

53

QUESTION PAPER
SERIES CODE
A

Registration No. :

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Centre of Exam. :

Name of Candidate :

Signature of Invigilator

ENTRANCE EXAMINATION, 2017

M.Sc. LIFE SCIENCES

[Field of Study Code : SLSM (225)]

Time Allowed : 3 hours

Maximum Marks : 100

INSTRUCTIONS FOR CANDIDATES

Candidates must read carefully the following instructions before attempting the Question Paper :

- (i) Write your Name and Registration Number in the space provided for the purpose on the top of this Question Paper and in the Answer Sheet.
- (ii) **Please darken the appropriate Circle of Question Paper Series Code on the Answer Sheet.**
- (iii) The Question Paper is divided into two parts : Part—A and Part—B. Both parts have multiple-choice questions. All answers are to be entered in the Answer Sheet provided with the Question Paper for the purpose by darkening the correct choice, i.e., (a) or (b) or (c) or (d) with BALLPOINT PEN only against each question in the corresponding Circle.
- (iv) Part—A consists of 30 questions and all are compulsory.
- (v) Part—B contains 100 questions. **Answer any 70 questions.**
In case any candidate answers more than the required 70 questions, the first 70 questions attempted will be evaluated.
- (vi) Each correct answer carries 1 mark. **There will be negative marking and $\frac{1}{3}$ mark will be deducted for each wrong answer.**
- (vii) Answer written by the candidates inside the Question Paper will not be evaluated.
- (viii) Calculators and Log Tables may be used.
- (ix) Pages at the end have been provided for Rough Work.
- (x) Return the Question Paper and Answer Sheet to the Invigilator at the end of the Entrance Examination. **DO NOT FOLD THE ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS

1. Use only Blue/Black Ballpoint Pen (do not use pencil) to darken the appropriate Circle.
2. Please darken the whole Circle.
3. Darken ONLY ONE CIRCLE for each question as shown in example below :

Wrong	Wrong	Wrong	Wrong	Correct
<input type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/>	<input checked="" type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/> (d)	<input checked="" type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/> (d)	<input checked="" type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/>	<input type="radio"/> (a) <input checked="" type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/>

4. Once marked, no change in the answer is allowed.
5. Please do not make any stray marks on the Answer Sheet.
6. Please do not do any rough work on the Answer Sheet.
7. Mark your answer only in the appropriate space against the number corresponding to the question.
8. **Ensure that you have darkened the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

/53-A

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2

PART—A

Answer all questions

1. A family consisting of grandmother, father, mother, four sons and their wives, and two daughters each of the sons went to dine in a restaurant. How many female guests are there in total?
 - (a) 12
 - (b) 14
 - (c) 16
 - (d) 18

2. Five friends Jayant, Kishore, Prem, Rajat and Suresh were standing in a row. Jayant was standing to the immediate left of Rajat, Prem was between Kishore and Suresh, and Suresh was between Jayant and Prem. Who was standing at the extreme left end of row?
 - (a) Kishore
 - (b) Jayant
 - (c) Suresh
 - (d) Prem

3. Two express trains A and B simultaneously started on two tracks from Varanasi to Delhi, which are 390 km apart. The ratio of the speed of express A and B is 6 : 7. After how many kilometers would express B exchange speed with express A, so that both trains reach their destinations simultaneously?
 - (a) 150 km
 - (b) 190 km
 - (c) 210 km
 - (d) 250 km

4. Kishore is as much younger to Nilesh as he is older to Manish. If the sum of the ages of Nilesh and Manish is 48 years, what is the present age of Kishore?
 - (a) 18 years
 - (b) 24 years
 - (c) 28 years
 - (d) 36 years

5. A watch reads 4:30. If the minute hand points to the East, in what direction will the hour hand point?
 - (a) North
 - (b) North-West
 - (c) North-East
 - (d) South-East

