



UNIVERSITI KUALA LUMPUR
INSTITUTE OF MEDICAL SCIENCE TECHNOLOGY

FINAL EXAMINATION
OCTOBER 2025 SEMESTER

COURSE CODE : HDB10102
COURSE TITLE : CELL BIOLOGY
PROGRAMME NAME : BACHELOR OF BIOMEDICAL SCIENCE (HONOURS)
DATE : 03 FEBRUARY 2026
TIME : 9:00AM - 11:00AM
DURATION : 2 HOURS



INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of TWO sections.
4. Answer ALL questions for Section A.
5. Section B consist of four questions. Answer THREE (3) questions only.
6. Please write your answer on the answer booklet provided.
7. Please answer all questions in English only.
8. Please answer MCQ/EMQ questions using OMR sheet. *Tick if applicable*
9. Refer to the attached Formula/ Appendies. *Tick if applicable*

THERE ARE 17 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 40 marks)

Answer ALL questions.

Please use the answer booklet provided.

1. Permanent inhibition of mitochondrial division in a muscle cell would most likely lead to which of the following outcomes?
 - A. Enhanced glucose uptake activity.
 - B. It will weaken the removal of damaged mitochondria.
 - C. ATP production will increase.
 - D. It will increase efficiency of protein synthesis in RER.

2. Failure of mitotic spindle attachment to a chromosome during prometaphase will activate which checkpoint?
 - A. Telophase checkpoint.
 - B. G1 checkpoint.
 - C. Metaphase checkpoint.
 - D. G2 checkpoint.

3. A mutation in cyclin-dependent kinases (Cdks) would most likely result in which of the following?
 - A. Formation of the contractile ring during cytokinesis.
 - B. Synapsis during meiosis I.
 - C. DNA replication during S phase.
 - D. Regulation of phase transitions and checkpoints.

4. Which of the following best explains the importance of apoptosis in development and the consequence of its failure during tissue remodeling?
- A. Increased cell adhesion and stability.
 - B. Improved organ function.
 - C. Enhanced immune response.
 - D. Uncontrolled cell proliferation and malformed tissues.
5. Which observation would best support the claim that the basement membrane is critical for tissue integrity?
- A. It will increase the rate of glycolysis.
 - B. Tissues lacking it show poor cell adhesion and disorganization.
 - C. It contains mitochondrial DNA.
 - D. Cells will migrate faster without it.
6. A patient has a defect in cytochrome c oxidase (Complex IV). Which phase of cellular respiration would be most directly affected?
- A. TCA cycle
 - B. Acetyl-CoA formation
 - C. Electron transport chain
 - D. Glycolysis
7. Which filament type would be most critical for maintaining cell shape against mechanical stress in skin cells?
- A. Membrane filament
 - B. Microtubules
 - C. Intermediate filaments (keratin)
 - D. Microfilaments

8. If caspases are inhibited, which apoptotic event would be directly prevented?
- A. ATP production.
 - B. Microtubule polymerization.
 - C. DNA replication.
 - D. Cell shrinkage and bleb formation.
9. Which event occurs in meiosis I but not in mitosis?
- A. Formation of a contractile ring.
 - B. Nuclear envelope breakdown.
 - C. Separation of sister chromatids.
 - D. Synapsis and genetic recombination between homologous chromosomes.
10. Which evidence most strongly supports the statement: "Intermediate filaments are less dynamic than microtubules and microfilaments"?
- A. They do not require ATP or GTP for assembly/disassembly.
 - B. They are involved in muscle contraction.
 - C. They have polarity and motor proteins move along them.
 - D. They are assembled from tubulin subunits.
11. If a vesicle needs to move from the cell center to the periphery, which motor protein and cytoskeletal track would be used?
- A. Dynein on microtubules toward the minus end.
 - B. Dynein on actin filaments toward the minus end.
 - C. Myosin on actin filaments toward the plus end.
 - D. Kinesin on microtubules toward the plus end.

