LIFE SCIENCES

J : CHEMISTRY (COMPULSORY)

USEFUL DATA

Gas constant, R = 8.314 $Jk^{-1} mol^{-1}$
= 0.0821 l $atm^{-1} K^{-1} mol^{-1}$

Faraday constant = 96500 coulombs

Atomic Numbers :

Ti = 22, V = 23, Cr = 24, Mn = 25, Fe = 26, Co = 27, Cu = 29

For each 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 x 1 = 20)

1. If the half-life of a chemical reaction is inversely proportional to the initial concentration, the order of the reactions is
   a. 0
   b. 1
   c. 2
   d. 3
2. The degenerate number of atomic orbital corresponding to the principal quantum number 4 for hydrogen atom is
   a. 16
   b. 9
   c. 4
   d. 7
3. The first Law of thermodynamics is valid for
   a. reversible process only
   b. irreversible process only
   c. adiabatic process only
   d. for all the processes
4. The maximum depression observed in the freezing point of water for four solutions containing equimolar amount of urea, KCl, $CuSO_4$, and $Ba(NO_3)_2$, respectively is for the solution having
   a. $CuSO_4$
   b. Urea
   c. $Ba(NO_3)_2$
   d. KCl
5. The paramagnetic character observed in case of O_2, O_2^+ and O_2^- is in the order as
   a. $O_2 > O_2^+ = O_2^-$
   b. $O_2 > O_2^- > O_2^+$
   c. $O_2^- = O_2^+ > O_2$
   d. $O_2^+ > O_2^- > O_2$
6. Number of atoms present in the body centered cubic cell is
   a. 1
   b. 2
   c. 3
   d. 4
7. Which of the following compounds has a high dipole moment?
   a. CO_2
   b. CCl_4
   c. H_2S
   d. BF_3
8. For the equilibrium reaction $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$
   a. $K_p = K_c$
   b. $K_p = 2K_c$
   c. $K_p > K_c$
   d. $K_p < K_c$
9. Which one of the following has T-shape structure?
   a. ICl_2^-
   b. NO_2^-
   c. ClF_3
   d. SF_4
10. Identity the tetragonally elongated complex from the following:
    a. $[Cr(H_2O)_6]^{3+}$
    b. $[Cu(H_2O)_6]^{2+}$

11. Which one of the following is least basic ?
    a. $(H_3Si)_2O$
    b. $(H_3C)_2O$
    c. H_2O
    d. N_2O

12. Which on of the following has cation surrounded by eight anions?
    a. CaF_2
    b. NaCl
    c. ZnS
    d. TiO_2

13. Which complex ion will exhibit intense transition in its electronic absorption spectrum ?
    a. $[Fe(H_2O)_6]^{2+}$
    b. $[Co(H_2O)_6]^{2+}$
    c. MnO_4^-
    d. $[Mn(H_2O)_6]^{3+}$

14. Identify the complex showing magnetic moment with respect to 4 unpaired electrons
    a. $[Fe(H_2O)_6]^{3+}$
    b. $[Ti(H_2O)_6]^{3+}$
    c. $[Co F_3(H_2O)_3]$
    d. $[V(H_2O)_6]^{3+}$

15. Which one of the following has B–F bond length shorter than the sum of their covalent radii ?
    a. BF_4^-
    b. BF_3
    c. $F_3B_4O(Et)_2$
    d. $F_3B.NH_3$

16. The molecule which behaves both as a nucleophile and an electrons is
    a. CH_3OH
    b. CH_3NH_2
    c. CH_3Cl
    d.

17. The structure of the intermediate product, formed by the oxidation of tolu with CrO_3 and acetic anhydride, whose hydrolysis gives benzaldehyde is
    a.

    b.

    c.

    d. Ph CH_2OAc

18. Trans-2-butene is transformed into

    by reacting with
    a. $^+CH_3$
    b. CH_3
    c. CH_2(singlet)
    d. CH_2(triplet)

19. Isomer preferentially formed on addition of Br_2 to E-β-methylstyrene is
    a.

    b.