6. The probability that an M.Sc. student will join university *A* is $\frac{2}{5}$ and that he will join university *B* is $\frac{1}{3}$. The probability that he will join either *A* or *B* is
- (a) $\frac{2}{15}$
 - (b) $\frac{4}{15}$
 - (c) $\frac{11}{15}$
 - (d) $\frac{3}{8}$
7. If mode of a series exceeds its mean by 12, then mode exceeds the median by
- (a) 4
 - (b) 8
 - (c) 6
 - (d) 10
8. If you have to prepare one litre of 1.0 mM (millimolar) sodium chloride solution, how much sodium chloride would you dissolve in water? [Molecular weight of sodium chloride is 58.44]
- (a) 58.44 g
 - (b) 5.844 g
 - (c) 58.44 mg
 - (d) 5.844 mg
9. The last Nobel Prize awarded to an Indian origin scientist was for the discovery of
- (a) novel therapy for roundworm and malaria
 - (b) ribosome structure
 - (c) the mechanism for reprogramming of stem cells
 - (d) the machinery for vesicle trafficking in living cells
10. The timber-yielding plants such as pine, fir, spruce and cedar that occur widely in the hilly regions of India belong to
- (a) dicotyledons
 - (b) monocotyledons
 - (c) angiosperms
 - (d) gymnosperms

11. Which of the following **does not** increase plant productivity?
- (a) Agrobacterium
 - (b) Mycorrhiza
 - (c) Rhizobium
 - (d) Trichoderma
12. Which of the following metal atoms is centrally located in the chlorophyll pigment?
- (a) Manganese
 - (b) Iron
 - (c) Sulfur
 - (d) Magnesium
13. The typical characteristic of sclerenchyma is
- (a) primary cell wall is thickened in all sides
 - (b) secondary cell wall is thickened in all sides
 - (c) primary cell wall is thickened in certain regions especially in the corners
 - (d) secondary cell wall is thickened in certain regions especially in the corners
14. When you boil an egg, the albumin is converted into a white solid mass. This phenomenon is
- (a) dehydration
 - (b) cross-linking
 - (c) denaturation
 - (d) degradation
15. DNA of a bacterium is not cleaved by its own restriction enzyme, because the recognition sequences are
- (a) methylated
 - (b) acetylated
 - (c) absent
 - (d) inaccessible to restriction enzymes

16. A total of how many histone molecules are found in a complete typical nucleosome in the eukaryotic chromatin?
- (a) Eight
 - (b) Four
 - (c) Five
 - (d) Two
17. RNA undergoes hydrolysis in alkali chiefly due to the
- (a) uracil residue in the RNA
 - (b) single-stranded nature of RNA
 - (c) 2'-hydroxyl in the ribose sugar backbone
 - (d) secondary structure of RNA
18. Which of the following stages related to mitosis shows a decondensed state of chromatin?
- (a) Interphase
 - (b) Metaphase
 - (c) Anaphase
 - (d) Telophase
19. Proto-oncogenes are
- (a) transforming genes found in retroviruses
 - (b) transforming genes present in Protozoa
 - (c) genes encoding oncogene-related proteins in extinct organisms
 - (d) cellular genes encoding proteins related to viral oncogenes
20. Which of the following is a constituent of spider silk?
- (a) Fibroin
 - (b) Fibronectin
 - (c) Albumin
 - (d) Fibrinogen

21. Which of the following is the ancestor of chordate?
- (a) Echinoderm
 - (b) Arthropod
 - (c) Mollusc
 - (d) Annelid
22. Which of the following is the correct order of early developmental stages in a frog?
- (a) Blastula, cleavage, gastrula, neurula
 - (b) Cleavage, gastrula, neurulation, organogenesis
 - (c) Tadpole, embryo, neurula, gastrula
 - (d) Neurulation, gastrulation, organogenesis, cleavage
23. Persons of which of the following blood groups will be most compatible to accept AB blood group?
- (a) O and A
 - (b) O and B
 - (c) AB
 - (d) A and B
24. Communication between two neurons at a chemical synapse involves
- (a) electrochemical, chemical and electrical processes
 - (b) predominantly an electrical process
 - (c) exclusively chemical process
 - (d) largely an electrical process followed by chemical process
25. Calcium sulphate is commonly called
- (a) plaster of Paris
 - (b) washing soda
 - (c) slaked lime
 - (d) baking soda

