PAPER CODE	3
SERIES CODE	A

Registration No. : _____

Centre of Exam. : _____

Name of Candidate : _____

S A U

Entrance Test for M.Sc. (Biotechnology)

[May 21, 2011]

Time : 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) This Question Paper has Two Parts.

(iii) Part—A has 30 questions of **1** mark each.

(iv) Part—B has 120 questions out of which please attempt 70 questions only. Each question carries **1** mark.

(v) *PLEASE DO NOT ATTEMPT MORE THAN 70 QUESTIONS IN PART—B. IF YOU ATTEMPT MORE THAN 70 QUESTIONS, ONLY THE FIRST 70 WILL BE EVALUATED.*

(vi) **Please darken the appropriate Circle of Question Paper Series Code on the Answer Sheet in the space provided.**

(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 the Answer Sheet to the Invigilator at the end of the Entrance Examination.

(xi) **DO NOT FOLD THE ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS IN THE OMR SHEET

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

Wrong	Wrong	Wrong	Wrong	Correct
● ⓑ ⓒ ●	⊘ ⓑ ⓒ ⓓ	⊘ ⓑ ⓒ ⊘	◉ ⓑ ⓒ ●	ⓐ ⓑ ⓒ ●

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 in the space provided.**
9. There will be no negative marking in evaluation.

PART—A

1. A haploid human genome would have

   (a) 3×10^9 bp

   (b) 2×10^9 bp

   (c) 6×10^9 bp

   (d) 9×10^9 bp

2. pH of an aqueous solution is 4. What is its pOH?

   (a) 4

   (b) 3

   (c) 10

   (d) 12

3. Non-pigmented bacterial suspensions also show optical density in visible light, because of

   (a) absorption of light of specific wavelength

   (b) refraction of specific wavelengths of light

   (c) non-specific refraction of light

   (d) scattering of light

4. The counts of bacteria per mL in samples withdrawn at two time points separated by one hour in the exponential phase are ca $1 \cdot 5 \times 10^8$ and 6×10^8, respectively. The generation time of the bacterium should be

   (a) 1 hour

   (b) 4 hours

   (c) $\frac{1}{2}$ hour

   (d) $\frac{1}{4}$ hour

5. For precipitating DNA from a solution in saline aqueous medium, it is recommended to add 2 volumes of absolute ethanol. The final concentration of ethanol in precipitating medium would be

   (a) 33% (v/v)

   (b) 33% (w/v)

   (c) 66% (v/v)

   (d) 66% (w/v)

6. A restriction enzyme recognizes four contiguous base pairs in DNA. What will be the approximate frequency of its occurrence?

(a) Once in 300 bp

(b) Once in 3 kb

(c) Once in 10 kb

(d) Once in 100 kb

7. The primary hosts for HIV-1 virus are

(a) monocytes

(b) T4 helper cells

(c) T8 killer/suppressor cells

(d) B cells

8. A father's age is the sum of the ages of his three sons. If the ratio of the ages of the sons is 1 : 2 : 3 and eight years later the difference between the ages of the father and the youngest son is 35 years, what is the current age of the eldest son?

