



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS  
2019/2020 ACADEMIC YEAR**

**THIRD YEAR SECOND TRIMESTER EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE MEDICAL LABORATORY SCIENCES  
MAIN EXAM**

**COURSE CODE: BML 215**

**COURSE TITLE: HISTOLOGY AND CYTOLOGY - MARKING  
KEY**

**DATE:**

**TIME:**

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**INSTRUCTIONS TO CANDIDATES**

This paper is divided into three sections, **A B** and **C**, carrying respectively: Multiple Choice Questions (**MCQs**), Short Answer Questions (**SAQs**) and Long Answer Questions (**LAQs**).

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 9 Printed Pages. Please Turn Over.

## SECTION A MULTIPLE CHOICE QUESTIONS 20 MARKS

1. In decalcification, formation of a precipitate after addition of ammonium oxalate indicates;

- A) **Traces of calcium**
- B) Substantial amounts of calcium
- C) Absence of calcium
- D) Decalcifying fluid is basic

2. Blood is considered a connective tissue because

- A) It connects parts of the body together
- B) It provides support
- C) **Arises from mesenchymal tissue and has a non-living fluid matrix**
- D) It contains fibroblasts

3. Iron hematoxylin:

- A) Enhances the combination of the dye with the nucleus
- B) **Colors the nucleus black**
- C) Used for progressive staining
- D) Used for regressive staining

4. Refers to the fact that an epithelium tissue has only one layer of cells

- A) Stratified
- B) Cuboidal
- C) **Simple**
- D) Pseudostratified

5. Which chemical is the most commonly used as a fixative for pathological specimens?

- A) Picric acid
- B) Mercuric chloride
- C) Ethanol
- D) **Formaldehyde**

6. Which of the following tissue types controls body functions?

- A) Blood
- B) **Nervous tissue**
- C) Muscular tissue
- D) Epithelial

7. Compound tissues is defined as

- A) **Different types of cells performing one function**
- B) Different types of cells which are different in structure and function
- C) Similar cells at different regions performing many functions
- D) Similar type of cells held together by connective tissue

8. Epithelium of the bronchi is

- A) Cuboidal
- B) Simple cuboidal
- C) Simple squamous
- D) **Pseudo stratified ciliated columnar.**

9. The element of a synapse which contains neurotransmitter prior to release is called the:

- A) Synaptic cleft
- B) presynaptic membrane
- C) postsynaptic membrane
- D) **synaptic vesicle**

10. A site of communication between neurons is called a:

- A) axon
- B) dendrite
- C) **synapse**
- D) cell body

11. The gap between two adjacent myelin segments along an axon is called the:

- A) axolemma
- B) internode
- C) axonal cleft
- D) **Node of Ranvier**

12. The process observed when intracytoplasmic enzymes are responsible for tissue degradation

- A) Anoxia
- B) Putrefaction
- C) Osmotic injury
- D) **Autolysis**

13. The portion of a nerve cell which contains the nucleus and most of the metabolic machinery is called the:

- A) Axon
- B) dendrite
- C) synapse
- D) **cell body**

14. This process facilitates easy handling and storage

- A) Deparaffinization
- B) Hydration
- C) Dehydration
- D) **Mounting**

15. Skeletal muscle fibers are best described as:

- A) **multinucleate "cellular" units.**
- B) subcellular bundles of contractile filaments.
- C) motor axons.

D) long protein molecules.

16. How is a pseudostratified epithelium different from a truly stratified tissue?

- A) The nuclei are at the same level in pseudostratified epithelia.
- B) The apical and basal surfaces are aligned.
- C) There are multiple cell layers in pseudostratified epithelia.
- D) **All the cells in a pseudostratified epithelium interact with the basement membrane.**

17. All of the following are natural dyes EXCEPT:

- A) Saffron
- B) Hematoxylin
- C) **Brazilin**
- D) Carmine

18. During the preparation of a routine H&E slide, what step occurs after the tissue is preserved?

- A) Fixation
- B) Embedding in paraffin
- C) Slicing
- D) **Dehydration**

19. The following factors are characteristic of fixatives EXCEPT

- A) Arrests autolysis
- B) **Activates bacterial decomposition**
- C) Minimizes loss of soluble cellular components
- D) Stabilizes tissue for further processing

20. Functional division of the nervous system responsible for the physiological changes seen during exercise

- A) Somatic
- B) **Autonomic**
- C) Enteric
- D) central

## **SECTION B: SHORT ANSWER QUESTIONS (40 MARKS)**

1. What are the qualities of a good histological fixative? (5 mks)

- i. Cause the death of cells / tissues without distortion
- ii. Stop putrefactive and autolytic changes
- iii. Coagulate diffusible substances to prevent further diffusion from the cells, thus making them insoluble.
- iv. Raise the refractive indices of the cells/tissues.
- v. Prepare the cells / tissues to withstand subsequent treatments during the tissue processing
- vi. Facilitate tissue/ cell straining.

