Important Instructions:

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on side-1 and side-2 carefully with blue/black ball point pen only.

2. The test is of 3 hours duration and Test Booklet contains 180 questions. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 720.

3. Use Blue/Black Ball Point Pen only for writing particulars on this page/markng responses.

4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.

5. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.

6. The CODE for this Booklet is E3. Make sure that the CODE printed on Side-2 of the Answer Sheet is the same as that on this Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.

7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.

8. Use of white fluid for correction is NOT permissible on the Answer Sheet.

9. Each candidate must show on demand his/her Admit Card to the Invigilator.

10. No candidate, without special permission of the Superintendent or Invigilator, would leave his/her seat.

11. 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 the Answer Sheet and dealt with as an unfair means case.

12. Use of Electronic/Manual Calculator is prohibited.

13. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.

14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet/Answer Sheet in the Attendance Sheet.

Name of the Candidate (in Capitals): ________________________________

Roll Number : in figures ________________________________

: in words ________________________________

Centre of Examination (in Capitals): ________________________________

Candidate’s Signature: ________________________________ Invigilator’s Signature: ________________________________

Facsimile signature stamp of

Centre Superintendent: ________________________________
1. Which of the following is a basic amino acid?
   (1) Serine
   (2) Alanine
   (3) Tyrosine
   (4) Lysine

2. The correct option for free expansion of an ideal gas under adiabatic condition is:
   (1) $q = 0$, $\Delta T = 0$ and $w = 0$
   (2) $q < 0$, $\Delta T < 0$ and $w > 0$
   (3) $q > 0$, $\Delta T = 0$ and $w = 0$
   (4) $q > 0$, $\Delta T > 0$ and $w > 0$

3. Measuring Zeta potential is useful in determining which property of colloidal solution?
   (1) Viscosity
   (2) Solubility
   (3) Stability of the colloidal particles
   (4) Size of the colloidal particles

4. The calculated spin only magnetic moment of Cr$^{2+}$ ion is:
   (1) 3.87 BM
   (2) 4.90 BM
   (3) 5.92 BM
   (4) 2.84 BM

5. Elimination reaction of 2-Bromo-pentane to form pent-2-ene is:
   (a) $\beta$-Elimination reaction
   (b) Follows Zaitsev rule
   (c) Dehydrohalogenation reaction
   (d) Dehydration reaction
   (1) (a), (b), (c)
   (2) (a), (c), (d)
   (3) (b), (c), (d)
   (4) (a), (b), (d)

6. On electrolysis of dil. sulphuric acid using Platinum (Pt) electrode, the product obtained at anode will be:
   (1) Hydrogen gas
   (2) Oxygen gas
   (3) $H_2S$ gas
   (4) $SO_2$ gas

7. Which of the following is not correct about carbon monoxide?
   (1) It forms carboxyhaemoglobin.
   (2) It reduces oxygen carrying ability of blood.
   (3) The carboxyhaemoglobin (haemoglobin bound to CO) is less stable than oxyhaemoglobin.
   (4) It is produced due to incomplete combustion.

8. Sucrose on hydrolysis gives:
   (1) $\beta$-D-Glucose + $\alpha$-D-Fructose
   (2) $\alpha$-D-Glucose + $\beta$-D-Glucose
   (3) $\alpha$-D-Glucose + $\beta$-D-Fructose
   (4) $\alpha$-D-Fructose + $\beta$-D-Fructose

9. Match the following and identify the correct option.
   (a) $CO(g) + H_2(g)$
   (i) Mg(HCO$_3$)$_2$ + Ca(HCO$_3$)$_2$
   (b) Temporary hardness of water
   (ii) An electron deficient hydride
   (c) B$_2$H$_6$
   (iii) Synthesis gas
   (d) H$_2$O$_2$
   (iv) Non-planar structure
   (1) (iii) (i) (ii) (iv)
   (2) (iii) (ii) (i) (iv)
   (3) (iii) (iv) (ii) (i)
   (4) (i) (iii) (ii) (iv)

10. An increase in the concentration of the reactants of a reaction leads to change in:
    (1) activation energy
    (2) heat of reaction
    (3) threshold energy
    (4) collision frequency

11. Which of the following is a natural polymer?
    (1) cis-1,4-polyisoprene
    (2) poly (Butadiene-styrene)
    (3) polybutadiene
    (4) poly (Butadiene-acrylonitrile)
12. The rate constant for a first order reaction is $4.606 \times 10^{-3} \text{ s}^{-1}$. The time required to reduce 2.0 g of the reactant to 0.2 g is:

(1) 100 s
(2) 200 s
(3) 500 s
(4) 1000 s

13. Identify the correct statements from the following:

(a) CO$_2$(g) is used as refrigerant for ice-cream and frozen food.
(b) The structure of C$_{60}$ contains twelve six carbon rings and twenty five carbon rings.
(c) ZSM-5, a type of zeolite, is used to convert alcohols into gasoline.
(d) CO is colorless and odourless gas.

(1) (a), (b) and (c) only
(2) (a) and (c) only
(3) (b) and (c) only
(4) (c) and (d) only

14. A mixture of N$_2$ and Ar gases in a cylinder contains 7 g of N$_2$ and 8 g of Ar. If the total pressure of the mixture of the gases in the cylinder is 27 bar, the partial pressure of N$_2$ is:

[Use atomic masses (in g mol$^{-1}$): N = 14, Ar = 40]

(1) 9 bar
(2) 12 bar
(3) 15 bar
(4) 18 bar

15. Which of the following set of molecules will have zero dipole moment?

(1) Ammonia, beryllium difluoride, water, 1,4-dichlorobenzene
(2) Boron trifluoride, hydrogen fluoride, carbon dioxide, 1,3-dichlorobenzene
(3) Nitrogen trifluoride, beryllium difluoride, water, 1,3-dichlorobenzene
(4) Boron trifluoride, beryllium difluoride, carbon dioxide, 1,4-dichlorobenzene

16. Hydrolysis of sucrose is given by the following reaction.

$$\text{Sucrose} + \text{H}_2\text{O} \rightleftharpoons \text{Glucose} + \text{Fructose}$$

If the equilibrium constant ($K$) is $2 \times 10^{13}$ at 300 K, the value of $\Delta_r G^\circ$ at the same temperature will be:

(1) $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
(2) $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
(3) $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})$
(4) $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(4 \times 10^{13})$

17. Anisole on cleavage with HI gives:

(1) OH
(2) +CH$_3$I
(3) OH
(4) +C$_2$H$_5$I
(4) +C$_2$H$_5$OH

18. The number of protons, neutrons and electrons in $^{175}_{71}$Lu, respectively, are:

(1) 71, 104 and 71
(2) 104, 71 and 71
(3) 71, 71 and 104
(4) 175, 104 and 71
19. Paper chromatography is an example of:
   (1) Adsorption chromatography
   (2) Partition chromatography
   (3) Thin layer chromatography
   (4) Column chromatography

20. Identify the incorrect match.

<table>
<thead>
<tr>
<th>Name</th>
<th>IUPAC Official Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Unnilinium</td>
<td>(i) Mendelevium</td>
</tr>
<tr>
<td>(b) Unniltrium</td>
<td>(ii) Lawrencium</td>
</tr>
<tr>
<td>(c) Unnilhexium</td>
<td>(iii) Seaborgium</td>
</tr>
<tr>
<td>(d) Unununnium</td>
<td>(iv) Darmstadtium</td>
</tr>
</tbody>
</table>

   (1) (a), (i)
   (2) (b), (ii)
   (3) (c), (iii)
   (4) (d), (iv)

21. Which one of the followings has maximum number of atoms?
   (1) 1 g of Ag(s) [Atomic mass of Ag = 108]
   (2) 1 g of Mg(s) [Atomic mass of Mg = 24]
   (3) 1 g of O₂(g) [Atomic mass of O = 16]
   (4) 1 g of Li(s) [Atomic mass of Li = 7]

22. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following?
   (1) −I effect of −CH₃ groups
   (2) +R effect of −CH₃ groups
   (3) −R effect of −CH₃ groups
   (4) Hyperconjugation

23. Which of the following amine will give the carbylamine test?

```
   NH₂
   (1)
   NHCH₃
   (2)
   N(CH₃)₂
   (3)
   NHC₂H₅
   (4)
```

24. Which of the following alkane cannot be made in good yield by Wurtz reaction?
   (1) n-Hexane
   (2) 2,3-Dimethylbutane
   (3) n-Heptane
   (4) n-Butane

25. The mixture which shows positive deviation from Raoult’s law is:
   (1) Ethanol + Acetone
   (2) Benzene + Toluene
   (3) Acetone + Chloroform
   (4) Chloroethane + Bromoethane
26. Reaction between benzaldehyde and acetophenone in presence of dilute NaOH is known as:
   (1) Aldol condensation
   (2) Cannizzaro’s reaction
   (3) Cross Cannizzaro’s reaction
   (4) Cross Aldol condensation

27. Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?
   (1) SCN⁻ < F⁻ < C₂O₄²⁻ < CN⁻
   (2) SCN⁻ < F⁻ < CN⁻ < C₂O₄²⁻
   (3) F⁻ < SCN⁻ < C₂O₄²⁻ < CN⁻
   (4) CN⁻ < C₂O₄²⁻ < SCN⁻ < F⁻

28. Which of the following is a cationic detergent?
   (1) Sodium lauryl sulphate
   (2) Sodium stearate
   (3) Cetyltrimethyl ammonium bromide
   (4) Sodium dodecylbenzene sulphonate

29. Reaction between acetone and methylmagnesium chloride followed by hydrolysis will give:
   (1) Isopropyl alcohol
   (2) Sec. butyl alcohol
   (3) Tert. butyl alcohol
   (4) Isobutyl alcohol

30. Urea reacts with water to form A which will decompose to form B. B when passed through Cu²⁺ (aq), deep blue colour solution C is formed. What is the formula of C from the following?
   (1) CuSO₄
   (2) [Cu(NH₃)₄]²⁺
   (3) Cu(OH)₂
   (4) CuCO₃Cu(OH)₂

31. The number of Faradays(F) required to produce 20 g of calcium from molten CaCl₂ (Atomic mass of Ca = 40 g mol⁻¹) is:
   (1) 1
   (2) 2
   (3) 3
   (4) 4

32. For the reaction, 2Cl(g) → Cl₂(g), the correct option is:
   (1) ΔₗH > 0 and Δₛ > 0
   (2) ΔₗH > 0 and Δₛ < 0
   (3) ΔₗH < 0 and Δₛ > 0
   (4) ΔₗH < 0 and Δₛ < 0

33. Find out the solubility of Ni(OH)₂ in 0.1 M NaOH. Given that the ionic product of Ni(OH)₂ is 2 × 10⁻¹³.
   (1) 2 × 10⁻¹³ M
   (2) 2 × 10⁻⁸ M
   (3) 1 × 10⁻¹³ M
   (4) 1 × 10⁸ M

34. The freezing point depression constant (K_f) of benzene is 5.12 K kg mol⁻¹. The freezing point depression for the solution of molality 0.078 m containing a non-electrolyte solute in benzene is (rounded off upto two decimal places):
   (1) 0.20 K
   (2) 0.80 K
   (3) 0.40 K
   (4) 0.60 K

35. Identify the incorrect statement.
   (1) Cr²⁺ (d⁴) is a stronger reducing agent than Fe²⁺ (d⁶) in water.
   (2) The transition metals and their compounds are known for their catalytic activity due to their ability to adopt multiple oxidation states and to form complexes.
   (3) Interstitial compounds are those that are formed when small atoms like H, C or N are trapped inside the crystal lattices of metals.
   (4) The oxidation states of chromium in CrO₄²⁻ and Cr₂O₇²⁻ are not the same.

36. An element has a body centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is:
   (1) \( \frac{\sqrt{3}}{4} \times 288 \) pm
   (2) \( \frac{\sqrt{2}}{4} \times 288 \) pm
   (3) \( \frac{4}{\sqrt{3}} \times 288 \) pm
   (4) \( \frac{4}{\sqrt{2}} \times 288 \) pm
37. Identify a molecule which does not exist.
   (1) He₂
   (2) Li₂
   (3) C₂
   (4) O₂

38. Which of the following oxoacid of sulphur has −O−O−linkage?
   (1) H₂SO₃, sulphurous acid
   (2) H₂SO₄, sulphuric acid
   (3) H₂S₂O₈, peroxodisulphuric acid
   (4) H₂S₂O₇, pyrosulphuric acid

39. An alkene on ozonolysis gives methanal as one of the product. Its structure is:

   CH₂ − CH₂ − CH₃
   (1)

   CH₂ − CH = CH₂
   (2)

   CH₂ − CH₂ − CH₃
   (3)

40. HCl was passed through a solution of CaCl₂, MgCl₂ and NaCl. Which of the following compound(s) crystallise(s)?
   (1) Both MgCl₂ and CaCl₂
   (2) Only NaCl
   (3) Only MgCl₂
   (4) NaCl, MgCl₂ and CaCl₂

41. Match the following:

<table>
<thead>
<tr>
<th>Oxide</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) CO</td>
<td>(i) Basic</td>
</tr>
<tr>
<td>(b) BaO</td>
<td>(ii) Neutral</td>
</tr>
<tr>
<td>(c) Al₂O₃</td>
<td>(iii) Acidic</td>
</tr>
<tr>
<td>(d) Cl₂O₇</td>
<td>(iv) Amphoteric</td>
</tr>
</tbody>
</table>

   Which of the following is correct option?
   (a) (b) (c) (d)
   (1) (i) (ii) (iii) (iv)
   (2) (ii) (i) (iv) (iii)
   (3) (iii) (iv) (i) (ii)
   (4) (iv) (iii) (ii) (i)

42. The following metal ion activates many enzymes, participates in the oxidation of glucose to produce ATP and with Na, is responsible for the transmission of nerve signals.
   (1) Iron
   (2) Copper
   (3) Calcium
   (4) Potassium

43. What is the change in oxidation number of carbon in the following reaction?
   CH₄(g) + 4Cl₂(g) → CCl₄(l) + 4HCl(g)
   (1) + 4 to + 4
   (2) 0 to + 4
   (3) − 4 to + 4
   (4) 0 to − 4

44. Identify the correct statement from the following:
   (1) Wrought iron is impure iron with 4% carbon.
   (2) Blister copper has blistered appearance due to evolution of CO₂.
   (3) Vapour phase refining is carried out for Nickel by Van Arkel method.
   (4) Pig iron can be moulded into a variety of shapes.
45. Identify compound X in the following sequence of reactions:

\[
\begin{align*}
 &\text{CH}_3 \\
 &\text{Cl}_2/\text{hv} \quad \text{CH}_2\text{Cl} \quad \text{CHCl}_2 \\
 &\text{X} \quad \text{CHO} \\
 &\text{Cl} \quad \text{CHCl}_2 \\
 &\text{373 K} \\
\end{align*}
\]

46. Which of the following regions of the globe exhibits highest species diversity?
(1) Western Ghats of India
(2) Madagascar
(3) Himalayas
(4) Amazon forests

47. In water hyacinth and water lily, pollination takes place by:
(1) insects or wind
(2) water currents only
(3) wind and water
(4) insects and water

48. The enzyme enterokinase helps in conversion of:
(1) protein into polypeptides
(2) trypsinogen into trypsin
(3) caseinogen into casein
(4) pepsinogen into pepsin

49. Presence of which of the following conditions in urine are indicative of Diabetes Mellitus?
(1) Uremia and Ketonuria
(2) Uremia and Renal Calculi
(3) Ketonuria and Glycosuria
(4) Renal calculi and Hyperglycaemia

50. Experimental verification of the chromosomal theory of inheritance was done by:
(1) Mendel
(2) Sutton
(3) Boveri
(4) Morgan

51. Which of the following is not an attribute of a population?
(1) Sex ratio
(2) Natality
(3) Mortality
(4) Species interaction

52. Goblet cells of alimentary canal are modified from:
(1) Squamous epithelial cells
(2) Columnar epithelial cells
(3) Chondrocytes
(4) Compound epithelial cells

53. Floridean starch has structure similar to:
(1) Starch and cellulose
(2) Amylopectin and glycogen
(3) Mannitol and algin
(4) Laminarin and cellulose
54. Identify the **correct** statement with reference to human digestive system.
   (1) Ileum opens into small intestine.
   (2) Serosa is the innermost layer of the alimentary canal.
   (3) Ileum is a highly coiled part.
   (4) Vermiform appendix arises from duodenum.

55. Secondary metabolites such as nicotine, strychnine and caffeine are produced by plants for their :
   (1) Nutritive value
   (2) Growth response
   (3) Defence action
   (4) Effect on reproduction

56. From his experiments, S.L. Miller produced amino acids by mixing the following in a closed flask :
   (1) CH₄, H₂, NH₃ and water vapor at 800°C
   (2) CH₃, H₂, NH₄ and water vapor at 800°C
   (3) CH₄, H₂, NH₃ and water vapor at 600°C
   (4) CH₃, H₂, NH₃ and water vapor at 600°C

57. Identify the **incorrect** statement.
   (1) Heart wood does not conduct water but gives mechanical support.
   (2) Sapwood is involved in conduction of water and minerals from root to leaf.
   (3) Sapwood is the innermost secondary xylem and is lighter in colour.
   (4) Due to deposition of tannins, resins, oils etc., heart wood is dark in colour.

58. Name the plant growth regulator which upon spraying on sugarcane crop, increases the length of stem, thus increasing the yield of sugarcane crop.
   (1) Cytokinin
   (2) Gibberellin
   (3) Ethylene
   (4) Abscisic acid

59. The first phase of translation is :
   (1) Binding of mRNA to ribosome
   (2) Recognition of DNA molecule
   (3) Aminoacylation of tRNA
   (4) Recognition of an anti-codon

60. Embryological support for evolution was disapproved by :
   (1) Karl Ernst von Baer
   (2) Alfred Wallace
   (3) Charles Darwin
   (4) Oparin

61. Dissolution of the synaptonemal complex occurs during :
   (1) Pachytene
   (2) Zygotene
   (3) Diplotene
   (4) Leptotene

62. Meiotic division of the secondary oocyte is completed :
   (1) Prior to ovulation
   (2) At the time of copulation
   (3) After zygote formation
   (4) At the time of fusion of a sperm with an ovum

63. Which of the following pairs is of unicellular algae ?
   (1) *Laminaria* and *Sargassum*
   (2) *Gelidium* and *Gracilaria*
   (3) *Anabaena* and *Volvox*
   (4) *Chlorella* and *Spirulina*

64. Identify the substances having glycosidic bond and peptide bond, respectively in their structure :
   (1) Chitin, cholesterol
   (2) Glycerol, trypsin
   (3) Cellulose, lecithin
   (4) Inulin, insulin
65. Strobili or cones are found in:
   (1) *Salvinia*
   (2) *Pteris*
   (3) *Marchantia*
   (4) *Equisetum*

66. The roots that originate from the base of the stem are:
   (1) Fibrous roots
   (2) Primary roots
   (3) Prop roots
   (4) Lateral roots

67. The ovary is half inferior in:
   (1) Brinjal
   (2) Mustard
   (3) Sunflower
   (4) Plum

68. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Organ of Corti</td>
<td>(i) Connects middle ear and pharynx</td>
</tr>
<tr>
<td>(b) Cochlea</td>
<td>(ii) Coiled part of the labyrinth</td>
</tr>
<tr>
<td>(c) Eustachian tube</td>
<td>(iii) Attached to the oval window</td>
</tr>
<tr>
<td>(d) Stapes</td>
<td>(iv) Located on the basilar membrane</td>
</tr>
</tbody>
</table>

   (a) (b) (c) (d)
   (1) (i) (iii) (i) (iv)
   (2) (ii) (iv) (i) (ii)
   (3) (iv) (ii) (i) (iii)
   (4) (i) (ii) (iv) (iii)

69. Identify the wrong statement with reference to immunity.

   (1) When exposed to antigen (living or dead) antibodies are produced in the host’s body. It is called “Active immunity”.
   (2) When ready-made antibodies are directly given, it is called “Passive immunity”.
   (3) Active immunity is quick and gives full response.
   (4) Foetus receives some antibodies from mother, it is an example for passive immunity.

70. Some dividing cells exit the cell cycle and enter vegetative inactive stage. This is called quiescent stage (G₀). This process occurs at the end of:

   (1) M phase
   (2) G₁ phase
   (3) S phase
   (4) G₂ phase

71. Select the correct statement.

   (1) Glucocorticoids stimulate gluconeogenesis.
   (2) Glucagon is associated with hypoglycemia.
   (3) Insulin acts on pancreatic cells and adipocytes.
   (4) Insulin is associated with hyperglycemia.

72. Match the following diseases with the causative organism and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Typhoid</td>
<td>(i) <em>Wuchereria</em></td>
</tr>
<tr>
<td>(b) Pneumonia</td>
<td>(ii) <em>Plasmodium</em></td>
</tr>
<tr>
<td>(c) Filarasis</td>
<td>(iii) <em>Salmonella</em></td>
</tr>
<tr>
<td>(d) Malaria</td>
<td>(iv) <em>Haemophilus</em></td>
</tr>
</tbody>
</table>

   (a) (b) (c) (d)
   (1) (i) (iii) (ii) (iv)
   (2) (iii) (iv) (i) (ii)
   (3) (ii) (i) (iii) (iv)
   (4) (iv) (i) (ii) (iii)

73. Select the correct match.

   (1) Haemophilia - Y linked
   (2) Phenylketonuria - Autosomal dominant trait
   (3) Sickle cell anaemia - Autosomal recessive trait, chromosome-11
   (4) Thalassemia - X linked
74. Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells?