(a) 30 years

(b) 28 years

(c) 21 years

(d) 24 years

9. Carbon atoms in graphite are in

(a) sp^2 configuration

(b) sp^3 configuration

(c) unbound form

(d) There are triple bonds between carbon atoms

10. The age of the universe is estimated to be

(a) 4·5 billion years

(b) 13·5 billion years

(c) 200 billion years

(d) 3·5 billion years

11. Human existence on the earth can be traced back to

(a) less than 10000 years

(b) 10000 to 100000 years

(c) 1 million to 10 million years

(d) 10 million to 100 million years

12. Which of the following transformations is an oxidation?

(a) $VO_3^- \rightarrow VO_2^+$

(b) $CrO_2^- \rightarrow CrO_4^{2-}$

(c) $SO_3^- \rightarrow SO_4^{2-}$

(d) $NO_3^- \rightarrow NO_2^-$

13. How many different compounds have the formula C_3H_8O?

(a) One

(b) Two

(c) Three

(d) Four

14. Which of the following salts is colourless?

(a) $KMnO_4$

(b) $BaSO_4$

(c) Na_2CrO_4

(d) $CuSO_4$

15. Which of the following molecules contains the shortest carbon-carbon bonds?

(a) C_2H_2

(b) C_2H_4

(c) C_3H_8

(d) C_6H_{12}

16. Gregor Johann Mendel's experiments with garden peas established that

(a) inheritance of characters is mediated by DNA

(b) there is a quantitative pattern of inheritance traits that correlate with the traits of parents. This suggests for some material basis of inheritance

(c) those are the chromosomes that are passed on to next generation

(d) the nature of genetic material is acidic

17. The unit of organization and functioning of living systems is

(a) cell

(b) nucleus

(c) plasma membrane

(d) mitochondria

18. The non-covalent bonds in biological system have a free energy in which of the following ranges?

(a) 0·1 kcal/mole

(b) 1–7 kcal/mole

(c) > 10 kcal

(d) No range of free energy can be defined for weak interactions

19. How many decapeptide variants will result if during peptide synthesis, ten of the twenty amino acids are allowed to be incorporated randomly?

(a) 10^{20}

(b) 10^{1}

(c) 10^{10}

(d) 20^{10}

20. The pressure of 14·7 pounds per square inch is equivalent to

(a) 1 atmosphere

(b) 2 atmosphere

(c) 5 atmosphere

(d) 10 atmosphere

21. Nitrogen liquefies at

(a) – 196 K

(b) – 196 °C

(c) 77 °F

(d) – 273 K

22. Which of the following constituents is present in viruses?

(a) Protein synthesis platform (ribosomes)

(b) Enzyme system for energy metabolism

(c) Mitochondria

(d) Genetic material

23. In an ecosystem, at which trophic level is the biomass maximal?

(a) Primary producers

(b) Herbivorous consumers

(c) Carnivorous consumers

(d) Decomposers

24. Which of the following cellular organisms has been revived by putting a synthetic genome in ghost cells?

(a) *Mycobacterium smegmatis*

(b) *Mycobacterium tuberculosis*

(c) *Mycoplasma genitalium*

(d) *Escherichia coli*

25. Who among the following scientists was responsible for adopting X-rays for clinical imaging?

(a) Ernest Rutherford

(b) Niels Bohr

(c) Marie Curie

(d) Wilhelm Roentgen

26. If $\log_x 9 = 2$, then $x =$

(a) $4 \cdot 5$

(b) 18

(c) 3

(d) 2

27. Which of the following amino acids contains sulfur?

(a) Alanine

(b) Glutamine

(c) Tryptophan

(d) Cysteine

28. As brakes are applied in a car, books on the passenger seat suddenly fly forward. That is most likely, because

(a) the car is not an inertial reference frame

(b) the seat supplies a forward push to make the books accelerate

(c) there is a strong gravitational field generated by the brakes

(d) there is a strong magnetic field generated by the brakes

29. Zero kelvin is defined as the temperature at which

(a) ice coexists with seawater at 1 atm

(b) ice coexists with pure water at 1 atm

(c) steam coexists with pure water at 1 atm

(d) one mole of argon gas would exert zero pressure

30. What is the oxidation number of manganese in $KMnO_4$?

(a) 3

(b) 5

(c) 7

(d) 9

PART—B

31. Which of the following is closest to the number of different sequences in a pool of random sequence 25-mer oligonucleotide?

