Maulana Azad College

# Department of Microbiology

MCB-A-CC-2-3

## SEMESTER 2

**Unit wise model questions for CC-3 (BIOCHEMISTRY)** **Credit :4**

## Unit 1: Bioenergetics

**Very short questions (1 mark)**

1. There are certain compounds inside cell which have higher phosphoryl group transfer potential than ATP. Cite two examples of such compounds.
2. Explain the significance of the prime notation in the expression of free energy for biological systems?
3. Which one will undergo a higher change in entropy by a given amount of heat, a hot body or a cold body? Explain
4. Give one biologically relevant example each of an open system and a closed system.
5. Define standard free energy change of a reaction.
6. Draw the structure of a typical thioester and show the high energy bond.
7. What does a value of zero free energy indicate for a particular reaction?
8. Why is heat engine not a significant term for biological systems?

**Short questions (2 marks)**

1. ATP is known as a universal energy currency inspite of the presence of compounds having higher phosphoryl group transfer potential. Justify.
2. Why is work considered to be a path function?
3. What is metabolic charge transfer ratio?
4. Explain why in case of biological systems, the concentration of solutes is a major determinant of free energy change.
5. State the limitations of the first law of thermodynamics.
6. Explain intrinsic and extrinsic variables with examples.
7. Why will hydrolysis of ATP to ADP and Pi yield more free energy than that of ADP to AMP and Pi (assuming this hydrolysis to be occurring)?
8. What do you mean by a proper thermodynamic variable?
9. Highly ordered macromolecules are synthesized inside cells. Is it in accordance with the second law of thermodynamics? Explain

**Broad questions (greater than 2 marks)**

1. Define enthalpy. Show that under constant pressure, the enthalpy change of a system is equal to heat gained/lost by the system.

(1+3)

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2. Arrive at a definition of free energy from the concept of entropy and second law of thermodynamics. (3)
3. Certain steps in metabolic pathway have a high positive free energy change whereas in case of certain others it is either close to zero or very slightly positive. Explain in each case the cellular strategy to drive these reactions in the forward direction?

(2+2)

4. Glucose 6 phosphate was hydrolysed enzymatically (at pH 7 and 25°C ) to glucose and inorganic phosphate . The concentration of glucose-6-phosphate was 0.1 M at the start. At equilibrium, only 0.05% of the original glucose-6-phosphate remained. Calculate a) $K(prime)_{eq}$ for the hydrolysis of glucose-6 phosphate (b) ΔG(prime) for the hydrolysis reaction.

(2+2)

5. State the ways by which ATP is regenerated inside the cell. (3)
6. In glycolysis, the enzyme phosphofructokinase I catalyses the following reaction
7. Frutose-6-phosphate + ATP = Fructose 1,6 bisphosphate + ADP
8. Given the data below, calculate the equilibrium constant for the reactions R = 8.315 J/mol.K T = 25°C ATP to ADP + Pi Standard free energy change = -30.5 kJ/mole, Fructose 1,6 bisphosphate to fructose- 6-phosphate and Pi = -16 kJ/mole.
9. Glucose 6 phosphate was hydrolysed enzymatically (at pH 7 and 25°C) to glucose and inorganic phosphate . The concentration of glucose-6-phosphate was 0.1 M at the start. At equilibrium, only 0.05% of the original glucose-6-phosphate remained. Calculate a) $K(prime)_{eq}$ for the hydrolysis of glucose-6 phosphate (b) ΔG(prime) for the hydrolysis reaction.

(2+2)

10. Calculate the ΔpH across the inner mitochondrial membrane that is required at 25°C to drive the synthesis of ATP from ADP and Pi, under standard conditions?

