

LIFE SCIENCES

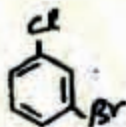
H : CHEMISTRY (COMPULSORY)

ONE MARKS QUESTIONS (1-14)

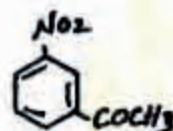
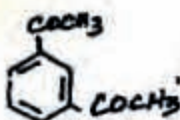
For each sub-question given below, four alternatives are provided of which only one is correct. Write the correct answer in the answer book by writing a, b, c or d along with the corresponding sub-question number.

(14 × 1 = 14)

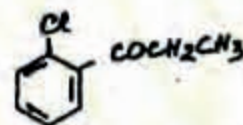
- The de Brogue length for a hydrogen atom is,
 - equal to that of a deuterium atom moving with the same velocity
 - twice that of a deuterium atom moving with the same velocity
 - equal to that of a deuterium atom moving with half the velocity
 - equal to that of a deuterium atom moving with twice the velocity
- The bond order in super oxide O_2^- ion is:
 - 1.0
 - 1.5
 - 2.5
 - 0.5
- Which one of the following compounds can probably be prepared in a pure state from Benzene by using two successive electrophonic substitution reactions?



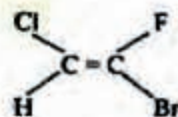
b.



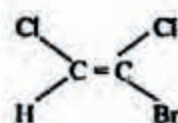
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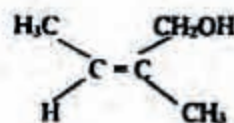
- Which one of the following cations will exhibit the highest polarizing power?
 - Li^+
 - Cs^+
 - Al^{3+}
 - Mg^{2+}
- Which of the following has Z configuration?



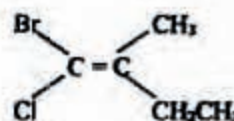
b.



c.



d.



- The transition metals usually exhibit higher oxidation states in their
 - oxides
 - sulfides

d. iodides

7. Which one of the following pairs of molecules does not constitute resonance structures?

a.



b.



c.



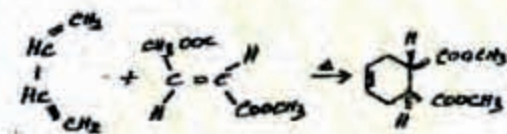
d.



8. Which one of the following alkali metals reacts most vigorously with water?

- a. Li
b. Na
c. K
d. Cs

9. Which of the following statements is true for the reaction given below?



- a. It can also be effected under photochemical conditions
b. It proceeds through a concerted mechanism involving a cyclic conjugated transition state
c. In addition to the trans product shown above, it will also give some amount of the cis isomer
d. It occurs via step-wise mechanism involving ionic intermediates

10. Which of the following has pyramidal shape?

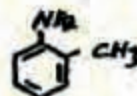
- b. CO_3^{2-}
c. NO_3^-
d. ClO_3^-

11. Which one of the following statements concerning diborane, B_2H_6 , is not correct?

- a. It is diamagnetic
b. It forms ammonia addition compounds
c. There is free rotation about B-B bond
d. The bonding of two hydrogens is of one type whereas the bonding of the other four is of another type

12. Which among the following amines is least basic in aqueous solution?

a.



- b. $\text{CH}_3\text{CH}_2\text{NH}_2$

c.



- d. $(\text{CH}_3\text{CH}_2)_2\text{NH}$

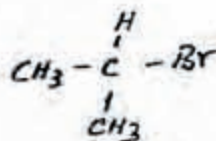
13. Which of the following halides is the least reactive in an $\text{S}_\text{N}2$ reaction?

- a. CH_3Br



- c. $\text{CH}_3\text{CH}_2\text{Br}$

d.



14. The free energy change for the process,



is ΔG and energy of activation is E_a . The energy of activation for the reverse process,



is

b. $\vec{E}_a = \Delta G - \vec{E}_c$

c. $\vec{E}_a = \vec{E}_c$

d. $\vec{E}_a = \Delta G + \vec{E}_c$

For each sub-question given below, four alternatives are provided of which only one is correct. Write the correct answer in the answer book by writing a, b, c or d along with the corresponding sub-question number.

(3 × 2 = 6)

15. The fraction of molecules possessing kinetic energy equal to 4.548×10^{-21} J at 300 K is:

a. $\frac{1}{2}$

b. $\frac{1}{3}$

c. $\frac{1}{4}$

d. $\frac{1}{5}$

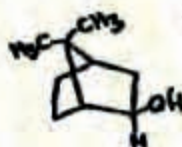
16. The major organic product of the following reaction is:



a.



b.