26. Which of the following is anisole?
- (a) $C_6H_5OCH_3$
 - (b) $C_6H_5NH_2$
 - (c) $C_6H_5ONH_2$
 - (d) C_6H_5OCl
27. The structure of PCl_5 is
- (a) pentagonal planar
 - (b) square pyramidal
 - (c) distorted octahedral
 - (d) trigonal bipyramidal
28. Friedel-Crafts alkylation of benzene with CH_3Cl will produce
- (a) toluene + HCl
 - (b) benzyl chloride + HCl
 - (c) *p*-chlorotoluene + HCl
 - (d) *o*-chlorotoluene + HCl
29. Which of the following is correct about domestic electric circuits?
- (a) Fuse is connected in parallel
 - (b) Earth wire is of green color
 - (c) Live wire is of black color
 - (d) Neutral wire is of red color
30. If the length of a wire is doubled and its area of cross-section is decreased to half, then its resistance will
- (a) increase 4 times
 - (b) become double
 - (c) remain the same as before
 - (d) become half the initial value

PART—B

Answer *any seventy* questions

31. In a biochemical reaction, the role of an enzyme is to
- (a) increase the activation energy
 - (b) decrease the activation energy
 - (c) increase the turnover number
 - (d) decrease the turnover number
32. Which of the following statements is *not* correct about biological membranes?
- (a) Membranes can undergo fluid to gel-like phase transition.
 - (b) Lipids but not proteins are laterally mobile.
 - (c) Sphingolipids are primary components of biomembranes.
 - (d) Cholesterol forms microdomains in membranes.
33. How many ATP molecules are generated per TCA cycle?
- (a) 12
 - (b) 10
 - (c) 24
 - (d) 6
34. Vitamin D is naturally made in
- (a) spleen
 - (b) liver
 - (c) skin
 - (d) bone
35. The amino acid that is not phosphorylated is
- (a) serine
 - (b) asparagine
 - (c) tyrosine
 - (d) threonine

36. Oxidation of fatty acids in mitochondria generates which of the following endproducts?
- (a) Coenzyme A
 - (b) Acetyl CoA
 - (c) Succinyl CoA
 - (d) Acetoacetyl CoA
37. Which of the following enzymes can limit the rate of glycolysis in animal tissues?
- (a) Enolase
 - (b) Phosphofructokinase
 - (c) Phosphotriose isomerase
 - (d) Glyceraldehyde-3-phosphate dehydrogenase
38. Which of the following statements is **not** true about Gram staining?
- (a) Developed in 1884 by a Danish physician.
 - (b) Can be used to classify Archaea.
 - (c) Alcohol is used in this process to generate the differential staining.
 - (d) Gram-negative cells appear red.
39. Which of the following statements is **not** true about mitochondria?
- (a) Mitochondria contain enzymes involved in TCA cycle.
 - (b) Number and size of mitochondria vary for a cell type.
 - (c) Mitochondria do not synthesize its own lipid.
 - (d) Some eukaryotic cell can survive without a mitochondrion.
40. If two tall heterozygous pea plants were crossed, how many of the F_1 progeny would be heterozygous?
- (a) All
 - (b) $\frac{1}{2}$
 - (c) $\frac{1}{4}$
 - (d) $\frac{3}{4}$

41. The principle of linkage was propounded by
- (a) Gregor Mendel
 - (b) William Bateson
 - (c) T. H. Morgan
 - (d) Hugo de Vries
42. Which of the following is the most accurate statement describing the consequences of mutations?
- (a) A mutated base always changes the amino acid sequence of the encoded protein.
 - (b) Mutations can sometimes change the properties of a protein, giving a survival advantage to an organism under specific conditions.
 - (c) A single-point mutation cannot change the properties or functions of a protein.
 - (d) A frameshift mutation is least likely to disrupt a protein function.
43. An individual homozygous for a recessive mutation x/x was mated with an individual homozygous for recessive mutation y/y . The resulting offspring showed normal phenotype due to
- (a) codominance
 - (b) epistasis
 - (c) complementation
 - (d) polymorphism
44. Which of the following is responsible for generation of lampbrush chromosome in *Xenopus* oocyte?
- (a) DNA replication
 - (b) Ribosomal RNA synthesis
 - (c) Chromatin duplication
 - (d) Pairing of homologous chromosomes
45. Which of the following processes is responsible for the formation of polytene chromosome in *Drosophila*?
- (a) Endoreduplication
 - (b) Aneuploidy
 - (c) Polyploidy
 - (d) Sister chromatid exchange