(1) Endoplasmic reticulum
(2) Peroxisomes
(3) Golgi bodies
(4) Polysomes

75. In relation to Gross primary productivity and Net primary productivity of an ecosystem, which one of the following statements is correct?

(1) Gross primary productivity is always less than net primary productivity.
(2) Gross primary productivity is always more than net primary productivity.
(3) Gross primary productivity and Net primary productivity are one and same.
(4) There is no relationship between Gross primary productivity and Net primary productivity.

76. Which of the following would help in prevention of diuresis?

(1) More water reabsorption due to undersecretion of ADH
(2) Reabsorption of Na\(^+\) and water from renal tubules due to aldosterone
(3) Atrial natriuretic factor causes vasoconstriction
(4) Decrease in secretion of renin by JG cells

77. Identify the correct statement with regard to G\(_1\) phase (Gap 1) of interphase.

(1) DNA synthesis or replication takes place.
(2) Reorganisation of all cell components takes place.
(3) Cell is metabolically active, grows but does not replicate its DNA.
(4) Nuclear Division takes place.

78. Which of the following refer to correct example(s) of organisms which have evolved due to changes in environment brought about by anthropogenic action?

(a) Darwin's Finches of Galapagos islands.
(b) Herbicide resistant weeds.
(c) Drug resistant eukaryotes.
(d) Man-created breeds of domesticated animals like dogs.

(1) only (a)
(2) (a) and (c)
(3) (b), (c) and (d)
(4) only (d)

79. The plant parts which consist of two generations - one within the other:

(a) Pollen grains inside the anther
(b) Germinated pollen grain with two male gametes
(c) Seed inside the fruit
(d) Embryo sac inside the ovule

(1) (a) only
(2) (a), (b) and (c)
(3) (c) and (d)
(4) (a) and (d)

80. Match the trophic levels with their correct species examples in grassland ecosystem.

(a) Fourth trophic level (i) Crow
(b) Second trophic level (ii) Vulture
(c) First trophic level (iii) Rabbit
(d) Third trophic level (iv) Grass

Select the correct option:

(a) (b) (c) (d)

(1) (ii) (iii) (iv) (i)
(2) (iii) (ii) (i) (iv)
(3) (iv) (iii) (ii) (i)
(4) (i) (ii) (iii) (iv)

81. The QRS complex in a standard ECG represents:

(1) Repolarisation of auricles
(2) Depolarisation of auricles
(3) Depolarisation of ventricles
(4) Repolarisation of ventricles
82. The process responsible for facilitating loss of water in liquid form from the tip of grass blades at night and in early morning is:
   (1) Transpiration
   (2) Root pressure
   (3) Imbibition
   (4) Plasmolysis

83. According to Robert May, the global species diversity is about:
   (1) 1.5 million
   (2) 20 million
   (3) 50 million
   (4) 7 million

84. In gel electrophoresis, separated DNA fragments can be visualized with the help of:
   (1) Acetocarmine in bright blue light
   (2) Ethidium bromide in UV radiation
   (3) Acetocarmine in UV radiation
   (4) Ethidium bromide in infrared radiation

85. Match the following concerning essential elements and their functions in plants:
   (a) Iron (i) Photolysis of water
   (b) Zinc (ii) Pollen germination
   (c) Boron (iii) Required for chlorophyll biosynthesis
   (d) Manganese (iv) IAA biosynthesis

Select the correct option:
   (a) (b) (c) (d)
   (1) (ii) (i) (iv) (iii)
   (2) (iv) (iii) (ii) (i)
   (3) (iii) (ii) (iv) (i)
   (4) (iv) (iii) (i) (ii)

86. Flippers of Penguins and Dolphins are examples of:
   (1) Adaptive radiation
   (2) Convergent evolution
   (3) Industrial melanism
   (4) Natural selection

87. If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is $6.6 \times 10^9$ bp, then the length of the DNA is approximately:
   (1) 2.0 meters
   (2) 2.5 meters
   (3) 2.2 meters
   (4) 2.7 meters

88. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Floating Ribs</td>
<td>(i) Located between second and seventh ribs</td>
</tr>
<tr>
<td>(b) Acromion</td>
<td>(ii) Head of the Humerus</td>
</tr>
<tr>
<td>(c) Scapula</td>
<td>(iii) Clavicle</td>
</tr>
<tr>
<td>(d) Glenoid cavity</td>
<td>(iv) Do not connect with the sternum</td>
</tr>
</tbody>
</table>

Select the correct option:
   (a) (b) (c) (d)
   (1) (ii) (iv) (i) (iii)
   (2) (i) (iii) (ii) (iv)
   (3) (iii) (ii) (iv) (i)
   (4) (iv) (iii) (i) (ii)

89. Montreal protocol was signed in 1987 for control of:
   (1) Transport of Genetically modified organisms from one country to another
   (2) Emission of ozone depleting substances
   (3) Release of Green House gases
   (4) Disposal of e-wastes

90. Choose the correct pair from the following:
   (1) Ligases - Join the two DNA molecules
   (2) Polymerases - Break the DNA into fragments
   (3) Nucleases - Separate the two strands of DNA
   (4) Exonucleases - Make cuts at specific positions within DNA
91. Which of the following statements about inclusion bodies is incorrect?
   (1) They are not bound by any membrane.
   (2) These are involved in ingestion of food particles.
   (3) They lie free in the cytoplasm.
   (4) These represent reserve material in cytoplasm.

92. Ray florets have:
   (1) Inferior ovary
   (2) Superior ovary
   (3) Hypogynous ovary
   (4) Half inferior ovary

93. Which of the following is not an inhibitory substance governing seed dormancy?
   (1) Gibberellic acid
   (2) Abscisic acid
   (3) Phenolic acid
   (4) Para-ascorbic acid

94. Bt cotton variety that was developed by the introduction of toxin gene of *Bacillus thuringiensis* (Bt) is resistant to:
   (1) Insect pests
   (2) Fungal diseases
   (3) Plant nematodes
   (4) Insect predators

95. Identify the wrong statement with reference to transport of oxygen.
   (1) Binding of oxygen with haemoglobin is mainly related to partial pressure of O₂.
   (2) Partial pressure of CO₂ can interfere with O₂ binding with haemoglobin.
   (3) Higher H⁺ conc. in alveoli favours the formation of oxyhaemoglobin.
   (4) Low pCO₂ in alveoli favours the formation of oxyhaemoglobin.

96. Bilaterally symmetrical and acoelomate animals are exemplified by:
   (1) Ctenophora
   (2) Platyhelminthes
   (3) Aschelminthes
   (4) Annelida

97. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Bt cotton</td>
<td>(i) Gene therapy</td>
</tr>
<tr>
<td>(b) Adenosine deaminase deficiency</td>
<td>(ii) Cellular defence</td>
</tr>
<tr>
<td>(c) RNAi</td>
<td>(iii) Detection of HIV infection</td>
</tr>
<tr>
<td>(d) PCR</td>
<td>(iv) <em>Bacillus thuringiensis</em></td>
</tr>
</tbody>
</table>

98. By which method was a new breed ‘Hisardale’ of sheep formed by using Bikaneri ewes and Marino rams?
   (1) Out crossing
   (2) Mutational breeding
   (3) Cross breeding
   (4) Inbreeding

99. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Eosinophils</td>
<td>(i) Immune response</td>
</tr>
<tr>
<td>(b) Basophils</td>
<td>(ii) Phagocytosis</td>
</tr>
<tr>
<td>(c) Neutrophils</td>
<td>(iii) Release histaminase, destructive enzymes</td>
</tr>
<tr>
<td>(d) Lymphocytes</td>
<td>(iv) Release granules containing histamine</td>
</tr>
</tbody>
</table>

   (1) (iii) (iv) (ii) (i)
   (2) (iii) (ii) (i) (iv)
   (3) (ii) (iii) (iv) (i)
   (4) (i) (ii) (iii) (iv)
100. Which of the following statements is correct?

(1) Adenine pairs with thymine through two H-bonds.
(2) Adenine pairs with thymine through one H-bond.
(3) Adenine pairs with thymine through three H-bonds.
(4) Adenine does not pair with thymine.

101. The infectious stage of *Plasmodium* that enters the human body is:

(1) Trophozoites
(2) Sporozoites
(3) Female gametocytes
(4) Male gametocytes

102. The body of the ovule is fused within the funicle at:

(1) Hilum
(2) Micropyle
(3) Nucellus
(4) Chalaza

103. Snow-blindness in Antarctic region is due to:

(1) Freezing of fluids in the eye by low temperature
(2) Inflammation of cornea due to high dose of UV-B radiation
(3) High reflection of light from snow
(4) Damage to retina caused by infra-red rays

104. Which of the following statements is not correct?

(1) In man insulin is synthesised as a proinsulin.
(2) The proinsulin has an extra peptide called C-peptide.
(3) The functional insulin has A and B chains linked together by hydrogen bonds.
(4) Genetically engineered insulin is produced in *E-Coli*.

105. Identify the wrong statement with regard to restriction enzymes.

(1) Each restriction enzyme functions by inspecting the length of a DNA sequence.
(2) They cut the strand of DNA at palindromic sites.
(3) They are useful in genetic engineering.
(4) Sticky ends can be joined by using DNA ligases.

106. Match the following with respect to meiosis:

(a) Zygotene (i) Terminalization
(b) Pachytene (ii) Chiasmata
(c) Diplotene (iii) Crossing over
(d) Diakinesis (iv) Synapsis

Select the correct option from the following:

(a) (b) (c) (d)

(1) (iii) (iv) (i) (ii)
(2) (iv) (iii) (ii) (i)
(3) (i) (ii) (iv) (iii)
(4) (ii) (iv) (iii) (i)

107. Which of the following statements are true for the phylum-Chordata?

(a) In Urochordata notochord extends from head to tail and it is present throughout their life.
(b) In Vertebrata notochord is present during the embryonic period only.
(c) Central nervous system is dorsal and hollow.
(d) Chordata is divided into 3 subphyla: Hemichordata, Tunicata and Cephalochordata.

(1) (d) and (c)
(2) (c) and (a)
(3) (a) and (b)
(4) (b) and (c)

108. Which of the following is correct about viroids?

(1) They have RNA with protein coat.
(2) They have free RNA without protein coat.
(3) They have DNA with protein coat.
(4) They have free DNA without protein coat.
109. The specific palindromic sequence which is recognized by EcoRI is:

(1) 5' - GAATTC - 3'
    3' - CTTAAG - 5'
(2) 5' - GGAACC - 3'
    3' - CCTTGG - 5'
(3) 5' - CTTAAG - 3'
    3' - GAATTC - 5'
(4) 5' - GGATCC - 3'
    3' - CCTAGG - 5'

110. Select the correct events that occur during inspiration.
(a) Contraction of diaphragm
(b) Contraction of external inter-costal muscles
(c) Pulmonary volume decreases
(d) Intra pulmonary pressure increases
(1) (a) and (b)
(2) (c) and (d)
(3) (a), (b) and (d)
(4) only (d)

111. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Pituitary gland</td>
<td>(i) Grave’s disease</td>
</tr>
<tr>
<td>(b) Thyroid gland</td>
<td>(ii) Diabetes mellitus</td>
</tr>
<tr>
<td>(c) Adrenal gland</td>
<td>(iii) Diabetes insipidus</td>
</tr>
<tr>
<td>(d) Pancreas</td>
<td>(iv) Addison’s disease</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (iv) (iii) (i) (ii)
(2) (iii) (ii) (i) (iv)
(3) (iii) (i) (iv) (ii)
(4) (ii) (i) (iv) (iii)

112. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
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</tr>
</thead>
<tbody>
<tr>
<td>(a) 6 - 15 pairs of gill slits</td>
<td>(i) Trygon</td>
</tr>
<tr>
<td>(b) Heterocercal caudal fin</td>
<td>(ii) Cyclostomes</td>
</tr>
<tr>
<td>(c) Air Bladder</td>
<td>(iii) Chondrichthyes</td>
</tr>
<tr>
<td>(d) Poison sting</td>
<td>(iv) Osteichthyes</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (ii) (iii) (iv) (i)
(2) (iii) (iv) (i) (ii)
(3) (iv) (ii) (iii) (i)
(4) (i) (iv) (iii) (ii)

113. If the head of cockroach is removed, it may live for few days because:

(1) the supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen.
(2) the cockroach does not have nervous system.
(3) the head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.
(4) the head holds a 1/3rd of a nervous system while the rest is situated along the dorsal part of its body.

114. How many true breeding pea plant varieties did Mendel select as pairs, which were similar except in one character with contrasting traits?

(1) 4
(2) 2
(3) 14
(4) 8

115. Cuboidal epithelium with brush border of microvilli is found in:

(1) lining of intestine
(2) ducts of salivary glands
(3) proximal convoluted tubule of nephron
(4) eustachian tube

116. The sequence that controls the copy number of the linked DNA in the vector, is termed:

(1) Selectable marker
(2) Ori site
(3) Palindromic sequence
(4) Recognition site

117. Match the organism with its use in biotechnology.

(a) Bacillus thuringiensis (i) Cloning vector
(b) Thermus aquaticus (ii) Construction of first rDNA molecule
(c) Agrobacterium tumefaciens (iii) DNA polymerase
(d) Salmonella typhimurium (iv) Cry proteins

Select the correct option from the following:

(a) (b) (c) (d)
(1) (ii) (iv) (iii) (i)
(2) (iv) (iii) (i) (ii)
(3) (iii) (ii) (iv) (i)
(4) (iii) (iv) (i) (ii)
118. In light reaction, plastoquinone facilitates the transfer of electrons from:
(1) PS-II to Cyto b₆ complex
(2) Cyto b₆ complex to PS-I
(3) PS-I to NADP⁺
(4) PS-I to ATP synthase

119. The process of growth is maximum during:
(1) Log phase
(2) Lag phase
(3) Senescence
(4) Dormancy

120. The product(s) of reaction catalyzed by nitrogenase in root nodules of leguminous plants is/are:
(1) Ammonia alone
(2) Nitrate alone
(3) Ammonia and oxygen
(4) Ammonia and hydrogen

121. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Gregarious, polyphagous (i)</td>
<td>Asterias pest</td>
</tr>
<tr>
<td>(b) Adult with radial symmetry and larva with bilateral symmetry (ii)</td>
<td>Scorpion</td>
</tr>
<tr>
<td>(c) Book lungs (iii)</td>
<td>Ctenoplana</td>
</tr>
<tr>
<td>(d) Bioluminescence (iv)</td>
<td>Locusta</td>
</tr>
</tbody>
</table>

- (a) (i) (iii) (ii) (iv)
- (b) (iv) (i) (ii) (iii)
- (c) (iii) (ii) (i) (iv)
- (d) (ii) (i) (iii) (iv)

122. Which one of the following is the most abundant protein in the animals?
(1) Haemoglobin
(2) Collagen
(3) Lectin
(4) Insulin

123. Identify the basic amino acid from the following:
(1) Tyrosine
(2) Glutamic Acid
(3) Lysine
(4) Valine

124. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Clostridium butylicum (i)</td>
<td>Cyclosporin-A</td>
</tr>
<tr>
<td>(b) Trichoderma polysporum (ii)</td>
<td>Butyric Acid</td>
</tr>
<tr>
<td>(c) Monascus purpureus (iii)</td>
<td>Citric Acid</td>
</tr>
<tr>
<td>(d) Aspergillus niger (iv)</td>
<td>Blood cholesterol lowering agent</td>
</tr>
</tbody>
</table>

- (a) (iii) (iv) (ii) (i)
- (b) (ii) (i) (iv) (iii)
- (c) (i) (ii) (iv) (iii)
- (d) (iv) (iii) (ii) (i)

125. Which of the following hormone levels will cause release of ovum (ovulation) from the graffian follicle?
(1) High concentration of Estrogen
(2) High concentration of Progesterone
(3) Low concentration of LH
(4) Low concentration of FSH

126. The oxygenation activity of RuBisCo enzyme in photorespiration leads to the formation of:
(1) 2 molecules of 3-C compound
(2) 1 molecule of 3-C compound
(3) 1 molecule of 6-C compound
(4) 1 molecule of 4-C compound and 1 molecule of 2-C compound

127. Select the option including all sexually transmitted diseases.
(1) Gonorrhoea, Syphilis, Genital herpes
(2) Gonorrhoea, Malaria, Genital herpes
(3) AIDS, Malaria, Filaria
(4) Cancer, AIDS, Syphilis
128. The transverse section of a plant shows following anatomical features:
(a) Large number of scattered vascular bundles surrounded by bundle sheath.
(b) Large conspicuous parenchymatous ground tissue.
(c) Vascular bundles conjoint and closed.
(d) Phloem parenchyma absent.
Identify the category of plant and its part:
(1) Monocotyledonous stem
(2) Monocotyledonous root
(3) Dicotyledonous stem
(4) Dicotyledonous root

129. The number of substrate level phosphorylations in one turn of citric acid cycle is:
(1) Zero
(2) One
(3) Two
(4) Three

130. Match the following:
(a) Inhibitor of catalytic activity
(b) Possess peptide bonds
(c) Cell wall material in fungi
(d) Secondary metabolite
Choose the correct option from the following:
(a) (b) (c) (d)
(1) (ii) (iv) (iii) (i)
(2) (iii) (i) (iv) (ii)
(3) (ii) (iv) (i) (ii)
(4) (ii) (iii) (i) (iv)

131. Identify the wrong statement with reference to the gene 'I' that controls ABO blood groups.
(1) The gene (I) has three alleles.
(2) A person will have only two of the three alleles.
(3) When IA and IB are present together, they express same type of sugar.
(4) Allele 'i' does not produce any sugar.

132. In which of the following techniques, the embryos are transferred to assist those females who cannot conceive?
(1) ZIFT and IUT
(2) GIFT and ZIFT
(3) ICSI and ZIFT
(4) GIFT and ICSI

133. Which of the following is put into Anaerobic sludge digester for further sewage treatment?
(1) Primary sludge
(2) Floating debris
(3) Effluents of primary treatment
(4) Activated sludge

134. Name the enzyme that facilitates opening of DNA helix during transcription.
(1) DNA ligase
(2) DNA helicase
(3) DNA polymerase
(4) RNA polymerase

135. Match the following columns and select the correct option.
<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Placenta</td>
<td>(i) Androgens</td>
</tr>
<tr>
<td>(b) Zona pellucida</td>
<td>(ii) Human Chorionic Gonadotropin (hCG)</td>
</tr>
<tr>
<td>(c) Bulbo-urethral glands</td>
<td>(iii) Layer of the ovum</td>
</tr>
<tr>
<td>(d) Leydig cells</td>
<td>(iv) Lubrication of the Penis</td>
</tr>
</tbody>
</table>

136. A cylinder contains hydrogen gas at pressure of 249 kPa and temperature 27°C.
Its density is: \( \frac{R}{8.3 \text{ J mol}^{-1} \text{ K}^{-1}} \)
(1) 0.5 kg/m³
(2) 0.2 kg/m³
(3) 0.1 kg/m³
(4) 0.02 kg/m³
137. When a uranium isotope $^{235}_{92}$U is bombarded with a neutron, it generates $^{89}_{36}$Kr, three neutrons and:

(1) $^{144}_{56}$Ba
(2) $^{91}_{40}$Zr
(3) $^{101}_{36}$Kr
(4) $^{103}_{36}$Kr

138. For the logic circuit shown, the truth table is:

![Logic Circuit Diagram]

(1) A B Y
0 0 0
0 1 0
1 0 0
1 1 1
(2) A B Y
0 0 0
0 1 1
1 0 1
1 1 1
(3) A B Y
0 0 1
0 1 1
1 0 1
1 1 0
(4) A B Y
0 0 1
0 1 0
1 0 0
1 1 0

139. A capillary tube of radius $r$ is immersed in water and water rises in it to a height $h$. The mass of the water in the capillary is 5 g. Another capillary tube of radius $2r$ is immersed in water. The mass of water that will rise in this tube is:

(1) 2.5 g
(2) 5.0 g
(3) 10.0 g
(4) 20.0 g

140. An electron is accelerated from rest through a potential difference of $V$ volt. If the de Broglie wavelength of the electron is $1.227 \times 10^{-2}$ nm, the potential difference is:

(1) 10 V
(2) $10^2$ V
(3) $10^3$ V
(4) $10^4$ V

141. In a certain region of space with volume 0.2 m$^3$, the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is:

(1) zero
(2) 0.5 N/C
(3) 1 N/C
(4) 5 N/C

142. The average thermal energy for a mono-atomic gas is: ($k_B$ is Boltzmann constant and $T$, absolute temperature)

(1) $\frac{1}{2} k_B T$
(2) $\frac{3}{2} k_B T$
(3) $\frac{5}{2} k_B T$
(4) $\frac{7}{2} k_B T$

143. Which of the following graph represents the variation of resistivity ($\rho$) with temperature ($T$) for copper?

(1) ![Graph 1]
(2) ![Graph 2]
(3) ![Graph 3]
(4) ![Graph 4]
144. A short electric dipole has a dipole moment of $16 \times 10^{-9}$ C m. The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of $60^\circ$ with the dipole axis is:

\[
\left( \frac{1}{4\pi\varepsilon_0} \right) = 9 \times 10^9 \text{ N m}^2/\text{C}^2
\]

(1) 50 V
(2) 200 V
(3) 400 V
(4) zero

145. Light with an average flux of 20 W/cm$^2$ falls on a non-reflecting surface at normal incidence having surface area 20 cm$^2$. The energy received by the surface during time span of 1 minute is:

(1) $10 \times 10^3$ J
(2) $12 \times 10^3$ J
(3) $24 \times 10^3$ J
(4) $48 \times 10^3$ J

146. The Brewster's angle $i_b$ for an interface should be:

(1) $0^\circ < i_b < 30^\circ$
(2) $30^\circ < i_b < 45^\circ$
(3) $45^\circ < i_b < 90^\circ$
(4) $i_b = 90^\circ$

147. Two cylinders A and B of equal capacity are connected to each other via a stop cock. A contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is:

(1) isothermal
(2) adiabatic
(3) isochoric
(4) isobaric

148. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is:

\[4 \text{ kg} \quad 6 \text{ kg}\]

(1) g
(2) g/2
(3) g/5
(4) g/10

149. In Young's double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes:

(1) double
(2) half
(3) four times
(4) one-fourth

150. For transistor action, which of the following statements is correct?

(1) Base, emitter and collector regions should have same doping concentrations.
(2) Base, emitter and collector regions should have same size.
(3) Both emitter junction as well as the collector junction are forward biased.
(4) The base region must be very thin and lightly doped.

