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3. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign the Attendance Sheet twice. Cases where a candidate has not signed the Attendance Sheet second time will be deemed not to have handed over Answer Sheet and dealt with as an unfair means case.

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Test Booklet Code: 

SCO

No.: 

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In case of any ambiguity in translation of any question, English version shall be treated as final.

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Name of the Candidate (in Capital):

AVADHESH KUMAR

Roll Number:

51149013

Centre of Examination (in Capital):

Centre/Invigilator's Signature:

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Issues to be noted:

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1. 2,3-Dimethyl-2-butene can be prepared by heating which of the following compounds with a strong acid?
   (1) (CH₃)₂C=CH-CH₃
   (2) (CH₃)₂C=CH-CH₃
   (3) (CH₃)₂C=CH-CH₂CH₃
   (4) (CH₃)₂C=CH-CH₂CH₂

2. Gadolinium belongs to 4f series. It's atomic number is 64. Which of the following is the correct electronic configuration of gadolinium?
   (1) [Xe] 4f⁷5d¹⁶⁶¹
   (2) [Xe] 4f⁷5d¹⁶⁶²
   (3) [Xe] 4f⁷5d¹⁶⁶³
   (4) [Xe] 4f⁷5d¹⁶⁶⁴

3. The formation of the oxide ion, O²⁻(g), from oxygen atom requires first an exothermic and then an endothermic step as shown below:
   O(g) + e⁻ → O⁺(g); ΔH° = -141 kJ mol⁻¹
   O⁺(g) + e⁻ → O²⁻(g); ΔH° = +789 kJ mol⁻¹
   Thus process of formation of O²⁻ in gas phase is unfavourable even though O²⁻ is ionic/electronic with neon. It is due to the fact that;
   (1) oxygen is more electronegative.
   (2) addition of electron in oxygen results in larger size of the ion.
   (3) electron repulsion outweighs the stability gained by achieving noble gas configuration.
   (4) O⁻ ion has comparatively smaller size than oxygen atom.

4. The number of structural isomers possible from the molecular formula C₄H₈N is:
   (1) 2
   (2) 3
   (3) 4
   (4) 5

5. If the equilibrium constant for N₂(g) + O₂(g) → 2NO(g) is K, the equilibrium constant for \(\frac{1}{2} N₂(g) + \frac{1}{2} O₂(g) = NO(g)\) will be:
   (1) K
   (2) K²
   (3) K³
   (4) \(\frac{1}{2} K\)

6. Which one of the following pairs of solutions is not an acidic buffer?
   (1) H₃PO₄ and Na₂HPO₄
   (2) H₂PO₄ and Na₂HPO₄
   (3) H₂CO₃ and Na₂CO₃
   (4) CH₃COOH and CH₃COONa

7. Aqueous solution of which of the following compounds is the best conductor of electric current?
   (1) Ammonia, NH₃
   (2) Fructose, C₄H₁₂O₆
   (3) Acetic acid, C₂H₄O₂
   (4) Hydrochloric acid, HCl

8. Caprolactam is used for the manufacture of:
   (1) Terylene
   (2) Nylon - 6, 6
   (3) Nylon - 6
   (4) Teflon

9. On heating which of the following releases CO₂ must easily?
   (1) MgCO₃
   (2) CaCO₃
   (3) K₂CO₃
   (4) Na₂CO₃

10. Strong reducing behaviour of H₃PO₄ is due to:
    (1) High oxidation state of phosphorus
    (2) Presence of two –OH groups and one P–H bond
    (3) Presence of one –OH group and two P–H bonds
    (4) High electron gain enthalpy of phosphorus

11. Decreasing order of stability of O₂⁻, O₃⁻ and O₄⁻ is:
    (1) O₂⁻ > O₃⁻ > O₄⁻ > O₂¹⁻
    (2) O₂⁻ > O₃⁻ > O₂¹⁻ > O₂⁻
    (3) O₃⁻ > O₂⁻ > O₃⁻ > O₂⁻
    (4) O₄⁻ > O₂⁻ > O₂⁻ > O₂⁻
12. The number of water molecules is maximum in:
(1) 18 grams of water
(2) 18 moles of water
(3) 18 molecules of water
(4) 1.8 grams of water

13. In which of the following pairs, both the species are not isomeric?
(1) NH₃, PH₃
(2) XeF₄, XeO₄
(3) SiCl₄, PCl₅
(4) diamond, silicon carbide

14. In the reaction with HCl, an alkene reacts in accordance with the Markovnikov's rule, to give a product 1-chloro-1-methylecyclohexane. The possible alkene is:

CH₃
CH₂
(O)

(1) CH₂CH₂
(2) CH₂CH₂CH₂
(3) (A) and (B)
(4) CH₃CH₂

15. Assuming complete ionization, same moles of which of the following compounds will require the least amount of acidified KMnO₄ for complete oxidation?
(1) Fe(CO)₅
(2) Fe(CN)₅(OH)⁻
(3) FeSO₄
(4) Fe₂(SO₄)₃

16. Reaction of phenol with chloroform in presence of dilute sodium hydroxide finally introduces which one of the following functional group?
(1) -CH₂Cl
(2) -CHO
(3) -CH₂Cl
(4) -COOH

17. The vacant space in bcc lattice unit cell is:
(1) 23%
(2) 32%
(3) 26%
(4) 48%

18. Which of the statements given below is incorrect?
(1) ONF is isoelectronic with O₃⁻
(2) OF₂ is an oxide of nitrogen
(3) Cl₂O₇ is an anhydride of perchloric acid
(4) O₃ molecule is bent

19. The name of complex ion, [Fe(CN)₆]³⁻ is:
(1) Tricyanoferrate (III) ion
(2) Hexacyanoferrate (III) ion
(3) Hexacyanoferrate (III) ion
(4) Hexacyanoferrate (III) ion

20. If Avogadro number Nₐ is changed from 6.022 × 10²³ mol⁻¹ to 6.022 × 10²⁰ mol⁻¹, this would change:
(1) the ratio of chemical species to each other in a balanced equation.
(2) the ratio of elements to each other in a compound.
(3) the definition of mass in units of grams.
(4) the mass of one mole of carbon.