(3)

## Unit 2: Carbohydrates

**Short questions (2 marks)**

1. Describe structure of starch with diagram.
2. What is mutarotation? How did it help in postulating cyclic structure of glucose?
3. About how many glucose molecules are present in an amylopectin molecule having average molecular weight of 275000?
4. Explain why sucrose is a non-reducing sugar.
5. Explain why monosaccharides are always reducing in nature. Mention the reaction.
6. Which structural features differentiate cellulose from starch and glycogen?
7. State the structural relationship between alpha D glucosamine and N-acetylglucosamine
8. What are the main biological functions of polysaccharides?
9. Compare epimers with anomers with example.
10. Name the i) units ii) bonds present in the following disaccharides….
    a) Lactulose b) cellobiose c) maltose d) sucrose e) trehalose

**Broad questions (4 marks)**

1. Draw the chair form of
   D-Glucose b) L- mannose c) D-Galactose d) D- fructose
2. Draw the Fischer projection formula of
   D-fructose b) D-Glucose c) L- mannose d) D-Galactose
3. Draw the Howrath projection formula of
   D- Sucrose b) D-Maltose c) D-Lactose

## Unit 3: Lipids

**Short questions (2 marks)**

1. Describe the structure of fatty acids.
2. Explain how saturated, monounsaturated, and polyunsaturated fatty acid structures differ from one another.
3. Predict how the number of carbons and the degree of unsaturation affect the melting points of fatty acids.
4. Explain how the structures of saturated and unsaturated triglycerides differ from one another.
5. Explain the difference in melting points of vegetable oils vs. animal fats.
6. What are eicosanoids? Give example.
7. Why stearic acid had a higher melting point than lauric acid.
8. Linolenic acid has a lower melting point than linoleic acid. Explain why.
9. What are complex lipid? Give example.
10. What are derived lipid? Give example.
11. How does a triglyceride obtained from plant differ from that of animal source?
12. Calculate the saponification number of palmitoylstearin. (M.W=862)
13. What are essential fatty acids?
14. Write down the structure of lecithin and cephalin.
15. What do you mean by Acid value of fat? Write its significance.
16. What is hardening of oil? How it is carried out?
17. Write the structure of glutathione. What is its function in cell?
18. What is volatile fatty acid number? Discuss its significance with example.
19. Write the structural features of palmitic acid.
20. What is saponification number? How it is determined?
21. Why most naturally occuring fatty acidscontain an even number of carbon atoms?

**Broad questions (greater than 2 marks)**

1. Describe the structure of waxes, how they are made, and the biological function of waxes.
2. Describe the general structure of triglycerides and list their biological functions.
3. Describe three reactions in which triglycerides are reactants.
4. Distinguish glycerophospholipids from sphingophospholipids.
5. Distinguish glyceroglycolipids from sphingoglycolipids.
6. Identify the structural component that is common to all steroids and identify three important members of this class of lipids.
7. Describe the structure and function of bile salts.
8. Describe the structure and function of lipoproteins. List different types of lipoproteins.

## Unit 4: Proteins

**Multiple choice questions (1 mark each)**

1. There are 10 amino acids in a peptide. In how many ways it can fold?
   A) 20 B)10 C) 1024 D) 512
2. A protein while getting folded is trapped in a local minimum. Estimate the amount of energy to bring it to its native structure.
   A)10-15 kJ/mole B) 2-5 KJ/mole C) 80-100 KJ/mole D) 0.1 -0.5 KJ/mole

3. An alpha helix is expected to be found in which protein?
   A)Cytosolic B) Membrane C) Organellar D) All of the above

4. Which amino acid is more commonplace than others in the active site of a protein
   A)Glycine B) Lysine C) Histidine D) Threonine

5. An antiparallel beta pleated sheet is stronger than a parallel one because
   A) It has more number of hydrogen bonds B) It has additional hydrophobic interactions among residues C)The hydrogen bond donors and acceptors are aligned linearly D) All of the above

6. Some proteins can denature if stored in low temperatures for long time. What is the most likely cause?
   A)Disruption of salt bridges B) Disruption of hydrogen bonding C) Stabilisation of a local minimum from a dynamic ensemble D) Decrease in hydrophobic effect

7. Which residue in a protein is most likely to form hydrogen bond with water
   A)Aspartate B) Lysine C) Histidine D) Serine

8. Two atoms approach each other from infinite separation. After a certain point, they will feel mutual attraction. The magnitude of this attraction varies inversely as
   A)Square of the distance of separation B) 6th power of the distance C) 3rd power of the

distance D) 12th power of the distance.

