contraction is stimulated by the motor neuron sending a message to the muscles from the somatic nervous system.
- Depolarization of the motor neuron results in neurotransmitters being released from the nerve terminal.
- The space between the nerve terminal and the muscle cell is called the neuromuscular junction.
- These neurotransmitters diffuse across the synapse and bind to specific receptor sites on the cell membrane of the muscle fiber.
- When enough receptors are stimulated, an action potential is generated and the permeability of the sarcolemma is altered.
- This process is known as initiation.

(b) Pulmonary circulation

The pulmonary circulatory system is the portion of the cardiovascular system in which oxygen-depleted blood is pumped away from the heart, via the pulmonary artery, to the lungs and returned, oxygenated, to the heart via the pulmonary vein.

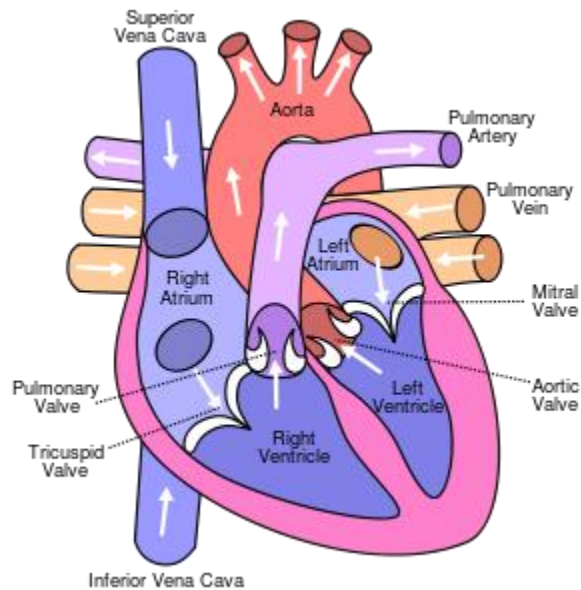
- Oxygen deprived blood from the superior and inferior vena cava, enters the right atrium of the heart and flows through the tricuspid valve (right atrioventricular valve) into the right ventricle, from which it is then pumped through the pulmonary semilunar valve into the pulmonary artery to the lungs.
- Gas exchange occurs in the lungs, whereby CO<sub>2</sub> is released from the blood, and oxygen is absorbed.
- The pulmonary vein returns the now oxygen-rich blood to the left atrium.

Hb + O<sub>2</sub> --> HbO<sub>2</sub>

- Hemoglobin takes up oxygen and becomes oxyhemoglobin.

## Question FOUR

(a)



(b) Inspiration, or inhalation – a very active process that requires input of energy  
Air flows into the lungs when the thoracic pressure falls below atmospheric pressure.

The diaphragm moves downward and flattens, when stimulated by phrenic nerves.  
External (inspiratory) intercostals muscles and thoracic muscles can be stimulated to contract and expand the thoracic cavity.

According to Charles' Law, the volume of a given quantity of gas is directly proportional to its absolute temperature

This means that as the inhaled air is warmed, it expands and inflates the lungs.

## Question FIVE

(a) Pulmonary Tuberculosis: Past and Recent Threat

- i. Caused by tubercle bacilli that invade lung tissue.
- ii. Surrounding cells build up protective capsule (tubercle) that can be seen on a chest X ray.
- iii. Skin test detects immunity developed due to previous exposure.
- iv. Historically a serious widespread disease; controlled by antibiotics.
- v. Again on rise with some strains resistant to antibiotics.

(b) Transport of Proteins - the ER, Golgi, and transport vesicles

- Ribosomes synthesize proteins
- Those destined for secretion contain a short sequence of amino acids that interact with a receptor protein on the surface of rough ER
- The ribosome interacts with the receptor protein, causing the synthesized protein to enter the ER
- The receptor protein removes the signal sequence
- Proteins that enter the ER are usually glycosylated
- The carbohydrate groups serve as chemical markers for protein distribution
- The carbohydrate groups can be modified within the ER
- In the Golgi Apparatus, proteins are segregated for transport to other regions in the cell
- The sugars attached to proteins bind to receptors in the *trans* walls of the Golgi
- These walls eventually bud off into the cytoplasm
- The vesicles then bind to the appropriate endomembrane system (ER, plasma membrane, etc) and release the contents.

## **AAB2250 HUMAN ANATOMY AND PHYSIOLOGY**

**Prerequisite: None**

**Contact hours: 45**

### **Purpose**

This course unit is intended to equip candidate with knowledge on structure and structural functions of the human body.

### **Objectives**

By the end of this course unit the student should be able to:

1. explain the structure and functions of the human body and relate the need of the various medical equipment
2. understand medical terms to communicate effectively with other members of the medical profession
3. describe the morphology of the components of body systems.
4. appreciate the need for operational medical equipment to assist diagnosis, basic medical ethics and patient care.

**Course Description**

Cells and tissues: structure of the cell, types of tissues, characteristics of tissues. Circulatory system: structure of the heart blood and its constituents, common laboratory investigations, related diagnostic and therapeutic equipments. Musculoskeletal system: axial and appendicular skeleton, main joints in the body, disorders of musculoskeletal system, fractures, related diagnostic and therapeutic equipment. Respiratory system: mechanism of breathing, internal and external respiration, diagnostic and therapeutic measures in the respiratory system.

**Teaching methodology:**

Lectures, tutorials and practical.

**Instructional materials/ Equipment:**

Text books, journals, audio-visual materials, illustration charts for demonstration

**Course assessment:**

A final examination and continuous assessments which will constitute 60% and 40% of the total unit score respectively