21. Which of the following statements is not correct for a nucleophile?
(1) Nucleophiles attack low e⁻ density sites
(2) Nucleophiles are not electron seeking
(3) Nucleophile is a Lewis acid
(4) Ammonia is a nucleophile

22. A gas such as carbon monoxide would be least likely to obey the ideal gas law at:
(1) high temperatures and high pressures
(2) low temperatures and low pressures
(3) high temperatures and low pressures
(4) low temperatures and high pressures.
23. The hybridization involved in complex [Ni(CN)₂]⁻ is
   (A) d²sp²
   (B) d⁴sp³
   (C) dsp²
   (D) sp³

24. The heat of combustion of carbon to CO₂ is
   -393.5 kJ/mol. The heat released upon formation of 35.2 g of CO₂ from carbon and oxygen gas is:
   (1) -630 kJ
   (2) -315 kJ
   (3) -315 kJ
   (4) +315 kJ

25. 200 g of a magnesium carbonate sample decomposes on heating to give carbon dioxide and 84.0 g magnesium oxide. What will be the percentage purity of magnesium carbonate in the sample?
   (1) 60
   (2) 84
   (3) 75
   (4) 96
   (At Wt: Mg = 24)

26. What is the mole fraction of the solute in a 1.00 m aqueous solution?
   (1) 0.0354
   (2) 0.0177
   (3) 0.177
   (4) 1.770

27. The correct statement regarding defects in crystalline solids is:
   (1) Frenkel defect is a dislocation defect.
   (2) Frenkel defect is found in halides of alkaline metals.
   (3) Schottky defects have no effect on the density of crystalline solids.
   (4) Frenkel defects decrease the density of crystalline solids.

28. The stability of +1 oxidation state among Al, Ga, In and Tl increases in the sequence:
   (1) Ti < In < Ga < Al
   (2) In < Ti < Ga < Al
   (3) Ga < In < Al < Ti
   (4) Al < Ga < In < Ti

29. Two possible stereo-structures of CH₃CHOH COOH, which are optically active, are called:
   (1) Enantiomers
   (2) Mesomers
   (3) Diastereomers
   (4) Atropisomers

30. The following reaction
   is known by the name:
   (1) Acetylation reaction
   (2) Schotten-Baumen reaction
   (3) Friedel-Craft's reaction
   (4) Perkin's reaction

31. The sum of coordination number and oxidation number of the metal M in the complex [M(en)₂(C₂O₄)₂]Cl (where en = ethylenediamine) is:
   (1) 7
   (2) 8
   (3) 9
   (4) 6

32. Reaction of a carbonyl compound with one of the following reagents involves nucleophilic addition followed by elimination of water. The reagent is:
   (1) hydrocyanic acid
   (2) sodium hydrogen sulphite
   (3) a Grignard reagent
   (4) hydrazine in presence of a weakly acidic solution

33. Which one of the following esters gets hydrolysed most easily under alkaline conditions?
   (1)
   (2)
   (3)
   (4)

34. In an S₂⁻ reaction on chiral centres, there is:
   (1) 100% retention
   (2) 100% inversion
   (3) 100% racemization
   (4) inversion more than retention leading to partial racemization

35. In an S₂⁻ reaction on chiral centres, there is:
   (1) 100% retention
   (2) 100% inversion
   (3) 100% racemization
   (4) inversion more than retention leading to partial racemization
35. The rate constant of the reaction \( A \rightarrow B \) is \( 0.6 \times 10^{-3} \) mole per second. If the concentration of \( A \) is 5 M, then concentration of \( B \) after 20 minutes is:
   - (1) 0.36 M
   - (2) 0.72 M
   - (3) 1.08 M
   - (4) 3.60 M

36. What is the pH of the resulting solution when equal volumes of 0.1 M AgNO₃ and 0.01 M HCl are mixed?
   - (1) 1.04
   - (2) 1.04
   - (3) 12.65
   - (4) 2.0

37. Number of possible isomers for the complex \([\text{Co}(_2\text{en})_2\text{Cl}]^+\) will be:
   - (1) 3
   - (2) 4
   - (3) 2
   - (4) 1

38. The variation of the boiling points of the hydrogen halides is in the order HF > HI > HBr > HCl. What explains the higher boiling point of hydrogen fluoride?
   - (1) The bond energy of HF molecules is greater than in other hydrogen halides.
   - (2) The effect of nuclear shielding is much reduced in fluorine which polarises the HF molecule.
   - (3) The electronegativity of fluorine is much higher than for other elements in the group.
   - (4) There is strong hydrogen bonding between HF molecules.

39. What is the mass of the precipitate formed when 50 mL of 16.9% solution of AgNO₃ is mixed with 50 mL of 5.8% NaCl solution?
   - (Ag = 107.8, N = 14, O = 16, Na = 23, Cl = 35.5)
   - (1) 7 g
   - (2) 14 g
   - (3) 28 g
   - (4) 3.5 g

40. The oxidation of benzene by V₂O₅ in the presence of air produces:
   - (1) benzoic acid
   - (2) benzoic acid
   - (3) benzoic anhydride
   - (4) maleic anhydride

41. Which of the following is not the product of dehydration of \( \text{CH}_2\text{OH} \text{OH} \)?
   - (1) \( \text{CH}_2\text{CH}_2\text{OH} \)
   - (2) \( \text{CH}_2\text{OH} \text{Cl} \)
   - (3) \( \text{CH}_2\text{Cl}_2 \)
   - (4) \( \text{CH}_2\text{OH} \text{Cl} \)

42. Method by which Aniline cannot be prepared is:
   - (1) reduction of nitrobenzene with H₂/Pd in ethanol.
   - (2) potassium salt of phthalimide treated with hydrolysis with aqueous NaOH solution.
   - (3) hydrolysis of phenylisocyanide with acidic solution.
   - (4) degradation of benzamide with bromine in alkaline solution.