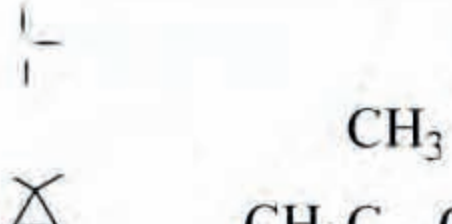
    c.

    d.

20. Diazomethane reacts with lactic acid to form
    a.

    b.

    c.

d. 

21. Match each item in column A with the most appropriate one in column B. (5 x 1 = 5)

Column A

A. Heat capacity of solids
B. Transition state theory
C. Orbital symmetry
D. Aromaticity
E. G.A.glah

Column B

1. Super acids
2. strong acids
3. Einstein
4. Mulliken
5. Woodward-Hoffman rules
6. Dewar
7. Tropylium ion
8. Eyering

22. Answer the following :

A. Calculate the molar conductance of ammonium hydroxide at infinite dilution from the following data : Λ^0 (NaOH) = 247.8 x 10^{-4}, Λ^0 (NaCl) = 126.5 x 10^{-4} and Λ^0 (NH_4Cl) = 149.7 x 10^{-4} mho mol^{-1} m^2. (2)

B. Calculate the standard emf of the reaction

$Fe^{3+} + 3e^- \rightarrow Fe(s)$

Given : $\varepsilon^0 = 0.771$ V, $\varepsilon^0 = -0.44$ V. (3)

23. Answer the following :

A. Three moles of ideal gas were allowed to expand isothermally and reversibly from V_1 to $6V_1$. The initial pressure was 20 atm. The work done in the above expansion is 45.6 kJ. Calculate V_1 and temperature. (3)

B. The magnetic moment of $[FeCl_4]^-$ as well as of $[Fe(C_2O_4)_3]^{3-}$ is ~5.9 BM.

24. Answer the following :

A. Estimate the magnitude ... and spin-only magnetic ... $[Mn(CN)_6]^{3-}$.

B. Write the structure of the ... product obtained on reduction of (S)-... phenyl-2-pentanone with $LiAlH_4$. Designate absolute configuration at the newly created asymmetric centre. (2)

25. Answer the following :

A. What is the product due to the reaction of alkali metal borohydrides with NH_4Cl ? Draw the structure of the product and comment on its electronic structure. (2)

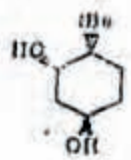
B. Draw the structure of hexachloro-triphosphazene. (1)

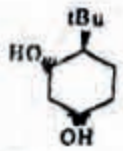
C. The chair conformation of β–D-glucose in which all hydroxyl groups are axial is not as we might have predicted from axial-axial non-bounded interaction. Write the structure and explain in brief about the favorable factor for the decreased instability. (2)

26. Answer the following :

A. Which of the following molecules forms intramolecular

Write its most stable conformation showing intramolecular hydrogen bond. (2)

1. 

2. 

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

correct. Write the correct answer in the answer book by writing a, b, c or d along with the corresponding sub-question number.

(20 x 1 = 20)

1. Which one of the following does not correctly represent the property of wave ?
   a. An ordered structure in the liquid state
   b. A high dielectric constant
   c. Does not interact electrostatically with charged solutes
   d. Ability to form hydrogen bonds with solutes

2. The pK values of carboxyl, imidazole and amino groups of histidine are 1.8, 6.0 and 9.2, respectively. Its isoelectric point will be
   a. 3.9
   b. 5.5
   c. 6.5
   d. 7.6

3. The interhelical amino acid residues of sperm-whale myoglobin are
   a. Nonpolar, stabilized by hydrophobic interactions
   b. Nonpolar, stabilized by hydrophilic interactions
   c. Charged and polar, stabilized by hydration
   d. Charged and polar, stabilized by dispersive forces

4. The oxygen dissociation curves of four substances, a, b, c and d are shown in figure 1.

   Which one of these substances will be the most effective respiratory carrier of oxygen ?