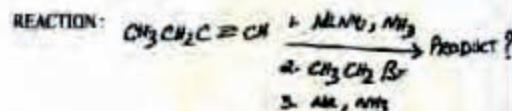
c.



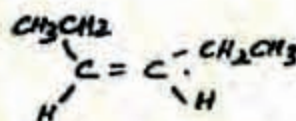
d.



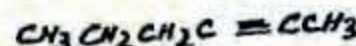
17. Which is the principal organic product of the following reaction?



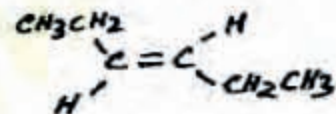
a.



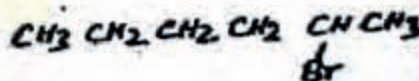
b.



c.



d.



18. Match each item in Column A with a most appropriate item in Column B.

(5 × 1 = 5)

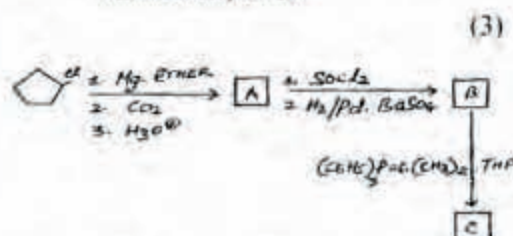
A

1. Paramagnetic
2. Carbonium
3. Fullerene
4. Producer Gas
5. Lewis Acid

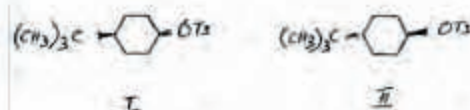
B

- (a) C_{60}
- (b) CO and H_2
- (c) NO_2
- (d) C^{14}
- (e) CO and N_2
- (f) SiC
- (g) BCl_3

19. (i) Write the structure of compounds A, B and C in the following reaction sequence.



- (ii) Which of the following two tosylates I and II, is expected to undergo faster acetolysis and why?



20. (i) Write an electrochemical cell for the zinc-bromine couple and calculate its standard potential from the data given below. State which is the strongest oxidizing agent.

REACTION	E°, V
$\frac{1}{2}Zn^{2+} + e \rightleftharpoons \frac{1}{2}Zn$	-0.763
$Na^+ + e \rightleftharpoons Na$	-2.712
$\frac{1}{2}Cl_2 + e \rightleftharpoons Cl^-$	1.358
$\frac{1}{2}Br_2 + e \rightleftharpoons Br^-$	1.065

21. For the NaCl structure given in Fig. H5 estimate

- a. the number of Na^+ and Cl^- ions per unit cell
b. the co-ordination number of Na^+



22. (i) One mole of an ideal gas expands isothermally from 100 cm³ to 500 cm³ at 300 K. Calculate the change in entropy of the system.

- (ii) The concentration of undissociated acetic acid in a 0.01 M sodium acetate solution is 2.4×10^{-3} M. Estimate the pH of the solution if the dissociation constant of acetic acid, $K_a = 1.75 \times 10^{-5}$.

23. (i) For a reaction,

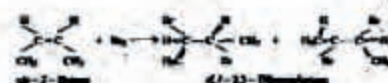


The initial rate of the reaction was studied at various concentrations of A and B, then following data were obtained:

[A], Mole/Liter	[B], Mole/Liter	Rate, Mole/Liter ² s ⁻¹
1.0	1.0	0.01
2.0	1.0	0.02
1.0	2.0	0.01

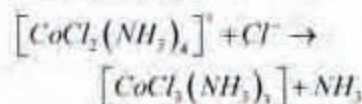
Deduce the order of the reaction with respect to A and B, and calculate the rate constant.

- (ii) Suggest a reasonable mechanism for the formation of products shown in the following reaction.



24. (i) Indicate the population of electrons expected for t_{2g} and e_g orbitals for $Mn(H_2O)_6^{2+}$ and $Mn(CN)_6^{3-}$ ions. Calculate the magnetic moment (spin only value) for $Mn(CN)_6^{3-}$ ion.

- (ii) In the reaction,



only one complex product is obtained. Is the initial complex cis or trans?

(2)

I: BIOCHEMISTRY**ONE MARKS QUESTIONS (1-10)**

For each sub-question given below, four alternatives are provided of which only one is correct. Write the correct answer in the answer book by writing a, b, c or d along with the corresponding sub-question number.