43. Which of the following reaction(s) can be used for the preparation of alkyl halides?
   - (1) \( \text{CH}_3\text{CH}_2\text{OH} + \text{HCl} \rightarrow \text{CH}_3\text{CH}_2\text{Cl} \) anh. ZnCl₂
   - (2) \( \text{CH}_3\text{OH} + \text{HCl} \rightarrow \text{CH}_3\text{Cl} \)
   - (3) \( \text{CH}_3\text{COH} + \text{HCl} \rightarrow \text{CH}_3\text{COCl} \)
   - (4) \( \text{CH}_2\text{CH}_2\text{OH} + \text{HCl} \rightarrow \text{CH}_2\text{CH}_2\text{Cl} \) anh. ZnCl₂

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   - (1) reduction of nitrobenzene with H₂/Pd in ethanol.
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   - (1) \( \text{CH}_3\text{CH}_2\text{OH} + \text{HCl} \rightarrow \text{CH}_3\text{CH}_2\text{Cl} \) anh. ZnCl₂
   - (2) \( \text{CH}_3\text{OH} + \text{HCl} \rightarrow \text{CH}_3\text{Cl} \)
   - (3) \( \text{CH}_3\text{COH} + \text{HCl} \rightarrow \text{CH}_3\text{COCl} \)
   - (4) \( \text{CH}_2\text{CH}_2\text{OH} + \text{HCl} \rightarrow \text{CH}_2\text{CH}_2\text{Cl} \) anh. ZnCl₂
44. Which is the correct order of increasing energy of the listed orbitals in the atom of titanium?

(A) 3s 3p 3d 4s
(1) 3s 3p 3d 4s
(2) 3s 3p 4s 4d
(3) 3s 4s 3p 3d
(4) 4s 3d 3p 3d

45. In the extraction of copper from its sulphide ore, the metal is finally obtained by the reduction of cuprous oxide with:

(1) copper(I) sulphide
(2) sulphur dioxide
(3) iron(II) sulphide
(4) carbon monoxide

46. Root pressure develops due to:

(1) Increase in transpiration
(2) Active absorption
(3) Low osmotic potential in soil
(4) Passive absorption

47. Which one is a wrong statement?

(1) Brown algae have chlorophyll a and c, and fucoxanthin
(2) Archegonia are found in Bryophyta, Pteridophyta and Gymnosperms
(3) Macor has biflagellate zoospores
(4) Haploid endosperm is typical feature of gymnosperms

48. Which of the following structures is not found in a prokaryotic cell?

(1) Plasma membrane
(2) Nuclear envelope
(3) Ribosome
(4) Mesosome

49. Which one of the following animals has two separate circulatory pathways?

(1) Shark
(2) Frog
(3) Lizard
(4) Whale

50. Most animals that live in deep oceanic waters are

(1) detritivores
(2) primary consumers
(3) secondary consumers
(4) tertiary consumers

51. An association of individuals of different species living in the same habitat and having functional interactions is:

(1) Population
(2) Ecological niche
(3) Biotic community
(4) Ecosystem

52. The oxygen evolved during photosynthesis comes from water molecules. Which one of the following pairs of elements is involved in this reaction?

(1) Magnesium and Chlorine
(2) Manganese and Chlorine
(3) Manganese and Potassium
(4) Magnesium and Molybdenum

53. Axile placentation is present in:

(1) Argemone
(2) Dianthus
(3) Lemon
(4) Pea

54. In which of the following both pairs have correct combination?

(1) Gaseous nutrient cycle - Sulphur and Phosphorus
(2) Sedimentary nutrient cycle - Carbon and Nitrogen
(3) Gaseous nutrient cycle - Carbon and Nitrogen
(4) Sedimentary nutrient cycle - Nitrogen and Phosphorus
55. In mammalian eye, the 'fovea' is the center of the visual field, where:
   1. more rods than cones are found.
   2. high density of cones occur, but no rods.
   3. the optic nerve leaves the eye.
   4. only rods are present.

56. Choose the wrong statement:
   1. Yeast is unicellular and useful in fermentation.
   2. Penicillium is multicellular and produces antibiotics.
   3. Neurospora is used in the study of biochemical genetics.
   4. Morels and truffles are poisonous mushrooms.

57. Which of the following are not membrane-bound?
   1. Mesosomes
   2. Vacuoles
   3. Ribosomes
   4. Lysosomes

58. In which of the following interactions both partners are adversely affected?
   1. Mutualism
   2. Competition
   3. Predation
   4. Parasitism

59. A colour blind man marries a woman with normal sight who has no history of colour blindness in her family. What is the probability of their grandsons being colour blind?
   1. 0.25
   2. 0.5
   3. 1
   4. Nil

60. Ectopic pregnancies are referred to as:
   1. Pregnancies terminated due to hormonal imbalance.
   2. Pregnancies with genetic abnormality.
   3. Implantation of embryo at site other than uterus.
   4. Implantation of defective embryo in the uterus.