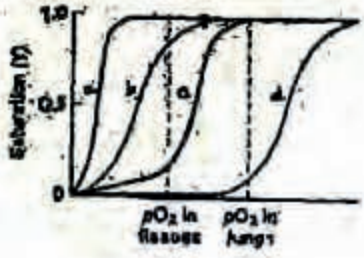


Figure 1

   a. a
   b. b
   c. c
   d. d

5. An uncharged molecule such [illegible] transported by passive diffu[illegible] outside to-inside of a bacterial me[illegible] under the following set of conditions:
   a. outside concentration = 10^{-3} M, inside concentration = 10^{-5} M
   b. outside concentration = 10^{-2} M, inside concentration = 10^{-5} M
   c. outside concentration = 10^{-1} M, inside concentration = 10^{-3} M
   d. outside concentration = 1 M, inside concentration = 10^{-2} M

   In which one of the above cases will the rate of transport be the highest ?

6. The following reaction takes place under standard conditions.

   glucose-6-phosphate → fruclose-6-phosphate

   Identify the correct / most appropriate statement.
   a. The free energy change, ΔG, is equal to zero.
   b. The standard free energy change, ΔG, is equal to zero.
   c. ΔG is equal to ΔG_0.
   d. The equilibrium constant is equal to one.

7. For which one of the following pairs of substances does the inner mitochondrial at membrane contain specific transport proteins:
   a. NAD and NADH
   b. AMP and ADP
   c. Malate and Aspartate
   d. Citrate and Oxaloacetate

8. How many ATP molecules will be generated on complete oxidation of phosphoenolpyruvate to CO_2 and H_2O ? Assume that the glycerol-3-phosphate shuttle is operating, and that one molecular of CTP is equivalent to one molecule of ATP.
   a. 10 ATP
   b. 11 ATP
   c. 13 ATP
   d. 15 ATP

9. [illegible]

a. The cycle produces 6 moles of NADN, 2 moles of $FADH_2$ and 2 moles of GTP per mole of acetyl CoA oxidized to CO_2 and H_2O

b. Increased levels of NADH stimulation oxidation of acetyl CoA

c. High concentration of AMP increases the oxidation of acetyl CoA

d. The cycle is inhibited by malonate

10. Which one of the following statement about the phosphoinositude cascade is correct ?

a. The cascade depends upon the hydrolysis of a protein component of the plasma membrane.

b. A polypeptide hormone interacts with a GMI ganglioside on the cell surface to trigger the cascade.

c. Phospholipase C does not play role in the cascade.

d. The cascade produces two different second messengers.

11. Which one of the following statements are cyclic photophosphorylation is not correct?

a. It uses electrons supplied by photo system II.

b. It does not involve NADPH formation.

c. It does not generate oxygen

d. It leads to ATP formation via the Cytochrome bf complex.

12. When photosynthetic algae is incubated with $^{14}CO_2$ in the presence of light for a very brief time (approx. 5 sec.) the ^{14}C-labelled 3-carbon compound, 3-phosphoglycerate is formed. Which of the following 2-carbon compounds might act as an acceptor ?

a. Acetyl CoA

b. Acetyl-phosphate

c. Acetaldehyde

d. None of these

13. Which one of the following events is not triggered by the hormone glucagons in liver?

a. Activation of glycogen synthase

b. Stimulation of c-AMP production

c. Activation of protein kinase

14. A continuous helix has [illegible] and a pitch p. The length traveled [illegible] of the helix is,

a. $\sqrt{p^2 + 4\pi^2 r^2}$

b. $\sqrt{r^2 + 4\pi^2 p^2}$

c. $r^2 + 4\pi^2 p^2$

d. $(r + 4\pi p)^2$

15. The phenomenon of fluorescence occurs when

a. a molecule absorbs energy and moves from a ground state energy level to an excited state.

b. an excited molecule returns to the ground state by emitting light.

c. an excited molecule returns to the ground state by non-radiative transition.

d. a molecule collides with another molecule in an excited state.

16. Which one of the following statements about the major histocompatibility complex (MHC) proteins is correct?

a. The MHC proteins are encoded by multiple genes.

b. The MHC proteins are present only on the surfaces of specialized cells

c. The genes encoding MHC proteins produce three classes of soluble proteins

d. The MHC proteins do not play a role in the rejection of transplanted tissues.

17. On addition of ethidium bromide to a sample of linear DNA; its $S_{20,w}$ (the standard sedimentation coefficient value) will

a. decrease.

b. increase

c. remain unaltered.

d. slightly increase.