(10 × 1 = 10)

- The Michaelis constant, K_m is
 - numerically equal to $\frac{1}{2}V_{max}$
 - dependent on enzyme concentration
 - independent of pH
 - numerically equal to the substrate concentration that gives half-maximal velocity
- For determining the C-terminal amino acid of a polypeptide chain, the reagent that would be useful is
 - trypsin
 - carboxypeptidase
 - phenyl isothiocyanate
 - 1 (N) HCl
- For the reaction, fructose 6-P + P_i \rightarrow fructose 1, 6-bisphosphate + H_2O (equilibrium constant, $K_{eq} = 0.001$ at pH 7; $T = 300^\circ K$; $R = 2$ cal/mol-degree) the standard free energy change ΔG° is approximately equal to
 - + 4.1 kcal/mol
 - 4.1 kcal/mol
 - + 2.1 kcal/mol
 - 2.1 kcal/mol
- In contrast to the resting state, vigorously contracting muscle shows
 - an increased conversion of pyruvate \rightarrow lactate
 - decreased oxidation of pyruvate to CO_2 and water
 - a decreased NADH/NAD ratio
- The catabolism of hemoglobin
 - occurs in the red blood cells
 - involves the oxidative cleavage of the heme porphyrin ring
 - results in the liberation of CO_2
 - is the sole source of bilirubin
- A ganglioside must contain in its structure
 - N-acetyl neuraminic acid (NANA), hexoses, sphingosine, long chain fatty acid
 - NANA, a hexose, a fatty acid, sphingosine, phosphorylcholine
 - NANA, sphingosine, ethanolamine
 - NANA, hexoses, fatty acid, glycerol
- Insulin does all of the following except
 - enhanced glucose transport into muscle
 - enhanced glycogen formation by liver
 - increased lipolysis in adipose tissue
 - gluconeogenesis inhibition in liver
- The genetic code is
 - degenerate in that many triplets code for more than one amino acid
 - read in the direction of $3' \rightarrow 5'$
 - generally referred to as universal, since it is nearly the same in all organisms
 - degenerate for all the amino acids
- To clone a gene corresponding to a protein with partial amino acid sequence, Met-Trp-Cys-Trp (number of codons for Met = 1, Cys = 2, Trp = 1), the number of oligonucleotides that need to be designed to screen c-DNA library is
 - 2
 - 4
 - 5
 - 8
- DNA sequencing by Sanger's method involves the use of
 - Ribonucleotide
 - $3'$ -deoxyribonucleotide
 - $2', 3'$ -dideoxyribonucleotide
 - fluorodinitrobenzene
- Match the entries in Column A with those in Column B and write the matching pairs

Column A

- A. Oxidative decarboxylation
- B. Water-soluble antioxidant
- C. Glutamate residue
- D. Vitamin precursor
- E. Increased Ca^{2+} uptake

Column B

- 1. Vitamin D
- 2. Ascorbic acid
- 3. Thiamine
- 4. Folic acid
- 5. β -carotene

In each of sub-questions, one answer among the alternatives is correct. Write the correct answer in your answer book using letter a, b, c or d along with the corresponding sub-question number.

(10 × 1 = 10)

12. Which of the following statements about the structure of B-DNA is incorrect?
 - a. Within the double helix, there are 10 bases per turn of the helix
 - b. Separation of the two strands of the double helix requires untwisting of the helix
 - c. The double helix contains antiparallel chains
 - d. Molar amount of adenine plus thymine is equal to the molar amount of guanine plus cytosine
13. Which of the following is not a characteristic of t-RNA?
 - a. It contains a codon
 - b. It contains an anticodon
 - c. It can become attached covalently to an amino acid
 - d. It interacts with m-RNA during transcription.
14. Which of the carbon atoms of pyruvate would be labelled during glycolysis of glucose having at ^{14}C -1?
 - a. carboxylate carbon
 - b. carbonyl carbon
 - c. methyl carbon
 - d. none