12. The primary role of the Bcl-2 family of proteins is to _____.
- A. regulate the intrinsic pathway of apoptosis
 - B. act as caspases in the extrinsic pathway
 - C. synthesize components of the ECM
 - D. form the contractile ring during cytokinesis
13. Predict the outcome if actin treadmilling is blocked in a migrating cell. Which process would be most affected?
- A. Chromosome separation in mitosis.
 - B. RNA transport along microtubules.
 - C. Organelle positioning.
 - D. Lamellipodium formation and cell movement.
14. A researcher observes a vesicle budding from the Trans Golgi Network with a clathrin coat. Select the most likely destination for this vesicle.
- A. It will enter the Endoplasmic Reticulum system.
 - B. To become a lysosome.
 - C. It will go to plasma membrane for exocytosis.
 - D. It will go to the mitochondrial matrix.
15. Which concept is most strongly supported by the observation that all cells use the same basic molecules (DNA, RNA, ATP) and similar metabolic pathway?
- A. Cell compartmentalization.
 - B. The endosymbiotic theory.
 - C. The common ancestry of all cells.
 - D. The fluid-mosaic model.

16. If a mutation made the inner mitochondrial membrane freely permeable to all small molecules, which specific process of ATP generation would be most severely affected?
- A. The conversion of pyruvate to Acetyl-CoA.
 - B. Glycolysis process.
 - C. The Krebs (TCA) cycle.
 - D. The function of ATP synthase.
17. A cell is placed in a solution with a high concentration of a large, uncharged polar molecule that cannot cross the membrane passively. The cell begins to swell. Which of the following is the most plausible explanation for this phenomena?
- A. The solute is entering the cell via simple diffusion.
 - B. The solution is hypotonic, and water is entering the cell via osmosis.
 - C. The solute is being actively transported out of the cell.
 - D. The solution is hypertonic, causing water to leave the cell.
18. Determine the fundamental cellular property that is structurally similar in both prokaryotic and eukaryotic cells.
- A. The process of cell division (mitosis/meiosis).
 - B. The use of a complex cytoskeleton for intracellular transport.
 - C. The segregation of genetic material within a membrane-bound nucleus.
 - D. The utilization of an electron transport chain for energy generation.
19. The centrosome is the organizing center for _____ cytoskeletal filament.
- A. microfilaments
 - B. microtubules
 - C. keratin filaments
 - D. intermediate filaments

20. During which phase of mitosis do the sister chromatids separate and move toward opposite poles?
- A. Metaphase
 - B. Telophase
 - C. Anaphase
 - D. Prophase
21. Where does the hydrogen atom that forms water during oxidative phosphorylation come from?
- A. Reduced flavin adenine dinucleotide (FADH₂)
 - B. Adenosine diphosphate (GDP)
 - C. Phosphoenolpyruvate (PEP)
 - D. Guanosine diphosphate (GDP)
22. A new single-celled organism is discovered. It has a nucleus, mitochondria, and its genetic material is organized in multiple linear chromosomes. However, it lacks a Golgi complex. Based on this information, which cellular process would be most directly impaired?
- A. Protein modification and sorting process.
 - B. ATP synthesis.
 - C. Lipid synthesis for the plasma membrane.
 - D. DNA replication.
23. Which of the following is a characteristic of microtubules?
- A. Has two distinct ends, called the plus (+) and minus (-) ends.
 - B. Involved in muscle contraction.
 - C. Composed of keratin filaments.
 - D. Made up of actin filaments.

24. Actin filaments _____.
- A. are found in the centre of flagella and cilia
 - B. are also known as microtubules
 - C. are made of different kinds of components in different tissues
 - D. able to assemble and disassemble from component proteins
25. The sodium-potassium pump in neurons, pumps _____.
- A. Na^+ into the cell and K^+ out of the cell
 - B. Na^+ and K^+ into the cell
 - C. Na^+ and K^+ out of the cell
 - D. Na^+ out of the cell and K^+ into the cell
26. The separation of organelles or vesicles derived from different organelles is called _____.
- A. cell ostentation
 - B. binary fission
 - C. cell division
 - D. subcelular fractionation
27. The function of cholesterol in the phospholipid molecules of the cell membrane is to _____.
- A. enhance the permeability of a membrane
 - B. regulate the fluidity of a membrane
 - C. act as receptor to foreign bodies
 - D. act as cell to cell recognition sites