18. Purified duplex DNA molecules cannot exist in which one of the following forms:

a. linear

b. circular and supercoiled

c. linear and supercoiled

d. circular and relaxed

19. Which one of the following statements about the poly A tails of the eukaryotic mRNAs is correct?
    a. The are added by poly A polymerase using ATP as the sole substrate.
    b. They are added by RNA polymerase II in a template independent reaction using ATP as the sole nucletine source.
    c. They are cleaved from the mRNAs by a sequence-specific endoribonuclease the recognizes the RNA sequence AAUAAA.
    d. They are encoded by stretches of polydeoxythymidylate in the template strand of the gene.

20. Methane can be oxidized by a monooxygenase enzymes to methanol. If the PMR spectra of methanol is taken, how many proton resonances would it show ?
    a. 1
    b. 2
    c. 3
    d. 4

21. Match the entries in the column A with those in column B and write the matching pairs in the answer book (5 x 1 = 5)

    Column A
    A. Replication form
    B. Leading strand
    C. Okazaki fragments
    D. DnaB helicase
    E. Rep protein

    Column B
    1. a Helicase that functions at the elongating replication fork
    2. synthesis direction is opposite to that to replication fork movement
    3. unwinds strands at the origin of replication in association with dnaA and dnaC proteins
    4. is synthesized continuously
    5. is the locus of DNA unwinding

22. Answer the following :
    A. Glutamic acid 35 is an active site residue in Lysozyme. The – COOH group of glutamic acid 35 is required in its protonated form for the hydrolytic activity of Lysozyme. The
    a. Calculate the percent… mic acid side chain groups… remain protonated at pH … aqueous environment (pK of … chain carboxyl group of glutami… in an aqueous environment is 4.3)
    b. How is it possible of glutamic acid 35 to remain mainly in its protonated form at pH 5.0, in order to exhibit maximal activity ?
    B. What are the characteristic features of the tertiary structural pattern known as α/β barrel ? (2)

23. Answer the following
    A. What are the functions of the proton pump and ATP synthetase as envisaged in the chemiosmotic hypothesis? (2)
    B. If protons are to be transported from outside of the inner mitochondrial membrane to the inside i.e., the matrix, in the presence of (i) a proton gradient whose outside concentration is 10^2 fold higher compared to the inside concentration and (ii) an electrical gradient whose value is 0.2 volts (the electrical potential being more negative inside the matrix). Calculate the value of free energy change that is associated with this electrochemical gradient at 27°C.

    Given, Faraday constant, F = 96,500 joules/(volt.mole)

    Gas constant, R = 8.3 joules/mole (3)

24. Answer the following :
    A. Escherichia coli bacterial are grown in a medium containing both glucose and lactose. It he bacterium possesses a normal lac operon, predict
    1. the effect on the intracellular concentration of allolactose
    2. the effect on the binding of catabolic activator protein (Cab) lac operon, and
    3. the effect on the synthesis of β–galactosidase. (3)
    B. Mention the two important factors that ensure the correct binding of M-formylmethionly-$tRNA^{f/Met}$ to 70s ribosomal initiation complex. (2)

25. Answer the following :

A. What is the difference between various classes of antibodies ? How are they formed ?

B. Calculate the number of different antibody specificities which can be formed by combinatorial association of *k* light chains with heavy chains. (3)

26. Answer the following :

A. In nitrogen fixing organisms such as Rhizobium, ATP is required for the nitrogenase reaction which catalyzes the reduction of diatomic N_2 to NH_3.

ATP is generated by electron transport and oxidative phosphorylation, which require O_2. However, the nitrogenase reaction is extremely sensitive to O_2. How does the presence of leghemoglobin in the bacterial membrane resolve this paradox ? (2)

B. What is the basic principle behind the phosphorothioate-based mutagenesis? What is the advantage of this method? (3)

J : BOTANY

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 and d along with the corresponding sub-question number.

(20 x 1 = 20)

1. The most distinctive feature of the family Umbelliferae is
   a. unisexual flowers
   b. type stature of plants
   c. type of inflorescence
   d. dissected leaves

2. According to the allopatric speciation model
   a. two or more populations of species become separated by geographic barriers.
   b. two species are separated by breeding barriers.
   c. speciation is sudden.
   d. speciation is reversible

3. When an objective lens of a light microscope is changed from low power to
   b. increase and appear da
   c. decrease and appear darke
   d. decrease and appear lighter.