15. Which of the following is not a component of chlorophyll
 - a. plastoquinone
 - b. Fe^{2+}
 - c. Fe^{3+}
 - d. substituted tetrapyrrole
16. Which of the following statements about natural sterols is incorrect?
 - a. cholesterol is the most abundant sterol in animal tissue
 - b. all the carbon atoms of cholesterol are derived from acetyl CoA
 - c. β -sitosterol is the most abundant plant sterol
 - d. dietary β -sitosterol and cholesterol are absorbed to about the same extent in the intestine of normal human
17. Which of the following statements is correct?
 - a. the α -helix can be composed of more than one polypeptide chain
 - b. β -sheets exist only in the antiparallel form
 - c. β -bends often contain proline
 - d. motifs is a type of secondary structure
18. Which one of the following statements concerning Ca^{2+} is correct?
 - a. intracellular concentration of Ca^{2+} is higher than that of the extra cellular fluid
 - b. the concentration of cytosolic Ca^{2+} is transiently decreased by activation of phospholipase C.
 - c. the effects of Ca^{2+} is most often mediated by calmodulin
 - d. intracellular Ca^{2+} is mostly free
19. Which of the following is not a membrane lipid?
 - a. cholesterol
 - b. choline
 - c. phosphoglycerides
 - d. cerebrosides
20. Which of the following enzymes is inhibited by methotrexate, an anticancer drug?

- b. reverse transcriptase
- c. dihydrofolate reductase
- d. DNA polymerase

21. Which of the following statements about monoclonal antibodies is incorrect?

- a. They can be produced in large amount by growing many mice, each of which is immunized with the same antigen
- b. They are useful in quantizing specific proteins in human blood
- c. They can be used to purify scarce proteins by affinity chromatography
- d. They can be used to prepare catalytic antibodies

22. (i) List three desired characteristics of a vector, useful for DNA cloning.

(3)

- (ii) Give a reason why genetic information encoded in DNA rather than in RNA.

(2)

23. (i) Although trypsin is a proteolytic enzyme, it does not digest the tissue in which it is produced. Explain why?

(2)

- (ii) When paper electrophoresis at pH 6.0 is performed on a mixture of alanine, arginine, glutamic acid, lysine and serine.

- (a) Which compound(s) would move towards the anode?
- (b) Which compound(s) would move towards the cathode?
- (c) Which compound(s) would remain near the origin?

(3)

24. (i) Calculate the yield in ATP molecules of the complete oxidation of palmitic acid ($C_{16}:O$).

(3)

- (ii) Explain why arsenate (AsO_4^{3-}) acts as an uncoupling agent for oxidative phosphorylation.

(2)

25. Write short notes on

(ii) Ribozymes.

26. (i) Give reasons why T_m value of linear double stranded DNA in 1 M NaCl solution is decreased when

- (a) the length of DNA molecule is decreased
- (b) the concentration of NaCl is decreased
- (c) urea is added to the solution

(3)

- (ii) When a monoclonal antibody preparation is treated with β -mercaptoethanol and then electrophoresed (PAGE) two bands appear. On the other hand, a single band appears without the treatment of β -mercaptoethanol. Explain why.

(2)

J : BOTANY

ONE MARKS QUESTIONS (1-21)

For each sub-question given below, four alternatives are provided of which only one is correct. Write the correct answer in the answer-book by writing a, b, c or d along with the corresponding sub-question number.

(21 × 1 = 21)

1. A short day plant in an inductive period will not flower if
 - a. the light period is interrupted by a brief dark period
 - b. the dark period is interrupted by a brief light period
 - c. the day length is shortened below the critical day length
 - d. kept continuously in the dark
2. The removal of the apical bud (decapitation) results in the outgrowth of dormant axillary buds. Which of the following compounds will present growth of the axillary buds when applied to the

- a. Indole-3-acetic acid
b. 6-furfuryl aminopurine
c. Abscissic acid
d. Gibberellic acid
3. Transposable elements are DNA sequences that can catalyse their own movement to different chromosomal location. This phenomena can occur in
a. only in prokaryotes
b. only in simple micro-organisms
c. only in somatic cells only of higher eukaryotes
d. somatic and germ line cells of higher eukaryotes
4. Mutations that occur due to the addition or deletion of a nucleotide are called
a. base substitution mutation
b. nonsense mutation
c. frame shift mutation
d. misense mutations
5. The basic features required for maintenance of a plasmid in a bacterial cell are
a. origin of replication, marker for selection
b. centro mere and origin of replication
c. ability to transcribe genes efficiently
d. ability to infect bacterial cells
6. The most abundant polymer of glucose found in plants
a. cellulose
b. sucrose
c. starch
d. xylose
7. Totipotency of plant cells refers to the following phenomenon
a. ability to alternate between sporophytic and gametophytic generations
b. ability to self-fertilize
c. ability to recover from viral infections
d. ability to generate fully developed plants from differentiated cells
8. The DNA content in a pollen mother cell is 2C. What would be the content of DNA
a. 1C
b. 2C
c. 4C
d. 6C
9. A lawn of grass is mowed. However, in a couple of days a growth of green leaf tissue is seen. This growth is primarily due to the activity of
a. apical meristem
b. intercalary meristem
c. axillary bud meristem
d. root bud development
10. Which of the following enzymes fix CO_2 in the Calvin cycle of photosynthesis and also play a role in photorespiration in C_3 plant?
a. Pyruvate carboxylase
b. isomerase
c. ribulose diphosphate carboxylase
d. phosphoribulokinase
11. P_2 (Iodicules) $\text{A}_3 + 3 \text{G}_1$ is the generalized floral formula of the family
a. Liliaceae
b. Asteraceae
c. Poaceae
d. Fabaceae
12. If tomato stems are grafted on to tobacco root stock, the leaves of the tomato will eventually contain nicotine. The best explanation for this is that
a. grafting caused a mutation in the tomato leaves
b. Phloem transports materials
c. nicotine is a toxic waste excreted by the tobacco leaves
d. leaves of the tomato require small amounts of nicotine
13. Which of the following organisms is likely to be more sensitive to radiation induced lethality during the major phase of their life cycle?
a. *Triticum aestivum*
b. *Oryza sativa*
c. *Saccharomyces cerevisiae*
d. *Brassica campestris*