9. Peptide bonds possess

   A)Partial double bonded character B) a finite dipole moment C) Resonance D) All of the above

10. Biological activity of a protein is seen when the protein has attained atleast

    A)Primary structure B) Secondary structure C) Tertiary structure D) Quaternary structure

**Very short questions (1 mark each)**

1. Name two prospective amino acids capable of forming a salt bridge.
2. What does global energy minima of a protein represent?
3. What does HbS represent?
4. Name one achiral amino acid found in proteins?
5. Draw a dipeptide and show the phi and psi dihedral angles.
6. What does increasing number of hydroxyproline residues in a tropocollagen indicate?
7. Give an example of a covalent bond necessary to stabilize the tertiary structure of a protein.
8. Why is glutathione moderately stable to hydrolysis by peptidases?
9. State the mechanism of action of Gramicidin D?
10. Give an example of a coiled coil structure.

**Short questions (2 marks each)**

1. Several oil droplets poured on water coalesce to a single droplet immediately. This effect is even pronounced if the water is at higher temperature. Explain this behaviour.
2. What are $3_{10}$ helix and pi helix?
3. Explain the significance of glutathione as a cellular anti-oxidant.
4. Differentiate between a domain and a motif of a protein
5. Why is proline known as a helix breaker?
6. What is methemoglobin?
7. What is a zwitterions?
8. Why is alanine chiral but beta alanine achiral?
9. Catalytic sites of enzymes are often located in the loops rather than in ordered secondary structure elements. Explain.
10. State the mechanism of action of Gramicidin D.

**Broad questions (more than 2 marks)**

1. What are non-ribosomal peptides? How are they synthesized? (1+3)
2. What is 6-12 potential? Explain its significance in terms of protein folding. (2+2)
3. Discuss the forces responsible for stabilisation of secondary structure of a protein. (4)
4. What is a Ramachandran plot? Draw a typical plot and show the tentative co-ordinates of
5. alpha helix b) beta pleated sheet and c) poly glycine 2+ {1+1+1)
6. Explain Bohr effect with respect to haemoglobin molecule. (3)
7. Haemoglobin and Myoglobin have different structures depending upon differential needs. Explain. (3)

8. Draw the titration curves of aspartic acid and lysine and obtain an equation to determine the isoelectric pH in each case. (2+2)
9. Design a biochemical experiment by which you can distinguish between
    a) a free amino acid and a peptide
    b) b) a protein and a peptide

(2+2)

## Unit 5: Enzymes

**Very short questions (1 mark each)**

1. Why enzymes are called biological catalyst?
2. How enzymes differ from inorganic catalists?
3. What is E.C number of enzyme?
4. Define Km
5. Define enzyme activity (U)
6. What is Turnover Number?
7. Define Vmax
8. What are Suicide inhibitors?
9. Define zymogens.
10. Define ribozymes.
11. What are abzymes?
12. What do you mean by rate-limiting enzymes?
13. Define allosteric enzymes.
14. What do you mean by isozyme?
15. Define single-displacement and double-displacement (ping-pong) reactions with examples.

**Short questions (2 marks each)**

1. Write the properties of allosteric enzymes.
2. Write the basic differences between simple enzymes and allosteric enzymes
3. Give example of two enzymes each that function in alkaline pH and acidic pH
4. Write the biological importance of isozymes.
5. What is the kinetic behavior of enzymes catalyzing bimolecular reactions?
6. Write the significance of $K_m$ of an enzyme
7. Write its significance of $V_{max}$ of an enzyme
8. Write the importance of *catalytic efficiency*.
9. Write the effect of pH on enzyme activity.

10. Write the effect of temperature on enzyme activity.
11. Define irreversible enzyme inhibition with examples.
12. Define reversible enzyme inhibition with examples.
13. Define single-displacement enzymatic reaction with example.
14. Define double-displacement (ping-pong) enzymatic reaction with example.