2.Enumerate the functions of connective tissues (5Mks)

- ✓ Binding and support.
- ✓ Protection.
- ✓ Insulation.
- ✓ Storage of reserve fuel.
- ✓ Transporting substances within the body.

3. Describe the chemical method of determining the end point of decalcification (5Mks)

- i. Take 5 mls of the decalcifying fluid and put into a test tube
- ii. Drop a piece of blue lithmus paper, it will turn red
- iii. Add strong ammonia drop by drop till the lithmus paper turns blue again
- iv. Add 1 ml of 5% ammonium oxalates solution and allow to stand for 30 minutes and look for turbidity

Presence of turbidity indicates decalcification is incomplete

4.Describe the process “bringing sections to water”. (5mks)

It applies to tissue sections processed with molten paraffin wax. It is done prior to staining of tissue sections.

Bringing sections to water involves subjecting tissue sections to temperatures above the melting point of paraffin wax.

The melted tissue sections are taken to a bath of xylene to dissolve the already melted wax After Xylene the sections are taken to a bath of alcohol to get rid of xylene which is not miscible with water given that most stains are water soluble.

The sections are then taken through descending grades of alcohol concentrations e.g. 90% through to 50% then water then the sections are stained as per the staining protocol

5. a) Outline the types of hematoxylin dyes [2mks]

- ✓ Iron haematoxylin
- ✓ Aluminum hematoxylin

b) Highlight the differences between the two types of hematoxylin 8 mks

Iron hematoxylin	Alumn Hematoxylin
<ol style="list-style-type: none"> <li>i. Stains the nucleus black</li> <li>ii. Uses iron as thee mordant</li> <li>iii. Makes permanent preparations</li> <li>iv. Mordant and stain are separate</li> </ol>	<ol style="list-style-type: none"> <li>i. Stains the nucleus blue</li> <li>ii. Uses Alumn as the mordant</li> <li>iii. The preparations fade away with time</li> <li>iv. Mordant and stain are in one solution</li> </ol>

6.a) List the different tissues cells making up the human body (4Mks)

- ✓ Muscle tissue
- ✓ Nerve tissue
- ✓ Epithelial tissue
- ✓ Connective tissue

b) Classify neurons based on their functions [6mks].

- i. Sensory Neurons - The neurons that conduct impulses from the receptors or sense organs to the central nervous system
- ii. Motor Neurons- The neurons that conduct impulses from the central nervous system to the effectors (muscles or glands)
- iii. Interneurons or Connecting Neurons - The neurons present in the brain that connect the sensory and the motor neurons

### **SECTION C: LONG ESSAY QUESTIONS**

1. Describe the cell block technique for cytological samples indicating its advantages and disadvantages as opposed to conventional smear technique [20mks]

#### **Procedure 10 mks**

- i. Take residual sample and transfer to a test tube
- ii. Centrifuge at 4000 revolutions per minute for 6 minutes
- iii. Discard the supernatant
- iv. Wrap the deposit properly in a filter paper and fix in formalin
- v. Process like any other paraffin specimen
- vi. Section in microtome
- vii. Stain the slide with H and E
- viii. Observe microscopically for characteristic features

#### **Advantages 7Mks**

Slides are more readily interpretable by histopathologists

Availability of block facilitates more sections

Cells are concentrated in a small area of the slide, so examination is less time consuming

Special stains can be done

Recognition of tumour cells is possible

Cell block is simple reproducible and readily available

No need of biopsy

Storage of cell blocks is easy

### **Disadvantages 3mks**

Takes longer time compared to conventional cytology

Sparse cellularity

Distortion artifacts

1. Discuss in detail the protocol of tissue processing utilizing molten paraffin wax. (20 Mks)

Tissue processing by molten paraffin wax involves the following procedures

- i. Dehydration
- ii. Clearing
- iii. Infiltration
- iv. Embedding

### **Dehydration**

This is the removal of water from the tissues either which occurs naturally, the water which comes from the fixative and/or the water used to wash the tissue. This is done by the use of reagents called dehydrating agents such as Ethanol, Butylalcohol, Methanol, Isopropyl alcohol, Acetone, Ether, Cellosolve (ethylene monoglucal ether), Dioxin

The dehydration procedure is that it should start with the low -grade alcohols and ascend to absolute alcohol. I.e. 70% - 90% - 95% - 100% this is done to effect the gradual removal of water and thus avoid sudden shrinkage of the cells and secondly to avoid the rupture of the cells. The water is removed since it is immiscible with the paraffin wax which is to be used at a later stage.