14. Compound X is formed in the stroma of a chloroplast in a plant cell. How many membrane boundaries must the molecule cross to move into the matrix of a mitochondrion of an adjacent non-green cell in the absence of plasmodesmata?
 - a. 3
 - b. 4
 - c. 5
 - d. 6.
15. A trihybrid cross is made between two plants with genotypes AABBr and aabbRR. A is dominant over a and B dominant over b but R and r show incomplete dominance. How many phenotypes will be seen in the F_1 generation?
 - a. 1
 - b. 2
 - c. 4
 - d. 6
16. Root tip squash preparations of four species of Solanum were found to have 36, 48, 72 and 96 chromosomes. The results suggest that
 - a. the species are probably aneuploids
 - b. the species appears to be natural polyploid with a common basic number of chromosomes
 - c. the species apparently share a common mitotic inhibitor in their roots which vary their ploidy level
 - d. they are really two species, a pair of diploids and their tetraploid forms
17. The climax plants in a desert would be expected to have such adaptations as
 - a. broad leaves and shallow roots
 - b. dull leaves and a thin epidermis
 - c. a large number of stomates on the upper surface of leaves
 - d. a reduced leaf surface and an extensive root system
18. Genotyping of individual plants of a species in a population can be done by
 - a. restriction fragment length polymorphism
 - b. isozyme variation
 - c. all of the above
19. The most commonly used molecular visual assay of promoter activity in transgenic plants is
 - a. β -glucuronidase
 - b. Octopine and Nopaline production
 - c. Anthocyanin production
 - d. albino sectors
20. Global warming refers to the increase in atmospheric temperature that is of serious environmental concern. The molecules that contribute to this phenomena are
 - a. CO_2 , ethylene, sulphur dioxide
 - b. sulphur dioxide, methane, carbon monoxide
 - c. ethylene, nitrous oxide, ozone
 - d. CO_2 , methane, chloro fluoro-carbon compounds
21. The causal agent for leaf curl disease of tomato is
 - a. mycoplasma
 - b. virus
 - c. bacteria
 - d. fungus
22. Match the model systems listed (Column I) with the biological systems (Column II) that have been studied well in that species
(4 \times 1 = 4)

Column I (Plant species) (A) Maize (B) Rice (C) Tomato (D) Tobacco	Column II (Biological systems) (i) Anthocyanin biosynthesis pathway (ii) Gene transfer with Agrobacterium Tumefaciens (iii) Hormonal control of fruit ripening (iv) Heterosis and hybrid vigor
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23. (a) Upon Agrobacterial infection of wound in a plant, the cells at the wound Site multiply rapidly to produce a gall. Firstly, name two

Secondly, what is the fate of the T-DNA in the Ti-plasmid of *Agrobacterium*?

(3)

- (b) Give the causal organism for the late blight disease of potato. State the symptoms and remedial measures.

(2)

24. (a) List three features that are useful selection criteria in choosing a model plant system for molecular genetics.

(3)

- (b) Two individuals of a species that are phenotypically wild type were crossed to each other. It was observed that 25% of the seeds produced from this cross aborted with embryos arrested in early stages of development. State most likely possible genetic cause for this result.

(2)

25. State what restriction enzymes are and how can a restriction enzyme that has its target sequence present twice in a plasmid be used to differentiate between linear and circular forms of this plasmid?