**Broad questions (3 marks)**

1. Derive the Michaelis–Menten equation of enzyme kinetics.
2. Compare the kinetic parameters of competitive, non- competitive and un competitive enzyme inhibitions.
3. Write short note on the MWC model and the KNF model of allosteric enzyme.
4. Explain negative and positive cooperativity of allosteric enzymes

## Unit 6: Vitamins

**Very short questions (1 mark each)**

1. Write the different types of vitamins
2. Name the fat soluble Vitamins
3. Niacin is the chemical name of which Vitamin?
4. Name the Vitamin that protects us from Pellagra disease?
5. Retinol is the scientific name of which Vitamin?
6. Where Vitamin C is present?
7. Liver damage is caused due to the overdose of which vitamin?
8. Name a substance that makes a vitamin metabolically ineffective?
9. Name the vitamin which is essential for the health of the brain?
10. Deficiency of which vitamin causes Beri-Beri?
11. What vitamin is called anti-aging factor?
12. What is the deficiency symptoms of vitamin K?
13. What are the two active forms of vitamin D?

**Short questions (2 marks each)**

1. What is anti-vitamin? Give an example
2. Megaloblastic anemia is caused due to deficiency of which vitamin?
3. What is pro-vitamin? Give an example
4. Write the names of the vitamins that takes part in blood clotting and serves as a hormone precursor?
5. What are the two vitamers of vitamin K?
6. What is vitamin? What is sunshine vitamin?
7. Write the deficiencies of fat soluble vitamins
8. What are the characteristics of vitamin?

9. Write the differences between fat-soluble and water soluble vitamins
10. Write the names of different groups of vitamin A.
11. How vitamin A absorbed in our body?
12. Write the dietary sources of vitamin D?
13. State the functions of vitamin E.
14. Write the chemical names of fat-soluble vitamin.

**Broad questions (3 marks)**

1. Write the chemical names of each of the vitamin in vitamin B complex.
2. Write the biological importance of vitamins.

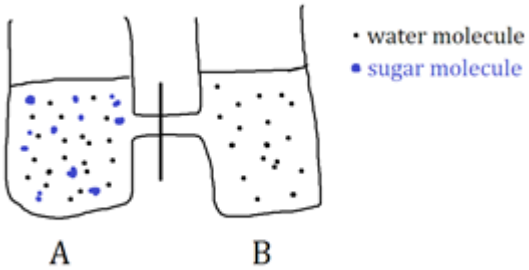
MCB-A-CC-2-4

## Unit wise model questions for CC-4 (CELL BIOLOGY) Credit :4

## Unit 1: STRUCTURE AND ORGANIZATION OF CELL

**Very short questions (1 mark)**

1. Name the region in eukaryotic cell where ds single circular DNA is present.
2. What are the subunits of ribosome of prokaryotic cell?
3. Which transcriptional control features are found in both prokaryotes and eukaryotes?
4. Kearns-Sayre syndrome is a disease caused by deletions in circular DNA that code for proteins of the electron transport chain. What is its inheritance pattern?
5. Tay Sachs is a congenital disorder in which molecules called gangliosides are not properly digested and instead accumulate in cells, causing toxicity. Misfunction in which organelle can lead to Tay Sachs?
6. How large molecules are transported across the cell membrane?
7. What is the name of the hollow sphere formed by lipid bilayer? Which ABC transport protein transports lipid in opposite direction?
8. How do potassium ions travel as they move into the cell?
9. Name the technique which is used to visualize the lateral movement of lipids?
10. How many filamentous structures together comprise the cytoskeleton?
11. Which subunits form microtubules?
12. Why no known motor proteins have been found to utilize intermediate filaments?
13. What are the different types of actin found in the cell?
14. What is the microtubule organizing center of most eukaryotic cells?
15. What is the function of tight junctions in epithelial cells?
16. What two drugs will prevent polymerization of microtubules?
17. What is the structural subunit of desmosome ?
18. What molecule, when bound to g-actin, promotes polymerization?
19. Which factor would slow sugar equilibrium the most once the shutter is raised to connect the two solutions?