46. A living cell has 28% thymine content in its chromosome. Which of the following is the correct proportion of guanine in its genome?
- (a) 18%
 - (b) 22%
 - (c) 30%
 - (d) 44%
47. Which of the following is **incorrect** about the process of translation?
- (a) The first AUG from the 5' end of mRNA serves as a translational start codon
 - (b) There are 61 triplet codons that specify 20 amino acids
 - (c) Translation is catalyzed by 80S ribosomes in eukaryotes
 - (d) Silent mutations are not decoded into amino acids
48. Targeting of proteins to various organelles is governed by the signal sequence
- (a) found on secretory vesicles carrying the proteins
 - (b) present on the surface of the organelle where it is targeted
 - (c) an integral part of the protein itself
 - (d) a part of the cytoskeleton that governs the protein trafficking
49. Salvage pathway refers to
- (a) nucleotide metabolism
 - (b) carbohydrate metabolism
 - (c) lipid metabolism
 - (d) amino acid metabolism
50. Which one of the following sequences is a type-II restriction enzyme recognition site?
- (a) CGGCTT
 - (b) CGCCGC
 - (c) GTAATG
 - (d) GTCGAC

51. To be a cloning vector a plasmid *does not* require
- (a) an origin of replication
 - (b) an antibiotic resistance marker
 - (c) a restriction site
 - (d) to be in high copy
52. Which one of the following is *not* addressed using a Northern blot?
- (a) Length of the reading frame
 - (b) Spatial expression of a particular gene
 - (c) Temporal expression of a particular gene
 - (d) Length of the mRNA
53. Chargaff's rule about double-stranded DNA states that
- (a) $A + G / C + T = 1$
 - (b) $A + G : C + T = 1 : 1$
 - (c) $A + T : G + C = 1 : 1$
 - (d) $A + C / G + T = 1$
54. Application of which of the following hormone combinations to a mass of calli is likely to induce maximum cell division?
- (a) Auxin + Abscisic acid
 - (b) Auxin + Gibberellin
 - (c) Cytokinin + Abscisic acid
 - (d) Gibberellin + Abscisic acid
55. Together carbon and oxygen contribute to almost what percent of plant's dry mass?
- (a) 35%
 - (b) 60%
 - (c) 75%
 - (d) 90%

- 56.** Which of the following is commonly used as pollution indicator?
- (a) Lichens and cereals
 - (b) Algae and angiosperm
 - (c) Gymnosperm and mosses
 - (d) Lichens and mosses
- 57.** The following agricultural practices are widely used for increasing crop yield :
- (i) Use of highly yielding variety seeds
 - (ii) Introduction of genetically modified crops
 - (iii) Application of chemical fertilizers and pesticides
 - (iv) Organic farming
- Which among them significantly contributed to Green Revolution in the 1960–70s?
- (a) (i) and (ii)
 - (b) (ii) and (iii)
 - (c) (i) and (iii)
 - (d) (ii) and (iv)
- 58.** The major element causing salinity stress in plants is
- (a) Ca
 - (b) Na
 - (c) Cl
 - (d) Mg
- 59.** Embryo sac of most angiosperms develops from megaspore after
- (a) two meiosis
 - (b) meiosis followed by mitosis
 - (c) mitosis followed by meiosis
 - (d) three mitosis
- 60.** Kranz anatomy is likely to be present in
- (a) maize and sugarcane
 - (b) sugarcane and rice
 - (c) maize and rice
 - (d) rice and wheat

61. A plant *X* cannot bear fruit but can help the plant *Y* to do so. Which of the following statements is correct?
- (a) *X* is a monoecious male and *Y* is a dioecious female.
 - (b) Both *X* and *Y* are dioecious where *X* is male and *Y* is female.
 - (c) *X* is a dioecious male and *Y* is a monoecious female.
 - (d) *X* is a dioecious female and *Y* is a monoecious male.
62. Rolling and unrolling of grass leaves are controlled by
- (a) guard cells present in the upper side of the leaves
 - (b) guard cells present in the lower side of the leaves
 - (c) bulliform cells present in the upper side of the leaves
 - (d) bulliform cells present in the lower side of the leaves
63. The correct order of arrangement of primary xylem (1X), secondary xylem (2X), primary phloem (1P) and secondary phloem (2P) from periphery to the centre of a perennial dicot stem is
- (a) 1X, 2X, 1P, 2P
 - (b) 2X, 1X, 1P, 2P
 - (c) 1P, 2P, 1X, 2X
 - (d) 1P, 2P, 2X, 1X
64. Heterosis is superiority of F_1 over parents caused by
- (a) spontaneous mutations
 - (b) large insertion/deletion mutations
 - (c) inversion mutation
 - (d) combination of QTLs
65. The natural genetic engineer most commonly used to transform plants is
- (a) *Bacillus thuringiensis*
 - (b) *Agrobacterium rhizogenes*
 - (c) *Agrobacterium tumefaciens*
 - (d) *Pseudomonas syringae*