151. Assume that light of wavelength 600 nm is coming from a star. The limit of resolution of telescope whose objective has a diameter of 2 m is:

(1) $3.66 \times 10^{-7}$ rad
(2) $1.83 \times 10^{-7}$ rad
(3) $7.32 \times 10^{-7}$ rad
(4) $6.00 \times 10^{-7}$ rad
152. A resistance wire connected in the left gap of a metre bridge balances a 10 \( \Omega \) resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of 1 \( \Omega \) of the resistance wire is:

- (1) \( 1.0 \times 10^{-2} \) m
- (2) \( 1.0 \times 10^{-1} \) m
- (3) \( 1.5 \times 10^{-1} \) m
- (4) \( 1.5 \times 10^{-2} \) m

153. The energy equivalent of 0.5 g of a substance is:

- (1) \( 4.5 \times 10^{16} \) J
- (2) \( 4.5 \times 10^{13} \) J
- (3) \( 1.5 \times 10^{13} \) J
- (4) \( 0.5 \times 10^{13} \) J

154. The mean free path for a gas, with molecular diameter \( d \) and number density \( n \) can be expressed as:

- (1) \( \frac{1}{\sqrt{2} n \pi d} \)
- (2) \( \frac{1}{\sqrt{2} n \pi d^2} \)
- (3) \( \frac{1}{\sqrt{2} n^2 \pi d^2} \)
- (4) \( \frac{1}{\sqrt{2} n^2 \pi^2 d^2} \)

155. The energy required to break one bond in DNA is \( 10^{-20} \) J. This value in eV is nearly:

- (1) 6
- (2) 0.6
- (3) 0.06
- (4) 0.006

156. Find the torque about the origin when a force of \( 3 \hat{j} \) N acts on a particle whose position vector is \( 2 \hat{k} \) m:

- (1) \( 6 \hat{i} \) N m
- (2) \( 6 \hat{j} \) N m
- (3) \(-6 \hat{i} \) N m
- (4) \( 6 \hat{k} \) N m

157. The increase in the width of the depletion region in a p-n junction diode is due to:

- (1) forward bias only
- (2) reverse bias only
- (3) both forward bias and reverse bias
- (4) increase in forward current

158. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is: \( (c = \text{speed of electromagnetic waves})\)

- (1) \( c : 1 \)
- (2) \( 1 : 1 \)
- (3) \( 1 : c \)
- (4) \( 1 : c^2 \)

159. A spherical conductor of radius 10 cm has a charge of \( 3.2 \times 10^{-7} \) C distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere?

\[
\left( \frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2 \right)
\]

- (1) \( 1.28 \times 10^4 \) N/C
- (2) \( 1.28 \times 10^5 \) N/C
- (3) \( 1.28 \times 10^6 \) N/C
- (4) \( 1.28 \times 10^7 \) N/C

160. Dimensions of stress are:

- (1) [MLT^{-2}]
- (2) [ML^2T^{-2}]
- (3) [ML^0T^{-2}]
- (4) [ML^{-1}T^{-2}]

161. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is:

- (1) \( \pi \) rad
- (2) \( \frac{3\pi}{2} \) rad
- (3) \( \frac{\pi}{2} \) rad
- (4) zero
162. A series LCR circuit is connected to an ac voltage source. When L is removed from the circuit, the phase difference between current and voltage is \( \frac{\pi}{3} \). If instead C is removed from the circuit, the phase difference is again \( \frac{\pi}{3} \) between current and voltage. The power factor of the circuit is:

(1) zero
(2) 0.5
(3) 1.0
(4) \(-1.0\)

163. A 40 \( \mu \)F capacitor is connected to a 200 V, 50 Hz ac supply. The rms value of the current in the circuit is, nearly:

(1) 1.7 A
(2) 2.05 A
(3) 2.5 A
(4) 25.1 A

164. In a guitar, two strings A and B made of same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency increases to 7 Hz. If the frequency of A is 530 Hz, the original frequency of B will be:

(1) 523 Hz
(2) 524 Hz
(3) 536 Hz
(4) 537 Hz

165. A ray is incident at an angle of incidence \( i \) on one surface of a small angle prism (with angle of prism A) and emerges normally from the opposite surface. If the refractive index of the material of the prism is \( \mu \), then the angle of incidence is nearly equal to:

(1) \( \frac{A}{2\mu} \)
(2) \( \frac{2A}{\mu} \)
(3) \( \mu A \)
(4) \( \frac{\mu A}{2} \)

166. The color code of a resistance is given below:

```
Yellow Violet Brown Gold
```

The values of resistance and tolerance, respectively, are:

(1) 470 k\( \Omega \), 5%
(2) 47 k\( \Omega \), 10%
(3) 4.7 k\( \Omega \), 5%
(4) 470 \( \Omega \), 5%

167. The capacitance of a parallel plate capacitor with air as medium is 6 \( \mu \)F. With the introduction of a dielectric medium, the capacitance becomes 30 \( \mu \)F. The permittivity of the medium is:

(\( \varepsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2} \))

(1) \( 0.44 \times 10^{-13} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2} \)
(2) \( 1.77 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2} \)
(3) \( 0.44 \times 10^{-10} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2} \)
(4) \( 5.00 \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2} \)

168. Two particles of mass 5 kg and 10 kg respectively are attached to the two ends of a rigid rod of length 1 m with negligible mass.

The centre of mass of the system from the 5 kg particle is nearly at a distance of:

(1) 33 cm
(2) 50 cm
(3) 67 cm
(4) 80 cm

169. A charged particle having drift velocity of \( 7.5 \times 10^{-4} \text{ m s}^{-1} \) in an electric field of \( 3 \times 10^{-10} \text{ V m}^{-1} \), has a mobility in \( \text{m}^2 \text{ V}^{-1} \text{ s}^{-1} \) of:

(1) \( 2.25 \times 10^{15} \)
(2) \( 2.5 \times 10^6 \)
(3) \( 2.5 \times 10^{-6} \)
(4) \( 2.25 \times 10^{-15} \)

170. A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is: (g = 10 m/s\(^2\))

(1) 360 m
(2) 340 m
(3) 320 m
(4) 300 m
171. The solids which have the negative temperature coefficient of resistance are:
   (1) metals
   (2) insulators only
   (3) semiconductors only
   (4) insulators and semiconductors

172. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled?
   (1) doubled
   (2) four times
   (3) one-fourth
   (4) zero

173. The quantities of heat required to raise the temperature of two solid copper spheres of radii $r_1$ and $r_2$ ($r_1 = 1.5 \times r_2$) through 1 K are in the ratio:
   (1) $\frac{27}{8}$
   (2) $\frac{9}{4}$
   (3) $\frac{3}{2}$
   (4) $\frac{5}{3}$

174. A body weighs 72 N on the surface of the earth. What is the gravitational force on it, at a height equal to half the radius of the earth?
   (1) 48 N
   (2) 32 N
   (3) 30 N
   (4) 24 N

175. Taking into account of the significant figures, what is the value of 9.99 m – 0.0099 m?
   (1) 9.9801 m
   (2) 9.98 m
   (3) 9.980 m
   (4) 9.9 m

176. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is:
   (1) 0.01 mm
   (2) 0.25 mm
   (3) 0.5 mm
   (4) 1.0 mm

177. For which one of the following, Bohr model is not valid?
   (1) Hydrogen atom
   (2) Singly ionised helium atom (He$^+$)
   (3) Deuteron atom
   (4) Singly ionised neon atom (Ne$^+$)

178. A wire of length $L$, area of cross section $A$ is hanging from a fixed support. The length of the wire changes to $L_1$ when mass $M$ is suspended from its free end. The expression for Young’s modulus is:
   (1) $\frac{MgL}{AL}$
   (2) $\frac{Mg(L - L)}{AL}$
   (3) $\frac{MgL}{AL_1}$
   (4) $\frac{MgL}{A(L_1 - L)}$

179. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is:
   (1) $6.28 \times 10^{-4}$ T
   (2) $3.14 \times 10^{-4}$ T
   (3) $6.28 \times 10^{-5}$ T
   (4) $3.14 \times 10^{-5}$ T

180. An iron rod of susceptibility 599 is subjected to a magnetising field of 1200 A m$^{-1}$. The permeability of the material of the rod is:
   (1) $2.4 \times 10^{-4}$ T m A$^{-1}$
   (2) $8.0 \times 10^{-5}$ T m A$^{-1}$
   (3) $2.4 \times 10^{-5}$ T m A$^{-1}$
   (4) $2.4 \times 10^{-7}$ T m A$^{-1}$
Space For Rough Work
Space For Rough Work
Space For Rough Work
Important Instructions:

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on side-1 and side-2 carefully with blue/black ball point pen only.

2. The test is of 3 hours duration and Test Booklet contains 180 questions. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 720.

3. Use Blue/Black Ball Point Pen only for writing particulars on this page/marking responses.

4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.

5. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.

6. The CODE for this Booklet is F3. Make sure that the CODE printed on Side-2 of the Answer Sheet is the same as that on this Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.

7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.

8. Use of white fluid for correction is NOT permissible on the Answer Sheet.

9. Each candidate must show on demand his/her Admit Card to the Invigilator.

10. No candidate, without special permission of the Superintendent or Invigilator, would leave his/her seat.

11. 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 the Answer Sheet and dealt with as an unfair means case.

12. Use of Electronic/Manual Calculator is prohibited.

13. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.

14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet/Answer Sheet in the Attendance Sheet.
1. For transistor action, which of the following statements is correct?
   (1) Both emitter junction as well as the collector junction are forward biased.
   (2) The base region must be very thin and lightly doped.
   (3) Base, emitter and collector regions should have same doping concentrations.
   (4) Base, emitter and collector regions should have same size.

2. A spherical conductor of radius 10 cm has a charge of $3.2 \times 10^{-7}$ C distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere?

   \[
   \frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2
   \]
   (1) $1.28 \times 10^6$ N/C
   (2) $1.28 \times 10^7$ N/C
   (3) $1.28 \times 10^4$ N/C
   (4) $1.28 \times 10^5$ N/C

3. Assume that light of wavelength 600 nm is coming from a star. The limit of resolution of telescope whose objective has a diameter of 2 m is:

   (1) $7.32 \times 10^{-7}$ rad
   (2) $6.00 \times 10^{-7}$ rad
   (3) $3.66 \times 10^{-7}$ rad
   (4) $1.83 \times 10^{-7}$ rad

4. Dimensions of stress are:
   (1) [ML$^0$T$^{-2}$]
   (2) [ML$^{-1}$T$^{-2}$]
   (3) [MLT$^{-2}$]
   (4) [ML$^2$T$^{-2}$]

5. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale.

   The pitch of the screw gauge is:
   (1) 0.5 mm
   (2) 1.0 mm
   (3) 0.01 mm
   (4) 0.25 mm

6. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is:

   ![Diagram of two bodies tied to the ends of a string passing over a pulley](image)
   (1) $g/5$
   (2) $g/10$
   (3) $g$
   (4) $g/2$

7. An electron is accelerated from rest through a potential difference of V volt. If the de Broglie wavelength of the electron is $1.227 \times 10^{-2}$ nm, the potential difference is:

   (1) $10^3$ V
   (2) $10^4$ V
   (3) $10$ V
   (4) $10^2$ V

8. In a certain region of space with volume $0.2$ m$^3$, the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is:

   (1) 1 N/C
   (2) 5 N/C
   (3) zero
   (4) 0.5 N/C

9. A cylinder contains hydrogen gas at pressure of 249 kPa and temperature $27^\circ C$. Its density is: ($R = 8.3$ J mol$^{-1}$ K$^{-1}$)

   (1) 0.1 kg/m$^3$
   (2) 0.02 kg/m$^3$
   (3) 0.5 kg/m$^3$
   (4) 0.2 kg/m$^3$

10. The mean free path for a gas, with molecular diameter $d$ and number density $n$ can be expressed as:

    (1) \frac{1}{\sqrt{2} \frac{n^3}{\pi d^2}}
    (2) \frac{1}{\sqrt{2} \frac{n^2}{\pi d^2}}
    (3) \frac{1}{\sqrt{2} \frac{n}{\pi d}}
    (4) \frac{1}{\sqrt{2} \frac{n}{\pi d^2}}
11. A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is: \((g = 10 \text{ m/s}^2)\)

(1) 320 m
(2) 300 m
(3) 360 m
(4) 340 m

12. For the logic circuit shown, the truth table is:

A

\[
\begin{array}{ccc}
A & B & Y \\
0 & 0 & 1 \\
0 & 1 & 1 \\
1 & 0 & 1 \\
1 & 1 & 0 \\
\end{array}
\]

B

\[
\begin{array}{ccc}
A & B & Y \\
0 & 0 & 1 \\
0 & 1 & 0 \\
1 & 0 & 0 \\
1 & 1 & 0 \\
\end{array}
\]

\[
\begin{array}{ccc}
A & B & Y \\
0 & 0 & 0 \\
0 & 1 & 0 \\
1 & 0 & 0 \\
1 & 1 & 1 \\
\end{array}
\]

13. A short electric dipole has a dipole moment of \(16 \times 10^{-9} \text{ C m}\). The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of 60° with the dipole axis is:

\[
\left(\frac{1}{4\pi\varepsilon_0}\right) = 9 \times 10^9 \text{ N m}^2/\text{C}^2
\]

(1) 400 V
(2) zero
(3) 50 V
(4) 200 V

14. A capillary tube of radius \(r\) is immersed in water and water rises in it to a height \(h\). The mass of the water in the capillary is 5 g. Another capillary tube of radius \(2r\) is immersed in water. The mass of water that will rise in this tube is:

(1) 10.0 g
(2) 20.0 g
(3) 2.5 g
(4) 5.0 g

15. Which of the following graph represents the variation of resistivity \((\rho)\) with temperature \((T)\) for copper?

(1)

(2)

(3)

(4)

16. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is: \((c = \text{speed of electromagnetic waves})\)

(1) \(1 : c\)
(2) \(1 : c^2\)
(3) \(c : 1\)
(4) \(1 : 1\)

17. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is:

\((\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1})\)

(1) \(6.28 \times 10^{-5} \text{T}\)
(2) \(3.14 \times 10^{-5} \text{T}\)
(3) \(6.28 \times 10^{-4} \text{T}\)
(4) \(3.14 \times 10^{-4} \text{T}\)
18. For which one of the following, Bohr model is not valid?

(1) Deuteron atom
(2) Singly ionised neon atom (Ne⁺)
(3) Hydrogen atom
(4) Singly ionised helium atom (He⁺)

19. The energy equivalent of 0.5 g of a substance is:

(1) $1.5 \times 10^{13}$ J
(2) $0.5 \times 10^{13}$ J
(3) $4.5 \times 10^{16}$ J
(4) $4.5 \times 10^{13}$ J

20. Taking into account of the significant figures, what is the value of $9.99 \text{ m} - 0.0099 \text{ m}$?

(1) 9.980 m
(2) 9.9 m
(3) 9.9801 m
(4) 9.98 m

21. In a guitar, two strings A and B made of same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency increases to 7 Hz. If the frequency of A is 530 Hz, the original frequency of B will be:

(1) 536 Hz
(2) 537 Hz
(3) 523 Hz
(4) 524 Hz

22. A series LCR circuit is connected to an ac voltage source. When L is removed from the circuit, the phase difference between current and voltage is $\frac{\pi}{3}$. If instead C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$ between current and voltage. The power factor of the circuit is:

(1) 1.0
(2) -1.0
(3) zero
(4) 0.5

23. The quantities of heat required to raise the temperature of two solid copper spheres of radii $r_1$ and $r_2$ ($r_1 = 1.5 \, r_2$) through 1 K are in the ratio:

(1) $\frac{3}{2}$
(2) $\frac{5}{3}$
(3) $\frac{27}{8}$
(4) $\frac{9}{4}$

24. The Brewsters angle $i_b$ for an interface should be:

(1) $45^\circ < i_b < 90^\circ$
(2) $i_b = 90^\circ$
(3) $0^\circ < i_b < 30^\circ$
(4) $30^\circ < i_b < 45^\circ$

25. Two cylinders A and B of equal capacity are connected to each other via a stop cock. A contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is:

(1) isochoric
(2) isobaric
(3) isothermal
(4) adiabatic

26. An iron rod of susceptibility 599 is subjected to a magnetising field of 1200 A m⁻¹. The permeability of the material of the rod is:

$\left(\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}\right)$

(1) $2.4\pi \times 10^{-5}$ T m A⁻¹
(2) $2.4\pi \times 10^{-7}$ T m A⁻¹
(3) $2.4\pi \times 10^{-4}$ T m A⁻¹
(4) $8.0 \times 10^{-5}$ T m A⁻¹

27. The capacitance of a parallel plate capacitor with air as medium is 6 µF. With the introduction of a dielectric medium, the capacitance becomes 30 µF. The permittivity of the medium is:

$\left(\varepsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}\right)$

(1) $0.44 \times 10^{-10}$ C² N⁻¹ m⁻²
(2) $5.00 \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
(3) $0.44 \times 10^{-13}$ C² N⁻¹ m⁻²
(4) $1.77 \times 10^{-12}$ C² N⁻¹ m⁻²
28. A charged particle having drift velocity of \(7.5 \times 10^{-4} \text{ m s}^{-1}\) in an electric field of \(3 \times 10^{-10} \text{ Vm}^{-1}\), has a mobility in \(\text{m}^2 \text{ V}^{-1} \text{ s}^{-1}\) of:

(1) \(2.5 \times 10^{-6}\)
(2) \(2.25 \times 10^{-15}\)
(3) \(2.25 \times 10^{15}\)
(4) \(2.5 \times 10^6\)

29. The color code of a resistance is given below:

Yellow Violet Brown Gold

The values of resistance and tolerance, respectively, are:

(1) 4.7 k\(\Omega\), 5%
(2) 470 \(\Omega\), 5%
(3) 470 k\(\Omega\), 5%
(4) 47 k\(\Omega\), 10%

30. The solids which have the negative temperature coefficient of resistance are:

(1) semiconductors only
(2) insulators and semiconductors
(3) metals
(4) insulators only

31. A body weighs 72 N on the surface of the earth. What is the gravitational force on it, at a height equal to half the radius of the earth?

(1) 30 N
(2) 24 N
(3) 48 N
(4) 32 N

32. A 40 \(\mu\text{F}\) capacitor is connected to a 200 V, 50 Hz ac supply. The rms value of the current in the circuit is, nearly:

(1) 2.5 A
(2) 25.1 A
(3) 1.7 A
(4) 2.05 A

33. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is:

(1) \(\frac{\pi}{2}\) rad
(2) zero
(3) \(\pi\) rad
(4) \(\frac{3\pi}{2}\) rad

34. The average thermal energy for a mono-atomic gas is: \((k_B\) is Boltzmann constant and \(T\), absolute temperature)

(1) \(\frac{5}{2} k_B T\)
(2) \(\frac{7}{2} k_B T\)
(3) \(\frac{1}{2} k_B T\)
(4) \(\frac{3}{2} k_B T\)

35. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled?

(1) one-fourth
(2) zero
(3) doubled
(4) four times

36. A wire of length \(L\), area of cross section \(A\) is hanging from a fixed support. The length of the wire changes to \(L_1\) when mass \(M\) is suspended from its free end. The expression for Young’s modulus is:

(1) \(\frac{MgL}{AL_1}\)
(2) \(\frac{MgL}{A(L_1 - L)}\)
(3) \(\frac{MgL_1}{AL}\)
(4) \(\frac{Mg(L_1 - L)}{AL}\)
37. A ray is incident at an angle of incidence $i$ on one surface of a small angle prism (with angle of prism $A$) and emerges normally from the opposite surface. If the refractive index of the material of the prism is $\mu$, then the angle of incidence is nearly equal to:

(1) $\frac{\mu A}{2}$
(2) $\frac{\mu A}{2}$
(3) $\frac{A}{2\mu}$
(4) $\frac{2A}{\mu}$

38. Find the torque about the origin when a force of $3 \hat{j}$ N acts on a particle whose position vector is $2 \hat{k}$ m.

(1) $-6 \hat{i}$ N m
(2) $6 \hat{k}$ N m
(3) $6 \hat{i}$ N m
(4) $6 \hat{j}$ N m

39. In Young’s double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes:

(1) four times
(2) one-fourth
(3) double
(4) half

40. The energy required to break one bond in DNA is $10^{-20}$ J. This value in eV is nearly:

(1) 0.06
(2) 0.006
(3) 6
(4) 0.6

41. When a uranium isotope $^{235}_{92}$U is bombarded with a neutron, it generates $^{89}_{36}$Kr, three neutrons and:

(1) $^{101}_{36}$Kr
(2) $^{103}_{36}$Kr
(3) $^{144}_{56}$Ba
(4) $^{91}_{40}$Zr

42. Two particles of mass 5 kg and 10 kg respectively are attached to the two ends of a rigid rod of length 1 m with negligible mass.