61. Cellular organelles with membranes are:
   1. lysosomes, Golgi apparatus and mitochondria
   2. nucleus, ribosomes and mitochondria
   3. chromosomes, ribosomes and endoplasmic reticulum
   4. endoplasmic reticulum, ribosomes and nucleolus

62. Cell wall is absent in:
   1. Nocice
   2. Aspergillus
   3. Fungi
   4. Mycoplasma

63. The term "linkage" was coined by:
   1. W. Sutton
   2. T.H. Morgan
   3. T. Boveri
   4. G. Mendel

64. Which of the following interactions both are adversely affected?
   1. Mutualism
   2. Competition
   3. Predation
   4. Parasitism

65. In which of the following interactions both partners are adversely affected?
   1. Mutualism
   2. Competition
   3. Predation
   4. Parasitism

66. Which of the following biomolecules does have a phosphodiester bond?
   1. Nucleic acids in a nucleotide
   2. Fatty acids in a diglyceride
   3. Monosaccharides in a polysaccharide
   4. Amino acids in a polypeptide

67. The primary dentition in human differs from permanent dentition in not having one of the following type of teeth:
   1. Incisors
   2. Canine
   3. Premolars
   4. Molars

68. Which of the following statements is not correct?
   1. Phosphodiester bond is found in DNA.
   2. Ectopic pregnancies are pregnancies terminated due to imbalance.
   3. Ectopic pregnancies are implantation of embryo at site other than uterus.
   4. Ectopic pregnancies are implantation of defective embryo in the uterus.

69. A protoplast is a cell:
   1. without cell wall
   2. without plasma membrane
   3. without nucleus
   4. undergoing division
67. In which group of organisms the cell walls form two thin overlapping shells which fit together?
   (1) Slime moulds
   (2) Chrysophytes
   (3) Euglenoids
   (4) Dinoflagellates

68. The DNA molecule to which the gene of interest is integrated by cloning is called:
   (1) Carrier
   (2) Transformer
   (3) Vector
   (4) Template

69. Male gamosporophyte in angiosperms produces:
   (1) Three sperms
   (2) Two sperms and a vegetative cell
   (3) Single sperm and a vegetative cell
   (4) Single sperm and two vegetative cells

70. Coconut water from a tender coconut is:
   (1) Degenerated nucellus
   (2) Immature embryo
   (3) Free nuclear endosperm
   (4) Innermost layers of the seed coat

71. In metagenesis referred to:
   (1) Presence of a segmented body and parthenogenetic mode of reproduction
   (2) Presence of different morphic forms
   (3) Alternation of generation between asexual and sexual phases of an organism
   (4) Occurrence of a drastic change in form during post-embryonic development

73. The enzyme that is not present in succus entericus is:
   (1) Lipase
   (2) Maltase
   (3) Nucleases
   (4) Nucleosidase

74. Enzymopohication of water bodies leading to killing of fishes is mainly due to non-availability of:
   (1) Oxygen
   (2) Food
   (3) Light
   (4) Essential minerals

75. The function of the gap junction is to:
   (1) Stop substance from leaking across a tissue.
   (2) Performing cementing to keep neighboring cells together.
   (3) Facilitate communication between adjoining cells by connecting the cytoplasm for rapid transfer of ions, small molecules and some large molecules.
   (4) Separate two cells from each other.

76. Match the following list of microbes and their importance:

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saccharomyces cerevisiae</td>
<td>Monascus purpureus</td>
<td>Trichoderma polysporum</td>
<td>Propionibacterium shermanii</td>
</tr>
<tr>
<td>(a) Production of immunosuppressive agents</td>
<td>(ii) Ripening of Swiss cheese</td>
<td>(iii) Commercial production of ethanol</td>
<td>(iv) Production of biodegradable cholesterol lowering agents</td>
</tr>
</tbody>
</table>

77. Which enzyme is responsible for the production of pepsin?
   (1) Lipase
   (2) Maltase
   (3) Nucleases
   (4) Nucleosidase
77. Arrange the following events of meiosis in correct sequence:
(a) Crossing over
(b) Synapsis
(c) Terminalisation of chiasmata
(d) Disappearance of nucleolus
(1) (d), (c), (b), (a)
(2) (b), (c), (d), (a)
(3) (a), (b), (c), (d)
(4) (a), (b), (d), (c)

78. The cutting of DNA at specific locations became possible with the discovery of:
(1) Ligases
(2) Restriction enzymes
(3) Probes
(4) Selectable markers

79. During biological nitrogen fixation, inactivation of nitrogases by oxygen poisoning is prevented by:
(1) Cytchrome
(2) Leghaemoglobin
(3) Xanthophyll
(4) Carotene

80. Grafted kidney may be rejected in a patient due to:
(1) Innate immune response
(2) Humoral immune response
(3) Cell-mediated immune response
(4) Passive immune response

81. The body cells in cockroach discharge their nitrogenous waste in the haemolymph mainly in the form of:
(1) Calcium carbonate
(2) Ammonia
(3) Potassium urate
(4) Urea

82. Filiform apparatus is characteristic feature of:
(1) Synergids
(2) Generative cell
(3) Nucellar embryo
(4) Aleurone cell

83. Acid rain is caused by increase in the atmospheric concentration of:
(1) O₂ and dust
(2) SO₂ and NO₂
(3) SO₃ and CO
(4) CO₂ and CO

84. The wheat grain has an embryo with one
(1) Coleoptile
(2) Epiblast
(3) Coleorhiza
(4) Scutellum

85. Among chinese rose, mustard, brinjal, potato, guava, cucumber, onion and tulip, how many plant have
(1) Four
(2) Five
(3) Six
(4) Three

86. Which of the following is not a function of the skeletal system?
(1) Locomotion
(2) Production of erythrocytes
(3) Storage of minerals
(4) Production of body heat

87. Golden rice is a genetically modified crop plant where the incorporated genes is meant for biosynthesis of:
(1) Vitamin A
(2) Vitamin B
(3) Vitamin C
(4) Omega-3

88. Chromatophores take part in:
(1) Respiration
(2) Photosynthesis
(3) Growth
(4) Movement
89. Select the wrong statement:
(1) Mosaic disease in tobacco and AIDS in human being are caused by viruses.
(2) The viruses were discovered by D.J. Ivanowski.
(3) W.M. Stanley showed that viruses could be crystallized.
(4) The term "contagium vivum fluidum" was coined by M.W. Beijerinck.