(a) 10^{12}

(b) 10^{15}

(c) 10^{20}

(d) 10^{25}

32. In a four-point (ABCD) cross between Hfr and F^- strains of *E. coli*, the pair-wise frequencies of recombination fell in the following order :

$$AB > AC > AD$$

The most probable order of these genes on bacterial chromosome would be

(a) ABCD

(b) ACDB

(c) ADCB

(d) ABDC

33. In the Holliday model of DNA recombination, branch migration is mediated by

(a) Ruv A and Ruv B

(b) Ruv A and Ruv C

(c) Ruv B and Ruv C

(d) Ruv A alone

34. At low titres, adsorption of virions by host cells follows a Poisson distribution. If a suspension of 10^6 virions is added to 10^6 host cells, the number of cells that will receive at least one virus particle would be close to

(a) $3 \cdot 7 \times 10^5$

(b) $6 \cdot 3 \times 10^5$

(c) $3 \cdot 7 \times 10^6$

(d) $6 \cdot 3 \times 10^6$

35. A genetic signature is created, based on 6 unlinked markers (a–f) with the frequencies (a) 0·01, (b) 0·02, (c) 0·003, (d) 0·001, (e) 0·004 and (f) 0·05. The theoretical probability of two individuals sharing this signature is

(a) $1 \cdot 2 \times 10^{-12}$

(b) $1 \cdot 2 \times 10^{-13}$

(c) $1 \cdot 2 \times 10^{-11}$

(d) $1 \cdot 2 \times 10^{-6}$

36. Embryonic cleavage in most of the teleost fishes is

(a) holoblastic

(b) semi-holoblastic

(c) meroblastic

(d) All of the above

37. Placental connection is typical of

(a) viviparous reproduction

(b) ovoviviparous reproduction

(c) oviparous reproduction

(d) All of the above

38. The optic lobe is also referred to as

(a) cerebellum

(b) tegmentum

(c) tectum

(d) pons

39. Larvae of the crab genus *Carcinus* swim towards the water surface when pressure increases. This is an example of

(a) photokinesis

(b) thigmokinesis

(c) barokinesis

(d) orthokinesis

40. Ciliary wheel organ used for locomotion is typical of

(a) molluscs

(b) sponges

(c) rotifers

(d) Animals do not have wheels

41. Retting is biodegradation of

(a) cellulose

(b) lignin

(c) pectin

(d) retinol

42. The value of which of the following parameters is zero when the cell is fully turgid?

(a) Turgor pressure

(b) Wall pressure

(c) Osmotic pressure

(d) Diffusion pressure deficit

43. The edible part of black pepper is

(a) aril

(b) perisperm

(c) embryo

(d) cotyledon

44. The advanced character in Cucurbitaceae is

(a) inferior ovary

(b) pepo fruit

(c) tendril

(d) parietal placentation

45. Kranz anatomy is seen in

(a) all monocots

(b) monocots with C_4 pathway

(c) monocots and dicots with C_4 pathway

(d) legumes

46. The number of pyrrole rings included in a porphyrin is

(a) three

(b) four

(c) five

(d) six

47. Among the *E. coli* DNA polymerases, which of the following has a $5' \rightarrow 3'$ exonuclease activity?

(a) Polymerase I

(b) Polymerase II

(c) Polymerase III

(d) Polymerase ε

48. Which of the following amino acids is found both in D and L forms in peptidoglycan?

(a) Alanine

(b) Glutamic acid

(c) Glutamine

(d) Lysine

49. Which one of the following enzymes in mammalian cells is attached to the membrane by a GPI-anchor?

(a) Alkaline phosphatase

(b) Lysyl oxidase

(c) NADPH-cytochrome P-450 reductase

(d) Adenylate cyclase

50. Cell surface protein that is not present in a B cell is

(a) CD4

(b) CD8

(c) CD3

(d) All of the above

51. Smallpox virus genome is a

(a) single-stranded DNA

(b) double-stranded linear DNA

(c) single-stranded RNA (+strand)

(d) single-stranded RNA (–strand)