The centre of mass of the system from the 5 kg particle is nearly at a distance of:

(1) 67 cm
(2) 80 cm
(3) 33 cm
(4) 50 cm

43. Light with an average flux of 20 W/cm$^2$ falls on a non-reflecting surface at normal incidence having surface area 20 cm$^2$. The energy received by the surface during time span of 1 minute is:

(1) $24 \times 10^3$ J
(2) $48 \times 10^3$ J
(3) $10 \times 10^3$ J
(4) $12 \times 10^3$ J

44. The increase in the width of the depletion region in a p-n junction diode is due to:

(1) both forward bias and reverse bias
(2) increase in forward current
(3) forward bias only
(4) reverse bias only

45. A resistance wire connected in the left gap of a metre bridge balances a 10 $\Omega$ resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of 1 $\Omega$ of the resistance wire is:

(1) $1.5 \times 10^{-1}$ m
(2) $1.5 \times 10^{-2}$ m
(3) $1.0 \times 10^{-2}$ m
(4) $1.0 \times 10^{-1}$ m
46. Identify compound X in the following sequence of reactions:

\[
\begin{align*}
\text{CH}_3 & \quad \text{Cl}_2/\text{hv} & \quad \text{CHO} \\
\text{Cl}_2/\text{hv} & \quad X & \quad \text{H}_2\text{O} \\
& \quad 373 \text{ K} &
\end{align*}
\]

\[
\begin{align*}
\text{CHCl}_2 & \\
\text{CCl}_3 & \\
\text{Cl} & \\
\text{CH}_2\text{Cl} &
\end{align*}
\]

47. Identify a molecule which does not exist.
   (1) C\textsubscript{2}
   (2) O\textsubscript{2}
   (3) He\textsubscript{2}
   (4) Li\textsubscript{2}

48. Which of the following is a natural polymer?
   (1) polybutadiene
   (2) poly (Butadiene-acrylonitrile)
   (3) cis-1,4-polyisoprene
   (4) poly (Butadiene-styrene)

49. An increase in the concentration of the reactants of a reaction leads to change in:
   (1) threshold energy
   (2) collision frequency
   (3) activation energy
   (4) heat of reaction

50. Anisole on cleavage with HI gives:
   (1) C\textsubscript{6}H\textsubscript{5}OH + C\textsubscript{2}H\textsubscript{5}I
   (2) C\textsubscript{6}H\textsubscript{5}OH + C\textsubscript{2}H\textsubscript{5}OH
   (3) C\textsubscript{6}H\textsubscript{5}OH + CH\textsubscript{3}I
   (4) C\textsubscript{6}H\textsubscript{5}OH + CH\textsubscript{3}OH

51. The number of protons, neutrons and electrons in \(^{175}\text{Lu}\), respectively, are:
   (1) 71, 71 and 104
   (2) 175, 104 and 71
   (3) 71, 104 and 71
   (4) 104, 71 and 71
52. The calculated spin only magnetic moment of Cr$^{2+}$ ion is:
(1) 5.92 BM
(2) 2.84 BM
(3) 3.87 BM
(4) 4.90 BM

53. Match the following:

<table>
<thead>
<tr>
<th>Oxide</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>(i) Basic</td>
</tr>
<tr>
<td>BaO</td>
<td>(ii) Neutral</td>
</tr>
<tr>
<td>Al$_2$O$_3$</td>
<td>(iii) Acidic</td>
</tr>
<tr>
<td>Cl$_2$O$_7$</td>
<td>(iv) Amphoteric</td>
</tr>
</tbody>
</table>

Which of the following is **correct** option?

(a) (b) (c) (d)
(1) (iii) (iv) (i) (ii)
(2) (iv) (iii) (ii) (i)
(3) (i) (ii) (iii) (iv)
(4) (ii) (i) (iv) (iii)

54. Urea reacts with water to form A which will decompose to form B. B when passed through Cu$^{2+}$ (aq), deep blue colour solution C is formed. What is the formula of C from the following?

(1) Cu(OH)$_2$
(2) CuCO$_3$·Cu(OH)$_2$
(3) CuSO$_4$
(4) [Cu(NH$_3$)$_4$]$_2^+$

55. Match the following and identify the **correct** option.

(a) CO(g) + H$_2$(g) (i) Mg(HCO$_3$)$_2$ + Ca(HCO$_3$)$_2$
(b) Temporary hardness of water (ii) An electron deficient hydride
(c) B$_2$H$_6$ (iii) Synthesis gas
(d) H$_2$O$_2$ (iv) Non-planar structure

(a) (b) (c) (d)
(1) (iii) (iv) (i) (i)
(2) (i) (iii) (ii) (iv)
(3) (iii) (i) (ii) (iv)
(4) (iii) (ii) (i) (iv)

56. The mixture which shows positive deviation from Raoult’s law is:

(1) Acetone + Chloroform
(2) Chloroethane + Bromoethane
(3) Ethanol + Acetone
(4) Benzene + Toluene

57. The freezing point depression constant ($K_f$) of benzene is 5.12 K kg mol$^{-1}$. The freezing point depression for the solution of molality 0.078 m containing a non-electrolyte solute in benzene is (rounded off up to two decimal places):

(1) 0.40 K
(2) 0.60 K
(3) 0.20 K
(4) 0.80 K

58. Which of the following set of molecules will have zero dipole moment?

(1) Nitrogen trifluoride, beryllium difluoride, water, 1,3-dichlorobenzene
(2) Boron trifluoride, beryllium difluoride, carbon dioxide, 1,4-dichlorobenzene
(3) Ammonia, beryllium difluoride, water, 1,4-dichlorobenzene
(4) Boron trifluoride, hydrogen fluoride, carbon dioxide, 1,3-dichlorobenzene

59. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following?

(1) $-$R effect of $-$CH$_3$ groups
(2) Hyperconjugation
(3) $-$I effect of $-$CH$_3$ groups
(4) $+$R effect of $-$CH$_3$ groups

60. Find out the solubility of Ni(OH)$_2$ in 0.1 M NaOH. Given that the ionic product of Ni(OH)$_2$ is $2 \times 10^{-15}$.

(1) $1 \times 10^{-13}$ M
(2) $1 \times 10^8$ M
(3) $2 \times 10^{-13}$ M
(4) $2 \times 10^{-8}$ M
61. Reaction between acetone and methylmagnesium chloride followed by hydrolysis will give:

(1) Tert. butyl alcohol
(2) Isobutyl alcohol
(3) Isopropyl alcohol
(4) Sec. butyl alcohol

62. Which of the following amine will give the carbylamine test?

(1) 
(2) 
(3) 
(4) 

63. An alkene on ozonolysis gives methanal as one of the product. Its structure is:

\[ \text{CH}_2 = \text{CH} = \text{CH}_2 \]

(1) 
(2) 
(3) 

64. A mixture of \( \text{N}_2 \) and \( \text{Ar} \) gases in a cylinder contains 7 g of \( \text{N}_2 \) and 8 g of \( \text{Ar} \). If the total pressure of the mixture of the gases in the cylinder is 27 bar, the partial pressure of \( \text{N}_2 \) is:

[Use atomic masses (in g mol\(^{-1}\)): \( N = 14 \), \( Ar = 40 \)]

(1) 15 bar
(2) 18 bar
(3) 9 bar
(4) 12 bar
65. Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?

(1) \(F^- < SCN^- < C_2O_4^{2-} < CN^-\)
(2) \(CN^- < C_2O_4^{2-} < SCN^- < F^-\)
(3) \(SCN^- < F^- < C_2O_4^{2-} < CN^-\)
(4) \(SCN^- < F^- < CN^- < C_2O_4^{2-}\)

66. Paper chromatography is an example of:

(1) Thin layer chromatography
(2) Column chromatography
(3) Adsorption chromatography
(4) Partition chromatography

67. Sucrose on hydrolysis gives:

(1) \(\alpha\)-D-Glucose + \(\beta\)-D-Fructose
(2) \(\alpha\)-D-Fructose + \(\beta\)-D-Fructose
(3) \(\beta\)-D-Glucose + \(\alpha\)-D-Fructose
(4) \(\alpha\)-D-Glucose + \(\beta\)-D-Glucose

68. The rate constant for a first order reaction is \(4.606 \times 10^{-3}\) s\(^{-1}\). The time required to reduce 2.0 g of the reactant to 0.2 g is:

(1) 500 s
(2) 1000 s
(3) 100 s
(4) 200 s

69. Reaction between benzaldehyde and acetophenone in presence of dilute NaOH is known as:

(1) Cross Cannizzaro’s reaction
(2) Cross Aldol condensation
(3) Aldol condensation
(4) Cannizzaro’s reaction

70. Which of the following is not correct about carbon monoxide?

(1) The carboxyhaemoglobin (haemoglobin bound to CO) is less stable than oxyhaemoglobin.
(2) It is produced due to incomplete combustion.
(3) It forms carboxyhaemoglobin.
(4) It reduces oxygen carrying ability of blood.

71. Hydrolysis of sucrose is given by the following reaction.

\[
\text{Sucrose} + H_2O \rightleftharpoons \text{Glucose} + \text{Fructose}
\]

If the equilibrium constant \((K_e)\) is \(2 \times 10^{13}\) at 300 K, the value of \(\Delta_r G^o\) at the same temperature will be:

(1) \(-8.314 J mol^{-1} K^{-1} \times 300 K \times \ln(3 \times 10^{13})\)
(2) \(-8.314 J mol^{-1} K^{-1} \times 300 K \times \ln(4 \times 10^{13})\)
(3) \(-8.314 J mol^{-1} K^{-1} \times 300 K \times \ln(2 \times 10^{13})\)
(4) \(-8.314 J mol^{-1} K^{-1} \times 300 K \times \ln(2 \times 10^{13})\)

72. HCl was passed through a solution of CaCl\(_2\), MgCl\(_2\) and NaCl. Which of the following compound(s) crystallise(s)?

(1) Only MgCl\(_2\)
(2) NaCl, MgCl\(_2\) and CaCl\(_2\)
(3) Both MgCl\(_2\) and CaCl\(_2\)
(4) Only NaCl

73. An element has a body centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is:

(1) \(\frac{4}{\sqrt{3}} \times 288\) pm
(2) \(\frac{4}{\sqrt{2}} \times 288\) pm
(3) \(\frac{\sqrt{3}}{4} \times 288\) pm
(4) \(\frac{\sqrt{2}}{4} \times 288\) pm

74. Which of the following oxoacid of sulphur has \(-O=O-\) linkage?

(1) \(H_2S_2O_8\), peroxodisulphuric acid
(2) \(H_2S_2O_7\), pyrosulphuric acid
(3) \(H_2SO_3\), sulphurous acid
(4) \(H_2SO_4\), sulphuric acid
75. Identify the incorrect statement.

(1) Interstitial compounds are those that are formed when small atoms like H, C or N are trapped inside the crystal lattices of metals.
(2) The oxidation states of chromium in \( \text{CrO}_4^{2-} \) and \( \text{Cr}_2\text{O}_7^{2-} \) are not the same.
(3) \( \text{Cr}^{2+} (d^4) \) is a stronger reducing agent than \( \text{Fe}^{2+} (d^6) \) in water.
(4) The transition metals and their compounds are known for their catalytic activity due to their ability to adopt multiple oxidation states and to form complexes.

76. Which of the following is a cationic detergent?

(1) Cetyltrimethyl ammonium bromide
(2) Sodium dodecylbenzene sulphonate
(3) Sodium lauryl sulphate
(4) Sodium stearate

77. The correct option for free expansion of an ideal gas under adiabatic condition is:

(1) \( q < 0, \Delta T = 0 \) and \( w = 0 \)
(2) \( q > 0, \Delta T > 0 \) and \( w > 0 \)
(3) \( q = 0, \Delta T = 0 \) and \( w = 0 \)
(4) \( q = 0, \Delta T < 0 \) and \( w > 0 \)

78. On electrolysis of dil. sulphuric acid using Platinum (Pt) electrode, the product obtained at anode will be:

(1) \( \text{H}_2\text{S} \) gas
(2) \( \text{SO}_2 \) gas
(3) Hydrogen gas
(4) Oxygen gas

79. Identify the correct statement from the following:

(1) Vapour phase refining is carried out for Nickel by Van Arkel method.
(2) Pig iron can be moulded into a variety of shapes.
(3) Wrought iron is impure iron with 4% carbon.
(4) Blister copper has blistered appearance due to evolution of \( \text{CO}_2 \).

80. Which of the following is a basic amino acid?

(1) Tyrosine
(2) Lysine
(3) Serine
(4) Alanine

81. Identify the incorrect match.

<table>
<thead>
<tr>
<th>Name</th>
<th>IUPAC Official Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Unnilunium</td>
<td>(i) Mendelevium</td>
</tr>
<tr>
<td>(b) Unniltrium</td>
<td>(ii) Lawrencium</td>
</tr>
<tr>
<td>(c) Unnilhexium</td>
<td>(iii) Seaborgium</td>
</tr>
<tr>
<td>(d) Unununnium</td>
<td>(iv) Darmstadtium</td>
</tr>
</tbody>
</table>
(1) (c), (iii)
(2) (d), (iv)
(3) (a), (i)
(4) (b), (ii)

82. Which of the following alkane cannot be made in good yield by Wurtz reaction?

(1) \( \text{n-Heptane} \)
(2) \( \text{n-Butane} \)
(3) \( \text{n-Hexane} \)
(4) \( 2,3\text{-Dimethylbutane} \)

83. Elimination reaction of 2-Bromo-pentane to form pent-2-ene is:

(a) \( \beta \)-Elimination reaction
(b) Follows Zaitsev rule
(c) Dehydrohalogenation reaction
(d) Dehydration reaction
(1) (b), (c), (d)
(2) (a), (b), (d)
(3) (a), (b), (c)
(4) (a), (c), (d)

84. The number of Faradays (F) required to produce 20 g of calcium from molten \( \text{CaCl}_2 \) (Atomic mass of \( \text{Ca} = 40 \text{ g mol}^{-1} \)) is:

(1) 3
(2) 4
(3) 1
(4) 2
85. Which one of the followings has maximum number of atoms?
   (1) 1 g of O\(_2\)(g) [Atomic mass of O = 16]
   (2) 1 g of Li(s) [Atomic mass of Li = 7]
   (3) 1 g of Ag(s) [Atomic mass of Ag = 108]
   (4) 1 g of Mg(s) [Atomic mass of Mg = 24]

86. For the reaction, 2Cl(g) → Cl\(_2\)(g), the correct option is:
   (1) \(\Delta_r H < 0\) and \(\Delta_r S > 0\)
   (2) \(\Delta_r H < 0\) and \(\Delta_r S < 0\)
   (3) \(\Delta_r H > 0\) and \(\Delta_r S > 0\)
   (4) \(\Delta_r H > 0\) and \(\Delta_r S < 0\)

87. Identify the correct statements from the following:
   (a) CO\(_2\)(g) is used as refrigerant for ice-cream and frozen food.
   (b) The structure of C\(_{60}\) contains twelve six carbon rings and twenty five carbon rings.
   (c) ZSM-5, a type of zeolite, is used to convert alcohols into gasoline.
   (d) CO is colorless and odourless gas.
   (1) (b) and (c) only
   (2) (c) and (d) only
   (3) (a), (b) and (c) only
   (4) (a) and (c) only

88. Measuring Zeta potential is useful in determining which property of colloidal solution?
   (1) Stability of the colloidal particles
   (2) Size of the colloidal particles
   (3) Viscosity
   (4) Solubility

89. What is the change in oxidation number of carbon in the following reaction?
   \(\text{CH}_4(g) + 4\text{Cl}_2(g) \rightarrow \text{CCl}_4(l) + 4\text{HCl(g)}\)
   (1) \(-4\) to \(+4\)
   (2) \(0\) to \(-4\)
   (3) \(+4\) to \(+4\)
   (4) \(0\) to \(+4\)

90. The following metal ion activates many enzymes, participates in the oxidation of glucose to produce ATP and with Na, is responsible for the transmission of nerve signals.
   (1) Calcium
   (2) Potassium
   (3) Iron
   (4) Copper

91. Presence of which of the following conditions in urine are indicative of Diabetes Mellitus?
   (1) Ketonuria and Glycosuria
   (2) Renal calculi and Hyperglycaemia
   (3) Uremia and Ketonuria
   (4) Uremia and Renal Calculi

92. Match the following columns and select the correct option.
   **Column - I**  **Column - II**
   (a) Placenta  (i) Androgens
   (b) Zona pellucida  (ii) Human Chorionic Gonadotropin (hCG)
   (c) Bulbo-urethral glands  (iii) Layer of the ovum glands
   (d) Leydig cells  (iv) Lubrication of the Penis
   (1) (iii) (ii) (iv) (i)
   (2) (ii) (iii) (iv) (i)
   (3) (iv) (iii) (i) (ii)
   (4) (i) (iv) (ii) (iii)

93. Match the following columns and select the correct option.
   **Column - I**  **Column - II**
   (a) Bt cotton  (i) Gene therapy
   (b) Adenosine deaminase deficiency  (ii) Cellular defence
   (c) RNAi  (iii) Detection of HIV infection
   (d) PCR  (iv) *Bacillus thuringiensis*
   (1) (ii) (iii) (iv) (i)
   (2) (i) (ii) (iii) (iv)
   (3) (iv) (i) (ii) (iii)
   (4) (iii) (ii) (i) (iv)
94. The sequence that controls the copy number of the linked DNA in the vector, is termed:
   (1) Palindromic sequence
   (2) Recognition site
   (3) Selectable marker
   (4) Ori site

95. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 6 - 15 pairs of</td>
<td>(i) Trygon</td>
</tr>
<tr>
<td>gill slits</td>
<td></td>
</tr>
<tr>
<td>(b) Heterocercal</td>
<td>(ii) Cyclostomes</td>
</tr>
<tr>
<td>caudal fin</td>
<td></td>
</tr>
<tr>
<td>(c) Air Bladder</td>
<td>(iii) Chondrichthyes</td>
</tr>
<tr>
<td>(d) Poison sting</td>
<td>(iv) Osteichthyes</td>
</tr>
<tr>
<td>(a) (b) (c) (d)</td>
<td></td>
</tr>
<tr>
<td>(1) (i) (ii) (iii) (i)</td>
<td></td>
</tr>
<tr>
<td>(2) (i) (iv) (iii) (ii)</td>
<td></td>
</tr>
<tr>
<td>(3) (ii) (iii) (iv) (i)</td>
<td></td>
</tr>
<tr>
<td>(4) (iii) (iv) (i) (ii)</td>
<td></td>
</tr>
</tbody>
</table>

96. In which of the following techniques, the embryos are transferred to assist those females who cannot conceive?
   (1) ICSI and ZIFT
   (2) GIFT and ICSI
   (3) ZIFT and IUT
   (4) GIFT and ZIFT

97. Select the correct events that occur during inspiration.
   (a) Contraction of diaphragm
   (b) Contraction of external inter-costal muscles
   (c) Pulmonary volume decreases
   (d) Intra pulmonary pressure increases
   (1) (a), (b) and (d)
   (2) only (d)
   (3) (a) and (b)
   (4) (c) and (d)

98. The QRS complex in a standard ECG represents:
   (1) Depolarisation of ventricles
   (2) Repolarisation of ventricles
   (3) Repolarisation of auricles
   (4) Depolarisation of auricles

99. The enzyme enterokinase helps in conversion of:
   (1) caseinogen into casein
   (2) pepsinogen into pepsin
   (3) protein into polypeptides
   (4) trypsinogen into trypsin

100. Identify the correct statement with reference to human digestive system.
   (1) Ileum is a highly coiled part.
   (2) Vermiform appendix arises from duodenum.
   (3) Ileum opens into small intestine.
   (4) Serosa is the innermost layer of the alimentary canal.

101. Ray florets have:
   (1) Hypogynous ovary
   (2) Half inferior ovary
   (3) Inferior ovary
   (4) Superior ovary

102. Which of the following is put into Anaerobic sludge digester for further sewage treatment?
   (1) Effluents of primary treatment
   (2) Activated sludge
   (3) Primary sludge
   (4) Floating debris

103. The number of substrate level phosphorylations in one turn of citric acid cycle is:
   (1) Two
   (2) Three
   (3) Zero
   (4) One

104. Identify the correct statement with regard to G1 phase (Gap 1) of interphase.
   (1) Cell is metabolically active, grows but does not replicate its DNA.
   (2) Nuclear Division takes place.
   (3) DNA synthesis or replication takes place.
   (4) Reorganisation of all cell components takes place.
105. Which of the following pairs is of unicellular algae?

(1) *Anabaena* and *Volvox*  
(2) *Chlorella* and *Spirulina*  
(3) *Laminaria* and *Sargassum*  
(4) *Gelidium* and *Gracilaria*

106. Identify the wrong statement with reference to immunity.

(1) Active immunity is quick and gives full response.
(2) Foetus receives some antibodies from mother, it is an example for passive immunity.
(3) When exposed to antigen (living or dead) antibodies are produced in the host’s body. It is called “Active immunity”.
(4) When ready-made antibodies are directly given, it is called “Passive immunity”.

107. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Floating Ribs</td>
<td>(i) Located between second and seventh ribs</td>
</tr>
<tr>
<td>(b) Acromion</td>
<td>(ii) Head of the Humerus</td>
</tr>
<tr>
<td>(c) Scapula</td>
<td>(iii) Clavicle</td>
</tr>
<tr>
<td>(d) Glenoid cavity</td>
<td>(iv) Do not connect with the sternum</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)  
(1) (iii) (ii) (iv) (i)  
(2) (iv) (iii) (i) (ii)  
(3) (ii) (iv) (i) (iii)  
(4) (i) (iii) (ii) (iv)

108. Identify the basic amino acid from the following.

(1) Lysine  
(2) Valine  
(3) Tyrosine  
(4) Glutamic Acid

109. The plant parts which consist of two generations - one within the other:

(a) Pollen grains inside the anther  
(b) Germinated pollen grain with two male gametes  
(c) Seed inside the fruit  
(d) Embryo sac inside the ovule

(1) (c) and (d)  
(2) (a) and (d)  
(3) (a) only  
(4) (a), (b) and (c)

110. Identify the wrong statement with reference to transport of oxygen.

(1) Higher $H^+$ conc. in alveoli favours the formation of oxyhaemoglobin.  
(2) Low $pCO_2$ in alveoli favours the formation of oxyhaemoglobin.  
(3) Binding of oxygen with haemoglobin is mainly related to partial pressure of $O_2$.  
(4) Partial pressure of $CO_2$ can interfere with $O_2$ binding with haemoglobin.

111. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Organ of Corti</td>
<td>(i) Connects middle ear and pharynx</td>
</tr>
<tr>
<td>(b) Cochlea</td>
<td>(ii) Coiled part of the labyrinth</td>
</tr>
<tr>
<td>(c) Eustachian tube</td>
<td>(iii) Attached to the oval window</td>
</tr>
<tr>
<td>(d) Stapes</td>
<td>(iv) Located on the basilar membrane</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)  
(1) (iv) (ii) (i) (iii)  
(2) (i) (ii) (iv) (iii)  
(3) (ii) (iii) (i) (iv)  
(4) (iii) (i) (iv) (ii)

112. Name the plant growth regulator which upon spraying on sugarcane crop, increases the length of stem, thus increasing the yield of sugarcane crop.

(1) Ethylene  
(2) Abscisic acid  
(3) Cytokinin  
(4) Gibberellin
113. The roots that originate from the base of the stem are:
   (1) Prop roots
   (2) Lateral roots
   (3) Fibrous roots
   (4) Primary roots

114. If the head of cockroach is removed, it may live for few days because:
   (1) the head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.
   (2) the head holds a 1/3rd of a nervous system while the rest is situated along the dorsal part of its body.
   (3) the supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen.
   (4) the cockroach does not have nervous system.

115. Strobili or cones are found in:
   (1) Marchantia
   (2) Equisetum
   (3) Salvinia
   (4) Pteris

116. Dissolution of the synaptonemal complex occurs during:
   (1) Diplotene
   (2) Leptotene
   (3) Pachytene
   (4) Zygotene

117. Match the following diseases with the causative organism and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Typhoid</td>
<td>(i) Wuchereria</td>
</tr>
<tr>
<td>(b) Pneumonia</td>
<td>(ii) Plasmodium</td>
</tr>
<tr>
<td>(c) Filariasis</td>
<td>(iii) Salmonella</td>
</tr>
<tr>
<td>(d) Malaria</td>
<td>(iv) Haemophilus</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
<th>(d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(ii)</td>
<td>(i)</td>
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<td>(2)</td>
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<td>(i)</td>
<td>(iii)</td>
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<tr>
<td>(3)</td>
<td>(i)</td>
<td>(iii)</td>
<td>(ii)</td>
</tr>
<tr>
<td>(4)</td>
<td>(iii)</td>
<td>(iv)</td>
<td>(i)</td>
</tr>
</tbody>
</table>

118. The first phase of translation is:
   (1) Aminoacylation of tRNA
   (2) Recognition of an anti-codon
   (3) Binding of mRNA to ribosome
   (4) Recognition of DNA molecule

119. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Clostridium</td>
<td>(i) Cyclosporin-A butylicum</td>
</tr>
<tr>
<td>(b) Trichoderma</td>
<td>(ii) Butyric Acid polysporum</td>
</tr>
<tr>
<td>(c) Monascus</td>
<td>(iii) Citric Acid purpureus</td>
</tr>
<tr>
<td>(d) Aspergillus niger</td>
<td>(iv) Blood cholesterol lowering agent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(a)</th>
<th>(b)</th>
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<tr>
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<td>(4)</td>
<td>(ii)</td>
<td>(i)</td>
<td>(iv)</td>
</tr>
</tbody>
</table>

120. The oxygenation activity of RuBisCo enzyme in photorespiration leads to the formation of:
   (1) 1 molecule of 6-C compound
   (2) 1 molecule of 4-C compound and 1 molecule of 2-C compound
   (3) 2 molecules of 3-C compound
   (4) 1 molecule of 3-C compound

121. Match the following concerning essential elements and their functions in plants:

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Iron</td>
<td>(i) Photolysis of water</td>
</tr>
<tr>
<td>(b) Zinc</td>
<td>(ii) Pollen germination</td>
</tr>
<tr>
<td>(c) Boron</td>
<td>(iii) Required for chlorophyll biosynthesis</td>
</tr>
<tr>
<td>(d) Manganese</td>
<td>(iv) IAA biosynthesis</td>
</tr>
</tbody>
</table>

Select the correct option:

<table>
<thead>
<tr>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
<th>(d)</th>
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</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(iii)</td>
<td>(iv)</td>
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<td>(2)</td>
<td>(iv)</td>
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<td>(3)</td>
<td>(ii)</td>
<td>(i)</td>
<td>(iv)</td>
</tr>
<tr>
<td>(4)</td>
<td>(iv)</td>
<td>(iii)</td>
<td>(i)</td>
</tr>
</tbody>
</table>
122. Name the enzyme that facilitates opening of DNA helix during transcription.
   (1) DNA polymerase
   (2) RNA polymerase
   (3) DNA ligase
   (4) DNA helicase

123. From his experiments, S.L. Miller produced amino acids by mixing the following in a closed flask:
   (1) CH₄, H₂, NH₃ and water vapor at 600°C
   (2) CH₃, H₂, NH₃ and water vapor at 600°C
   (3) CH₄, H₂, NH₃ and water vapor at 800°C
   (4) CH₃, H₂, NH₄ and water vapor at 800°C

124. Goblet cells of alimentary canal are modified from:
   (1) Chondrocytes
   (2) Compound epithelial cells
   (3) Squamous epithelial cells
   (4) Columnar epithelial cells

125. Cuboidal epithelium with brush border of microvilli is found in:
   (1) proximal convoluted tubule of nephron
   (2) eustachian tube
   (3) lining of intestine
   (4) ducts of salivary glands

126. In light reaction, plastoquinone facilitates the transfer of electrons from:
   (1) PS-I to NADP⁺
   (2) PS-I to ATP synthase
   (3) PS-II to Cytb₆ complex
   (4) Cytb₆ complex to PS-I

127. If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is $6.6 \times 10^9$ bp, then the length of the DNA is approximately:
   (1) 2.2 meters
   (2) 2.7 meters
   (3) 2.0 meters
   (4) 2.5 meters

128. Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells?
   (1) Golgi bodies
   (2) Polysomes
   (3) Endoplasmic reticulum
   (4) Peroxisomes

129. Which of the following statements is not correct?
   (1) The functional insulin has A and B chains linked together by hydrogen bonds.
   (2) Genetically engineered insulin is produced in E-Coli.
   (3) In man insulin is synthesised as a proinsulin.
   (4) The proinsulin has an extra peptide called C-peptide.

130. Identify the incorrect statement.
   (1) Sapwood is the innermost secondary xylem and is lighter in colour.
   (2) Due to deposition of tannins, resins, oils etc., heart wood is dark in colour.
   (3) Heart wood does not conduct water but gives mechanical support.
   (4) Sapwood is involved in conduction of water and minerals from root to leaf.

131. Floridean starch has structure similar to:
   (1) Mannitol and algin
   (2) Laminarin and cellulose
   (3) Starch and cellulose
   (4) Amylopectin and glycogen

132. Match the following with respect to meiosis:
   (a) Zygotene (i) Terminalization
   (b) Pachytene (ii) Chiasmata
   (c) Diplotene (iii) Crossing over
   (d) Diakinesis (iv) Synapsis
   Select the correct option from the following:
   (a) (b) (c) (d)
   (1) (i) (ii) (iv) (iii)
   (2) (ii) (iv) (iii) (i)
   (3) (iii) (iv) (i) (ii)
   (4) (iv) (iii) (ii) (i)
133. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Eosinophils</td>
<td>(i) Immune response</td>
</tr>
<tr>
<td>(b) Basophils</td>
<td>(ii) Phagocytosis</td>
</tr>
<tr>
<td>(c) Neutrophils</td>
<td>(iii) Release histaminase, destructive enzymes</td>
</tr>
<tr>
<td>(d) Lymphocytes</td>
<td>(iv) Release granules containing histamine</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (i) (ii) (iv) (iii)
(2) (ii) (i) (iii) (iv)
(3) (iii) (iv) (ii) (i)
(4) (iv) (i) (ii) (iii)

134. The process of growth is maximum during:
(1) Senescence
(2) Dormancy
(3) Log phase
(4) Lag phase

135. Match the following:
(a) Inhibitor of catalytic activity
(b) Possess peptide bonds
(c) Cell wall material in fungi
(d) Secondary metabolite

(i) Ricin
(ii) Malonate
(iii) Chitin
(iv) Collagen

Choose the correct option from the following:
(a) (b) (c) (d)
(1) (iii) (iv) (i) (ii)
(2) (ii) (iii) (i) (iv)
(3) (ii) (iv) (iii) (i)
(4) (iii) (i) (iv) (ii)

136. Some dividing cells exit the cell cycle and enter vegetative inactive stage. This is called quiescent stage ($G_0$). This process occurs at the end of:
(1) S phase
(2) G2 phase
(3) M phase
(4) G1 phase

137. Which of the following would help in prevention of diuresis?
(1) Atrial natriuretic factor causes vasoconstriction
(2) Decrease in secretion of renin by JG cells
(3) More water reabsorption due to undersecretion of ADH
(4) Reabsorption of Na$^+$ and water from renal tubules due to aldosterone

138. Which of the following is correct about viroids?
(1) They have DNA with protein coat.
(2) They have free DNA without protein coat.
(3) They have RNA with protein coat.
(4) They have free RNA without protein coat.

139. The infectious stage of *Plasmodium* that enters the human body is:
(1) Female gametocytes
(2) Male gametocytes
(3) Trophozoites
(4) Sporozoites

140. Which of the following statements is correct?
(1) Adenine pairs with thymine through three H-bonds.
(2) Adenine does not pair with thymine.
(3) Adenine pairs with thymine through two H-bonds.
(4) Adenine pairs with thymine through one H-bond.

141. Flippers of Penguins and Dolphins are examples of:
(1) Industrial melanism
(2) Natural selection
(3) Adaptive radiation
(4) Convergent evolution
142. Montreal protocol was signed in 1987 for control of:
   (1) Release of Green House gases
   (2) Disposal of e-wastes
   (3) Transport of Genetically modified organisms from one country to another
   (4) Emission of ozone depleting substances

143. Identify the **wrong** statement with regard to Restriction Enzymes.
   (1) They are useful in genetic engineering.
   (2) Sticky ends can be joined by using DNA ligases.
   (3) Each restriction enzyme functions by inspecting the length of a DNA sequence.
   (4) They cut the strand of DNA at palindromic sites.

144. By which method was a new breed ‘Hisardale’ of sheep formed by using Bikaneri ewes and Marino rams?
   (1) Cross breeding
   (2) Inbreeding
   (3) Out crossing
   (4) Mutational breeding

145. Which of the following refer to **correct** example(s) of organisms which have evolved due to changes in environment brought about by anthropogenic action?
   (a) Darwin’s Finches of Galapagos islands.
   (b) Herbicide resistant weeds.
   (c) Drug resistant eukaryotes.
   (d) Man-created breeds of domesticated animals like dogs.
   (1) (b), (c) and (d)
   (2) only (d)
   (3) only (a)
   (4) (a) and (c)

146. Meiotic division of the secondary oocyte is completed:
   (1) After zygote formation
   (2) At the time of fusion of a sperm with an ovum
   (3) Prior to ovulation
   (4) At the time of copulation

147. In relation to Gross primary productivity and Net primary productivity of an ecosystem, which one of the following statements is **correct**?
   (1) Gross primary productivity and Net primary productivity are one and same.
   (2) There is no relationship between Gross primary productivity and Net primary productivity.
   (3) Gross primary productivity is always less than Net primary productivity.
   (4) Gross primary productivity is always more than Net primary productivity.

148. Identify the **wrong** statement with reference to the gene T that controls ABO blood groups.
   (1) When IA and IB are present together, they express same type of sugar.
   (2) Allele ‘i’ does not produce any sugar.
   (3) The gene (I) has three alleles.
   (4) A person will have only two of the three alleles.

149. Match the following columns and select the **correct** option.

<table>
<thead>
<tr>
<th>Column - I</th>
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</tr>
</thead>
<tbody>
<tr>
<td>(a) Pituitary gland</td>
<td>(i) Grave’s disease</td>
</tr>
<tr>
<td>(b) Thyroid gland</td>
<td>(ii) Diabetes mellitus</td>
</tr>
<tr>
<td>(c) Adrenal gland</td>
<td>(iii) Diabetes insipidus</td>
</tr>
<tr>
<td>(d) Pancreas</td>
<td>(iv) Addison’s disease</td>
</tr>
</tbody>
</table>

150. According to Robert May, the global species diversity is about:
   (1) 50 million
   (2) 7 million
   (3) 1.5 million
   (4) 20 million
151. The body of the ovule is fused within the funicle at:

(1) Nucellus
(2) Chalaza
(3) Hilum
(4) Micropyle

152. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Gregarious, polyphagous (i)</td>
<td>Asterias pest</td>
</tr>
<tr>
<td>(b) Adult with radial (ii) Scorpion symmetry and larva with bilateral symmetry</td>
<td>(c) Book lungs (iii) Ctenoplana</td>
</tr>
<tr>
<td>(d) Bioluminescence (iv) Locusta</td>
<td></td>
</tr>
</tbody>
</table>

153. Embryological support for evolution was disapproved by:

(1) Charles Darwin
(2) Oparin
(3) Karl Ernst von Baer
(4) Alfred Wallace

154. Match the organism with its use in biotechnology.

| (a) Bacillus thuringiensis (i) Cloning vector | (b) Thermus aquaticus (ii) Construction of first rDNA molecule |
| (c) Agrobacterium tumefaciens (iii) DNA polymerase | (d) Salmonella typhimurium (iv) Cry proteins |

Select the correct option from the following:

(a) (b) (c) (d)

155. Which of the following is not an inhibitory substance governing seed dormancy?

(1) Phenolic acid
(2) Para-ascorbic acid
(3) Gibberellic acid
(4) Abscisic acid

156. Which of the following statements about inclusion bodies is incorrect?

(1) They lie free in the cytoplasm.
(2) These represent reserve material in cytoplasm.
(3) They are not bound by any membrane.
(4) These are involved in ingestion of food particles.

157. The ovary is half inferior in:

(1) Sunflower
(2) Plum
(3) Brinjal
(4) Mustard

158. Match the trophic levels with their correct species examples in grassland ecosystem.

(a) Fourth trophic level (i) Crow
(b) Second trophic level (ii) Vulture
(c) First trophic level (iii) Rabbit
(d) Third trophic level (iv) Grass

Select the correct option:

(a) (b) (c) (d)

159. The process responsible for facilitating loss of water in liquid form from the tip of grass blades at night and in early morning is:

(1) Imbibition
(2) Plasmolysis
(3) Transpiration
(4) Root pressure
Choose the correct pair from the following:

1. Nucleases - Separate the two strands of DNA
2. Exonucleases - Make cuts at specific positions within DNA
3. Ligases - Join the two DNA molecules
4. Polymerases - Break the DNA into fragments

The transverse section of a plant shows following anatomical features:
(a) Large number of scattered vascular bundles surrounded by bundle sheath.
(b) Large conspicuous parenchymatous ground tissue.
(c) Vascular bundles conjoint and closed.
(d) Phloem parenchyma absent.
Identify the category of plant and its part:
1. Dicotyledonous stem
2. Dicotyledonous root
3. Monocotyledonous stem
4. Monocotyledonous root

Experimental verification of the chromosomal theory of inheritance was done by:
1. Boveri
2. Morgan
3. Mendel
4. Sutton

Bt cotton variety that was developed by the introduction of toxin gene of Bacillus thuringiensis (Bt) is resistant to:
1. Plant nematodes
2. Insect predators
3. Insect pests
4. Fungal diseases

Select the correct statement:
1. Insulin acts on pancreatic cells and adipocytes.
2. Insulin is associated with hyperglycemia.
3. Glucocorticoids stimulate gluconeogenesis.
4. Glucagon is associated with hypoglycemia.

The specific palindromic sequence which is recognized by EcoRI is:
1. 5' - CTTAAG - 3'
2. 3' - GAATTC - 5'
3. 5' - GGATCC - 3'
4. 3' - CCTAGG - 5'

Identify the substances having glycosidic bond and peptide bond, respectively in their structure:
1. Cellulose, lecithin
2. Inulin, insulin
3. Chitin, cholesterol
4. Glycerol, trypsin

The product(s) of reaction catalyzed by nitrogenase in root nodules of leguminous plants is/are:
1. Ammonia and oxygen
2. Ammonia and hydrogen
3. Ammonia alone
4. Nitrate alone

Which of the following hormone levels will cause release of ovum (ovulation) from the graffian follicle?
1. Low concentration of LH
2. Low concentration of FSH
3. High concentration of Estrogen
4. High concentration of Progesterone

Which of the following statements are true for the phylum-Chordata?
(a) In Urochordata notochord extends from head to tail and it is present throughout their life.
(b) In Vertebrata notochord is present during the embryonic period only.
(c) Central nervous system is dorsal and hollow.
(d) Chordata is divided into 3 subphyla: Hemichordata, Tunicata and Cephalochordata.

(a) and (b)
(b) and (c)
(d) and (c)
(c) and (a)
170. Bilaterally symmetrical and acoelomate animals are exemplified by:
   (1) Aschelminthes  
   (2) Annelida  
   (3) Ctenophora  
   (4) Platyhelminthes

171. Which of the following regions of the globe exhibits highest species diversity?
   (1) Himalayas  
   (2) Amazon forests  
   (3) Western Ghats of India  
   (4) Madagascar

172. Select the correct match.
   (1) Sickle cell anaemia - Autosomal recessive trait, chromosome-11  
   (2) Thalassemia - X linked  
   (3) Haemophilia - Y linked  
   (4) Phenylketonuria - Autosomal dominant trait

173. Which one of the following is the most abundant protein in the animals?
   (1) Lectin  
   (2) Insulin  
   (3) Haemoglobin  
   (4) Collagen

174. Select the option including all sexually transmitted diseases.
   (1) AIDS, Malaria, Filariasis  
   (2) Cancer, AIDS, Syphilis  
   (3) Gonorrhoea, Syphilis, Genital herpes  
   (4) Gonorrhoea, Malaria, Genital herpes

175. In water hyacinth and water lily, pollination takes place by:
   (1) wind and water  
   (2) insects and water  
   (3) insects or wind  
   (4) water currents only

176. In gel electrophoresis, separated DNA fragments can be visualized with the help of:
   (1) Acetocarmine in UV radiation  
   (2) Ethidium bromide in infrared radiation  
   (3) Acetocarmine in bright blue light  
   (4) Ethidium bromide in UV radiation

177. Secondary metabolites such as nicotine, strychnine and caffeine are produced by plants for their:
   (1) Defence action  
   (2) Effect on reproduction  
   (3) Nutritive value  
   (4) Growth response

178. How many true breeding pea plant varieties did Mendel select as pairs, which were similar except in one character with contrasting traits?
   (1) 14  
   (2) 8  
   (3) 4  
   (4) 2

179. Which of the following is not an attribute of a population?
   (1) Mortality  
   (2) Species interaction  
   (3) Sex ratio  
   (4) Natality

180. Snow-blindness in Antarctic region is due to:
   (1) High reflection of light from snow  
   (2) Damage to retina caused by infra-red rays  
   (3) Freezing of fluids in the eye by low temperature  
   (4) Inflammation of cornea due to high dose of UV-B radiation
Space For Rough Work
Space For Rough Work
Space For Rough Work
Important Instructions:

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on side-1 and side-2 carefully with blue/black ball point pen only.

2. The test is of 3 hours duration and Test Booklet contains 180 questions. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 720.

3. Use Blue/Black Ball Point Pen only for writing particulars on this page/marking responses.

4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.

5. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.

6. The CODE for this Booklet is G3. Make sure that the CODE printed on Side-2 of the Answer Sheet is the same as that on this Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.

7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.

8. Use of white fluid for correction is NOT permissible on the Answer Sheet.

9. Each candidate must show on demand his/her Admit Card to the Invigilator.

10. No candidate, without special permission of the Superintendent or Invigilator, would leave his/her seat.

11. 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 the Answer Sheet and dealt with as an unfair means case.

12. Use of Electronic/Manual Calculator is prohibited.

13. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.

14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet/Answer Sheet in the Attendance Sheet.
1. Identify the **wrong** statement with reference to transport of oxygen.
   (1) Partial pressure of CO\(_2\) can interfere with O\(_2\) binding with haemoglobin.
   (2) Higher H\(^+\) conc. in alveoli favours the formation of oxyhaemoglobin.
   (3) Low pCO\(_2\) in alveoli favours the formation of oxyhaemoglobin.
   (4) Binding of oxygen with haemoglobin is mainly related to partial pressure of O\(_2\).

