1 Mark Questions

1. Deamination of cytosine produces
   (a) uracil (b) pseudouracil
   (c) hypoxanthine (d) 5-methyluracil

2. Which of the following hormones binds to a cell surface receptor?
   (a) Oestrogen (b) Thyroid hormone
   (c) Insulin (d) Aldosterone

3. Systemic lupus erythematosus (SLE), an autoimmune disease, is characterized by the presence of
   (a) anti-DNA antibodies
   (b) anti-thyroglobulin antibodies
   (c) anti-insulin antibodies
   (d) anti-collagen antibodies

4. Optical density of 1 means
   (a) 1% of the incident light is absorbed
   (b) 1% of the incident light is transmitted
   (c) 90% of the incident light is absorbed
   (d) 90% of the incident light is transmitted

5. One of the carbon atoms of a glucose molecule is [^{14}C]-labelled. If $^{14}CO_2$ is released during the conversion of pyruvate to acetyl coenzyme-A, which carbon atom of glucose was radiolabelled?
   (a) C_3 but not C_4 (b) C_3 or C_4
   (c) C_1 or C_6 (d) C_1 but not C_6

6. When yeast cells are shifted from a medium containing glycerol to glucose, an increase in the transcription of four genes involved in glucose metabolism was reported. Which of the following would be the most appropriate technique to demonstrate increased transcription of these genes?
   (a) Southern hybridization
   (b) Northern hybridization
   (c) Western hybridization
   (d) Fluorescence *in situ* hybridization

2 Marks Questions

7. A mixture containing protein-1, 2, 4 and 5 with molecular weights 5,000, 10,000, 25,000, 65,000 and 100,000, respectively, were separated on a Sephadex G-50 column. The order of elution of these proteins from the column will be
   (a) protein-1, 2, 3, 4 and 5
   (b) protein-5, 4, 3, 2 and 1
   (c) protein-1, 2 and 3 elute first, followed by protein-5 and 4
   (d) protein-4 and 5 elute first, followed by protein-2, 3 and 1

8. The maximum number of hydrogen bonds that a molecule of water can form is
   (a) 1 (b) 2 (c) 3 (d) 4

9. Match the techniques mentioned in group I with their applications given in group II.

Group I	Group II
A. PCR	1. Identification of transcription factor binding sites in chromatin
B. DNA microarray	2. Identification of HIV infected patients using serum samples
C. ELISA	3. Isolation of mouse homologue of a yeast gene
	4. Analysis of differential gene expression in cancer and normal cells

Codes

	A	B	C		A	B	C
(a)	4	1	3	(b)	3	4	2
(c)	4	1	2	(d)	3	2	1

10. A non-sense mutation in the gene encoding protein X leading to the synthesis of a truncated protein results in a slow growing strain. Mutagenesis of this strain towards the isolation of extragenic suppressors led to

the isolation of a strain which grew normally and synthesized the full-length protein X. The extragenic suppressor is likely to be a gene coding for

(a) *rRNA* (b) RNA polymerase
(c) *tRNA* (d) ribosomal protein

11. The total radioactivity in 1 mL solution 0.25 mg of glycine is 1 mCi. The specific activity (mCi/millimole) of radiolabelled glycine will be

(a) 300 (b) 18.75
(c) 3000 (d) 1875

12. Ten grams of butter was saponified. The non-saponifiable fraction was extracted into 25 mL of chloroform. The absorbance of this solution in a 1 cm cuvette is 0.53 at 328 nm. If the extinction coefficient ($a_{1\%}$) of vitamin-A at this wavelength is 1550, calculate the amount of vitamin-A present

(a) 3.419×10^{-3} g/100 mL
(b) 3.419×10^{-6} g/100 mL
(c) 3.419×10^{-5} g/100 mL
(d) 3.419×10^{-4} g/100 mL

13. Folate derivatives are required for the synthesis of which deoxynucleotides?

(a) Adenylate and guanylate
(b) Cytidylate and thymidylate
(c) Adenylate, guanylate and thymidylate
(d) Adenylate, guanylate and cytidylate

14. Cytochrome-*c* reductase, also called as complex III or cytochrome *b*-c_1 complex, localized on the inner mitochondrial membrane receives electrons from ubiquinol and donates to cytochrome-*c*. In one cycle

(a) two cytochrome-c molecules are reduced
(b) one ubiquinol is oxidized
(c) two ubiquinols are oxidized and one ubiquinone is reduced
(d) one cytochrome-*c* is reduced

15. Match the biological functions mentioned in group I with the enzymes given in group II.

Group I	Group II
A. Diacylglycerol synthesis	1. Protein kinase A
B. CREB phosphorylation	2. Ras
C. GTP hydrolysis	3. Phospholipase C
	4. Phospholipase D
	5. Protein kinase G

Codes

	A	B	C		A	B	C
(a)	3	1	5	(b)	4	1	2
(c)	3	1	2	(d)	3	5	2

16. How does haemoglobin carry carbon dioxide generated in tissues back to the lungs?

(a) By coordination with haeme
(b) By forming N-terminal carbamate
(c) By forming C-terminal carbamate
(d) By linkage to the epsilon-amino group of lysine

17. Which of the following enzyme activities can be detected in the supernatant obtained by centrifugation of liver homogenate at 100,000 g for 1 hr at 4°C?