52. The nucleic acid base with no oxygen in its molecule is

(a) adenine

(b) cytosine

(c) guanine

(d) thymine

53. Which of the following operons is regulated by both repression and attenuation?

(a) Arabinose operon

(b) Histidine operon

(c) Tryptophan operon

(d) β-Galactosidase operon

54. Which of the following is closest to the size of a white blood cell?

(a) 1 mm

(b) 0·5 mm

(c) 0·05 mm

(d) 0·01 mm

55. Transposons (jumping genes) were discovered by

(a) Temin

(b) Abelson

(c) Harvey

(d) McClintock

56. SDS-PAGE separates proteins mainly on the basis of mass and not charge, because

(a) SDS neutralizes the proteins to be separated

(b) neutral species can move in electrical field only on the basis of mass

(c) SDS confers homogeneous negative charge on the protein molecules

(d) β-mercaptoethanol neutralizes the protein molecules

57. Southern blotting detects

(a) DNA

(b) RNA

(c) proteins

(d) carbohydrates

58. Which of the following subunits of *E. coli* RNA polymerase is essential for promoter recognition?

(a) Alpha

(b) Beta

(c) Beta′

(d) Sigma

59. Which of the following membranes has the greatest ratio of lipid to protein?

(a) Mitochondrial inner membrane

(b) Myelin

(c) Sarcoplasmic reticulum

(d) Membrane of the Golgi body

60. Inhibition of HMG-CoA reductase decreases the rate of synthesis of

(a) acetoacetate

(b) cholesterol

(c) palmitate

(d) phosphatidic acid

61. Biosynthesis of proline employs which of the following precursors?

(a) Alanine

(b) Glycine

(c) Aspartic acid

(d) Glutamic acid

62. Lyme disease is caused by the bacterium

(a) *Clostridium tetani*

(b) *Pseudomonas aeruginosa*

(c) *Borrelia burgdorferi*

(d) *Bordetella pertussis*

63. The haemoglobin chain that replaces the beta chain in embryonic haemoglobin is

(a) delta

(b) epsilon

(c) gamma

(d) alpha

64. The codon found to encode selenocysteine is

(a) UAA

(b) UAG

(c) UGA

(d) UAC

65. The oncogene that was identified first is

(a) Mas

(b) Myc

(c) Src

(d) Sip

66. Vitamin B_{12} (cobalamin) is only synthesized by

(a) fishes

(b) microorganisms

(c) plants

(d) mammals

67. Chlorophyll molecules in chloroplasts are located in

(a) stroma

(b) thylakoid

(c) internal lipid micelle

(d) inner chloroplast membrane

68. In addition to AUG, what initiation codon is recognized by prokaryotes?

(a) ACG

(b) CUC

(c) GUG

(d) AAG

69. The dye used in Gram's staining protocol for bacteria is

(a) eosin

(b) hematoxylin

(c) iodine and crystal violet

(d) methylene blue

70. Which of the following bacterial protein toxins is the most potent toxin?

(a) Botulin

(b) Diphtheria toxin

(c) Tetanus toxin

(d) Cholera toxin

71. The bases that can pair with inosine (in tRNA) according to the wobble hypothesis are

(a) A, C and G

(b) A, C and U

(c) C, G and U

(d) A, G and U

72. The number of chromosomes in the budding yeast (*Saccharomyces cerevisiae*) is

(a) 16

(b) 17

(c) 18

(d) 1

73. Fc and Fab fragments of IgG are produced upon digestion with

(a) chymotrypsin

(b) papain

(c) trypsin

(d) lysozyme

74. The activity of transaminase is dependent on the coenzyme

(a) biotin

(b) pyridoxal phosphate

(c) tetrahydrobiopterin

(d) albumin

75. Which one of the following is not a plant hormone?

(a) Indoleacetic acid

(b) Gibberellic acid

(c) Prephenate

(d) Zeatin

76. Catabolic breakdown of alanine yields

(a) fumarate

(b) oxaloacetate

(c) pyruvate

(d) malate

77. Which of the following viruses replicates in the cytoplasm?

(a) Epstein-Barr virus

(b) Poliovirus

(c) Vaccinia

(d) Papillomavirus

78. Plant leghaemoglobin in root nodules provides oxygen to the

(a) roots

(b) amyloplasts

(c) bacteroids

(d) chloroplasts

79. Retroviral replication is primed by

(a) a short linear RNA

(b) a tRNA

(c) a viral protein

(d) a ribosomal RNA

80. By which year were all the triplet codons defined?

(a) 1952

(b) 1958

(c) 1966

(d) 1968

81. The lambda phage's repressor protein binds to DNA as a

(a) dimer

(b) monomer

(c) trimer

(d) tetramer

82. The first recessive genetic disorder described was

(a) albinism

(b) alkaptonuria

(c) phenylketonuria

(d) sickle-cell anaemia

83. The selection markers on the plasmid pbr322 confer resistance to