4. Datum anther cultures regenerate
   What would be the ploidy of regenerants?
   a. Haploid
   b. both haploid and diploid
   c. diploid
   d. polyploid

5. An algal and fungal association that gives it the identity to an independent organism occurs in the group of
   a. Lichens
   b. Orchids
   c. Cycads
   d. Slime molds

6. Which of the following organisms listed below makes the most significant contribution to nitrogen fixation in paddy fields of India?
   a. Azatobacter
   b. Anabena
   c. Frankia
   d. Clostridium

7. Which one of the following antibiotics is inactivated by neomycin phospho-transferase?
   a. Kanamycin
   b. Chloramphenicol
   c. Spectinomycin
   d. ampicillin

8. Hexokinase from spinach cytosol was purified in two steps. The activity Of the enzyme and the amount of the protein obtained are given below:

Step	Activity	Protein
Ammonium sulphate precipitation	100 IU/ml	10 mg/ml
DEAE cellulose column chromatography	50 IU/ml	1 mg/ml

   The fold of purification achieved in going from step 1 to step 2 is
   a. 10
   b. 5
   c. 2
   d. 50

9. Somatic embryogenesis i.e. induction of embryos from somatic tissue is strongly

a. auxin and NH_4NO_3
b. gibberellins and KNO_3
c. ethylene and gibberellins
d. abscissic acid and polyethylene glycol

10. The function of Leg haemoglobin in root nodules in rhizobium legume symbiosis is
a. to transport oxygen to the nodule formation
b. to transport nitrogen to the nodule bacterium.
c. to protect the nodule bacterium.
d. to protect the nitrogenase in the nodule bacterium.

11. The net synthesis of glucose from lipids can take place during the germination of oil seeds in a pathway known as
a. Hexose monophosphate shunt
b. Malate aspartate shuttle
c. glyoxylate cycle
d. Calvin cycle

12. In many species of plants due to attack by microorganism or other physical factors, the synthesis of the following is induced :
a. Phycobilins
b. Phytoalexins
c. Ribozyme
d. phytochrome

13. Chloroplast genome of higher plant is
a. double stranded RNA
b. double stranded circular DNA
c. single stranded RNA
d. single stranded DNA

14. The exchange of genetic information between homologous chromatids at meiosn has been shown to involve a cross-bridged structure called Holiday structure. The cytological version of this structure is
a. Synapsis
b. Chiasmata
c. Centromere
d. Spindle fibers

15. A plant is said to be homozygous, when
a. it has the same allele for a gene on each chromosome of a pair
b. the plant is derived from two similar looking parents.

16. Phloem is concerned with [illegible] of organic substances from [illegible] 'sinks' in plants. Turgor [illegible] functional phloem will be
a. low at the source and high at the [illegible]
b. low at the sink and high at the source
c. low at both, the sink and source, and high in between
d. all of the above.

17. The number of primary consumers in a food web has decreased. Which organism in the food web would most likely be the first to shown an increase in numbers ?
a. secondary consumers
b. producers
c. climax organisms
d. carnivores

18. The form in which the bulk of carbohydrate is transported in vascular plants is
a. fructose
b. raffinose
c. sucrose
d. soluble starch

19. Which one of the following is responsible for defestation of groundnut crop?
a. Puccinia arachidis
b. Sclerospora gramini
c. Phytophthora infestans
d. Neurospora crassa

20. Which one of the following forests is more diverse?
a. coniferous evergreen
b. deciduous evergreen
c. tropical rain forest
d. subtropical rain forest

21. Match the plant species (column I) with the appropriate families (column II). (1 x 5 = 5)

Column I
A. Carrot
B. Tomato
C. Peas
D. Cabbage
E. Pumpkin

Column II

2. Cucurbitaceae
3. Umbelliferae
4. Leguminosae
5. Solanaceae

22. Answer the following :

A. Dichlorophenyldimethyurea (DCMU), an herbicide interferes with photo-phosphorylation and oxygen evolution. It does not block Hill reaction.