66. Genetically engineered male-sterile crops may be produced by inserting
- (a) lectin gene
 - (b) barnase gene
 - (c) Bt toxin gene
 - (d) chitinase gene
67. Which of the following hormones is principally responsible for homeostasis of calcium and phosphate for mineralization of bones?
- (a) Thyroid hormone
 - (b) Parathyroid hormone
 - (c) Glucocorticoid
 - (d) Corticosteroid
68. Which of the following statements is **not** a feature of cancerous cells?
- (a) Cancer cells divide without restraint.
 - (b) Cancer cells generally carry multiple mutations in their genome.
 - (c) Cancer cells undergo metastasis through the lymphatic and circulatory systems.
 - (d) Cancer cells generally arise after a normal cell is infected with certain bacteria.
69. Cancer cells are different from normal cells because
- (a) cell size is larger for normal cells
 - (b) cancer cells divide continuously whereas normal cells do not
 - (c) normal cells are immortal
 - (d) cancer cells divide but not differentiate like normal cells
70. Where in the body of a mammal the B cells are primed by the antigen?
- (a) Spleen
 - (b) Lymph node
 - (c) Thymus
 - (d) Blood

71. Which one of the following patterns of curves best represent the growth of mice population in a new environment?
- (a) S-shaped
 - (b) U-shaped
 - (c) Bell-shaped
 - (d) J-shaped
72. In mammals, urine is maximally concentrated in the
- (a) Bowman's capsule
 - (b) loop of Henle
 - (c) proximal tubule of the nephron
 - (d) glomerular tuft
73. A tissue biopsy sample needs to be microsectioned into thin slices to be able to observe under light microscope, because
- (a) cells are separated in space for better visualization
 - (b) light can pass through the section so that cells and their components can be visualized
 - (c) the 3-dimensional organization of tissue is retained
 - (d) any interference from extracellular matrices can be eliminated
74. The propagation of action potential through an axon is proportional to the
- (a) diameter and myelination of the axon
 - (b) length and diameter of the axon
 - (c) length and myelination of the axon
 - (d) number of dendrites and soma size
75. Which of the following physiological functions is **not** normally regulated by kidney?
- (a) Blood pressure
 - (b) Electrolyte balance of the body fluids
 - (c) Blood pH and ammonia level
 - (d) Production of WBC

- 76.** An electrocardiogram (ECG) record provides information about the
- (a) force of contraction of the heart muscles
 - (b) conduction of electrical signals through the heart
 - (c) oxygenation and deoxygenation levels of the atrial and ventricular blood
 - (d) ejection volume of the ventricular blood
- 77.** The source of energy mostly used by the spermatozoa in the seminal fluid is
- (a) sucralose
 - (b) mannose
 - (c) fructose
 - (d) glucose
- 78.** In higher animals, which one of the following vasculatures would constitute the largest cumulative cross-sectional area?
- (a) Arteries
 - (b) Arterioles
 - (c) Capillaries
 - (d) Veins
- 79.** Of the following diseases, which one is caused by an intracellular pathogen?
- (a) Tetanus
 - (b) Sleeping sickness
 - (c) Chickenpox
 - (d) Schistosomiasis
- 80.** Which of the following is a part of the specific host defence during pathogen challenge?
- (a) Mucous membranes
 - (b) Low pH
 - (c) Lysozyme
 - (d) Antibodies