(a) chloramphenicol and kanamycin

(b) kanamycin and ampicillin

(c) kanamycin and tetracycline

(d) tetracycline and ampicillin

84. Ribotyping is

(a) 5S rRNA based

(b) 16S rRNA based

(c) 23S rRNA based

(d) None of the above

85. In protein structure, the α-helix and β-pleated sheets are examples of

(a) primary structure

(b) secondary structure

(c) tertiary structure

(d) quaternary structure

86. Genetic engineering requires which of the following enzymes?

(a) β-Galactosidase

(b) Amylase

(c) Lipase

(d) Restriction endonuclease

87. The minimum size of an epitope is

(a) one amino acid residue

(b) two amino acid residues

(c) five amino acid residues

(d) twenty amino acid residues

88. Plastics do not elicit good antibody response, because

(a) they are toxic

(b) they are hydrophobic

(c) they are artificially synthesized

(d) they cannot be processed and presented as antigens

89. An autoimmune disease is caused by

(a) defective thymus development

(b) defective cellular immunity

(c) defective bone marrow

(d) immune response against self-antigens

90. Which of the following drugs is used for immunocompromising patients receiving grafts?

(a) Streptomycin

(b) Cyclosporine

(c) Tetracycline

(d) Penicillin

91. Suppose the density of a solid is D and its average atomic mass is M. Which of the following represents the average spacing between the atoms in the solid?

(a) D / M

(b) M / D

(c) $(D / M)^{1/3}$

(d) $(M / D)^{1/3}$

92. A person A is in an elevator. Another person B, sitting on the ground, observes A to be travelling upward with a constant speed of 5 m/s. At one instant, A drops a pen from rest. Immediately after, the acceleration of the pen according to A is

(a) $10\,m/s^2$, down

(b) 0

(c) $15\,m/s^2$, down

(d) $5\,m/s^2$, up

93. A mass hangs from an ideal spring. When the mass is set into oscillation with amplitude of 1 cm, its frequency is 10 Hz. If the amplitude is increased to 2 cm, the new frequency will be

(a) 5 Hz

(b) 7 Hz

(c) 10 Hz

(d) 20 Hz

94. Two artificial bones (solid cylindrical) are made of the same material and length, one with twice the radius as the other. When the two have the same tension force applied, the larger bone stretches by what factor compared to the smaller bone?

(a) 2

(b) 0·25

(c) 0·5

(d) 4

95. Two identical blocks of mass m are tied together (by a light cord) and pulled up a rough inclined plane at constant speed by a pulling force F directed along the incline and applied to the upper block. Which of the following statements is true?

(a) The work done by F is zero because the blocks move at constant speed

(b) The total friction force must equal F because the blocks move at constant speed

(c) The tension in the cord is F because the two blocks are identical

(d) The work done by F is equal in magnitude to the work done by gravity plus the work done by friction

96. In a head-on collision between a bird and a jet airplane

(a) the momentum of the airplane is exactly conserved

(b) the total kinetic energy is exactly conserved

(c) the magnitude of the change in momentum of the bird divided by the collision time equals the magnitude of the average force on the jet

(d) the total momentum is zero

97. A damped driven oscillator has an equation of motion given by $ma = -kx - bv + F_0 \cos(\omega_d t)$, where ω_d is the angular frequency of the driving force. At resonance, ma must be equal to

(a) $-kx$

(b) $-bv$

(c) $+F_0 \cos(\omega_d t)$

(d) zero

98. Ultrasonic imaging (ultrasonography/ultrasound) is not based on

(a) pulse-echo techniques

(b) differences in acoustic impedance

(c) cavitation

(d) scanning

99. The equipotential surfaces around a long straight wire with a uniform charge/length are concentric

(a) spheres

(b) cylinders

(c) triangles

(d) planes

100. "The current in a resistor is directly proportional to the potential difference across the resistor." It is known as

(a) Coulomb's law

(b) Gauss's law

(c) Ohm's law

(d) Ampere's law

101. If the first-order double-slit diffraction minimum lies at the same place as the fourth-order interference maximum, how many fringes will be visible in the central diffraction maximum?