28. The pairing of homologous chromosomes during Prophase I of Meiosis is called _____.
- A. synapsis
 - B. cytokinesis
 - C. checkpoint
 - D. apoptosis
29. Cell biologist have introduced radioactively labelled carbohydrates, fats, and amino acids to living cells, allowed time for cell metabolism, and then disrupted the cells in a blender, separating out the various cell organelles from the cytoplasm. They found that the radioactive molecules could soon be detected as part of various cellular compounds, although the visible cell structures appeared unchanged. This leads for a conclusion of _____.
- A. radioactivity was transferred from the introduced molecules to the resident stable molecules
 - B. molecules diffuse at random through the cytoplasm and into cell organelles
 - C. the carbohydrates, fats and amino acids are used only for energy
 - D. most cell components are constantly being broken down and rebuilt
30. A cell line is engineered to inhibit function of peroxisomes. In which cellular function would you expect to be affected?
- A. The synthesis of steroid hormones.
 - B. The detoxification of alcohol in liver cells.
 - C. The initial glycosylation of proteins.
 - D. The degradation of old, worn-out organelles.

31. Which of the following is the cell component of the cell-cycle control system.
- I. Caspases
 - II. Checkpoints
 - III. Cyclins
 - IV. Cyclin-dependent kinases (Cdks)
- A. I, II and IV.
 - B. I, III and IV.
 - C. II, III and IV.
 - D. I, II and III.
32. Which of the following organelles able to replicate on its own?
- I. Deoxyribonucleic acid (DNA)
 - II. Ribosome
 - III. Chloroplast
 - IV. Mitochondria
- A. I, II, III and IV.
 - B. I, II and IV only.
 - C. I, III and IV only.
 - D. I, II and III only.
33. Which of the following is **TRUE** about cellular respiration?
- I. A molecule of glucose yields 38 net ATP in liver cells.
 - II. Energy in the form of ATP is produced only in Krebs cycle.
 - III. Pyruvate is produced in cytoplasm and transported into mitochondria to be oxidized.
 - IV. For each pair of electrons that is transferred from FADH_2 to oxygen, 2 ATP are produced.
- A. I, III and IV only.
 - B. I, II, III and IV.
 - C. I, II and III only.
 - D. I, II and IV only.

34. Why is it important for the daughter cells to divide a second time during meiosis?
- A. The second division switches parts of matching chromatids to increase genetic variation.
 - B. The second division forms four identical cells to ensure that all offspring have the same traits.
 - C. The second division forms haploid cells that can combine with other haploid cells during fertilization to increase genetic variation.
 - D. The second division sorts chromosomes into cells that are the same as the parent cells.
35. Which of the following were the first to propose that cell membranes are phospholipid bilayers?
- A. H. Davson and J. Danielli.
 - B. C. Overton and I. Langmuir.
 - C. S. Singer and G. Nicolson.
 - D. E. Gorter and F. Grendel.
36. Choose **TWO (2)** major proteins that make up tight junctions, which are cellular junctions that prevent fluid from travelling between cells and generally contribute to morphology by holding cell together.
- A. Claudins and adherins.
 - B. Claudins and occludins.
 - C. Connexins and integrins.
 - D. Occludins and connexins.

37. A patient is found to have a defect in his intermediate filament. Which of the following cellular junctions might be affected in this patient?
- I. Desmosomes
 - II. Gap junctions
 - III. Hemidesmosomes
- A. II and III only.
 - B. I, II and III.
 - C. I and II only.
 - D. I and III only.
38. Cells can be described as having a cytoskeleton of internal structures that contributes to the shape, organization, and movement of the cell. Which of the following are part of the cytoskeleton?
- I. Actin
 - II. Microtubules
 - III. Microfilaments
 - IV. Nuclear envelop
- A. I, II, III and IV.
 - B. I, II and III only.
 - C. I and II only.
 - D. II and III only.
39. Which of the following is **TRUE** regarding desmosomes and hemidesmosomes?
- A. Both are linked to the same cytoskeletal filament.
 - B. Desmosomes can only be found in epithelial cells.
 - C. The cell adhesion molecule integrin is used in both junctions.
 - D. Desmosomes are cell-matrix junctions, whereas hemidesmosomes are cell-cell junctions.

40. Which lipid is known for playing an important role in facilitating the activity of proteins involved in ATP synthesis in mitochondria and can be found in bacteria?
- I. Cardiolipin
 - II. Phosphatidyl inositol
 - III. Phosphatidic acid
 - IV. Diphosphatidylglycerol
- A. II and III only.
 - B. I, II, III and IV.
 - C. I and IV only.
 - D. I and II only.