2. Which of the following refer to **correct** example(s) of organisms which have evolved due to changes in environment brought about by anthropogenic action?
   (a) Darwin’s Finches of Galapagos islands.
   (b) Herbicide resistant weeds.
   (c) Drug resistant eukaryotes.
   (d) Man-created breeds of domesticated animals like dogs.
   (1) (a) and (c)
   (2) (b), (c) and (d)
   (3) only (d)
   (4) only (a)

3. Which of the following is **not** an inhibitory substance governing seed dormancy?
   (1) Abscisic acid
   (2) Phenolic acid
   (3) Para-ascorbic acid
   (4) Gibberellic acid

4. Match the following diseases with the causative organism and select the **correct** option.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>(a) Typhoid</td>
<td>(i) <em>Wuchereria</em></td>
</tr>
<tr>
<td>(b) Pneumonia</td>
<td>(ii) <em>Plasmodium</em></td>
</tr>
<tr>
<td>(c) Malaria</td>
<td>(iii) <em>Salmonella</em></td>
</tr>
<tr>
<td>(d) (a) (b) (c) (d)</td>
<td>(iv) <em>Haemophilus</em></td>
</tr>
</tbody>
</table>

5. Select the **correct** events that occur during inspiration.
   (a) Contraction of diaphragm
   (b) Contraction of external inter-costal muscles
   (c) Pulmonary volume decreases
   (d) Intra pulmonary pressure increases
   (1) (c) and (d)
   (2) (a), (b) and (d)
   (3) only (d)
   (4) (a) and (b)

6. The oxygenation activity of RuBisCo enzyme in photorespiration leads to the formation of:
   (1) 1 molecule of 3-C compound
   (2) 1 molecule of 6-C compound
   (3) 1 molecule of 4-C compound and 1 molecule of 2-C compound
   (4) 2 molecules of 3-C compound

7. In light reaction, plastoquinone facilitates the transfer of electrons from:
   (1) Cytb\(_{6f}\) complex to PS-I
   (2) PS-I to NADP\(^+\)
   (3) PS-I to ATP synthase
   (4) PS-II to Cytb\(_{6f}\) complex

8. In gel electrophoresis, separated DNA fragments can be visualized with the help of:
   (1) Ethidium bromide in UV radiation
   (2) Acetocarmine in UV radiation
   (3) Ethidium bromide in infrared radiation
   (4) Acetocarmine in bright blue light

9. The QRS complex in a standard ECG represents:
   (1) Depolarisation of auricles
   (2) Depolarisation of ventricles
   (3) Repolarisation of ventricles
   (4) Repolarisation of auricles
10. The plant parts which consist of two generations - one within the other:
   (a) Pollen grains inside the anther
   (b) Germinated pollen grain with two male gametes
   (c) Seed inside the fruit
   (d) Embryo sac inside the ovule
   (1) (a), (b) and (c)
   (2) (c) and (d)
   (3) (a) and (d)
   (4) (a) only

11. The infectious stage of *Plasmodium* that enters the human body is:
   (1) Sporozoites
   (2) Female gametocytes
   (3) Male gametocytes
   (4) Trophozoites

12. Identify the incorrect statement.
   (1) Sapwood is involved in conduction of water and minerals from root to leaf.
   (2) Sapwood is the innermost secondary xylem and is lighter in colour.
   (3) Due to deposition of tannins, resins, oils etc., heart wood is dark in colour.
   (4) Heart wood does not conduct water but gives mechanical support.

13. Flippers of Penguins and Dolphins are examples of:
   (1) Convergent evolution
   (2) Industrial melanism
   (3) Natural selection
   (4) Adaptive radiation

14. Identify the wrong statement with reference to the gene 'I' that controls ABO blood groups.
   (1) A person will have only two of the three alleles.
   (2) When I^A and I^B are present together, they express same type of sugar.
   (3) Allele 'i' does not produce any sugar.
   (4) The gene (I) has three alleles.

15. Which of the following statements are true for the phylum-Chordata?
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   (c) Central nervous system is dorsal and hollow.
   (d) Chordata is divided into 3 subphyla: Hemichordata, Tunicata and Cephalochordata.
   (1) (c) and (a)
   (2) (a) and (b)
   (3) (b) and (c)
   (4) (d) and (c)

16. Presence of which of the following conditions in urine are indicative of Diabetes Mellitus?
   (1) Uremia and Renal Calculi
   (2) Ketonuria and Glycosuria
   (3) Renal calculi and Hyperglycaemia
   (4) Uremia and Ketonuria

17. The first phase of translation is:
   (1) Recognition of DNA molecule
   (2) Aminoacylation of tRNA
   (3) Recognition of an anti-codon
   (4) Binding of mRNA to ribosome

18. Ray florets have:
   (1) Superior ovary
   (2) Hypogynous ovary
   (3) Half inferior ovary
   (4) Inferior ovary

19. The process of growth is maximum during:
   (1) Lag phase
   (2) Senescence
   (3) Dormancy
   (4) Log phase
20. The roots that originate from the base of the stem are:
   (1) Primary roots
   (2) Prop roots
   (3) Lateral roots
   (4) Fibrous roots

21. In water hyacinth and water lily, pollination takes place by:
   (1) water currents only
   (2) wind and water
   (3) insects and water
   (4) insects or wind

22. Which of the following is put into Anaerobic sludge digester for further sewage treatment?
   (1) Floating debris
   (2) Effluents of primary treatment
   (3) Activated sludge
   (4) Primary sludge

23. Bilaterally symmetrical and acoelomate animals are exemplified by:
   (1) Platyhelminthes
   (2) Aschelminthes
   (3) Annelida
   (4) Ctenophora

24. Identify the basic amino acid from the following.
   (1) Glutamic Acid
   (2) Lysine
   (3) Valine
   (4) Tyrosine

25. In which of the following techniques, the embryos are transferred to assist those females who cannot conceive?
   (1) GIFT and ZIFT
   (2) ICSI and ZIFT
   (3) GIFT and ICSI
   (4) ZIFT and IUT

26. Which of the following statements about inclusion bodies is **incorrect**?
   (1) These are involved in ingestion of food particles.
   (2) They lie free in the cytoplasm.
   (3) These represent reserve material in cytoplasm.
   (4) They are not bound by any membrane.

27. Experimental verification of the chromosomal theory of inheritance was done by:
   (1) Sutton
   (2) Boveri
   (3) Morgan
   (4) Mendel

28. Select the option including all sexually transmitted diseases.
   (1) Gonorrhoea, Malaria, Genital herpes
   (2) AIDS, Malaria, Filaria
   (3) Cancer, AIDS, Syphilis
   (4) Gonorrhoea, Syphilis, Genital herpes

29. Which of the following statements is **not** correct?
   (1) The proinsulin has an extra peptide called C-peptide.
   (2) The functional insulin has A and B chains linked together by hydrogen bonds.
   (3) Genetically engineered insulin is produced in E.Coli.
   (4) In man insulin is synthesised as a proinsulin.

30. Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells?
   (1) Peroxisomes
   (2) Golgi bodies
   (3) Polysomes
   (4) Endoplasmic reticulum
31. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Clostridium butylicum</td>
<td>(i) Cyclosporin-A</td>
</tr>
<tr>
<td>(b) Trichoderma polysporum</td>
<td>(ii) Butyric Acid</td>
</tr>
<tr>
<td>(c) Monascus purpureus</td>
<td>(iii) Citric Acid</td>
</tr>
<tr>
<td>(d) Aspergillus niger</td>
<td>(iv) Blood cholesterol lowering agent</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (ii) (i) (iv) (iii)
(2) (i) (ii) (iv) (iii)
(3) (iv) (iii) (ii) (i)
(4) (iii) (iv) (ii) (i)

32. Embryological support for evolution was disapproved by:
(1) Alfred Wallace
(2) Charles Darwin
(3) Oparin
(4) Karl Ernst von Baer

33. The sequence that controls the copy number of the linked DNA in the vector, is termed:
(1) Ori site
(2) Palindromic sequence
(3) Recognition site
(4) Selectable marker

34. Which of the following is correct about viroids?
(1) They have free RNA without protein coat.
(2) They have DNA with protein coat.
(3) They have free DNA without protein coat.
(4) They have RNA with protein coat.

35. Montreal protocol was signed in 1987 for control of:
(1) Emission of ozone depleting substances
(2) Release of Green House gases
(3) Disposal of e-wastes
(4) Transport of Genetically modified organisms from one country to another

36. The number of substrate level phosphorylations in one turn of citric acid cycle is:
(1) One
(2) Two
(3) Three
(4) Zero

37. Which of the following hormone levels will cause release of ovum (ovulation) from the graffian follicle?
(1) High concentration of Progesterone
(2) Low concentration of LH
(3) Low concentration of FSH
(4) High concentration of Estrogen

38. Select the correct match.
(1) Phenylketonuria - Autosomal dominant trait
(2) Sickle cell anaemia - Autosomal recessive trait, chromosome-11
(3) Thalassemia - X linked
(4) Haemophilia - Y linked

39. Cuboidal epithelium with brush border of microvilli is found in:
(1) ducts of salivary glands
(2) proximal convoluted tubule of nephron
(3) eustachian tube
(4) lining of intestine

40. Snow-blindness in Antarctic region is due to:
(1) Inflammation of cornea due to high dose of UV-B radiation
(2) High reflection of light from snow
(3) Damage to retina caused by infra-red rays
(4) Freezing of fluids in the eye by low temperature

41. Which of the following pairs is of unicellular algae?
(1) Gelidium and Gracilaria
(2) Anabaena and Volvox
(3) Chlorella and Spirulina
(4) Laminaria and Sargassum
42. The transverse section of a plant shows following anatomical features:
   (a) Large number of scattered vascular bundles surrounded by bundle sheath.
   (b) Large conspicuous parenchymatous ground tissue.
   (c) Vascular bundles conjoint and closed.
   (d) Phloem parenchyma absent.
Identify the category of plant and its part:
(1) Monocotyledonous root
(2) Dicotyledonous stem
(3) Dicotyledonous root
(4) Monocotyledonous stem

43. How many true breeding pea plant varieties did Mendel select as pairs, which were similar except in one character with contrasting traits?
(1) 2
(2) 14
(3) 8
(4) 4

44. Floridean starch has structure similar to:
   (1) Amylopectin and glycogen
   (2) Mannitol and algin
   (3) Laminarin and cellulose
   (4) Starch and cellulose

45. Identify the correct statement with regard to \( G_1 \) phase (Gap 1) of interphase.
   (1) Reorganisation of all cell components takes place.
   (2) Cell is metabolically active, grows but does not replicate its DNA.
   (3) Nuclear Division takes place.
   (4) DNA synthesis or replication takes place.

46. By which method was a new breed ‘Hisardale’ of sheep formed by using Bikaneri ewes and Marino rams?
   (1) Mutational breeding
   (2) Cross breeding
   (3) Inbreeding
   (4) Out crossing

47. Identify the wrong statement with reference to immunity.
   (1) When ready-made antibodies are directly given, it is called “Passive immunity”.
   (2) Active immunity is quick and gives full response.
   (3) Foetus receives some antibodies from mother, it is an example for passive immunity.
   (4) When exposed to antigen (living or dead) antibodies are produced in the host’s body. It is called “Active immunity”.

48. The specific palindromic sequence which is recognized by EcoRI is:
   (1) 5' - GGAACC - 3'
       3' - CCTTGG - 5'
   (2) 5' - CTTAAG - 3'
       3' - GAATTC - 5'
   (3) 5' - GGATCC - 3'
       3' - CCTAGG - 5'
   (4) 5' - GAAATC - 3'
       3' - CTAAAG - 5'

49. If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is \( 6.6 \times 10^9 \) bp, then the length of the DNA is approximately:
   (1) 2.5 meters
   (2) 2.2 meters
   (3) 2.7 meters
   (4) 2.0 meters

50. If the head of cockroach is removed, it may live for few days because:
   (1) the cockroach does not have nervous system.
   (2) the head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.
   (3) the head holds a 1/3rd of a nervous system while the rest is situated along the dorsal part of its body.
   (4) the supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen.
51. Match the trophic levels with their **correct** species examples in grassland ecosystem.

(a) Fourth trophic level  (i) Crow
(b) Second trophic level  (ii) Vulture
(c) First trophic level    (iii) Rabbit
(d) Third trophic level   (iv) Grass

Select the **correct** option:

(a) (b) (c) (d)
(1) (iii) (ii) (i) (iv)
(2) (iv) (iii) (ii) (i)
(3) (i) (ii) (iii) (iv)
(4) (ii) (iii) (iv) (i)

52. The enzyme enterokinase helps in conversion of:

(1) trypsinogen into trypsin
(2) caseinogen into casein
(3) pepsinogen into pepsin
(4) protein into polypeptides

53. Identify the **correct** statement with reference to human digestive system.

(1) Serosa is the innermost layer of the alimentary canal.
(2) Ileum is a highly coiled part.
(3) Vermiform appendix arises from duodenum.
(4) Ileum opens into small intestine.

54. Name the plant growth regulator which upon spraying on sugarcane crop, increases the length of stem, thus increasing the yield of sugarcane crop.

(1) Gibberellin
(2) Ethylene
(3) Abscisic acid
(4) Cytokinin

55. Identify the **wrong** statement with regard to Restriction Enzymes.

(1) They cut the strand of DNA at palindromic sites.
(2) They are useful in genetic engineering.
(3) Sticky ends can be joined by using DNA ligases.
(4) Each restriction enzyme functions by inspecting the length of a DNA sequence.

56. Match the following:

(a) Inhibitor of catalytic activity (i) Ricin
(b) Possess peptide bonds (ii) Malonate
(c) Cell wall material in fungi (iii) Chitin
(d) Secondary metabolite (iv) Collagen

Choose the **correct** option from the following:

(a) (b) (c) (d)
(1) (iii) (i) (iv) (ii)
(2) (iii) (iv) (i) (ii)
(3) (ii) (iii) (i) (iv)
(4) (i) (iv) (iii) (ii)

57. Goblet cells of alimentary canal are modified from:

(1) Columnar epithelial cells
(2) Chondrocytes
(3) Compound epithelial cells
(4) Squamous epithelial cells

58. Match the following columns and select the **correct** option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 6 - 15 pairs of gill slits</td>
<td>(i) Trygon</td>
</tr>
<tr>
<td>(b) Heterocercal</td>
<td>(ii) Cyclostomes</td>
</tr>
<tr>
<td>(c) Air Bladder</td>
<td>(iii) Chondrichthyes</td>
</tr>
<tr>
<td>(d) Poison sting</td>
<td>(iv) Osteichthyes</td>
</tr>
</tbody>
</table>

Choose the correct option:

(a) (b) (c) (d)
(1) (iii) (iv) (i) (ii)
(2) (iv) (ii) (iii) (i)
(3) (i) (iv) (iii) (ii)
(4) (ii) (iii) (iv) (i)

59. Dissolution of the synaptonemal complex occurs during:

(1) Zygote
(2) Diplote
(3) Leptote
(4) Pachyto

60. Name the enzyme that facilitates opening of DNA helix during transcription.

(1) DNA helicase
(2) DNA polymerase
(3) RNA polymerase
(4) DNA ligase
61. Which of the following statements is correct?

(1) Adenine pairs with thymine through one H-bond.
(2) Adenine pairs with thymine through three H-bonds.
(3) Adenine does not pair with thymine.
(4) Adenine pairs with thymine through two H-bonds.

62. Which of the following regions of the globe exhibits highest species diversity?

(1) Madagascar
(2) Himalayas
(3) Amazon forests
(4) Western Ghats of India

63. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Pituitary gland</td>
<td>(i) Grave's disease</td>
</tr>
<tr>
<td>(b) Thyroid gland</td>
<td>(ii) Diabetes mellitus</td>
</tr>
<tr>
<td>(c) Adrenal gland</td>
<td>(iii) Diabetes insipidus</td>
</tr>
<tr>
<td>(d) Pancreas</td>
<td>(iv) Addison's disease</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)

(1) (iii) (ii) (i) (iv)
(2) (i) (iv) (ii) (iii)
(3) (ii) (i) (iv) (iii)
(4) (iv) (i) (ii) (iii)

64. The product(s) of reaction catalyzed by nitrogenase in root nodules of leguminous plants is/are:

(1) Nitrate alone
(2) Ammonia and oxygen
(3) Ammonia and hydrogen
(4) Ammonia alone

65. Match the following concerning essential elements and their functions in plants:

(a) Iron (i) Photolysis of water
(b) Zinc (ii) Pollen germination
(c) Boron (iii) Required for chlorophyll biosynthesis
(d) Manganese (iv) IAA biosynthesis

Select the correct option:

(a) (b) (c) (d)

(1) (iv) (iii) (ii) (i)
(2) (iii) (iv) (ii) (i)
(3) (iv) (i) (ii) (iii)
(4) (ii) (i) (iv) (iii)

66. Which of the following would help in prevention of diuresis?

(1) Reabsorption of Na⁺ and water from renal tubules due to aldosterone
(2) Atrial natriuretic factor causes vasoconstriction
(3) Decrease in secretion of renin by JG cells
(4) More water reabsorption due to undersecretion of ADH

67. Meiotic division of the secondary oocyte is completed:

(1) At the time of copulation
(2) After zygote formation
(3) At the time of fusion of a sperm with an ovum
(4) Prior to ovulation

68. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Gregarious, polyphagous</td>
<td>(i) Asterias pest</td>
</tr>
<tr>
<td>(b) Adult with radial symmetry and larva with bilateral symmetry</td>
<td>(ii) Scorpion</td>
</tr>
<tr>
<td>(c) Book lungs</td>
<td>(iii) Ctenoplana</td>
</tr>
<tr>
<td>(d) Bioluminescence</td>
<td>(iv) Locusta</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)

(1) (iv) (i) (ii) (iii)
(2) (iii) (i) (i) (iv)
(3) (ii) (i) (iii) (iv)
(4) (i) (iii) (ii) (iv)
69. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Floating Ribs</td>
<td>Located between second and seventh ribs</td>
</tr>
<tr>
<td>(b) Acromion</td>
<td>Head of the Humerus</td>
</tr>
<tr>
<td>(c) Scapula</td>
<td>Clavicle</td>
</tr>
<tr>
<td>(d) Glenoid cavity</td>
<td>Do not connect with the sternum</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (i) (iii) (ii) (iv)
(2) (iii) (ii) (iv) (i)
(3) (iv) (iii) (i) (ii)
(4) (ii) (iv) (i) (iii)

70. Secondary metabolites such as nicotine, strychnine and caffeine are produced by plants for their:
(1) Growth response
(2) Defence action
(3) Effect on reproduction
(4) Nutritive value

71. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Bt cotton</td>
<td>Gene therapy</td>
</tr>
<tr>
<td>(b) Adenosine deaminase deficiency</td>
<td>Cellular defence</td>
</tr>
<tr>
<td>(c) RNAi</td>
<td>Detection of HIV infection</td>
</tr>
<tr>
<td>(d) PCR</td>
<td>Bacillus thuringiensis</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (iii) (ii) (i) (iv)
(2) (ii) (iii) (iv) (i)
(3) (i) (ii) (iv) (iii)
(4) (iv) (i) (ii) (iii)

72. From his experiments, S.L. Miller produced amino acids by mixing the following in a closed flask:
(1) CH₃, H₂, NH₄ and water vapor at 800°C
(2) CH₄, H₂, NH₃ and water vapor at 600°C
(3) CH₃, H₂, NH₃ and water vapor at 600°C
(4) CH₄, H₂, NH₃ and water vapor at 800°C

73. Match the organism with its use in biotechnology.

- Bacillus thuringiensis (i) Cloning vector
- Thermus aquaticus (ii) Construction of first rDNA molecule
- Agrobacterium tumefaciens (iii) DNA polymerase
- Salmonella typhimurium (iv) Cry proteins

Select the correct option from the following:

(a) (b) (c) (d)
(1) (iv) (iii) (i) (ii)
(2) (iii) (ii) (iv) (i)
(3) (iii) (iv) (i) (ii)
(4) (ii) (iv) (iii) (i)

74. Bt cotton variety that was developed by the introduction of toxin gene of Bacillus thuringiensis (Bt) is resistant to:
(1) Fungal diseases
(2) Plant nematodes
(3) Insect predators
(4) Insect pests

75. Choose the correct pair from the following:

1) Polymerases - Break the DNA into fragments
2) Nucleases - Separate the two strands of DNA
3) Exonucleases - Make cuts at specific positions within DNA
4) Ligases - Join the two DNA molecules

76. The body of the ovule is fused within the funicle at:
(1) Micropyle
(2) Nucellus
(3) Chalaza
(4) Hilum
77. Strobili or cones are found in:
(1) Pteris
(2) Marchantia
(3) Equisetum
(4) Salvinia

78. Match the following columns and select the correct option.
<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Eosinophils</td>
<td>(i) Immune response</td>
</tr>
<tr>
<td>(b) Basophils</td>
<td>(ii) Phagocytosis</td>
</tr>
<tr>
<td>(c) Neutrophils</td>
<td>(iii) Release histaminase, destructive enzymes</td>
</tr>
<tr>
<td>(d) Lymphocytes</td>
<td>(iv) Release granules containing histamine</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (iv) (i) (ii) (iii)
(2) (i) (ii) (iv) (iii)
(3) (ii) (i) (iii) (iv)
(4) (iii) (iv) (ii) (i)

79. Identify the substances having glycosidic bond and peptide bond, respectively in their structure:
(1) Glycerol, trypsin
(2) Cellulose, lecithin
(3) Insulin, insulin
(4) Chitin, cholesterol

80. In relation to Gross primary productivity and Net primary productivity of an ecosystem, which one of the following statements is correct?
(1) Gross primary productivity is always more than net primary productivity.
(2) Gross primary productivity and Net primary productivity are one and same.
(3) There is no relationship between Gross primary productivity and Net primary productivity.
(4) Gross primary productivity is always less than net primary productivity.