(a) 3

(b) 5

(c) 6

(d) 7

102. Which of the following is not true of an optically active molecule?

(a) It produces a circular birefringence signal

(b) It produces a circular dichroism signal

(c) It must be asymmetric

(d) A solution of them can always be imaged in a polarizing microscope

103. According to Bohr's theory, when a hydrogen atom makes a transition from $n = 5$ to $n = 2$ state, the average radial distance of the electron from the nucleus changes by

(a) $3\,r_1$

(b) $25\,r_1$

(c) $21\,r_1$

(d) $5\,r_1$

104. The spectrum resulting from blackbody radiation is

(a) line spectrum

(b) continuous spectrum

(c) band spectrum

(d) Blackbody does not emit any spectrum

105. Which of the following have the same dimensions?

(a) Energy and G

(b) Work and energy

(c) Specific gravity and relative density

(d) Two physical units cannot have same dimensions

106. At absolute zero, a semiconductor behaves as

(a) an insulator

(b) a metal

(c) a superconductor

(d) a plasma

107. In the equilibrium state, ΔG is

(a) positive

(b) negative

(c) zero

(d) either positive or negative

108. Current in a circuit becomes wattless when phase transition between current and voltage is

(a) zero

(b) $\pi/2$

(c) $+\pi$

(d) $-\pi$

109. Wien's displacement law expresses the relation

(a) between colour of light and temperature

(b) between wavelength and temperature

(c) among radiation, energy and temperature

(d) None of the above

110. If a certain polymer has the formula $(-CH_2CCl_2CH_2CCl_2-)_n$, then from which monomer is it made?

(a) $HC{=}CCl$

(b) $ClHC{=}CClH$

(c) $Cl_2C{=}CH_2$

(d) $H_2C{=}CClH$

111. The nitrite ion (NO_2^-) may be represented by two major resonance forms. The lengths of the nitrogen-to-oxygen bonds in this ion are expected to be

(a) the same as the lengths of nitrogen-to-oxygen double bonds

(b) the same as the lengths of nitrogen-to-oxygen triple bonds

(c) between the lengths of a nitrogen-to-oxygen single bond and a nitrogen-to-oxygen double bond

(d) between the lengths of a nitrogen-to-oxygen double bond and a nitrogen-to-oxygen triple bond

112. How should a student prepare 100 mL of a 1·0 M H_2SO_4 solution from a 10M H_2SO_4 solution?

(a) Adding 90 mL of H_2O to 10 mL of 10M H_2SO_4

(b) Adding 10 mL of 10M H_2SO_4 to 90 mL of H_2O

(c) Adding 10 mL of 10M H_2SO_4 to 80 mL of H_2O, stirring and diluting to 100 mL after allowing to cool

(d) Adding 80 mL of H_2O to 10 mL of 10M H_2SO_4, stirring and diluting to 100 mL after allowing to cool