**Short questions (2 marks)**

1. Give chemical composition of plasma membrane.
2. What is role of cholesterol in plasma membrane?

3. Differentiate between simple and facilitated diffusion.
4. What is role of carrier protein in facilitated protein?
5. What is isotonic solution? Give its effect on plasma membrane.
6. Write the common and different properties of Cadherin and Integrins
7. Define active transport and passive diffusion.
8. The openings of membrane channel proteins are controlled by gates. What factors can cause these gates to open?
9. What drugs prevent polymerization of actin? What prevents it from depolymerizing?
10. What is the structure of microtubules?
11. What structures found at the centrosome?
12. How thick are actin filaments, Intermediate filaments and Microtubules?

**Broad questions (greater than 2 marks)**

1. What factors influence the rate of diffusion across a membrane? Give examples of how membranes might be altered in a biological system to change the rate of diffusion. Can you give a few examples of where diffusion is important for proper physiological function?

   (2+2+2 )

2. 2. State the functions of the sodium potassium ATPase pump. Name the inhibitor of Na+-K+ ATPase. Two solutions (A & B) are separated by a semi-permeable membrane which only allows the passage of water solution A contains 600 mmoles of NaCl and solution B contains 250 mmoles of NaCl. In which direction osmosis will occur?

   (2+1+1)

3. What is the main function of intermediate filaments? What is the structure of intermediate filaments? What are the chief types of intermediate filaments and where are they found?

   (1+2+2)

4. Explain why no known motor proteins have been found to utilize intermediate filaments?
5. A common chemotherapeutic agent, called Vincristine, is used to treat cancers. It acts by inhibiting tubulin. What can you conclude about Vincristine? Write the structure of microfilaments with simple diagram.

   (2+1+2)

## Unit 2: NUCLEUS

**Very short questions (1 mark)**

1. Define apoplast and symplast.
2. What is desmotubule?
3. What are micelles?
4. What is cell plate?

5. Out of P-wall and S-wall which one is optically active?
6. What is Nucleoplasm?
7. What is Nuclear Pore Complex?

**Short questions (2 marks)**

1. What is the chemical composition of middle lamella?
2. What is molecular trafficking?
3. What is meant by gross structure of plant cell wall.?
4. What is the chemical composition of primary wall?
5. What role played by IAA for the formation of S-wall?
6. Write the function of the nuclear membrane
7. Write the function nucleus.

**Broad questions (greater than 2 marks)**

1. Two components are evident in the fine structure of plant cell wall- write in brief these two components. (3+3)
2. Explain the orientation of microfibrilsin the light of apposition and intussuception theories. (2.5+2.5)
3. Write a note on the chemical nature of plant cell wall. ( 4)
4. Describe the ultrastructure of plasmodemata. ( 4)
5. What is phragmoplast? Write its role in the formation of middle lamella. (1+3)
6. Describe the structure of nuclear envelope
7. Write short note on Nuclear Pore Complex

## Unit 3: PROTEIN SORTING AND TRANSPORT

**Very short questions (1 mark)**

1. Cite 2 examples of microtubule destabilising drugs.
2. What do you mean by Overlap Microtubules?
3. How the Early cell plate is formed?
4. Describe the significance of the term N-linked glycosylation.
5. What marker does designate the proteins targeted to lysosome?
6. What is the significance of the term ‘Gro’ in GroEL or GroES?
7. How is the energy harnessed in protein folding mediated by GroEL/GroES system?
8. What is cotranslational translocation?
9. Cite the functions of SecB & SecA.
10. What is Signal patch?
11. Define Karyopherin.

12. Define Peroxin.
13. What is the peroxisomal targeting signal?
14. Define Chaperonin.
15. What is NIR?
16. What is the Full form of SNARE?
17. What is the significance of the terms R-SNARE & Q-SNARE?
18. Give suitable examples of v-SNARE & t-SNARE.
19. Define glycosaminoglycan with example.
20. Define: Anterograde & Retrograde transport.
21. Comment on Bottlebrush structure.
22. Define lateral gating mechanism.
23. Cite the function of PDI & BiP.
24. What is Lipid-linked protein?

25. Write the names of the types of sugar chains associated to the protein during N-linked glycosylation.
26. What do you mean by I-cell disease?
27. Define autophagy.
28. Define Residual bodies.