(5)

26. (a) Name four of the major tropical vegetation types seen in India. In which vegetation type would you expect the highest diversity of trees?

(3)

- (b) List any three methods used currently to conserve plant genetic resources.

(2)

27. Give the amino acid that is the precursor for synthesis of the plant hormone ethylene. List the two reactions and enzymes catalyzing the reactions that produce ethylene from S-adenosylmethionine

(5)

K: MICROBIOLOGY

ONE MARKS QUESTIONS

For each sub-question given below, four alternatives are provided of which only one is correct. Write the correct answer in the answer book by writing a, b, c or d along with the corresponding sub-question number.

(15 × 1 = 15)

- A microbial specimen will appear in varying degrees of darkness when examined under
 - bright—field microscope
 - phase—contrast microscope
 - dark—field microscope
 - electron microscope
- Which of the following organelles specializes in the synthesis and transport of lipids and membrane proteins?
 - Endoplasmic reticulum
 - Lysosomes
 - Golgi apparatus
 - Peroxisomes
- With respect to which of the following features do archaebacteria resemble eucaryotes?
 - Membrane-enclosed nucleus
 - Types of ribosomes
 - Cell wall
 - Initiator tRNA
- The cytoplasm of the eucaryotic cells contains a network of fibrous proteins called cytoskeleton. Which of the following protein filaments is not a part of the cytoskeleton?
 - Microtubules
 - Actin microfilaments
 - Intermediate filaments
 - Myosin filaments
- During cell division cycle, the interval between the completion of mitosis and the beginning of DNA synthesis is called the
 - G₁ phase
 - S phase

6. The basis for the blocking action of the alkaloid colchicine on cell division is
 - a. to block chromosome condensation
 - b. to block daughter cell formation
 - c. to bind tubulin
 - d. to allow only spindle formation but retard the movement of chromosomes
7. Which of the following statements about a cell organelle is not true?
 - a. An organelle is any sub-cellular entity that catalyzes requisite chemical reactions
 - b. An organelle encloses and separates specific regions from rest of the cytoplasm
 - c. An organelle is any sub-cellular entity that can be isolated by centrifugation at a high speed
 - d. The specificity of the organelle resides in the organelle's membranes
8. RNA polymerase II is responsible for synthesis of
 - a. rRNA precursors
 - b. mRNA precursors
 - c. tRNA precursors
 - d. 5S rRNA and tRNA precursors
9. A merozygote resulting from recombination of two *Escherichia Coli* lac mutants produced half maximal level of β -galactosidase without the inducer and maximal level of β -galactosidase with the inducer. The genotype of the merozygote is
 - a. $O^+I^-Z^- / O^+I^-Z^-$
 - b. $O^sI^-Z^- / O^+I^-Z^-$
 - c. $O^+I^-Z^- / O^+I^-Z^-$
 - d. $O^cI^-Z^- / O^+I^-Z^-$
10. A mutant of *Escherichia Coli* was isolated that synthesized greater than normal levels of tryptophan synthesizing enzymes in the absence of tryptophan. It was found to make normal *trp* repressor and also had normal *trp* operator. Which of the following mutations might result in the observed phenotype?
 - a. deletion in the *trp* promoter
 - b. deletion just before the *trp* coding sequences for the *trp* enzyme
 - c. deletion in the *trp* operator
 - d. deletion in the *trp* repressor gene
11. The type of immunity that develops in an individual is infected with anthrax causing bacterium, *Bacillus anthracis*, is
 - a. passive immunity
 - b. active immunity
 - c. innate immunity
 - d. individual immunity
12. Which of the following cells phagocytize and process antigens?
 - a. Macrophages
 - b. T-lymphocytes
 - c. B-lymphocytes
 - d. Plasma cells
13. Syntrophism is the microbial association in which
 - a. the organisms utilize nutrients contained in the medium
 - b. the organisms utilize nutrients made through photosynthesis
 - c. the organisms utilize insoluble substrates
 - d. the organisms crossfeed on nutrients synthesized and released by the other organism
14. Which of the following statements about cyclic photophosphorylation is not correct?
 - a. It does not lead to the synthesis of NADPH
 - b. It uses electrons supplied by photosystem II
 - c. It does not generate oxygen
 - d. It leads to pumping of protons via cytochrome *bf* complex
15. The heat-sensitive components of microbial media are sterilized by using
 - a. moist heat
 - b. dry heat
 - c. radiation
 - d. membrane filtration
16. Match the metal ions, vitamins and related

specific functions in microbial metabolism listed in Column B.