81. Match the following columns and select the correct option.
<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Placenta</td>
<td>(i) Androgens</td>
</tr>
<tr>
<td>(b) Zona pellucida</td>
<td>(ii) Human Chorionic Gonadotropin (hCG)</td>
</tr>
<tr>
<td>(c) Bulbo-urethral glands</td>
<td>(iii) Layer of the ovum glands</td>
</tr>
<tr>
<td>(d) Leydig cells</td>
<td>(iv) Lubrication of the Penis</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (i) (iv) (ii) (iii)
(2) (ii) (i) (iv) (i)
(3) (ii) (iii) (iv) (i)
(4) (iv) (iii) (i) (ii)

82. Which of the following is not an attribute of a population?
(1) Natality
(2) Mortality
(3) Species interaction
(4) Sex ratio

83. Match the following columns and select the correct option.
<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Organ of Corti</td>
<td>(i) Connects middle ear and pharynx</td>
</tr>
<tr>
<td>(b) Cochlea</td>
<td>(ii) Coiled part of the labyrinth</td>
</tr>
<tr>
<td>(c) Eustachian tube</td>
<td>(iii) Attached to the oval window</td>
</tr>
<tr>
<td>(d) Stapes</td>
<td>(iv) Located on the basilar membrane</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (iii) (i) (iv) (ii)
(2) (iv) (ii) (i) (iii)
(3) (i) (ii) (iv) (iii)
(4) (ii) (iii) (i) (iv)

84. Which one of the following is the most abundant protein in the animals?
(1) Collagen
(2) Lectin
(3) Insulin
(4) Haemoglobin
85. Match the following with respect to meiosis:
   (a) Zygote (i) Terminalization
   (b) Pachytene (ii) Chiasmata
   (c) Diplotene (iii) Crossing over
   (d) Diakinesis (iv) Synapsis
Select the correct option from the following:
   (a) (b) (c) (d)
   (1) (iv) (iii) (ii) (i)
   (2) (i) (ii) (iv) (iii)
   (3) (ii) (iv) (iii) (i)
   (4) (iii) (iv) (i) (ii)

86. According to Robert May, the global species diversity is about:
   (1) 20 million
   (2) 50 million
   (3) 7 million
   (4) 1.5 million

87. The ovary is half inferior in:
   (1) Mustard
   (2) Sunflower
   (3) Plum
   (4) Brinjal

88. Select the correct statement.
   (1) Glucagon is associated with hypoglycemia.
   (2) Insulin acts on pancreatic cells and adipocytes.
   (3) Insulin is associated with hyperglycemia.
   (4) Glucocorticoids stimulate gluconeogenesis.

89. The process responsible for facilitating loss of water in liquid form from the tip of grass blades at night and in early morning is:
   (1) Root pressure
   (2) Imbibition
   (3) Plasmolysis
   (4) Transpiration

90. Some dividing cells exit the cell cycle and enter vegetative inactive stage. This is called quiescent stage \( (G_0) \). This process occurs at the end of:
   (1) \( G_1 \) phase
   (2) \( S \) phase
   (3) \( G_2 \) phase
   (4) \( M \) phase

91. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is:
   (1) \( \frac{3\pi}{2} \) rad
   (2) \( \frac{\pi}{2} \) rad
   (3) zero
   (4) \( \pi \) rad

92. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is:
   \( \mu_0 = 4\pi \times 10^{-7} \text{T m A}^{-1} \)
   (1) \( 3.14 \times 10^{-4} \text{T} \)
   (2) \( 6.28 \times 10^{-5} \text{T} \)
   (3) \( 3.14 \times 10^{-5} \text{T} \)
   (4) \( 6.28 \times 10^{-4} \text{T} \)

93. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity \( (g) \) is:

94. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is \( (c = \text{speed of electromagnetic waves}) \)
   (1) 1 : 1
   (2) 1 : \( c \)
   (3) 1 : \( c^2 \)
   (4) \( c : 1 \)
95. In a certain region of space with volume 0.2 m³, the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is:

- (1) 0.5 N/C
- (2) 1 N/C
- (3) 5 N/C
- (4) zero

96. The average thermal energy for a mono-atomic gas is: (k_B is Boltzmann constant and T, absolute temperature)

- (1) \( \frac{3}{2} k_B T \)
- (2) \( \frac{5}{2} k_B T \)
- (3) \( \frac{7}{2} k_B T \)
- (4) \( \frac{1}{2} k_B T \)

97. Find the torque about the origin when a force of \( \dot{3} j \) N acts on a particle whose position vector is \( \ddot{2} k \) m.

- (1) \( 6 \dot{j} \) N m
- (2) \( -6 \dot{i} \) N m
- (3) \( 6 \dot{k} \) N m
- (4) \( 6 \dot{i} \) N m

98. The mean free path for a gas, with molecular diameter d and number density n can be expressed as:

- (1) \( \frac{1}{\sqrt{2} n \pi d^2} \)
- (2) \( \frac{1}{\sqrt{2} n^2 \pi d^2} \)
- (3) \( \frac{1}{\sqrt{2} n^2 \pi^2 d^2} \)
- (4) \( \frac{1}{\sqrt{2} n \pi d} \)

99. The energy equivalent of 0.5 g of a substance is:

- (1) \( 4.5 \times 10^{13} \) J
- (2) \( 1.5 \times 10^{13} \) J
- (3) \( 0.5 \times 10^{13} \) J
- (4) \( 4.5 \times 10^{16} \) J

100. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is:

- (1) 0.25 mm
- (2) 0.5 mm
- (3) 1.0 mm
- (4) 0.01 mm

101. Two cylinders A and B of equal capacity are connected to each other via a stop cock. A contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is:

- (1) adiabatic
- (2) isochoric
- (3) isobaric
- (4) isothermal

102. A cylinder contains hydrogen gas at pressure of 249 kPa and temperature 27°C. Its density is: (R = 8.3 J mol⁻¹ K⁻¹)

- (1) 0.2 kg/m³
- (2) 0.1 kg/m³
- (3) 0.02 kg/m³
- (4) 0.5 kg/m³

103. When a uranium isotope \(^{235}\text{U}\) is bombarded with a neutron, it generates \(^{89}\text{Kr}\), three neutrons and:

- (1) \(^{91}\text{Zr}\)
- (2) \(^{101}\text{Kr}\)
- (3) \(^{103}\text{Kr}\)
- (4) \(^{144}\text{Ba}\)

104. A charged particle having drift velocity of \( 7.5 \times 10^{-4} \) m s⁻¹ in an electric field of \( 3 \times 10^{-10} \) Vm⁻¹, has a mobility in m² V⁻¹ s⁻¹ of:

- (1) \( 2.5 \times 10^6 \)
- (2) \( 2.5 \times 10^{-6} \)
- (3) \( 2.25 \times 10^{-15} \)
- (4) \( 2.25 \times 10^{15} \)

105. Taking into account of the significant figures, what is the value of 9.99 m - 0.0099 m?

- (1) 9.98 m
- (2) 9.980 m
- (3) 9.9 m
- (4) 9.9801 m
106. An iron rod of susceptibility 599 is subjected to a magnetising field of 1200 A m\(^{-1}\). The permeability of the material of the rod is:

\[ \mu_0=4\pi \times 10^{-7} \text{ T m A}^{-1} \]

(1) \(8.0 \times 10^{-5} \text{ T m A}^{-1}\)
(2) \(2.4\pi \times 10^{-5} \text{ T m A}^{-1}\)
(3) \(2.4\pi \times 10^{-7} \text{ T m A}^{-1}\)
(4) \(2.4\pi \times 10^{-4} \text{ T m A}^{-1}\)

107. A spherical conductor of radius 10 cm has a charge of \(3.2 \times 10^{-7} \text{ C}\) distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere?

\[ \frac{1}{4\pi \varepsilon_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2 \]

(1) \(1.28 \times 10^5 \text{ N/C}\)
(2) \(1.28 \times 10^6 \text{ N/C}\)
(3) \(1.28 \times 10^7 \text{ N/C}\)
(4) \(1.28 \times 10^4 \text{ N/C}\)

108. A series LCR circuit is connected to an ac voltage source. When L is removed from the circuit, the phase difference between current and voltage is \(\frac{\pi}{3}\). If instead C is removed from the circuit, the phase difference is again \(\frac{\pi}{3}\) between current and voltage. The power factor of the circuit is:

(1) 0.5
(2) 1.0
(3) \(-1.0\)
(4) zero

109. A capillary tube of radius \(r\) is immersed in water and water rises in it to a height \(h\). The mass of the water in the capillary is 5 g. Another capillary tube of radius 2\(r\) is immersed in water. The mass of water that will rise in this tube is:

(1) 5.0 g
(2) 10.0 g
(3) 20.0 g
(4) 2.5 g

110. In Young’s double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes:

(1) half
(2) four times
(3) one-fourth
(4) double

111. For the logic circuit shown, the truth table is:

```
   A B Y
0  0  0
0  1  1
1  0  1
1  1  1
```

(1) A B Y
0  0  1
0  1  1
1  0  1
1  1  0

(2) A B Y
0  0  1
0  1  0
1  0  0
1  1  0

(3) A B Y
0  0  1
0  1  0
1  0  0
1  1  1

(4) A B Y
0  0  0
0  1  0
1  0  0
1  1  1

112. The color code of a resistance is given below:

Yellow Violet Brown Gold

The values of resistance and tolerance, respectively, are:

(1) 47 kΩ, 10%
(2) 4.7 kΩ, 5%
(3) 470 Ω, 5%
(4) 470 kΩ, 5%

113. The capacitance of a parallel plate capacitor with air as medium is 6 μF. With the introduction of a dielectric medium, the capacitance becomes 30 μF. The permittivity of the medium is:

\[ \varepsilon_0=8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2} \]

(1) \(1.77 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}\)
(2) \(0.44 \times 10^{-10} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}\)
(3) \(5.00 \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}\)
(4) \(0.44 \times 10^{-13} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}\)
114. A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is: \( g = 10 \text{ m/s}^2 \)

(1) 340 m  
(2) 320 m  
(3) 300 m  
(4) 360 m

115. A body weighs 72 N on the surface of the earth. What is the gravitational force on it, at a height equal to half the radius of the earth?

(1) 32 N  
(2) 30 N  
(3) 24 N  
(4) 48 N

116. Two particles of mass 5 kg and 10 kg respectively are attached to the two ends of a rigid rod of length 1 m with negligible mass.

The centre of mass of the system from the 5 kg particle is nearly at a distance of:

(1) 50 cm  
(2) 67 cm  
(3) 80 cm  
(4) 33 cm

117. The increase in the width of the depletion region in a p-n junction diode is due to:

(1) reverse bias only  
(2) both forward bias and reverse bias  
(3) increase in forward current  
(4) forward bias only

118. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled?

(1) four times  
(2) one-fourth  
(3) zero  
(4) doubled

119. Assume that light of wavelength 600 nm is coming from a star. The limit of resolution of telescope whose objective has a diameter of 2 m is:

(1) \( 1.83 \times 10^{-7} \text{ rad} \)  
(2) \( 7.32 \times 10^{-7} \text{ rad} \)  
(3) \( 6.00 \times 10^{-7} \text{ rad} \)  
(4) \( 3.66 \times 10^{-7} \text{ rad} \)

120. A resistance wire connected in the left gap of a metre bridge balances a 10 Ω resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of 1 Ω of the resistance wire is:

(1) \( 1.0 \times 10^{-1} \text{ m} \)  
(2) \( 1.5 \times 10^{-1} \text{ m} \)  
(3) \( 1.5 \times 10^{-2} \text{ m} \)  
(4) \( 1.0 \times 10^{-2} \text{ m} \)

121. Light with an average flux of 20 W/cm² falls on a non-reflecting surface at normal incidence having surface area 20 cm². The energy received by the surface during time span of 1 minute is:

(1) \( 12 \times 10^3 \text{ J} \)  
(2) \( 24 \times 10^3 \text{ J} \)  
(3) \( 48 \times 10^3 \text{ J} \)  
(4) \( 10 \times 10^3 \text{ J} \)

122. A ray is incident at an angle of incidence \( i \) on one surface of a small angle prism (with angle of prism \( A \)) and emerges normally from the opposite surface. If the refractive index of the material of the prism is \( \mu \), then the angle of incidence is nearly equal to:

(1) \( \frac{2A}{\mu} \)  
(2) \( \mu A \)  
(3) \( \frac{\mu A}{2} \)  
(4) \( \frac{A}{2\mu} \)

123. A 40 µF capacitor is connected to a 200 V, 50 Hz ac supply. The rms value of the current in the circuit is, nearly:

(1) 2.65 A  
(2) 2.5 A  
(3) 25.1 A  
(4) 1.7 A

124. Dimensions of stress are:

(1) \([\text{ML}^2\text{T}^{-2}]\)  
(2) \([\text{ML}^0\text{T}^{-2}]\)  
(3) \([\text{ML}^{-1}\text{T}^{-2}]\)  
(4) \([\text{MLT}^{-2}]\)

125. The Brewsters angle \( i_b \) for an interface should be:

(1) \( 30^\circ < i_b < 45^\circ \)  
(2) \( 45^\circ < i_b < 90^\circ \)  
(3) \( i_b = 90^\circ \)  
(4) \( 0^\circ < i_b < 30^\circ \)
126. A wire of length \( L \), area of cross section \( A \) is hanging from a fixed support. The length of the wire changes to \( L_1 \) when mass \( M \) is suspended from its free end. The expression for Young’s modulus is:

\[
\text{(1)} \quad \frac{Mg(L_1 - L)}{AL}
\]

\[
\text{(2)} \quad \frac{MgL}{AL_1}
\]

\[
\text{(3)} \quad \frac{MgL}{A(L_1 - L)}
\]

\[
\text{(4)} \quad \frac{MgL_1 - L}{AL}
\]

127. A short electric dipole has a dipole moment of \( 16 \times 10^{-9} \text{ C m} \). The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of 60° with the dipole axis is:

\[
\frac{1}{4\pi e_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2
\]

\[
\text{(1)} \quad 200 \text{ V}
\]

\[
\text{(2)} \quad 400 \text{ V}
\]

\[
\text{(3)} \quad \text{zero}
\]

\[
\text{(4)} \quad 50 \text{ V}
\]

128. In a guitar, two strings A and B made of same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency increases to 7 Hz. If the frequency of A is 530 Hz, the original frequency of B will be:

\[
\text{(1)} \quad 524 \text{ Hz}
\]

\[
\text{(2)} \quad 536 \text{ Hz}
\]

\[
\text{(3)} \quad 537 \text{ Hz}
\]

\[
\text{(4)} \quad 523 \text{ Hz}
\]

129. An electron is accelerated from rest through a potential difference of \( V \) volt. If the de Broglie wavelength of the electron is \( 1.227 \times 10^{-2} \text{ nm} \), the potential difference is:

\[
\text{(1)} \quad 10^2 V
\]

\[
\text{(2)} \quad 10^3 V
\]

\[
\text{(3)} \quad 10^4 V
\]

\[
\text{(4)} \quad 10 V
\]
134. For transistor action, which of the following statements is correct?
   (1) Base, emitter and collector regions should have same size.
   (2) Both emitter junction as well as the collector junction are forward biased.
   (3) The base region must be very thin and lightly doped.
   (4) Base, emitter and collector regions should have same doping concentrations.

135. For which one of the following, Bohr model is not valid?
   (1) Singly ionised helium atom (He⁺)
   (2) Deuterion atom
   (3) Singly ionised neon atom (Ne⁺)
   (4) Hydrogen atom

136. What is the change in oxidation number of carbon in the following reaction?
   \[ \text{CH}_4(g) + 4\text{Cl}_2(g) \rightarrow \text{CCl}_4(l) + 4\text{HCl}(g) \]
   (1) 0 to +4
   (2) −4 to +4
   (3) 0 to −4
   (4) +4 to +4

137. On electrolysis of dil. sulphuric acid using Platinum (Pt) electrode, the product obtained at anode will be:
   (1) Oxygen gas
   (2) \( \text{H}_2\text{S} \) gas
   (3) \( \text{SO}_2 \) gas
   (4) Hydrogen gas

138. An increase in the concentration of the reactants of a reaction leads to change in:
   (1) heat of reaction
   (2) threshold energy
   (3) collision frequency
   (4) activation energy

139. Reaction between benzaldehyde and acetophenone in presence of dilute NaOH is known as:
   (1) Cannizzaro’s reaction
   (2) Cross Cannizzaro’s reaction
   (3) Cross Aldol condensation
   (4) Aldol condensation

140. Which of the following alkane cannot be made in good yield by Wurtz reaction?
   (1) 2,3-Dimethylbutane
   (2) n-Heptane
   (3) n-Butane
   (4) n-Hexane

141. Which of the following is a natural polymer?
   (1) poly (Butadiene-styrene)
   (2) polybutadiene
   (3) poly (Butadiene-acrylonitrile)
   (4) \( \text{cis}-1,4\)-polyisoprene

142. A mixture of \( \text{N}_2 \) and \( \text{Ar} \) gases in a cylinder contains 7 g of \( \text{N}_2 \) and 8 g of \( \text{Ar} \). If the total pressure of the mixture of the gases in the cylinder is 27 bar, the partial pressure of \( \text{N}_2 \) is:
   [Use atomic masses (in g mol\(^{-1}\)) : \( \text{N} = 14 \), \( \text{Ar} = 40 \)]
   (1) 12 bar
   (2) 15 bar
   (3) 18 bar
   (4) 9 bar

143. Match the following and identify the correct option.
   (a) \( \text{CO}(g) + \text{H}_2(g) \) (i) \( \text{Mg} \)\( (\text{HCO}_3)_2 \) + \( \text{Ca} \)\( (\text{HCO}_3)_2 \)
   (b) Temporary hardness of water (ii) An electron deficient hydride
   (c) \( \text{B}_2\text{H}_6 \) (iii) Synthesis gas
   (d) \( \text{H}_2\text{O}_2 \) (iv) Non-planar structure

(a) (b) (c) (d)
   (1) (iii) (ii) (i) (iv)
   (2) (iii) (iv) (ii) (i)
   (3) (i) (iii) (ii) (iv)
   (4) (iii) (i) (ii) (iv)
144. For the reaction, $2\text{Cl}(g) \rightarrow \text{Cl}_2(g)$, the correct option is:

1. $\Delta_rH > 0$ and $\Delta_rS < 0$
2. $\Delta_rH < 0$ and $\Delta_rS > 0$
3. $\Delta_rH < 0$ and $\Delta_rS < 0$
4. $\Delta_rH > 0$ and $\Delta_rS > 0$

145. An element has a body centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is:

1. $\frac{\sqrt{2}}{4} \times 288$ pm
2. $\frac{4}{\sqrt{3}} \times 288$ pm
3. $\frac{4}{\sqrt{2}} \times 288$ pm
4. $\frac{\sqrt{3}}{4} \times 288$ pm

146. Urea reacts with water to form A which will decompose to form B. B when passed through $\text{Cu}^{2+} (\text{aq})$, deep blue colour solution C is formed. What is the formula of C from the following?

1. $[\text{Cu(NH}_3)_4]^2^+$
2. $\text{Cu(OH)}_2$
3. $\text{CuCO}_3 \cdot \text{Cu(OH)}_2$
4. $\text{CuSO}_4$

147. Reaction between acetone and methylmagnesium chloride followed by hydrolysis will give:

1. Sec. butyl alcohol
2. Tert. butyl alcohol
3. Isobutyl alcohol
4. Isopropyl alcohol

148. The following metal ion activates many enzymes, participates in the oxidation of glucose to produce ATP and with Na, is responsible for the transmission of nerve signals.

1. Copper
2. Calcium
3. Potassium
4. Iron

149. The number of protons, neutrons and electrons in $^{175}_{71}\text{Lu}$, respectively, are:

1. 104, 71 and 71
2. 71, 71 and 104
3. 175, 104 and 71
4. 71, 104 and 71

150. Which of the following set of molecules will have zero dipole moment?

1. Boron trifluoride, hydrogen fluoride, carbon dioxide, 1,3-dichlorobenzene
2. Nitrogen trifluoride, beryllium difluoride, water, 1,3-dichlorobenzene
3. Boron trifluoride, beryllium difluoride, carbon dioxide, 1,4-dichlorobenzene
4. Ammonia, beryllium difluoride, water, 1,4-dichlorobenzene

151. Identify a molecule which does not exist.

1. $\text{Li}_2$
2. $\text{C}_2$
3. $\text{O}_2$
4. $\text{He}_2$

152. Identify the incorrect match.

<table>
<thead>
<tr>
<th>Name</th>
<th>IUPAC Official Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Unnilunium</td>
<td>(i) Mendelevium</td>
</tr>
<tr>
<td>(b) Unniltrium</td>
<td>(ii) Lawrencium</td>
</tr>
<tr>
<td>(c) Unnilhexium</td>
<td>(iii) Seaborgium</td>
</tr>
<tr>
<td>(d) Unununnium</td>
<td>(iv) Darmstadtium</td>
</tr>
</tbody>
</table>

153. The rate constant for a first order reaction is $4.606 \times 10^{-5}$ s$^{-1}$. The time required to reduce 2.0 g of the reactant to 0.2 g is:

1. 200 s
2. 500 s
3. 1000 s
4. 100 s
154. Identify the correct statement from the following:

(1) Blister copper has blistered appearance due to evolution of CO$_2$.