**Short questions (2 marks)**

1. Name the components which control the Dynamic Instability of microtubules during separation
2. of sister chromatids.
3. What is the constituent of microtubule nucleator?
4. What are the features of lipid raft?
5. How does neurotoxin like BOTOX or TetTox interact with vesiclular traffic?
6. Describe the properties of leader peptide in Sec system.
7. Give the significance of the terms: TOM & TIM.
8. How does Oxa complex locate the proteins in proper position?
9. Comment on Zellweger's syndrome.
10. What is the specific function of peroxisomes?
11. Cite the specific functions of sER.
12. Ribosome can't be considered as a true organelle-justify.
13. How the nuclear membrane and ER membrane are located?
14. Define the terms: Stop transfer sequence; Retention signal.
15. Comment on the structural & functional aspects of lipid carrier molecule involved in glycosylation
16. of proteins.
17. Describe the utilities of "Coat" structure in vesicular trafficking.
18. State the functions of Rab effector proteins.
19. What exactly Rab proteins do in vesicle fusion?
20. What do you mean by Trans-SNARE complex?
21. What are the different portions of Golgi complex?
22. What are the various sulphated oligosaccharides synthesised in Golgi complex?
23. What are the types of oligosaccharide chains attached to proteins?

24. Why the cytosolic proteins are commonly not glycosylated?
25. Cite the role of DOlichol in glycosylation of proteins.
26. Indicate the functions of GPI-Anchored proteins.
27. What is the main difference between N & O-linked glycosylation?
28. What is the purpose of these both types of glycosylation?
29. How the pH in lysosomal vesicle is kept at fairly acidic?
30. Differentiate between early & late endosome.
31. Describe the utility of lipid raft structure in vesicular trafficking.
32. What are the differences between cellular drinking & cellular eating?
33. Why don't macrophages engulf any live animal cell?

**Broad questions (greater than 2 marks)**

1. Briefly describe the function of GroEL/GroES system in folding a particular target protein with suitable diagram.
2. Elaborate the features of protein translocation through NPC.
3. Define injectiosome & injectosome.
4. What is the probable function of Hsp70 in two proposed models for protein translocation in bioblasts?
5. What are the various proteins functioning in formation of Clathrin coat? Discuss with proper functions of them.
6. Describe the role of GTPases in vesicular trafficking process.
7. What is nucleolus? Why it is known as 'ribosome producing factory'?
8. Give the functions of SRP & SRP receptor.
9. Cite two crucial functions of Golgi apparatus.
10. Write short notes on: Maturation of vesicles in Golgi complex.
11. Discuss the roles vesicular transport & cisternal maturation model in movement of vesicles through Golgi complex with justification.
12. Give the function of Sec61 complex briefly.
13. How do calnexin & calreticulin function to give correct conformation of target proteins?
14. Write the MOA of Tunicamycin & Bacitracin briefly.
15. Define local recycling with respect to neurotransmission.
16. Differentiate between clathrin & caveolin mediated endocytosis.
17. Describe transcytosis with suitable diagram.
18. Enlist the features of receptor mediated endocytosis.

## Unit 4: CELL SIGNALLING

**Broad questions (greater than 2 marks)**

1. Write in brief the molecular circuits in which signal transduction depends. (4)
2. What is G-protien? Write the role of G-protien in signal transduction pathway. (1+4)
3. What is cross talk? How do diacyl lipids play crucial roles in cell signaling? (1+4)

4. What are ligands and effectors? Explain how $IP_3$ causes rapid release of $Ca^{2+}$from the intracellular stores in the ER. (2+4)
5. How can one estimate free $Ca^{2+}$ concentrations inside living cells? What is calmodulin? ( 3+1)
6. Many signals are transduced by mitogen-activated protien kinase (MAPK)cascade-Explain. ( 4)

