

A. **Multiple choice** (2% each, total 30%. Please choose the BEST answer)

1. Which of the following microscope is the best for visualization of mitochondria?
 - A. phase-contrast microscope
 - B. fluorescent microscope
 - C. light microscope
 - D. Transmission electron microscope (TEM)
2. What is the purpose of fetal bovine serum (FBS) in a cell culture experiment?
 - A. provide an optimal pH
 - B. for detachment of cell
 - C. provide growth factors for cell division
 - D. provide antibodies to kill bacteria/virus
3. Which of the following equipment can examine global RNA expression profile?
 - A. electron microscope
 - B. MALDI-TOF
 - C. HPLC
 - D. Next generation sequencer (NGS)
4. Which of the followings is correct about animal cell membrane?
 - A. amphiphilic
 - B. protein can diffuse through the membrane easily
 - C. composed of single lipid layer
 - D. contain cellulose cell wall
5. Which of the followings does not exist in animal cell membrane?
 - A. phospholipid
 - B. membrane protein
 - C. cholesterol
 - D. cellulase
6. Which of the following molecule is mainly found in cytosolic face of animal cell membrane?
 - A. Phosphatidyl-choline, PC
 - B. Phosphatidyl-serine, PS
 - C. Cholesterol
 - D. carbohydrate

7. Which of the following properties of cell membrane can be used to detect programmed cell death (apoptosis)?
- A. phosphatidyl-choline (PC) can be found in exoplasmic face
 - B. phosphatidyl-serine (PS) can be found in cytosolic face
 - C. cholesterol can be found in both face of cell membrane
 - D. phosphatidyl-inositol (PI) can be phosphorylated to be form PIP₂
8. Which of the following transporter require ATP?
- A. P-glycoprotein (MDR1)
 - B. Na/glucose symporter
 - C. GLUT2 glucose uniporter
 - D. potassium channel
9. Which of the following transporter does not require ATP?
- A. ABC transporter
 - B. Na/K pump
 - C. acetylcholine-gated Na⁺ channel
 - D. proton pump
10. Which of the following event occur at S phase of the cell cycle?
- A. formation of pre-replicative complexes
 - B. DNA replication
 - C. phosphorylation of Rb
 - D. activation of cyclin D-CDK 4
11. Which of the following is a G1 cyclin?
- A. Cyclin A.
 - B. Cyclin B
 - C. Cyclin C
 - D. Cyclin D
12. At what phase of the cell cycle will chromosome aligned at the equator of the spindle
- A. prophase
 - B. metaphase
 - C. anaphase
 - D. telophase

13. What is p53?
 - A. receptor
 - B. growth factor
 - C. transcription factor
 - D. cytoskeleton
14. Which of the following is a tumor suppressor gene?
 - A. Src
 - B. Ras
 - C. Rb
 - D. HER2
15. Which of the following protein is related to apoptosis?
 - A. Caspase
 - B. Wee1
 - C. E-cadherin
 - D. P-glycoprotein (MDR1)

B. Short Question (70%)

1. What is intrinsic apoptosis? (5%)
2. What is the role of cyclin, Rb and E2F in cell cycle progression? (5%)
3. What is EMT (epithelial mesenchymal transition) in cancer metastasis? (5%)
4. Describe the structure and function of intestinal cell for glucose uptake? (5%)
5. Please describe the biological function of (A) Ran; (B) Rab; (C) Rac. (9 points)
6. Compare and contrast the function of α -tubulin, β -tubulin and γ -tubulin. (9 points)
7. Both γ -interferon and tumor necrosis factor α (TNF α) are cytokines, but they act via different pathways to induce cellular responses. Please describe the pathways in details and starting from the structure of their receptors. (16 points)
8. How to activate following molecules? (A) Protein kinase C; (B) Arf protein; (C) ATF6. (9 points)
9. What is SRP (signal recognition particle)? Please describe the cellular event mediated by SRP. (7 points)