Propose a site for the inhibitory action of DCMU. (3)

B. If you were going to extract chlorophyll a and chlorophyll b from crushed spinach leaves, would you peeler acetone or water as a solvent. Explain your answer briefly. (2)

23. Answer the following :

A. Both, cellulose and α-amylose, consist of(1 →4) - linked D-glucose units end Can he extensively hydrolyzed. Despite this similarly, a person on a diet consisting predominantly of α-amylose (starch) will gain weight, whereas a person on a diet of cellulose (cotton) will starve. Why? (2)

B. Why do most fibrous proteins have low nutritional value? (3)

24. Answer the following :

A. Name the carbondioxide fixation cycle that characterizes a desert plant Mention briefly the physiological significance of this system. (3)

B. What are the three life forms of plants that are adapted to deserts ? Explain how these plants avoid drought. (2)

25. Answer the following :

A. Name a herbicide that exhibits auxin-like activity and a compound that exhibits cytokinin-like activity.

B. Numerous annual plants-and individual parts of both, annual and perennial, plants exhibit sigmoid growth kinetics. Draw and indicate the three phases in the growth curve.

26. Answer the following :

A. Place the following components, reactants and products of the nitrogenase complex reaction in their correct sequence during the electron

a. Oxidized ferredoxin
b. Reductase component
c. Nitrogenase component
d. Ammonia
e. Nitrogen
f. Reduced ferrodoxin
g. Electron source (3)

B. TMV contains double stranded RNA. If Adenine content is 28%, what is the most probable composition of the genome ? (2)

K : MICROBIOLOGY

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 x 1= 20)

1. Under the five kingdom system of classification of living world, eubacteria are placed under the kingdom :
   a. Plantae
   b. Protista
   c. Fungi
   d. Monera
2. Which of the following set of organism belong to archaebacterial ?
   a. Mycoplasma, Sarcina, Pneumococcus
   b. Methanosarcina, Halococcus, thermoplasma
   c. Nitrosococcus, Nitromonas, Erwinia
   d. Streptococcus, Nitrococcus, Halococcus
3. The Scientist who proved by experiments that the theory of spontaneous generation is wrong, is
   a. Joseph Lister
   b. Robert Koch
   c. Louis Pasteur
   d. Edward Jenner
4. Synthetic medium containing phosphates, calcium, and iron salts, upon autoclaving leads to precipitate formation. This is

b. Ethylene diamine tetracetate
c. Tris
d. Glucose

5. The resolving power of a microscope is determined by
   a. Wavelength of the light source
   b. Refractive index of the medium between the specimen and objective lens
   c. Half-angle of the objective lens
   d. All the three above

6. The following is the asexual rimgal spore :
   a. Ascospore
   b. Chlamydospore
   c. Basidiospore
   d. Zygospore

7. Dipicolinic acid is present in
   a. Endospore
   b. Exospore
   c. Cysts
   d. Conidia

8. In agricultural fields, the nitrogen fixed by symbiotic organism, as compared to free-living nitrogen fixes, is
   a. Equal in amount
   b. 2-fold higher
   c. 100 to 1000-fold higher
   d. 10-fold lower

9. The energy source for the genus Nitrosomonas is :
   a. Ammonia
   b. Nitrite
   c. Nitrogen
   d. Nitrate

10. Zymomonus mobilis ferments glucose by Emner-doouderoff pathway to produce ethanol. The number of moles of ATP formed per mole of glucose fermented is :
    a. 1 mole
    b. 2 moles
    c. 36 moles
    d. 38 moles

11. Diphtheria toxin inhibits protein synthesis through
    a. Release of peptidyl tRNA from 'P' site
    b. Binding to factor EF-1
    d. Causing peptide bond

12. Hydroxylation of steroid rin
    II) and dehydrogenation (at posi
    2) could be effected by two org
    They are, respectively,
    a. Corynebacterium sp. & Streptomyce sp.
    b. Rhizopus sp. & Corynebacterium sp.
    c. Aspergillus sp. & Rhizopus sp.
    d. Pseudomonas sp. & Aspergillus sp.