## Unit 5: CELL CYCLE,CELL DEATH AND CELL RENEWAL

**Very short questions (1 mark)**

1. What are the various growth phases in cell cycle?
2. What is the basis of the nomenclature 'cyclin'?
3. Define 'restriction point'.
4. Define CKI.
5. What are the enzymes to regulate apoptosis?
6. Define apoptosome.
7. What is replicative cell senescence?
8. Define the terms: Chondroma, Adenosarcoma, Ganglioma.
9. Define Metastasis.
10. Define carcinogen.
11. What is Cancer critical gene?
12. Cite the function of catastrophin.
13. What is Philadelphia chromosome?
14. Cite two examples of viruses causing cancer.
15. Cite two examples of viral proteins which are known to induce cancer of host cells.
16. Give two examples of RNA viruses causing cancer in host cells.
17. What is MTOC?
18. Define the terms: contractile ring, preprophase band, early cell plate.

**Short questions (2 marks)**

1. What are the utilities of xenopus oocytes in cell cycle studies?
2. What is the role of CAKs in cell cycle control?
3. What are the various types of Cdks available in mammalian system?
4. How does Cyclosome lead the cell to anaphase?
5. How can p53 be activated in mammalian system?
6. What role does p53 play in inducing apoptosis?
7. Cite two examples each of anti & pro apoptotic genes.
8. What is the difference between Mitogen & MPF?
9. Differentiate between malignant & benign tumour.
10. What are the principal causes of cancer?
11. Differentiate between tumour promoter and tumour inducer.

12. p53 is not required for normal development of cells but it is indispensable- justify.
13. Ionising radiations are not always fruitful in treating cancers- explain.
14. Why carcinoma is mostly found compared to other types of cancers?
15. Differentiate between Chondroma & Chondrosarcoma.
16. Why a single mutation only is not enough to cause cancer?
17. What is the difference between potential & ultimate carcinogen?
18. What is asymmetric cell division?
19. Why zygote is not considered as stem cell?
20. Why ESCs are known as pluripotent cells?
21. What are the master transcription factors in controlling stem cell behaviour?

**Broad questions (greater than 2 marks)**

1. How can the cell cycle stages be identified?
2. Yeasts are considered as very suitable model organism for cell cycle studies – justify.
3. Inhibitory phosphorylation is necessary in cell cycle progression- justify.
4. Briefly describe the functions of Cdc6, Polo kinase, Separase, Cohesin complex.
5. Discuss the role of MPF with diagram.
6. The event of DNA replication occurs once per cycle- explain with proper justification.
7. What preparatory functions are performed by MCdk prior to plunge into mitosis?
8. Ubiquitination of cyclins is key to regulate cell cycle progression- explain with examples.
9. How can a same protein APC trigger as well as finish M-phase witing stipulated time period?
10. Describe the role of pRb in regulating the entry of cell in S-phase.
11. p53 is saviour of genetic traits- explain.
12. What do you mean by Ataxia Telangiectasia? How ATM & ATR are related to Ataxia Telangiectasia?
13. Cell membrane asymmetry can be a measure of apoptosis- justify.
14. Enlist at least three methods for detection of induction apoptosis.
15. Describe the functions of FasL & APAF-1 in initiating apoptotic pathways.
16. How chromosome translocation can be related to cancer development?
17. DNA damage always does not lead to cancer- explain.
18. Replicative senescence is opposite to cancer development- explain.
19. How cell adhesion molecules can be related to metastatic development?
20. What do you mean by nondisjunction? Classify it.
21. Define recombination nodule. What function it does play?
22. Describe the factors controlling the pluripotency of stem cells.
23. How X-inactivation phenomenon can be used in studying cancer cells?
24. How can the defect in DNA repair system be attributed to cancer? Explain with example.

25. How genetic instability can be related to cancer development?
26. Describe various steps of Metastasis.
27. Give examples of some environmental carcinogens.
28. How mutations can generate an oncogene?
29. How can bridge-breakage-fusion cycle lead to neoplasia?
30. How telomere shortening can be related to cancer development?
31. Discuss the role of cohesion & condensin complexes in mitosis.
32. What are the three classes of microtubules detected in mitotic division of animal cells?
33. What is cellularisation?
34. What are the totipotent & pluripotent cells?
35. How iPSC can be stably prepared?
36. Haemoatopoetic stem cells are multipotent not pluripotent- justify.

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