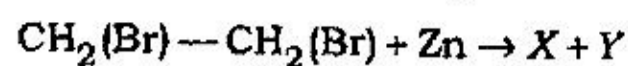
- 81.** Which of the following terms is **not** associated with an allergic response?
- (a) IgM antibodies
 - (b) Atopy
 - (c) Mast cells
 - (d) IgE antibodies
- 82.** Which of the following is **incorrect** about events linked to phagocytosis?
- (a) Fusion of phagosome with lysosome
 - (b) Engulfment of microbe
 - (c) Proteolytic degradation of microbe
 - (d) Disintegration of macrophage nucleus
- 83.** What is the smallest fragment of an antibody capable of specific binding to antigens?
- (a) IgG
 - (b) Light chains
 - (c) Fc fragment
 - (d) Fab fragment
- 84.** What would be the consequence of mixing of individual cells obtained from an embryo which was disaggregated by chemicals or proteases?
- (a) The cells would associate with each other randomly
 - (b) Like-type cells would sort themselves and remain together
 - (c) Cells would reassociate with one another forming a complete embryo
 - (d) Cells would not reassociate
- 85.** In morphallactic-type of regeneration
- (a) repatterning of the existing cells without new growth
 - (b) repatterning of the existing cells with extensive new growth
 - (c) reinitiation of division in the differentiated cells followed by patterning
 - (d) dedifferentiation, division and then patterning

86. During gastrulation of frog embryo, the very first cells which move into the interior of the embryo through the blastopore come from the surface layer of cells in the marginal zone would likely become
- (a) ectoderm
 - (b) endoderm
 - (c) mesoderm
 - (d) yolk
87. The organizer in *Xenopus* is responsible for
- (a) initiating involution and gastrulation
 - (b) inducing mesodermal fate in the nearby cells
 - (c) specifying dorsal region of the embryo
 - (d) initiating cleavage
88. Which of the following proteins is largely responsible for the anterior fate in *Drosophila*?
- (a) Bicoid
 - (b) Torso
 - (c) Caudal
 - (d) Nanos
89. The programmed cell death that separates the digits of the forelimb is largely dependent on which of the following pathways?
- (a) Bone morphogenetic protein
 - (b) Fibroblast growth factor
 - (c) Sonic hedgehog
 - (d) Wingless
90. Which one of the following immunization procedures will give a good antibody response against a hapten?
- (a) Give multiple intravenous injections of hapten alone
 - (b) Use large amounts of hapten for each immunization
 - (c) Immunize with a conjugate of hapten and a large molecular weight protein
 - (d) Use a mixture of hapten and a protein

91. Ecological succession is
- (a) the replacement of closely related species at successive altitudes of a mountain
 - (b) the successive and continuous colonization of a site by a certain species accompanied by the extinction of others
 - (c) the synchronous ageing of a cohort of animals born at the same time
 - (d) the successive links in a food chain from plants to herbivores and carnivores
92. Which of the following species is *not* native to India?
- (a) Nilgai
 - (b) Impala
 - (c) Royal Bengal Tiger
 - (d) One-horned Rhinoceros
93. A bee pollinates a flower and the flower provides nectar to the bee. This ecological interaction is a case of
- (a) predation
 - (b) competition
 - (c) mutualism
 - (d) commensalism
94. Micelles in aqueous environment are
- (a) bilayers of long-chain fatty acids with an inner hydrophilic core and an outer hydrophobic core
 - (b) bilayers of long-chain fatty acids with an inner hydrophobic core and an outer hydrophilic core
 - (c) monolayers of long-chain fatty acids with an inner hydrophilic core and an outer hydrophobic core
 - (d) monolayers of long-chain fatty acids with an inner hydrophobic core and an outer hydrophilic core
95. Predict the product of the following reaction :
- $$\text{CH}_3\text{C(O)CH}_3 + \text{NaCN} \xrightarrow{\text{H}^+} ?$$
- (a) Cyanohydrin
 - (b) Alcohol
 - (c) Aldehyde
 - (d) Keto acid

96. Treating a secondary alcohol with $K_2Cr_2O_7$ will yield
- (a) a primary alcohol
 - (b) an aldehyde
 - (c) a ketone
 - (d) a carboxylic acid
97. For the carbanion $H_2C^- - X$ to be most stable, X must be
- (a) Cl
 - (b) RH_2N^+
 - (c) OH
 - (d) COO
98. Which of the following will be most reactive to nitration?
- (a) $PhCH_3$
 - (b) $PhCH_2Cl$
 - (c) $PhCHCl_2$
 - (d) $PhCCl_3$
99. Ethanol when heated in the presence of 95% H_2SO_4 will produce
- (a) ethane
 - (b) acetaldehyde
 - (c) ethylene
 - (d) acetic acid
100. The greater number of alkyl groups attached to a positively charged carbon atom
- (a) has no effect on the stability of the carbocation
 - (b) reduces the stability of the carbocation due to negative inductive effect
 - (c) increases the stability of the carbocation due to hyperconjugation
 - (d) increases the stability of the carbocation due to positive resonance effect