### **Clearing (de-alcoholization)**

The purpose of this stage is the removal of alcohol from tissues which was used during dehydration. This is because the alcohol is immiscible with the molten paraffin wax. The clearing agent also raises the refractive index. It also makes the tissue translucent. The following are examples of clearing agents: -- xylene ( xylol), benzene, chloroform, toluene, clove oil, cedar woodoil

Clearing agents are also called anti - medium and have the following characteristics:

- 1) are volatile
- 2) are very flammable
- 3) are toxic

The only exception which is not flammable is chloroform

### **Infiltration (Impregnation)**

This stage involves the treatment of tissues with molten paraffin wax. Tissues are infiltrated for 2 reasons:

- a) To remove (displace) the clearing agent
- b) To allow the molten paraffin wax to penetrate and tissue and provide internal support to the tissue when allowed to solidify.

### **Blocking (Embedding)**

After infiltration of tissues with molten paraffin wax, it is necessary to obtain a solid block of wax containing the tissue. This is done by putting a drop of molten paraffin wax in the embedding mould, placing the tissue on the wax and ensuring that the tissue is lying in the right

plane to be sectioned and finally the mold being filled with wax. Care must be taken to make sure there are no air bubbles in the wax during blocking; on solidifying air bubbles leave air spaces. The wax is then left to cool to room temperatures in the mould. Solidification of the wax to form smaller crystals and improves sectioning characteristics. After the block of wax cools, it is attached to a wooden block to allow its attachment to the microtome block holder as follows:

A layer of molten wax is built up on the surface of the wooden block to allow its attachment to the microtome block holder as follows:

A layer of molten wax is built up on the surface of the wooden block and allowed to cool.

The block is then pressed onto this hardened wax and fused with it with the aid of a heated metal.

NB: Care must be taken to press only very slightly with the forefinger and to perform the whole operation as speedily as possible to avoid softening the wax in which object is embedded. Label the specimen accordingly.

### **Mark distributions**

**1 mk for every correct outline of procedure = 4mks**

**4Mks for correct description for each step = 16 mks**

**Total 20Mks**

3. Classify and describe the various epithelial tissues (20 mks)

Epithelial tissues are classified by cell shape and the number of cell layers.

There are three principal cell shapes associated with epithelial cells:

- ✓ Squamous epithelium
- ✓ Cuboidal epithelium
- ✓ Columnar epithelium.

There are three ways of describing the layering of epithelium:

- ✓ Simple
- ✓ Stratified
- ✓ Pseudostratified

Epithelial tissue is described with two names. The first name describes the number of cell layers present and the second name describes the shape of the cells. Epithelial cells are therefore classified into;

- i. Simple squamous epithelium - cells are flat in shape and arranged in a single layer. This epithelial type is found in the walls of capillaries, linings of the pericardium, and the linings of the alveoli of the lungs.
- ii. Simple cuboidal epithelium - consists of a single layer cells that are as tall as they are wide. This epithelial type is found in the small collecting ducts of the kidneys, pancreas, and salivary glands.
- iii. Simple columnar epithelium - is a single row of tall, closely packed cells, aligned in a row. These cells are found in areas with high secretory function such as the wall of the stomach, or absorptive areas as in small intestine.
- iv. Pseudostratified epithelium also ciliated pseudostratified epithelium - These are simple columnar epithelial cells whose nuclei appear at different heights, giving the misleading (hence pseudo) impression that the epithelium is stratified when the cells are viewed in cross section. Found in the airways (nose, bronchi), but is also found in the uterus and fallopian tubes of females, where the cilia propel the ovum to the uterus.



- v. Stratified squamous epithelium – Consists of two or more layers of squamous cells. Are mainly found in Linings of the esophagus, mouth, and vagina. it Protects against abrasion
- vi. Stratified cuboidal epithelium - consists of two or more layers of cuboidal cells. Are found in Sweat glands, salivary glands, and mammary glands.
- vii. Stratified columnar epithelium - consists of two or more layers of columnar cells. Are found in male urethra and the ducts of some glands

**Marks distribution**

**1 mark for each correct classification = 6 Marks**

**2 marks for each correct description for the 7 types = 14 marks**

**Total 20 marks**