90. A eugregarine: (1) is expressed only in primitive plants.
(2) is a gene evolved during Pliocene.
(3) controls multiple traits in an individual.
(4) is a gene evolved during Pliocene.

91. Human urine is usually acidic because: (1) hydrogen ions are actively secreted into the filtrate.
(2) the sodium transporter exchanges one hydrogen ion for each sodium ion, in peritubular capillaries.
(3) excrated plasma proteins are acidic.
(4) potassium and sodium exchange generates acidity.

92. Auxin can be bioassayed by: (1) Lettuce hypocotyl elongation.
(2) Avena coleoptile curvature.
(3) Hydroponics.
(4) Potometer.

93. Which of the following events is not associated with ovulation in human female? (1) LH surge.
(2) Decrease in estradiol.
(3) Full development of Graafian follicle.
(4) Release of secondary oocyte.

94. Body having meshwork of cells, internal cavities lined with food filtering flagellated cells and indirect development are the characteristics of phylum: (1) Protozoa.
(2) Coelenterata.
(3) Porifera.
(4) Mollusca.

95. Which one of the following hormones is not involved in sugar metabolism? (1) Glucagon.
(2) Cortisone.
(3) Aldosterone.
(4) Insulin.

96. Which of the following diseases is caused by a protozoan? (1) Blastomycosis.
(2) Syphilis.
(3) Influenza.
(4) Babesiosis.

97. Outbreeding is an important strategy of animal husbandry because it: (1) exposes harmful recessive genes that are eliminated by selection.
(2) helps in accumulation of superior genes.
(3) is useful in producing purelines of animals.
(4) is useful in overcoming inbreeding depression.

98. A childless couple can be assisted to have a child through a technique called GIFT. The full form of this technique is: (1) Germ cell internal fallopian transfer.
(2) Gamete inseminated fallopian transfer.
(3) Gamete intrafallopian transfer.
(4) Gamete internal fertilization and transfer.

99. A jawless fish, which lays eggs in fresh water and whose ammocoetes larvae after metamorphosis return to the ocean is: (1) Petromyzon.
(2) Epitrateus.
(3) Myxine.
(4) Neomyxine.
| SCO | 106. In angiosperms, **megasporogenesis** and **megaspore** **formation** occur in the **ovule**. | 100. The structures that help some bacteria to attach to rocks and/or host tissues are:  
   (1) Holdfast  
   (2) Rhizoids  
   (3) Fimbriae  
   (4) Sporangia  

101. If you suspect major deficiency of antibodies in a person, to which of the following would you look for confirmatory evidence?  
   (1) Serum globulins  
   (2) Fibrinogen in plasma  
   (3) Serum albumins  
   (4) Haemocytos  

102. In human females, meiosis II is not completed until?  
   (1) Birth  
   (2) Puberty  
   (3) Fertilization  
   (4) Uterine implantation  

103. Which of the following layers in an antial follicle is acellular?  
   (1) Zona pellucida  
   (2) Granulosa  
   (3) Theca interna  
   (4) Stroma  

104. In his classic experiments on pea plants, Mendel did not use:  
   (1) Flower position  
   (2) Seed colour  
   (3) Pod length  
   (4) Seed shape  

105. Which one of the following fruits is parthenocarpic?  
   (1) Banana  
   (2) Brinjal  
   (3) Apple  
   (4) Jackfruit  

107. A gene showing codominance has:  
   (1) Both alleles independently expressed in the heterozygote  
   (2) A allele dominant to the other  
   (3) Alleles tightly linked on the same chromosome  
   (4) Alleles that are recessive to each other  

108. The chitinous exoskeleton of arthropods is formed by the polymerisation of:  
   (1) Lipopolysaccharides  
   (2) Keratin sulphate and chondroitin sulphate  
   (3) D-glucosamine  
   (4) N-acetyl glucosamine  

109. The imperfect fungi which are decomposers of litter and help in mineral cycling belong to:  
   (1) Ascomycetes  
   (2) Deuteromycetes  
   (3) Basidomycetes  
   (4) Phycomycetes  

110. The wings of a bird and the wings of an insect are:  
   (1) Homologous structures and represent convergent evolution  
   (2) Homologous structures and represent divergent evolution  
   (3) Analogous structures and represent convergent evolution  
   (4) Phylogenetic structures and represent divergent evolution  

111. Flowers are unisexual in:  
   (1) Onion  
   (2) Pea  
   (3) Cucumber  
   (4) China rose  

112. Which of the following is not a water soluble vitamin?  
   (1) Thiamine  
   (2) Riboflavin  
   (3) Pyridoxine  
   (4) Folic acid  

113. Which of the following is an example of an asexual reproduction?  
   (1) Budding  
   (2) Sporulation  
   (3) Pollination  
   (4) Fertilization
122. During ecological succession:
(1) the changes lead to a community that is in
near equilibrium with the environment and
includes pioneer community.
(2) the gradual and predictable change in species
composition occurs in a given area.
(3) the establishment of a new biotic community
is very fast in its primary phase.
(4) the numbers and types of animals remain
constant.