(5 × 1 = 5)

Column A

- (i) p-aminobenzoic acid
- (ii) Pantothenic acid
- (iii) Vitamin B₁₂
- (iv) Zn²⁺
- (v) Cu²⁺

Column B

- A. Precursor of tetrahydrofolic acid, a coenzyme involved in transfer of one-carbon units.
- B. Constituent of thiamine pyrophosphate that is the prosthetic group of decarboxylases and transketolases.
- C. Present in cytochrome oxidase.
- D. Precursor of NAD⁺ and NADP⁺ which are coenzymes of many dehydrogenases.
- E. Involved in rearrangement reactions (e.g., glutamate mutase)
- F. Involved in various transport processes.
- G. Constituent of RNA and DNA polymerases, DNA binding proteins.
- H. Precursor of coenzyme A and of the prosthetic group of acyl carrier proteins.

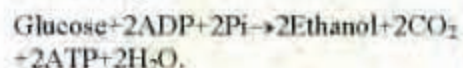
17. Fill in the blanks:

(5 × 1 = 5)

- a. Each eucaryotic chromosome contains three functional elements, autonomic replicating sequences, centromere and _____.
- b. Since host cells do not have enzymes that can copy RNA into RNA, the RNA viruses must encode an RNA-dependent RNA polymerase and _____ for their multiplication.
- c. Photolithotrophs differ from photoorganotrophs in that the electron donors used by them are _____.
- d. When reduced flavoproteins come together with oxygen, two toxic compounds, hydrogen peroxide and _____

dismutase to convert _____ into harmless compounds. _____ catalyzed by superoxide dismutase.

- e. The overall stoichiometric equation for fermentation of glucose into ethanol and carbon dioxide by the yeast *Saccharomyces Cerevisiae* is:



The standard free energy change for this reaction is -235 kJ per mole of glucose.

If the growth of the yeast is neglected, the yield of ethanol will be _____ grams per gram of glucose consumed.

- 18. (a) How does selective media differ from differential media? (2)
- (b) What is the role of "fixation" of cells prior to staining? (2)
- (c) Name a fluorescent dye commonly used for fluorescence microscopy. (1)
- 19. (a) What is Pasteur effect? Mention briefly the biochemical basis of this effect. (3)
- (b) Calculate the minimum value of standard redox potential difference ($\Delta E_0'$) in volts that must be generated by an aerobic microorganism through its electron carriers to generate one mole of ATP. Assume that one electron is transferred. Given:
 - (i) standard free energy charge ($\Delta G_0'$) for hydrolysis of ATP is -7.3 kcal/mole and
 - (ii) Faraday constant, F, is 23.06 kcal/volt.mole
 (2)
- 20. The plasmid molecules in the *Escherichia coli* cytoplasm readily undergo recombination. When these plasmids are isolated from the *E. coli* cells, about a

K6a. If these are treated with EcoRI endonuclease (Which cuts these plasmids at one site only), a structure with four arms is seen (Fig K6b) suggesting two plasmid circles covalently joined at a single point.

- a. (a) Illustrate how such structures (in the shape of figure eight) can result during recombination using Holliday model of recombination.

(3)

- b. If the dimer (Fig. K6a) was made of interlocked plasmid circles or if it were a twisted double length circle, what type of structure would be formed on clearing it with EcoRI?

(1)

- c. How can recombination of plasmids be prevented in the E. Coli host?

(1)



Fig. K6(a)



Fig. K6(b)

21. (a) Write down the two key reactions specific to the glyoxalate cycle which are utilized by microorganisms growing on 2-carbon substrate, acetic acid, as the sole source of carbon and energy under aerobic conditions.

(2)

- (b) Write down the balanced equation for conversion of acetyl CoA to succinate which includes cofactors also.

(1)

assuming succinate is the end products? Assume the organism possesses phosphate shuttle for transfer of NADH from cytoplasm to mitochondria.

(2)

22. (a) Define the terms trophophase and idiophase as they apply to secondary metabolism.

(2)

- (b) In penicillin fermentation, why is it important to feed glucose slowly to the fermentation broth during production phase to get high yield of penicillin?

(1)

- (c) What are the specific features of the mutant strain of *Corynebacterium glutamicum* which make them industrially useful for production of glutamic acid?

(2)

O: ZOOLOGY

ONE MARKS QUESTIONS (1-20)

For each sub-question given below, four alternatives are provided of which only one is correct. Write the correct answer in the answer-book by writing a, b, c or d along with the corresponding sub-question number.