101. Identify products X and Y of the following reaction :



- (a) $\text{CH}_2=\text{CH}_2 + \text{Br}_2$
- (b) $\text{HC}\equiv\text{CH} + \text{ZnBr}_2$
- (c) $\text{CH}_2=\text{CH}(\text{Br}) + \text{Br}_2$
- (d) $\text{CH}_2=\text{CH}_2 + \text{ZnBr}_2$

102. What will be the product of the reaction $\text{C}_6\text{H}_5\text{OH} + \text{Zn} \rightarrow X$?

- (a) C_6H_6
- (b) $\text{C}_6\text{H}_6\text{OZn}$
- (c) $\text{C}_6\text{H}_5\text{COOH}$
- (d) $\text{C}_6\text{H}_5\text{CHO}$

103. Hemoglobin is a protein molecule with one atom of

- (a) Fe^{3+} complexed within a corrin ring
- (b) Fe^{3+} complexed within a porphyrin ring
- (c) Fe^{2+} complexed within a corrin ring
- (d) Fe^{2+} complexed within a porphyrin ring

104. The Schrödinger equation is a wave equation that helps us to determine

- (a) the wave energy of the matter waves in different physical situations
- (b) the wave function of the matter waves in different physical situations
- (c) the work function of the matter waves in different physical situations
- (d) None of the above

105. With increase of humidity, the velocity of sound in air

- (a) decreases
- (b) increases
- (c) fluctuates irregularly
- (d) remains unaffected

106. The quantity d in the equation of Bragg's law ($n\lambda = 2d \sin\theta$) is the
- (a) length of the incident waves
 - (b) length of the diffracted waves
 - (c) perpendicular distance between the planes
 - (d) None of the above
107. If $a*b = a^2 + b^2$, then the value of $(2*3)*4$ is
- (a) $(2^2 + 3^2) + 4^2$
 - (b) $(2 + 3)^2 + 4^2$
 - (c) $13^2 + 4^2$
 - (d) $(2 + 3 + 4)^2$
108. Differentiation of $\sin(x^2 + 1)$ with respect to x is
- (a) $2x \cos(x^2 + 1)$
 - (b) $3x \cos(2x)$
 - (c) $x \cos(x^2 + 1)$
 - (d) $4x \cos(x^2 + 1)$
109. The normal to the curve $x^2 = 4y$ passing through $(2, 3)$ is
- (a) $x + y = 1$
 - (b) $x + y = 5$
 - (c) $x - y = 0$
 - (d) $x - y = 5$
110. Which of the following is most effective in reducing hypertension?
- (a) Cyclooxygenase inhibitor
 - (b) Beta blocker
 - (c) Phosphodiesterase inhibitor
 - (d) Na^+ / K^+ ATPase inhibitor

111. Which of the following is **not** a part of Southern blot hybridization to detect a single-copy gene using a radioactively labelled DNA probe?
- (a) Restriction enzyme digestion of genomic DNA
 - (b) 5' end-labelling of probe
 - (c) Autoradiography
 - (d) Probe denaturation
112. Which of the following in the ribosome is involved in proofreading during translation in prokaryotes?
- (a) 30 S subunit
 - (b) 50 S subunit
 - (c) A site
 - (d) P site
113. Which of the following can be used to measure both current and voltage with suitable modifications?
- (a) Potentiometer
 - (b) Galvanometer
 - (c) Ammeter
 - (d) Hot-wire voltmeter
114. The characteristic color of KMnO_4 is due to
- (a) charge transfer transition from ligand \rightarrow metal
 - (b) charge transfer transition from metal \rightarrow ligand
 - (c) d subshell to d subshell transition
 - (d) σ to σ^* transition
115. Which one of the following has the highest melting point?
- (a) Xe
 - (b) Ne
 - (c) Kr
 - (d) He