123. In the following human pedigree, the filled symbols
represent the affected individuals. Identify the type
of given pedigree.
(1) X-linked dominant
(2) Autosomal dominant
(3) X-linked recessive
(4) Autosomal recessive

124. Balbanci rings are sites of:
(1) RNA and protein synthesis
(2) Lipid synthesis
(3) Nucleotide synthesis
(4) Poly saccharide synthesis

125. Name the pulmonary disease in which alveolar
surface area involved in gas exchange is drastically
reduced due to damage in the alveolar walls.
(1) Asthma
(2) Pleurisy
(3) Emphysema
(4) Pneumonia

126. Which of the following are most suitable indicators of SO2 pollution in the environment?
(1) Fungi
(2) Lichens
(3) Conifers
(4) Algae

127. Satellite DNA is important because it:
(1) codes for enzymes needed for DNA replication
(2) codes for proteins needed in cell cycle
(3) shows high degree of polymorphism in population and also the same degree of polymorphism in an individual, which is
heritable from parents to children.
(4) does not code for proteins and is same in all members of the population.

128. Industrial melanism is an example of:
(1) Neo Lamarckism
(2) Neo Darwinism
(3) Natural selection
(4) Mutation

129. A column of water within xylem vessels of tall
trees does not break under its weight because of:
(1) Positive root pressure
(2) Dissolved sugars in water
(3) Tensile strength of water
(4) Lightigation of xylem vessels

130. The introduction of t-DNA into plants involves:
(1) Allowing the plant roots to stand in water
(2) Infection of the plant by Agrobacterium tumefaciens
(3) Altering the pH of the soil, then heat-shocking the plant.
(4) Exposing the plants to cold for a brief period

131. Which of the following is a basic unit of DNA?
(1) Sugar
(2) Phosphate
(3) Nitrogen base
(4) Carbohydrate
131. Nuclear membrane is present in Monera
132. In photosynthesis, the light-independent reactions take place at:
   (1) Stroma matrix
   (2) Thylakoid lumen
   (3) Photosystem I
   (4) Photosystem II
133. Which of the following statements is false?
   (1) Nuclear membrane is present in Monera
   (2) Cell wall is absent in Animalia
   (3) Protista have photosynthetic and heterotrophic modes of nutrition
   (4) Some fungi are edible
134. Which of the following pairs is not correctly matched?
   Mode of reproduction   Example
   (1) Conidia   Penicillium
   (2) Offset   Water hyacinth
   (3) Rhizome   Banana
   (4) Binary fission   Sargassum
135. The UN conference of Parties on climate change in the year 2012 was held at:
   (1) Warsaw
   (2) Durban
   (3) Doha
   (4) Lima
136. In the spectrum of hydrogen, the ratio of the longest wavelength in the Lyman series to the longest wavelength in the Balmer series is:
   (1) 
   (2) 
   (3) 
   (4) 
137. The energy of the electron wave is of the order of 15 keV. To which part of the spectrum does it belong?
   (1) y-rays
   (2) X-rays
   (3) Infra-red rays
   (4) Ultraviolet rays
138. An electron moves on a straight line path XY as shown. The abcd is a roll adjacent to the path of electron. What will be the direction of current, if any, induced in the coil?
   (1) No current induced
   (2) abcd
   (3) adc
   (4) The current will reverse its direction as the electron goes past the coil
139. Two wires of the same length and same area of cross-section, one of steel and another of brass are suspended from the same roof. If we want the lower ends of the wires to be at the same level, then the weights added to the steel and brass wires must be in the ratio of:
   (1) 2:1
   (2) 1:2
   (3) 1:3
   (4) 3:1
141. A potentiometer wire of length L and a resistance R are connected in series with a battery of e.m.f. E and a resistance R. An unknown e.m.f. E is balanced at a length l of the potentiometer wire. The e.m.f. E will be given by:

\[ E = \frac{V}{l} \]

\[ E_0 = \frac{V}{l_0} \]

\[ E_0 = \frac{V}{l_0} \]

\[ E_0 = \frac{V}{l_0} \]

\[ E_0 = \frac{V}{l_0} \]

142. A particle is executing a simple harmonic motion. Its maximum acceleration is a and maximum velocity is \( \beta \). Then, its time period of vibration will be:

\[ T = \frac{2\pi a}{\beta} \]

143. If vectors \( \vec{A} = \cos \theta \hat{i} + \sin \theta \hat{j} \) and \( \vec{B} = \cos \phi \hat{i} + \sin \phi \hat{j} \) are functions of time, then the value of t at which they are orthogonal to each other is:

\[ \theta = \frac{\pi}{2} \]

\[ \phi = \frac{\pi}{2} \]

\[ \theta = \frac{\pi}{2} \]

\[ \phi = \frac{\pi}{2} \]

144. A source of sound emitting waves of frequency 100 Hz and an observer O are located at some distance from each other. The source is moving with a speed of 194 m/s at an angle of 60° with the source observer line as shown in the figure. The observer measures the apparent frequency observed by the observer. Velocity of sound in air 330 m/s, is:

\[ f' = \frac{v - v_s}{v} f \]

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\[ f' = \frac{v - v_s}{v} f \]

\[ f' = \frac{v - v_s}{v} f \]

145. An automobile moves on a road with a speed of 54 km/h. The radius of its wheels is 0.45 m and the moment of inertia of the wheel about its axis of rotation is 3 kg m². If the vehicle is brought to rest in 15 s, the magnitude of average torque transmitted by its brakes to the wheel is:

\[ T = \frac{\Delta p}{\Delta t} \]

\[ T = \frac{\Delta p}{\Delta t} \]

\[ T = \frac{\Delta p}{\Delta t} \]

\[ T = \frac{\Delta p}{\Delta t} \]