13. The growth of Leuconostoc dextranicum and L. Citrovorum imparts the characteristic aroma to the fermented milk. It is because of their ability to produce
    a. Acetyl CoA
    b. Aetoacetic acid
    c. Diacetyl
    d. Acetoion

14. The two modified sugars present in murein of Gram positive bacteria are
    a. Glucosamine and N-Acetylaglucosamine
    b. N-Acetyl glucosamine and N-acetylmuramic acid
    c. N-Acetylmuramic acid and N-acetylglucoronic acid
    d. glucosamine and Mannosamine

15. The genome of vaccinia virus is
    a. Single stranded DNA
    b. Single stranded RNA
    c. Double stranded DNA
    d. Double stranded RNA

16. Immunisation with triple antigen offers protection against the following diseases
    a. Diphtheria, Pertussis, Tetanus
    b. Pertussis, Tetanus, Cholera
    c. Typhoid, Paratyphoid A, paratyphoid B
    d. Tuberculosis, Typhoid, Tetanus

17. The number of distinct peptides one would get on running secretory IgA on SDS PAGE under reducing conditions, is
    a. 1
    b. 2
    c. 3
    d. 4

a. Antibodies
b. Complements
c. Interleukins
d. Class II MHG proteins

19. Endogenous viral antigens are presented to CD^+ T-cells by
a. MHC Class I
b. MHC Class II
c. CD4
d. CD2

20. The prokaryotic ribosome has sedimentation value of :
a. 80S
b. 70S
c. 60S
d. 40S

21. Listed in Column A are some antimicrobial agents, in Column B the organisms against which they are used and in Column C their most important mechanism of action. Match the antimicrobial agent (A) with the organism (B) and the corresponding mechanism of action (C). (1 x 5 = 5)

Column A
A. Penicillin
B. Nystatin
C. Azidothymidine
D. Chloroquine
E. Rifamycin

Column B
1. Yeasts
2. Gram positive bacteria
3. Malarial parasite
4. Tuberculosis
5. HIV

Column C
a. Inhibits RNA polymerase
b. Inhibits cell wall biosynthesis
c. Damages cell membrane
d. Inhibits reverse transcriptance
e. Blinds to DNA

22. Answer the following :
A. In an actively growing bacterial culture the cell number increased from 10^3 cells/ml to 10^7 cells/ml in 4 hours.
1. number of generatio... one through, and
2. generation time in minutes.
B. How do light and electron mic... differ in the following features :
1. source of radiation for image formatio...
2. Nature of lenses (2)

23. Answer the following :
A. In autotrophic micro-organisms carbon dioxide is fixed by Calvin cycle. Balance the reaction given below to produce one mole of glycerol-dehyde-3-phosphate, after filling the missing component in the reactants : (2 + 1)

CO_2 + ATP + ...→ glycerol dehyde-3-phosphate + ADP + $NADP^+$

B. Write the key reaction catalyzed by Aldolase in glycolysis (by naming the substrate and products) (2)

24. Answer the following :
A. Show diagrammatically how trp operon functions (2)
B. What are photo-autotrophs and chemoheterotrophs ? (2)

25. Define the following in one or two sentences : (1 x 5 = 5)
A. Shattle vector
B. Intron
C. Auxotroph
D. Restriction endonuclease
E. Transduction

26. Answer the following :
A. Various types of amylases are used in the production of syrup and dextrose from starch. Name enzymes which mediate each of the following conversions :
1. starch to glucose
2. starch to oligosaccharides and maltose
3. starch to maltose and dextrins (3)
B. Name the conditions under which acetic bacteria and bacteria and lactic acid bacteria cause spoilage of wine. (2)

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For each sub-question given below, four alternatives are provided of which only one is

book by writing a, b, c or d along with the corresponding sub-question number.