SECTION B (Total: 60 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

Compare the structural and functional differences between microtubules, intermediate filaments, and microfilaments with further explanation of how each type of filament contributes to cell shape, motility, and intracellular transport.

(20 marks)

Question 2

The cyclins and Cdks of cell cycle checkpoints is important in maintaining genomic stability.

(a) Explain the roles of cyclins and Cdks in checkpoint regulation.

(8 marks)

(b) Predict the consequences if the G2 checkpoint fails before mitosis.

(6 marks)

(c) Predict the consequences if the metaphase checkpoint fails during mitosis.

(6 marks)

Question 3

Answer the questions below:

- (a) Compare and contrast the structural and functional roles of collagen and proteoglycans in the extracellular matrix (ECM).

(15 marks)

- (b) Explain how do their distinct properties contribute to the overall mechanical and biochemical functions of the ECM?

(5 marks)

Question 4

Answer the questions below:

- (a) Figure below shows the structure of a mitochondria. Name the parts labelled A, B, C, D and E.

Refer Below - Figure1 : Structure of a mitochondria .

(5 marks)

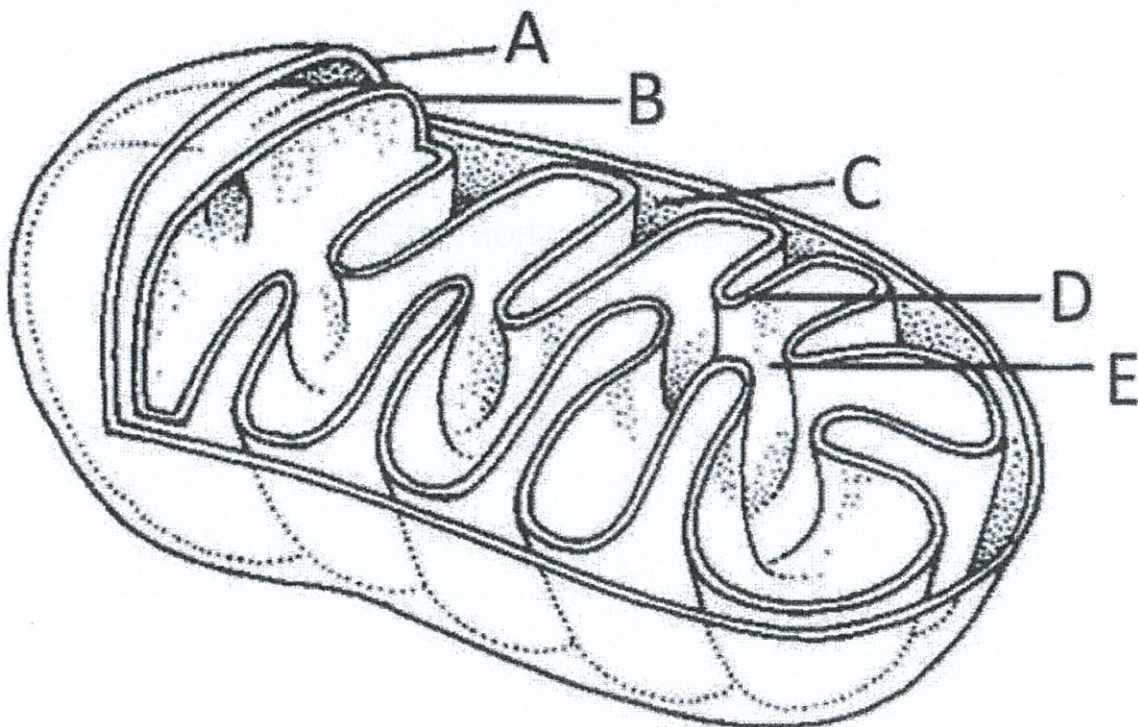


Figure 1: Structure of a mitochondria

- (b) State where do the following reactions take place in a eukaryotic cell.

i. Glycolysis

(2 marks)

ii. The link reaction

(2 marks)

iii. Kreb's cycle

(2 marks)

(c) Explain how hydrogen ions (H^+) enters from E to C, and travel back to E again to generate ATP.

(5 marks)

(d) State how much CO_2 is produced during glycolysis.

(2 marks)

(e) Name **TWO (2)** products of glycolysis.

(2 marks)

END OF EXAMINATION PAPER