146. A rectangular coil of length 0.12 m and width 0.01 m having 50 turns of wire is suspended vertically in a uniform magnetic field of strength 0.2 Weber/m². The coil carries a current of 2 A. If the plane of the coil is inclined at an angle of 45° with the direction of the field, the torque required to keep the coil in stable equilibrium will be:

\[ T = \frac{N}{2} B I L \]

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\[ T = \frac{N}{2} B I L \]

\[ T = \frac{N}{2} B I L \]
A parallel plate air capacitor has capacity \( C \) and potential difference \( V \) applied between the plates. The distance of separation between plates is \( d \) and the force of attraction between the plates is

\[
\left(\frac{C V^2}{2 d^2}\right)
\]

Two vessels separately contain two ideal gases A and B at the same temperature. The pressure of A is twice that of B. Under such conditions, the density of A is found to be 1.5 times the density of B. The ratio of molecular weight of A and B is

\[
\frac{M_A}{M_B} = \frac{1.5}{2}
\]

A remote-sensing satellite of earth revolves in a circular orbit at a height of 0.25 x 10^6 m above the surface of earth. If earth's radius is 6.38 x 10^6 m and \( g = 9.8 \text{ m/s}^2 \), then the orbital speed of the satellite is

\[
\begin{align*}
(1) & \quad 6.67 \text{ km/s} \\
(2) & \quad 7.76 \text{ km/s} \\
(3) & \quad 8.56 \text{ km/s} \\
(4) & \quad 9.13 \text{ km/s}
\end{align*}
\]

The position vector of a particle \( \mathbf{r} \) as a function of time is given by:

\[
\mathbf{r} = 4 \sin(2\pi t) \mathbf{i} + 4 \cos(2\pi t) \mathbf{j}
\]

Where \( \mathbf{r} \) is in meters, \( t \) in seconds and \( \mathbf{i} \) and \( \mathbf{j} \) denote unit vectors along x-and y-directions, respectively. Which one of the following statements is wrong for the motion of particle?

\[
\begin{align*}
(1) & \quad \text{Path of the particle is a circle of radius 4 meter.} \\
(2) & \quad \text{Acceleration vector is along } -\mathbf{R}. \\
(3) & \quad \text{Magnitude of acceleration vector is } \frac{\pi^2}{8} \text{ m/s}^2 . \\
(4) & \quad \text{Magnitude of velocity of particle is 8 meter/second}.
\end{align*}
\]

A string is stretched between fixed points separated by 75.0 cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequencies between these two. The lowest resonant frequency for this string is

\[
\begin{align*}
(1) & \quad 105 \text{ Hz} \\
(2) & \quad 155 \text{ Hz} \\
(3) & \quad 205 \text{ Hz} \\
(4) & \quad 105.1 \text{ Hz}
\end{align*}
\]
154. Point masses $m_1$ and $m_2$ are placed at the opposite ends of a rigid rod of length $L$ and negligible mass. The rod is to be set rotating about an axis perpendicular to it. The position of point $F$ on this rod through which the axis should pass so that the work required to set the rod rotating with angular velocity $\omega_0$ is minimum, is given by:

\[ x = \frac{m_1 L}{m_1 + m_2} \]

155. At the first minimum adjacent to the central maximum of a single slit diffraction pattern, the phase difference between the Huygens' wavelets is $\pi$. If the angle of the slit and the wavelet from the midpoint of the slit is:

\[ \varphi = \frac{\pi}{2} \] (radian)

156. A force $F = a \hat{i} + b \hat{j} + c \hat{k}$ is acting at a point $r = x \hat{i} + y \hat{j} + z \hat{k}$. The value of $a$ for which angular momentum about origin is conserved is:

\[ a = 0 \]

157. Two particles A and B move with constant velocities $v_1$ and $v_2$. At the initial instant their position vectors are $\vec{r}_1$ and $\vec{r}_2$ respectively. The condition for particles A and B to be in collision is:

\[ \vec{r}_1 + \vec{r}_2 = \vec{r}_1 - \vec{r}_2 \]

158. A nucleus of uranium decays at rest into nuclei of thorium and helium. Then:

\[ \text{(1)} \quad \text{The helium nucleus has less kinetic energy than the thorium nucleus.} \\
\text{(2)} \quad \text{The helium nucleus has more kinetic energy than the thorium nucleus.} \\
\text{(3)} \quad \text{The helium nucleus has low momentum than the thorium nucleus.} \\
\text{(4)} \quad \text{The helium nucleus has more momentum than the thorium nucleus.} \]

159. Two metal wires of identical dimensions are connected in series. If $\sigma_1$ and $\sigma_2$ are the conductivities of the two wires respectively, the effective conductivity of the combination is:

\[ \frac{1}{\sigma} = \frac{1}{\sigma_1} + \frac{1}{\sigma_2} \]

160. Light of wavelength 500 nm is incident on a metal with work function 2.8 eV, the de Broglie wavelength of the emitted electron is:

\[ \lambda = \frac{h}{p} \]

Where $h$ is Planck's constant and $p$ is the momentum of the electron.
161. 4.0 g of a gas occupies 22.4 litres at NTP. The speed of sound in this gas at NTP is 332 m s\(^{-1}\). If the speed of sound in this gas at 273 K and 1 bar is 332 m s\(^{-1}\), then the heat capacity at constant pressure is (Take: gas constant \(R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}\))

162. A series R-C circuit is connected to an alternating voltage source. Consider two situations:

(1) When capacitor is air filled
(2) When capacitor is mica filled

Current through resistor is \(i\) and voltage across capacitor is \(V\) then:

163. A plank with a box on it at one end is gradually raised about the other end. As the angle of inclination with the horizontal reaches 30°, the box starts to slip and slides 4.0 m down the plank in 4.0 s. The coefficients of static and kinetic friction between the box and the plank will be, respectively:

164. Two stones of masses \(m\) and \(2m\) are whirled in horizontal circles, the heavier one in a radius \(\frac{1}{2}\) and the lighter one in radius \(r\). The tangential speed of lighter stone is twice that of the heavier stone when they experience same centripetal force. The value of \(r\) is:

165. If potential (in volts) in a region is expressed as \(V(x, y, z) = 6xy - y^2 + z^2\), the electric field (in N/C) at point \((1, 1, 0)\) is:

166. The coefficient of performance of a refrigerator is:

167. A ball is thrown vertically downwards from a height of 20 m with an initial velocity \(v_0\). It collides with the ground, loses 50 percent of its energy in collision and rebounds to the same height. The initial velocity \(v_0\) is (Take: \(g = 10 \text{ m s}^{-2}\))

168. On a frictionless surface, a block of mass \(M\) moving, as speed, collides elastically with another block of same mass \(M\) which is initially at rest. After collision, the first block moves at an angle \(\theta\) to its initial direction and has a speed of \(\frac{1}{3}\). The second block's speed after the collision is:

169. If \(f(x, y) = 3xy - y^2 - 2y\), the electric field (in N/C) at point \((1, 1, 0)\) is:

170. If potential (in volts) in a region is expressed as \(V(x, y, z) = 6xy - y^2 + z^2\), the electric field (in N/C) at point \((1, 1, 0)\) is:

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173. On a frictionless surface, a block of mass M moving, as speed, collides elastically with another block of same mass M which is initially at rest. After collision, the first block moves at an angle \(\theta\) to its initial direction and has a speed of \(\frac{1}{3}\). The second block's speed after the collision is:

174. If \(f(x, y) = 3xy - y^2 - 2y\), the electric field (in N/C) at point \((1, 1, 0)\) is:
170. Two slits in Young’s experiment have widths in the ratio 1:25. The ratio of intensity at the maxima and minima in the interference pattern, $I_{\text{max}}/I_{\text{min}}$, is:

(1) 4
(2) 9
(3) 49
(4) 121

171. The heart of a man pumps 5 litres of blood through the arteries per minute at a pressure of 150 mm of mercury. If the density of mercury be $13.6 \times 10^3$ kg/m$^3$ and $g = 10$ m/s$^2$ then the power of heart in watt is:

(1) 1.50
(2) 1.70
(3) 3.25
(4) 3.0

172. A proton and an alpha particle both enter a region of uniform magnetic field $B$, moving at right angles to the field. If the radius of circular orbits for both the particles is equal and the kinetic energy acquired by proton is 1 MeV, the energy acquired by the alpha particle will be:

(1) 1 MeV
(2) 4 MeV
(3) 0.5 MeV
(4) 1.5 MeV

173. The input signal given to a CE amplifier having a voltage gain of 150 is $V_i = 2 \cos (15t + \frac{\pi}{3})$. The corresponding output signal will be:

(1) $300 \cos (15t + \frac{\pi}{6})$
(2) $300 \cos (15t + \frac{\pi}{8})$
(3) $75 \cos (15t + \frac{2\pi}{3})$
(4) $2 \cos (25t + \frac{5\pi}{6})$

174. If dimensions of critical velocity $u_c$ of a liquid flowing through a tube are expressed as $[m^{3/2} t^{1/2}]$, where $\eta$, $\rho$ and $r$ are the coefficient of viscosity, density of liquid and radius of the tube respectively, then the values of $\eta$, $\rho$ and $r$ are given by:

(1) $1, 1, 1$
(2) $1, 1, 1$
(3) $1, 1, 1$
(4) $1, 1, 1$

175. A circuit contains an ammeter, a battery of 30 V and a resistance 40 ohm all connected in series. If the ammeter has a coil of resistance 40 ohm and a shunt of 20 ohm, the reading in the ammeter will be:

(1) 1 A
(2) 0.5 A
(3) 0.25 A
(4) 2 A

176. Water rises to a height ‘H’ in capillary tube. If the length of capillary tube above the surface of water is made less than ‘H’, then:

(1) water does not rise at all.
(2) water rises up to the tip of capillary tube and then starts overflowing like a fountain.
(3) water rises up to the top of capillary tube and stays there without overflowing.
(4) water rises up a point a little below the top and stays there.

177. An astronomical telescope in normal adjustment, a straight black line of length ‘l’ is drawn on inside part of objective lens. The eye-piece forms a real image of this line. The length of this image is ‘l’. The magnification of the telescope is:

(1) $\frac{1}{l}$
(2) $\frac{1}{l} - 1$
(3) $\frac{1}{l}$
(4) $\frac{1}{l} - 1$

178. In an astronomical telescope in normal adjustment, a straight black line of length ‘1’ is drawn on inside part of objective lens. The eye-piece forms a real image of this line. The length of this image is ‘l’. The magnification of the telescope is:

(1) $\frac{1}{l}$
(2) $\frac{1}{l} - 1$
(3) $\frac{1}{l}$
(4) $\frac{1}{l} - 1$
180. A beam of light consisting of red, green, and blue colours is incident on a right-angled prism. The refractive index of the material of the prism for the above-red, green, and blue wavelengths are 1.35, 1.44, and 1.51, respectively.

181. A beam of monochromatic light of wavelength \( \lambda \) is incident on a surface at an angle \( \theta \). If the maximum kinetic energy of the emitted electrons is half the energy of the incident light, the work function of the material is

\[ W = \frac{\hbar^2}{8m}\left(\frac{1}{3}\right) \]

where \( \hbar \) is Planck's constant and \( m \) is the mass of the electron.