(13 x 1 = 13)

1. Euryhaline animals succeed well particularly in
   a. Sea
   b. River
   c. Estuary
   d. Lagoon
2. Mutualism is a relationship between two species when
   a. Both species are benefited
   b. One survives and the other dies
   c. Essential to one but neither harmful nor helpful to the other
   d. Essential to one and harmful to the other
3. The abyssopelagic zone in the marine ecosystem is located at a depth
   a. Upto 200 m
   b. of 1000 m
   c. of 2000 m
   d. below 4000 m
4. Undifferentiated mesoderm develops into
   a. Nervous tissue
   b. Connective tissue
   c. Sensory organs
   d. Digestive glands
5. Protein anchored in the plasma membrane by glycosyphosphatidyl inositol linkage can be cleaved by
   a. Phosphorylase B
   b. Phospholipase C
   c. Phosphodiesterase
   d. Phosphokinase
6. During glycoprotein synthesis in the mammalian cells glycosylation occurs
   a. In the ribosomes
   b. In the mitochondria
   c. In the endoplasmic reticulum and Golgi vesicles
   d. Lysosomes
7. The marker protein for mitochondria is
   a. Ribosomes
   b. Catalase
   d. Cytochrome C
8. Glucose molecules move [illegible] plasma membrane of mammalia[illegible]
   a. An ATP powered pump called [illegible] transport process
   b. A passive diffusion process
   c. An ion channel protein down their concentration gradient
   d. A membrane transport protein called transporter protein
9. Somatic mutation of immunoglobulin genes accounts for
   a. Allelic exclusion
   b. Class switching
   c. Affinity maturation
   d. All of these
10. CD-4⁺ helper T cells bind to processed antigen when expressed in association with
    a. Class I MHC molecules
    b. Class II MHC molecules
    c. Both the above
    d. IL-2 receptor
11. An essential amino acid is one body
    a. cannot be reabsorbed by the renal tubules.
    b. Cannot be reabsorbed by the renal tubules.
    c. Is required for the synthesis of certain proteins only
    d. Is poorly absorbed from the diet.
12. Epinephrine decreases
    a. Heart rate
    b. Cardiac contractility
    c. Basal metabolic rate
    d. Cutaneous blood flow
13. The main constituent of a blood clot is
    a. Thrombin
    b. Fibrin
    c. Plasminogen
    d. Thromboplastin
14. Match the name of the animals in column I with their contributions to human existence in column II. (4 x 1 = 4)

    Column I

    A. Manatee

    B. Pig

D. Lady bird beetles

Column II

1. Affectionate bonds
2. control of insects
3. Heart surgery
4. Cleaning waterways of obstructing vegetation

15. Match the types of inactivity in animals in column I to their definitions in Column II (4 x 1 = 4)

Column I

A. Torpor
B. Hibernation
C. Winter sleep
D. Aestivation

Column II

1. Inactivity to withstand extended periods of drying
2. Inactivity with near normal body temperature with near normal body temperature by large energy reserves and the animal is easily aroused.
3. Inactivity with lowered body temperature and decreased metabolism that may last for weeks or months.
4. Inactivity with lowered body temperature and decreased metabolism that occurs daily.

16. Match the entries in Column I with those in Column II. (4 x 1 = 4)

Column I

A. Neuromast
B. Johnston's organ
C. Glochidium
D. Jacobson's organ

Column II

1. auditory receptor
2. Lateral line system
3. Olfactory receptor
4. Bivalve larva

Give brief answers to questions below :

17. Define the following : (5 x 1 = 5)

A. Western blotting
B. Anthropomorphism
D. Altricial
E. Batesian mimicry

18. Answer the following :

A. What is allopatric speciation ?
B. What is amplexus ?
C. What is a fertilization membrane ?
D. What are Kleptoparasites ?
E. What is 'Complement' in the immune system ?

19. Answer the following :

A. Why from eggs have light pigmenation to the bottom on the top ? (2)
B. How does a ready-to-mate female moth send signal for mating to a male moth ? (1)
C. Write the scientific name of two living representatives of monotremes. (2)

20. Answer the following :

A. What is aneuploidy and how is it likely to occur ? (2)
B. What are linked genes ? (1)
C. Why do the X-linked recessive traits always express in male offsprings? (2)

21. Answer the following :

A. What are the three DNA sequence elements that are always needed to form a stable linear functional eukaryotic chromosome ? (1)
B. Mention the eukaryotic RNA polymerase which is responsible for the synthesis of precursor ribosomal RNA ? (1)
C. Are eukaryotic mRNAs monocistronic or polycistronic ? (1)
D. What modifications do occur at the 5' and 3' end of nascent mRNA transcripts immediately after their synthesis in the nucleus ? (2)