(20 × 1 = 20)

- The largest number of living animal species belongs to the phylum:
 - Chordata
 - Arthropoda
 - Annelida
 - Mollusca
- The scientist who proposed theory of evolution based on natural selection similar to that proposed by Darwin was
 - Wallace
 - Lamarck

- d. Lyell
3. A human male was found to have a single Barr body. What is the sex chromosomal constitution of this individual
 - a. XY
 - b. XXXY
 - c. XXY
 - d. XYY
4. In a xenograft, the source of the grafted tissue is from:
 - a. the same individual
 - b. an individual of the same species but different strain
 - c. an individual of the same strain
 - d. an individual of a different species
5. Which among the following is a marine ecosystem:
 - a. Lentic
 - b. Lotic
 - c. Wetlands
 - d. Pelagic
6. *Caenorhabditis elegans*, an organism extensively used in the study of development is
 - a. Arthropod
 - b. Annelid
 - c. Nematode
 - d. Protozoan
7. Miracidium larva is found in the life cycle of
 - a. Fasciola
 - b. Taenia
 - c. Ascaris
 - d. Lumbricus
8. The amino acid corresponding to the nucleotides present in intron are not found in proteins because
 - a. introns are not transcribed
 - b. intron sequences are lost during mRNA processing
 - c. intron sequences of mRN are not translated
 - d. intron sequences are lost during protein splicing
- a. trypanosome
- b. plasmodium
- c. paramoecium
- d. entamoeba
10. During development, if the blastopore forms anus, the embryo is of
 - a. Mollusc
 - b. Echinoderm
 - c. Annelid
 - d. Arthropod
11. The cells that produce and secrete antibody molecules in mammals are
 - a. Macrophages
 - b. Eosinophils
 - c. Plasma cells
 - d. Erythrocytes
12. Which of the following hormones is used in pregnancy detection in humans
 - a. Testosterone
 - b. Leutenising hormone
 - c. Chorionic gonadotropin
 - d. Progesterone
13. Mules cannot produce mules because of
 - a. Hybrid sterility
 - b. Behavioural isolation
 - c. Hybrid inviability
 - d. Ecological isolation
14. The Respiratory pigment in *Limulus* is
 - a. Haemerythrin
 - b. Haemoglobin
 - c. Chlorocruorin
 - d. Haemocyanin
15. Which of the following proteins is involved in ATP hydrolysis during muscular contraction
 - a. Actin
 - b. Myosin
 - c. Dystrophin
 - d. Tubulin
16. Which of the following is a living fossil?
 - a. Lepidosiren
 - b. Hippocampus

17. A family tree constructed using phylogenetic classification is called
 - a. dendrogram
 - b. histogram
 - c. hologram
 - d. cladogram
18. The hormone responsible for reduction of urine secretion by human kidney is
 - a. Vasopressin
 - b. Oxytocin
 - c. Epinephrin
 - d. Thyroxine
19. The amino acid encoded by the Codon AUG is
 - a. Leucine
 - b. Methionine
 - c. Glycine
 - d. Lysine
20. Which of the following genetic disorders is due to the defective synthesis of a secretory protein in liver
 - a. Cystic fibrosis
 - b. Hypercholesterolaemia
 - c. Haemophilia
 - d. Sickle cell anemia
21. Match the scientists in Column I with their contributions in Column II:

(5 × 1 = 5)

Column I

- A. Jacob and Monod
- B. Spemann and Mangold
- C. Hardy and Weinberg
- D. Urey and Miller
- E. Edelman and Porter

Column II

1. Allele frequency in a population
2. Antibody structure
3. Operon concept
4. Embryonic induction
5. Biochemical evolution
6. Genetic code
7. Membrane structure

22. Define the following:

- a. Paedomorphosis
- b. Parthenogenesis
- c. Homeobox
- d. Diapause
- e. Ribozyme.

23. (a) What is altruistic behaviour? What is its evolutionary significance? (2)
- (b) In a small lake, the population of catla was attempted to be estimated. 500 catla were caught, 400 of them were marked and released. A week later, from amongst a catch of 600 catla, only 30 were found to be marked. What is the total population of catla in the lake? How did you derive the answer? (3)
24. (a) In humans, blood is pumped into the aorta at a much higher pressure than the blood entering pulmonary artery. Explain how this is achieved and what is its physiological significance? (2)
- (b) Name the cells required to generate hybridoma for the production of monoclonal antibodies. How is the hybridoma selected? What is the principle involved in the selection of hybridoma? (3)