113. Which of the following pairs of gases has the same average rate of diffusion at 25 °C?

(a) He and Ne

(b) N_2 and O_2

(c) N_2O and CO_2

(d) NH_3 and HCl

114. Which of the following is true for any endothermic reaction?

(a) $\Delta H < 0$

(b) $\Delta H > 0$

(c) $\Delta G < 0$

(d) $\Delta G > 0$

115. How many valence electrons are there in one ion of thiosulfate, $S_2O_3^{2-}$?

(a) 26

(b) 28

(c) 30

(d) 32

116. Zero-order chemical reaction will have the unit as

(a) mol lit^{-1} sec^{-1}

(b) sec^{-1}

(c) sec/mol

(d) mol^{-1} lit sec^{-1}

117. The temperature at which a real gas obeys the ideal gas laws over a wide range of pressure is called as

(a) Boyle's temperature

(b) critical temperature

(c) ideal temperature

(d) inversion temperature

118. The order of reaction for decay of a radioactive substance is

(a) 0

(b) 1

(c) 2

(d) 3

119. The last element in uranium decay series is

(a) lead

(b) platinum

(c) plutonium

(d) bismuth

120. A triatomic molecule will have —— degrees of freedom.

(a) 3

(b) 6

(c) 9

(d) 1

121. Rank the enthalpies of fusion, sublimation and vaporization for water.

(a) Sublimation = Vaporization = Fusion

(b) Vaporization < Sublimation < Fusion

(c) Fusion < Sublimation < Vaporization

(d) Fusion < Vaporization < Sublimation

122. Which of the following statements about the radii of atoms and their ions is correct?

(a) Cations are smaller than their atoms, but anions are larger

(b) Cations and anions are both smaller than their atoms

(c) Cations and anions are both larger than their atoms

(d) Cations are larger than their atoms, but anions are smaller

123. What would be the coefficients x, y, z, respectively, in order to balance the following equation?

$$x C_6H_{12}O_6 \rightarrow y C_2H_5OH + z CO_2$$

(a) 1, 2, 2

(b) 1, 3, 3

(c) 1, 1, 4

(d) 2, 4, 2

124. The process in which fine particles clump together to form flakes is called

(a) precipitation

(b) peptization

(c) flocculation

(d) extraction

125. Which of the following properties of liquid does not increase with increasing strengths of intermolecular forces?

(a) Boiling point

(b) Enthalpy of vaporization

(c) Vapour pressure

(d) Viscosity

126. Which of the following is the weakest acid?

(a) Ascorbic acid ($K_a = 8 \cdot 0 \times 10^{-5}$)

(b) Boric acid ($K_a = 5 \cdot 8 \times 10^{-10}$)

(c) Butyric acid ($K_a = 1 \cdot 5 \times 10^{-5}$)

(d) Hydrocyanic acid ($K_a = 4 \cdot 9 \times 10^{-10}$)

127. Which of the following techniques can be used to determine the number of components in a plant pigment?

(a) Calorimetry

(b) Chromatography

(c) Colorimetry

(d) Gravimetry

128. The IUPAC name of adipic acid is

(a) Heptanedioic acid

(b) Propanedioic acid

(c) Hexanedioic acid

(d) Butanedioic acid

129. Which of the following functional groups is not commonly found in proteins?

(a) Alcohol

(b) Aldehyde

(c) Amide

(d) Amine

130. What is the position of the bromine atom relative to the methyl group in 3-bromotoluene?

(a) *meta*

(b) *ortho*

(c) *para*

(d) *trans*

131. An α-^{32}P-CTP preparation has a specific radioactivity of 400 Ci per millimole. It has been aliquoted as 10 μCi per μL. The amount of CTP in each μL in this aliquot would be

(a) 250 pmoles

(b) 25 pmoles

(c) 25 μmoles

(d) 40 μmoles

132. Phenol on distillation with zinc dust will give

(a) alcohol

(b) primary amine

(c) aromatic aldehyde

(d) benzene

133. An enzyme facilitates biochemical reaction by

(a) creating an excited state of the substrate

(b) holding the transition state for longer time than in an unaided reaction

(c) not letting the product undergo a reverse reaction and regenerate the substrate

(d) locally increasing the temperature

134. Which of the following parts of nucleic acid has/have maximal hydrophobicity?

(a) The bases

(b) The ribose and deoxyribose sugars

(c) The phosphodiester backbone

(d) The 5′ and 3′ ends

135. The conversion of R1—CO—R2 into (R1, R2, R3)—C—OH can be accomplished by

(a) Grignard reaction

(b) aldol condensation

(c) Beckmann rearrangement

(d) None of the above

136. Rate of sedimentation depends on applied centrifugal field (G) which is directed outward, angular velocity ω and the radial distance r of the particle from the axis of rotation. Which of the following equations correctly describes the relationship among the three?