116. Focal length of objective of an astronomical telescope is 1.5 m. What should be the focal length of eyepiece to get the magnification of 25 times?
- (a) 0.06 m
 - (b) 2.5 m
 - (c) 1.0 m
 - (d) 1.35 m
117. A ray of light incident on a 60° angled prism of refractive index $\sqrt{2}$ suffers minimum deviation. The angle of incidence is
- (a) 90
 - (b) 60
 - (c) 45
 - (d) 15
118. A glass slab of thickness 12 mm is placed on a table. The lower surface of the slab has a red spot. At what depth from the upper surface will the spot appear when viewed from above? [Refractive index of glass = 1.5]
- (a) 8 mm
 - (b) 9 mm
 - (c) 12 mm
 - (d) 18 mm
119. A stone is dropped into a lake from a tower 500 m high. The sound of the splash will be heard by a man on the tower after
- (a) 10 sec
 - (b) 11.5 sec
 - (c) 14 sec
 - (d) 21 sec
120. The work done in holding 15 kg suitcase while waiting for a bus for 45 minutes is
- (a) 675 J
 - (b) 4500 J
 - (c) 150 J
 - (d) zero

121. In Alaska, the temperature of air is $-30\text{ }^{\circ}\text{C}$. A lake has partially frozen up to 2 feet from the top. What will be the temperature of the lake at a distance of 5 feet from the top?
- (a) $-30\text{ }^{\circ}\text{C}$
 - (b) $-15\text{ }^{\circ}\text{C}$
 - (c) $0\text{ }^{\circ}\text{C}$
 - (d) $-1.5\text{ }^{\circ}\text{C}$
122. By increasing the temperature of a liquid
- (a) both volume and density decreases
 - (b) both volume and density increases
 - (c) volume increases and density decreases
 - (d) volume decreases and density increases
123. A wave of frequency 1000 Hz travels between X and Y , a distance of 600 m in 2 seconds. The number of wavelengths present within the distance XY is
- (a) 3.3
 - (b) 300
 - (c) 180
 - (d) 2000
124. A gun fires a bullet of mass 50 g with a velocity of 30 m s^{-1} . Because of this, gun is pushed back with a velocity of 1 m s^{-1} . Mass of the gun is
- (a) 1.5 kg
 - (b) 3.5 kg
 - (c) 20 kg
 - (d) 30 kg
125. If x and y are positive integers with $x > y$ and $x + xy = 143$, what is the value of $x + y$?
- (a) 11
 - (b) 13
 - (c) 33
 - (d) 39

- 126.** Ice is known as the solid state of water where each water molecule interacts with the neighboring ones to yield the ice lattice structure. What type of interaction exists between water molecules in ice?
- Hydrophobic interactions
 - Hydrogen bonding interactions
 - Both hydrogen bonding and covalent bonding interactions
 - Both hydrophobic and hydrogen bonding interactions
- 127.** Which of the following is the correct expression of the Henderson-Hasselbalch equation?
- $\text{pH} = \text{pK}_a + \log \left(\frac{[\text{HA}]}{[\text{A}^-]} \right)$
 - $\text{pH} = \text{pK}_a - \log \left(\frac{[\text{A}^-]}{[\text{HA}]} \right)$
 - $\text{pK}_a = \text{pH} + \log \left(\frac{[\text{A}^-]}{[\text{HA}]} \right)$
 - $\text{pH} = \text{pK}_a + \log \left(\frac{[\text{A}^-]}{[\text{HA}]} \right)$
- 128.** Which one of the following statements about ATP is correct?
- ATP can diffuse through cell membranes.
 - ATP is considered a low energy phosphate compound.
 - ATP is present at high concentrations in the cell.
 - Hydrolysis of ATP is a strongly exergonic reaction.
- 129.** Which of the following statements about acids and bases is correct?
- At pH values below its pK_a , more than 50% of a weak acid will be present in the dissociated state (as the conjugate base).
 - At pH values above its pK_a , more than 50% of a weak acid will be present in the dissociated state (as the conjugate base).
 - The pH value of a 0.001 M solution of hydrochloric acid (HCl) is 4.
 - Acetic (ethanoic) acid ($\text{pK}_a = 4.76$) is a good physiological buffer in blood.
- 130.** Which of the following is correct about having double lipid bilayers around mitochondria?
- They act as a store of phospholipids
 - They prevent the entry of chemicals into mitochondria
 - They protect the cell from free radicals
 - They maintain a proton gradient

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32

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