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

1. Which of the following microscope is the best for viewing cells in tissue culture?
   A. light microscope
   B. fluorescence microscope
   C. Phase contrast microscope
   D. Transmission electron microscope (TEM)

2. What is the purpose of fetal bovine serum (FBS) in a cell culture experiment?
   A. provide nutrients such as glucose
   B. for cell passage
   C. provide growth factors for cell division
   D. provide antibodies to protect the cells

3. Which of the following experiment is the best for studying chromosome number changes?
   A. cDNA microarray
   B. Real time RT-PCR
   C. comparative genomic hybridization (CGH)
   D. Chromatin immunoprecipitation (ChIP)-PCR

4. Which of the followings is/are correct about phospholipid in animal cell membrane?
   A. amphiphilic
   B. a polar head with 2 carbon tails
   C. form bilyer in aqueous solution
   D. All of the above
   E. none of the above

5. Which of the followings does not exist in animal cell membrane?
   A. phospholipid
   B. membrane protein
   C. cholesterol
   D. all of the above
   E. none of the above

6. Which of the following lipid is mainly found in cytosolic face of animal cell membrane?
   A. Phosphatidyl-choline, PC
   B. Phosphatidyl-serine, PS
   C. Cholesterol
   D. All of the above
   E. none of the above

7. Which of the following properties of cell membrane can be used to detect programmed cell death (apoptosis)?
   A. phophatidyl-choline (PC) can be found in exoplamic face
   B. phosphaidyl-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
   E. none of the above

8. Which of the following transporter(s) require ATP?
   A. ABC transporter
   B. Na/glucose symporter
   C. GLUT2 glucose uniporter
   D. All of the above
   E. None of the above

9. Which of the following transporter(s) do(es) not require ATP?
   A. ABC transporter
   B. V-type pump
   C. acetylcholine-gated Na+ channel
   D. B & C only
   E. None of the above

10. Which of the following membrane protein is important for maintaining cell volume in red blood cell?
   A. Na+ leak channel
   B. Na+/K+ ATPase
   C. ABC transporter
   D. Aquaporins
   E. CFTR

11. Which of the following will not occur at G1 phase of cell cycle?
   A. formation of pre-replicative complexes
   B. degradation of Cdc6
   C. phosphorylation of Rb
   D. activation of cyclin D-CDK 4
   E. none of the above

12. Which of the following is a G1 cyclin?
   A. Cyclin A.
   B. Cyclin B
   C. Cyclin C
   D. Cyclin D
   E. None of the above

13. Which of the following mutation can generate a Giant *S. pombe*?
    A. activating mutation of Wee1
    B. inactivating mutation of p53
    C. activating mutation of Cdc25
    D. activating mutation of CAK
    E. none of the above

14. Which of the following mutation can generate a tiny *S. pombe*?
    A. activating mutation of Wee1
    B. inactivating mutation of p53
    C. activating mutation of Cdc25
    D. activating mutation of CAK
    E. none of the above

15. Chromosomal DNA is replicated only once /cell cycle because
    A. assembly of replication complex only at M phase where Cyclin B-CDK is low
    B. presence of Rb tumor suppressor to control cell cycle check point only once/cell cycle
    C. replication initiate only once during cell cycle where S phase cyclin activity is high
    D. Amount of DNA polymerase is tightly controlled during cell cycle
    E. all of the above

B. Short Question (total 70%)

1. Please ***illustrate*** what is intrinsic and extrinsic pathway of apoptosis? How do they relate to each other? (10%)
2. What is cancer? How does it arise? What is its relationship with cell cycle progression? (10%)
3. Compare and contrast GPCR (G-protein-coupled receptor) and Smoothened in items of structure, location, and the signal pathways they involved. (12%)
4. Compare and contrast clathrin and V-SNARE in terms of their biological function. (8%)
5. What is the role of mitochondrial Hsp70? (4 %)
6. What is the unfolded protein response? (5 %)
7. Compare and contrast dynein and Tau protein in terms of function. (8%)
8. Compare and contrast desmosomes and hemidesmosomes. (8 %)
9. When a molecule is found to contain repeating amino sugar (*N*-acetylglucosamine or *N*-acetylgalactosamine) and a uronic acid (glucuronic or iduronic) disaccharide sequence, what kind of molecule it is? What biological role does it play? (5 %)