(a) $G = \omega^2 r$

(b) $\omega = G^2 r$

(c) $G = \omega r^2$

(d) $G = \omega / r^2$

137. Covalent bonds can either stretch or bend. If a molecule has n atoms, then it will have $(3n - 6)$ fundamental vibrations in total. Out of $(3n - 6)$ vibrations, how many of them will be stretching vibrations?

(a) $n - 1$

(b) $2n - 1$

(c) $2n - 5$

(d) $3n - 5$

138. The reagent, you would use to measure steroids by colorimetric methods, is

(a) Folin's reagent

(b) Liebermann-Burchard reagent

(c) Ehrlich's reagent

(d) ammonium molybdate

139. Which of the following compounds is used for separation of cells by density gradient methods?

(a) Caesium sulphate

(b) Sodium iodide

(c) Ficoll

(d) Glycerol

140. Passing of charged particle through a gas causes ionization of the atoms of the gas. Which of the following correctly represents the ability to induce ionization in increasing order?

(a) $\alpha > \beta > \gamma$

(b) $\beta > \alpha > \gamma$

(c) $\gamma > \beta > \alpha$

(d) $\gamma > \alpha > \beta$

141. The first five terms of the sequence defined inductively as $u_1 = 1$ and $u_{k+1} = u_k + 2^k$ are

(a) 1, 3, 7, 15, 31

(b) 1, 3, 5, 9, 17

(c) 3, 7, 15, 31, 63

(d) 3, 5, 9, 17, 32

142. For large values of n, the value of $\frac{n^2 - n}{n + 1}$ tends to

(a) ∞

(b) 0

(c) 1

(d) an unknown value

143. For the function $f : x \to x^2$ with domain $x : -3 \leq x \leq 3$, what is the range?

(a) $\{y : 0 \leq y \leq 9\}$

(b) The set of all real numbers

(c) $\{y : -9 \leq y \leq 9\}$

(d) $\{y : y \leq 3\}$

144. Which of the following expressions is/are true?

$(E1)$ $\dfrac{x^2 - y^2}{x + y} = x - y$

$(E2)$ $(\sqrt{a} + \sqrt{b})^2 = a + b$

(a) $E1$ and $E2$

(b) $E1$ only

(c) $E2$ only

(d) Neither $E1$ nor $E2$

145. The mean of a data set is equal to 12 and its standard deviation is equal to 1. If we add 4 to each data value, then the mean and standard deviation become

(a) mean = 16, standard deviation = 5

(b) mean = 12, standard deviation = 5

(c) mean = 16, standard deviation = 1

(d) mean = 12, standard deviation = 1

146. What number must be added to $A = x^3 + 5x^2 + 10x + 1$ to make $(x + 1)$ a factor?

(a) 10

(b) 1

(c) 5

(d) 3

147. At what points does the graph of $y = 2x^3 - 6x^2$ equally reach a maximum and a minimum?

(a) (0, 0) (maximum) and (2, 8) (minimum)

(b) (0, 0) (maximum) and (2, – 8) (minimum)

(c) (0, 0) (maximum) and (3, – 5) (minimum)

(d) (2, – 8) (maximum) and (0, 0) (minimum)

148. Given $\log_{10} 100 = \log_{10} 10^2 = 2$, what is the value of $\log_2 64$?

(a) 6·0

(b) 2·3

(c) 1·5

(d) 4·0

149. If $2^x \approx 10^{cx}$, then the value of c is approximately

(a) 1

(b) 0·5

(c) 0·3

(d) 2

150. $[\sec(x) \sin^2 x] / [1 + \sec(x)]$ is

(a) 1·0

(b) $\sqrt{3}$

(c) $\sqrt{2}$

(d) $1 - \cos x$

★★★

SPACE FOR ROUGH WORK

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