(a) Succinate dehydrogenase
(b) Glyceraldehyde 3-phosphate dehydrogenase
(c) Glycogen synthetase
(d) Aconitase

18. Which of the following statements about the enzyme complexes of the electron transport system is correct?

(a) The interact with one another via mobile electron carriers
(b) They are located in the mitochondrial matrix
(c) They can not be separated from one another in a functional form
(d) They all have cytochromes

19. Match the DNA binding motifs mentioned in group I with the proteins given in group II.

Group I	Group II
A. Zinc finger	1. c-jun
B. Leucine zipper	2. Growth hormone receptor
C. Helix-turn-helix motif	3. Glucocorticoid receptor
	4. Histone H_1
	5. Lambda repressor

Codes

	A	B	C		A	B	C
(a)	4	5	1	(b)	2	5	4
(c)	2	1	5	(d)	3	1	5

20. Which of the DNA plymerases listed below is primarily responsible for the *de novo* synthesis of new DNA strands?

(a) DNA polymerase I (b) DNA polymerase II
(c) DNA polymerase III (c) DNA polymerase IV

21. F_1-F_0-ATPase in chloroplasts is located on the

(a) inner chloroplast membrane with F_1 facing the stroma
(b) inner chloroplast membrane with F_1 facing the inner membrane space
(c) thylakoid membrane with F_1 facing the stroma
(d) thylakoid membrane with F_1 facing the thylakoid lumen

22. In addition to adjuvants, generation of anti-hapten antibodies will require injection of

(a) the hapten to a mice

(b) a mixture of hapten and protein to a mice

(c) the hapten covalently linked to a protein to a mice

(d) a mixture of hapten and lipid to a mice

Common Data for Questions 23 and 24

The number of protons translocated by the various vectorial proteins localized on the inner mitochondrial membrane of an organism was determined. They are as follows : NADH dehydrogenase : 4, cytochrome-*b*-c_1 complex : 2, cytochrome-*a*-a_3 complex : 4 and F_1-F_0 – ATPase : 3. One proton is also required for the transport of inorganic phosphate into the mitochondrial matrix.

23. The number of ATP molecules that can be synthesized by the oxidation of one NADH molecule is

(a) 2 (b) 2.5

(c) 3 (d) 3.3

24. If the cytosolic NADH is transported to the matrix by the glyceraldehydes 3-phosphate shuttle, then the number of ATPs synthesized is

(a) 1.5 (b) 2

(c) 2.5 (d) 3.3

Statement for Linked Answer Questions 25 and 26

Two mammalian cell lines were found to express either epidermal growth factor receptor (EGFR) alone (cell line A) or both EGFR and Ras (cell line B). These cell lines were treated with epidermal growth factor (EGF) and protein phosphorylation was examined in the membrane and cytosolic fractions using anti-phosphotyrosine and anti-phosphoserine antibodies.

25. EGF-dependent tyrosine phosphorylation will be detected in

(a) membrane and cytosolic fractions of both the cell lines

(b) only the membrane fraction of only cell line A

(c) only the membrane fraction of both cell lines

(d) only the cytosolic fractions of both cell lines

26. EGF-dependent serine phosphorylation will be detected in

(a) membrane and cytosolic fractions of both the cell lines

(b) only the membrane fraction of cell line A

(c) only the membrane fraction of cell line B

(d) only the cytosolic fraction of cell line A

Statement for Linked Answer Questions 27 and 28

ΔG° is the symbol used to denote standard free-energy change of a chemical reaction in biological systems. The standard conditions are $T = 298$ K, concentration of water = 55.5 M, pH = 7, and the reactants and products (other than water and proton) are initially present at 1 M concentration.

27. Suppose ΔG denotes the free-energy change for the reaction $A + B \rightleftharpoons C + H^+$ at pH5, all other conditions being the same as the standard conditions specified above. Them

(a) $\Delta G = \Delta G^{\circ\prime}$

(b) $\Delta G = \Delta G^{\circ\prime} + 11.5\,RT$

(c) $\Delta G = \Delta G^{\circ\prime} + 4.6\,RT$

(d) $\Delta G = \Delta G^{\circ\prime} + 16.1\,RT$

28. If $\Delta G^{\circ\prime}$ for the reaction is -11.7 kJ/mol and $R = 8.314$ kJ/mol, the reaction is

(a) Endergonic at both 37°C and 25°C

(b) Endergonic at 37°C and exergonic at 25°C

(c) Exergonic at both 37°C and 25°C

(d) Exergonic at 37° and endergonic at 25°C