(2) Vapour phase refining is carried out for Nickel by Van Arkel method.

(3) Pig iron can be moulded into a variety of shapes.

(4) Wrought iron is impure iron with 4% carbon.

155. Measuring Zeta potential is useful in determining which property of colloidal solution?

(1) Solubility

(2) Stability of the colloidal particles

(3) Size of the colloidal particles

(4) Viscosity

156. Which of the following oxoacid of sulphur has $\text{-O-O-}$ linkage?

(1) H$_2$SO$_4$, sulphuric acid

(2) H$_2$S$_2$O$_8$, peroxodisulphuric acid

(3) H$_2$S$_2$O$_7$, pyrosulphuric acid

(4) H$_2$SO$_3$, sulphurous acid

157. Elimination reaction of 2-Bromo-pentane to form pent-2-ene is:

(a) β-Elimination reaction

(b) Follows Zaitsev rule

(c) Dehydrohalogenation reaction

(d) Dehydration reaction

(1) (a), (c), (d)

(2) (b), (c), (d)

(3) (a), (b), (d)

(4) (a), (b), (c)

158. Identify the correct statements from the following:

(a) CO$_2$(g) is used as refrigerant for ice-cream and frozen food.

(b) The structure of C$_{60}$ contains twelve six carbon rings and twenty five carbon rings.

(c) ZSM-5, a type of zeolite, is used to convert alcohols into gasoline.

(d) CO is colorless and odourless gas.

(1) (a) and (c) only

(2) (b) and (c) only

(3) (c) and (d) only

(4) (a), (b) and (c) only

159. An alkene on ozonolysis gives methanal as one of the product. Its structure is:

CH$_2$ − CH$_2$ − CH$_3$

(1)

CH$_2$ − CH = CH$_2$

(2)

CH$_2$CH$_2$CH$_3$

(3)

CH = CH − CH$_3$

(4)
160. Paper chromatography is an example of:
(1) Partition chromatography
(2) Thin layer chromatography
(3) Column chromatography
(4) Adsorption chromatography

161. Match the following:

<table>
<thead>
<tr>
<th>Oxide</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) CO</td>
<td>(i) Basic</td>
</tr>
<tr>
<td>(b) BaO</td>
<td>(ii) Neutral</td>
</tr>
<tr>
<td>(c) Al₂O₃</td>
<td>(iii) Acidic</td>
</tr>
<tr>
<td>(d) Cl₂O₇</td>
<td>(iv) Amphoteric</td>
</tr>
</tbody>
</table>

Which of the following is correct option?
(a) (b) (c) (d)
(1) (ii) (i) (iv) (iii)
(2) (iii) (iv) (i) (ii)
(3) (iv) (iii) (ii) (i)
(4) (i) (ii) (iii) (iv)

162. Which one of the followings has maximum number of atoms?
(1) 1 g of Mg(s) [Atomic mass of Mg = 24]
(2) 1 g of O₂(g) [Atomic mass of O = 16]
(3) 1 g of Li(s) [Atomic mass of Li = 7]
(4) 1 g of Ag(s) [Atomic mass of Ag = 108]

163. Which of the following is a basic amino acid?
(1) Alanine
(2) Tyrosine
(3) Lysine
(4) Serine

164. The calculated spin only magnetic moment of Cr²⁺ ion is:
(1) 4.90 BM
(2) 5.92 BM
(3) 2.84 BM
(4) 3.87 BM

165. Sucrose on hydrolysis gives:
(1) α-D-Glucose + β-D-Glucose
(2) α-D-Glucose + β-D-Fructose
(3) α-D-Fructose + β-D-Glucose
(4) β-D-Glucose + α-D-Fructose

166. The mixture which shows positive deviation from Raoult’s law is:
(1) Benzene + Toluene
(2) Acetone + Chloroform
(3) Chloroethane + Bromoethane
(4) Ethanol + Acetone

167. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following?
(1) + R effect of −CH₃ groups
(2) − R effect of −CH₃ groups
(3) Hyperconjugation
(4) − I effect of −CH₃ groups

168. Find out the solubility of Ni(OH)₂ in 0.1 M NaOH. Given that the ionic product of Ni(OH)₂ is 2 × 10⁻¹⁵.
(1) 2 × 10⁻⁸ M
(2) 1 × 10⁻¹³ M
(3) 1 × 10⁸ M
(4) 2 × 10⁻¹³ M

169. Which of the following is a cationic detergent?
(1) Sodium stearate
(2) Cetyltrimethyl ammonium bromide
(3) Sodium dodecylbenzene sulphonate
(4) Sodium lauryl sulphate

170. The freezing point depression constant (K_f) of benzene is 5.12 K kg mol⁻¹. The freezing point depression for the solution of molality 0.078 m containing a non-electrolyte solute in benzene is (rounded off upto two decimal places):
(1) 0.80 K
(2) 0.40 K
(3) 0.60 K
(4) 0.20 K
171. Identify the incorrect statement.

(1) The transition metals and their compounds are known for their catalytic activity due to their ability to adopt multiple oxidation states and to form complexes.

(2) Interstitial compounds are those that are formed when small atoms like H, C or N are trapped inside the crystal lattices of metals.

(3) The oxidation states of chromium in $\text{CrO}_4^{2-}$ and $\text{Cr}_2\text{O}_7^{2-}$ are not the same.

(4) $\text{Cr}^{2+}(d^4)$ is a stronger reducing agent than $\text{Fe}^{2+}(d^6)$ in water.

172. Which of the following is not correct about carbon monoxide?

(1) It reduces oxygen carrying ability of blood.

(2) The carboxyhaemoglobin (haemoglobin bound to CO) is less stable than oxyhaemoglobin.

(3) It is produced due to incomplete combustion.

(4) It forms carboxyhaemoglobin.

173. Hydrolysis of sucrose is given by the following reaction.

$$\text{Sucrose} + \text{H}_2\text{O} \rightleftharpoons \text{Glucose} + \text{Fructose}$$

If the equilibrium constant ($K_c$) is $2 \times 10^{13}$ at 300 K, the value of $\Delta_r G^0$ at the same temperature will be:

(1) $8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$

(2) $8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})$

(3) $-8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(4 \times 10^{13})$

(4) $-8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$

174. Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?

(1) $\text{SCN}^- < \text{F}^- < \text{CN}^- < \text{C}_2\text{O}_4^{2-}$

(2) $\text{F}^- < \text{SCN}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$

(3) $\text{CN}^- < \text{C}_2\text{O}_4^{2-} < \text{SCN}^- < \text{F}^-$

(4) $\text{SCN}^- < \text{F}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$

175. Identify compound X in the following sequence of reactions:

```
CH₃Cl₂
Cl₂/hv
X
H₂O → 373 K

CH₂Cl

CHCl₂

CCl₃

(1) (2) (3) (4)
```

176. The correct option for free expansion of an ideal gas under adiabatic condition is:

(1) $q = 0$, $\Delta T < 0$ and $w > 0$

(2) $q < 0$, $\Delta T = 0$ and $w = 0$

(3) $q > 0$, $\Delta T > 0$ and $w > 0$

(4) $q = 0$, $\Delta T = 0$ and $w = 0$
177. The number of Faradays (F) required to produce 20 g of calcium from molten CaCl\(_2\) (Atomic mass of Ca = 40 g mol\(^{-1}\)) is:

(1) 2  
(2) 3  
(3) 4  
(4) 1

178. HCl was passed through a solution of CaCl\(_2\), MgCl\(_2\) and NaCl. Which of the following compound(s) crystallise(s)?

(1) Only NaCl  
(2) Only MgCl\(_2\)  
(3) NaCl, MgCl\(_2\) and CaCl\(_2\)  
(4) Both MgCl\(_2\) and CaCl\(_2\)

179. Anisole on cleavage with HI gives:

(1) \( + \text{CH}_3\text{OH} \)  
(2) \( + \text{C}_2\text{H}_5\text{I} \)  
(3) \( + \text{C}_2\text{H}_5\text{OH} \)  
(4) \( + \text{CH}_3\text{I} \)

180. Which of the following amine will give the carbylamine test?

(1) \( \text{NHCH}_3 \)

(2) \( \text{N(CH}_3)_2 \)

(3) \( \text{NHC}_2\text{H}_5 \)

(4) \( \text{-o o o-} \)
Space For Rough Work
Space For Rough Work
Important Instructions:

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on side-1 and side-2 carefully with blue/black ball point pen only.

2. The test is of 3 hours duration and Test Booklet contains 180 questions. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 720.

3. Use Blue/Black Ball Point Pen only for writing particulars on this page/marking responses.

4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.

5. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.

6. The CODE for this Booklet is H3. Make sure that the CODE printed on Side-2 of the Answer Sheet is the same as that on this Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.

7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.

8. Use of white fluid for correction is NOT permissible on the Answer Sheet.

9. Each candidate must show on demand his/her Admit Card to the Invigilator.

10. No candidate, without special permission of the Superintendent or Invigilator, would leave his/her seat.

11. 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 the Answer Sheet and dealt with as an unfair means case.

12. Use of Electronic/Manual Calculator is prohibited.

13. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.

14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet/Answer Sheet in the Attendance Sheet.

Name of the Candidate (in Capitals):

Roll Number: in figures
            : in words

Centre of Examination (in Capitals):

Candidate’s Signature: __________________ Invigilator’s Signature: __________________

Facsimile signature stamp of

Centre Superintendent: __________________
1. The color code of a resistance is given below:

```
Yellow  Violet  Brown  Gold
```

The values of resistance and tolerance, respectively, are:

(1) 470 Ω, 5%
(2) 470 kΩ, 5%
(3) 47 kΩ, 10%
(4) 4.7 kΩ, 5%

2. Find the torque about the origin when a force of 3\(\hat{j}\) N acts on a particle whose position vector is 2\(\hat{k}\) m.

(1) 6\(\hat{k}\) N m
(2) 6\(\hat{i}\) N m
(3) 6\(\hat{j}\) N m
(4) −6\(\hat{i}\) N m

3. A cylinder contains hydrogen gas at pressure of 249 kPa and temperature 27°C.

Its density is: \((R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1})\)

(1) 0.02 kg/m³
(2) 0.5 kg/m³
(3) 0.2 kg/m³
(4) 0.1 kg/m³

4. Two cylinders A and B of equal capacity are connected to each other via a stop cock. A contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is:

(1) isobaric
(2) isothermal
(3) adiabatic
(4) isochoric

5. Two particles of mass 5 kg and 10 kg respectively are attached to the two ends of a rigid rod of length 1 m with negligible mass.

The centre of mass of the system from the 5 kg particle is nearly at a distance of:

(1) 80 cm
(2) 33 cm
(3) 50 cm
(4) 67 cm

6. A ray is incident at an angle of incidence \(i\) on one surface of a small angle prism (with angle of prism \(A\)) and emerges normally from the opposite surface. If the refractive index of the material of the prism is \(\mu\), then the angle of incidence is nearly equal to:

(1) \(\frac{\mu A}{2}\)
(2) \(\frac{A}{2\mu}\)
(3) \(\frac{2A}{\mu}\)
(4) \(\mu A\)

7. A body weighs 72 N on the surface of the earth. What is the gravitational force on it, at a height equal to half the radius of the earth?

(1) 24 N
(2) 48 N
(3) 32 N
(4) 30 N

8. An iron rod of susceptibility 599 is subjected to a magnetising field of 1200 A m\(^{-1}\). The permeability of the material of the rod is:

\((\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1})\)

(1) \(2.4\pi \times 10^{-7} \text{ T m A}^{-1}\)
(2) \(2.4\pi \times 10^{-4} \text{ T m A}^{-1}\)
(3) \(8.0 \times 10^{-5} \text{ T m A}^{-1}\)
(4) \(2.4\pi \times 10^{-5} \text{ T m A}^{-1}\)

9. For transistor action, which of the following statements is correct?

(1) The base region must be very thin and lightly doped.
(2) Base, emitter and collector regions should have same doping concentrations.
(3) Base, emitter and collector regions should have same size.
(4) Both emitter junction as well as the collector junction are forward biased.
10. Light with an average flux of $20 \text{ W/cm}^2$ falls on a non-reflecting surface at normal incidence having surface area $20 \text{ cm}^2$. The energy received by the surface during time span of 1 minute is:

(1) $48 \times 10^3 \text{ J}$

(2) $10 \times 10^3 \text{ J}$

(3) $12 \times 10^3 \text{ J}$

(4) $24 \times 10^3 \text{ J}$

11. A short electric dipole has a dipole moment of $16 \times 10^{-9} \text{ C m}$. The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of 60° with the dipole axis is:

\[
\left( \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2 \right)
\]

(1) zero

(2) 50 V

(3) 200 V

(4) 400 V

12. A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is:

(1) 300 m

(2) 360 m

(3) 340 m

(4) 320 m

13. A resistance wire connected in the left gap of a metre bridge balances a $10 \Omega$ resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of 1 Ω of the resistance wire is:

(1) $1.5 \times 10^{-2} \text{ m}$

(2) $1.0 \times 10^{-2} \text{ m}$

(3) $1.0 \times 10^{-1} \text{ m}$

(4) $1.5 \times 10^{-1} \text{ m}$

14. When a uranium isotope $^{235}_{92}\text{U}$ is bombarded with a neutron, it generates $^{88}_{36}\text{Kr}$, three neutrons and:

(1) $^{103}_{36}\text{Kr}$

(2) $^{144}_{56}\text{Ba}$

(3) $^{91}_{40}\text{Zr}$

(4) $^{101}_{36}\text{Kr}$

15. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is:

\[
(\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1})
\]

(1) $3.14 \times 10^{-5} \text{ T}$

(2) $6.28 \times 10^{-4} \text{ T}$

(3) $3.14 \times 10^{-4} \text{ T}$

(4) $6.28 \times 10^{-5} \text{ T}$

16. The average thermal energy for a mono-atomic gas is:

(1) $\frac{7}{2} k_B T$

(2) $\frac{1}{2} k_B T$

(3) $\frac{3}{2} k_B T$

(4) $\frac{5}{2} k_B T$

17. A capillary tube of radius $r$ is immersed in water and water rises in it to a height $h$. The mass of the water in the capillary is 5 g. Another capillary tube of radius $2r$ is immersed in water. The mass of water that will rise in this tube is:

(1) 20.0 g

(2) 2.5 g

(3) 5.0 g

(4) 10.0 g
18. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is: \( c = \text{speed of electromagnetic waves} \)

<table>
<thead>
<tr>
<th>Option</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>1 : ( c^2 )</td>
</tr>
<tr>
<td>(2)</td>
<td>( c : 1 )</td>
</tr>
<tr>
<td>(3)</td>
<td>1 : 1</td>
</tr>
<tr>
<td>(4)</td>
<td>1 : ( c )</td>
</tr>
</tbody>
</table>

19. Assume that light of wavelength 600 nm is coming from a star. The limit of resolution of telescope whose objective has a diameter of 2 m is:

<table>
<thead>
<tr>
<th>Option</th>
<th>Limit of Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>( 6.00 \times 10^{-7} ) rad</td>
</tr>
<tr>
<td>(2)</td>
<td>( 3.66 \times 10^{-7} ) rad</td>
</tr>
<tr>
<td>(3)</td>
<td>( 1.83 \times 10^{-7} ) rad</td>
</tr>
<tr>
<td>(4)</td>
<td>( 7.32 \times 10^{-7} ) rad</td>
</tr>
</tbody>
</table>

20. A wire of length \( L \), area of cross section \( A \) is hanging from a fixed support. The length of the wire changes to \( L_1 \) when mass \( M \) is suspended from its free end. The expression for Young’s modulus is:

<table>
<thead>
<tr>
<th>Option</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>( \frac{MgL}{A(L_1 - L)} )</td>
</tr>
<tr>
<td>(2)</td>
<td>( \frac{MgL_1}{AL} )</td>
</tr>
<tr>
<td>(3)</td>
<td>( \frac{Mg(L_1 - L)}{AL} )</td>
</tr>
<tr>
<td>(4)</td>
<td>( \frac{MgL}{AL_1} )</td>
</tr>
</tbody>
</table>

21. The energy required to break one bond in DNA is \( 10^{-20} \) J. This value in eV is nearly:

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>0.006</td>
</tr>
<tr>
<td>(2)</td>
<td>6</td>
</tr>
<tr>
<td>(3)</td>
<td>0.6</td>
</tr>
<tr>
<td>(4)</td>
<td>0.06</td>
</tr>
</tbody>
</table>

22. In a certain region of space with volume \( 0.2 \) m\(^3\), the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is:

<table>
<thead>
<tr>
<th>Option</th>
<th>Field Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>5 N/C</td>
</tr>
<tr>
<td>(2)</td>
<td>zero</td>
</tr>
<tr>
<td>(3)</td>
<td>0.5 N/C</td>
</tr>
<tr>
<td>(4)</td>
<td>1 N/C</td>
</tr>
</tbody>
</table>

23. The mean free path for a gas, with molecular diameter \( d \) and number density \( n \) can be expressed as:

<table>
<thead>
<tr>
<th>Option</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>( \frac{1}{\sqrt{2} n^2 \pi^2 d^2} )</td>
</tr>
<tr>
<td>(2)</td>
<td>( \frac{1}{\sqrt{2} n \pi d} )</td>
</tr>
<tr>
<td>(3)</td>
<td>( \frac{1}{\sqrt{2} \pi d^2} )</td>
</tr>
<tr>
<td>(4)</td>
<td>( \frac{1}{\sqrt{2} n^2 \pi d^2} )</td>
</tr>
</tbody>
</table>

24. An electron is accelerated from rest through a potential difference of \( V \) volt. If the de Broglie wavelength of the electron is \( 1.227 \times 10^{-2} \) nm, the potential difference is:

<table>
<thead>
<tr>
<th>Option</th>
<th>Potential Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>( 10^4 ) V</td>
</tr>
<tr>
<td>(2)</td>
<td>10 V</td>
</tr>
<tr>
<td>(3)</td>
<td>( 10^2 ) V</td>
</tr>
<tr>
<td>(4)</td>
<td>( 10^3 ) V</td>
</tr>
</tbody>
</table>

25. In a guitar, two strings A and B made of same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency increases to 7 Hz. If the frequency of A is 530 Hz, the original frequency of B will be:

<table>
<thead>
<tr>
<th>Option</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>537 Hz</td>
</tr>
<tr>
<td>(2)</td>
<td>523 Hz</td>
</tr>
<tr>
<td>(3)</td>
<td>524 Hz</td>
</tr>
<tr>
<td>(4)</td>
<td>536 Hz</td>
</tr>
</tbody>
</table>

26. A 40 \( \mu \)F capacitor is connected to a 200 V, 50 Hz ac supply. The rms value of the current in the circuit is, nearly:

<table>
<thead>
<tr>
<th>Option</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>25.1 A</td>
</tr>
<tr>
<td>(2)</td>
<td>1.7 A</td>
</tr>
<tr>
<td>(3)</td>
<td>2.05 A</td>
</tr>
<tr>
<td>(4)</td>
<td>2.5 A</td>
</tr>
</tbody>
</table>

27. The increase in the width of the depletion region in a p-n junction diode is due to:

<table>
<thead>
<tr>
<th>Option</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>increase in forward current</td>
</tr>
<tr>
<td>(2)</td>
<td>forward bias only</td>
</tr>
<tr>
<td>(3)</td>
<td>reverse bias only</td>
</tr>
<tr>
<td>(4)</td>
<td>both forward bias and reverse bias</td>
</tr>
</tbody>
</table>
28. The Brewsters angle $i_b$ for an interface should be:
(1) $i_b = 90^\circ$
(2) $0^\circ < i_b < 30^\circ$
(3) $30^\circ < i_b < 45^\circ$
(4) $45^\circ < i_b < 90^\circ$

29. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is:
(1) zero
(2) $\pi$ rad
(3) $\frac{3\pi}{2}$ rad
(4) $\frac{\pi}{2}$ rad

30. A spherical conductor of radius 10 cm has a charge of $3.2 \times 10^{-7}$ C distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere?
$$\left(\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2\right)$$
(1) $1.28 \times 10^7 \text{ N/C}$
(2) $1.28 \times 10^4 \text{ N/C}$
(3) $1.28 \times 10^5 \text{ N/C}$
(4) $1.28 \times 10^6 \text{ N/C}$

31. The capacitance of a parallel plate capacitor with air as medium is 6 $\mu$F. With the introduction of a dielectric medium, the capacitance becomes 30 $\mu$F. The permittivity of the medium is:
$$\varepsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$$
(1) $5.00 \times 10^{-1} \text{ m}^{-2}$
(2) $0.44 \times 10^{-13} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
(3) $1.77 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
(4) $0.44 \times 10^{-10} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$

32. Taking into account of the significant figures, what is the value of 9.99 m − 0.0099 m?
(1) 9.9 m
(2) 9.9801 m
(3) 9.98 m
(4) 9.980 m

33. A series LCR circuit is connected to an ac voltage source. When L is removed from the circuit, the phase difference between current and voltage is $\frac{\pi}{3}$. If instead C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$ between current and voltage. The power factor of the circuit is:
(1) −1.0
(2) zero
(3) 0.5
(4) 1.0

34. Dimensions of stress are:
(1) $[\text{ML}^{-1}\text{T}^{-2}]$
(2) $[\text{MLT}^{-2}]$
(3) $[\text{ML}^2\text{T}^{-2}]$
(4) $[\text{ML}^0\text{T}^{-2}]$

35. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled?
(1) zero
(2) doubled
(3) four times
(4) one-fourth

36. The solids which have the negative temperature coefficient of resistance are:
(1) insulators and semiconductors
(2) metals
(3) insulators only
(4) semiconductors only

37. A charged particle having drift velocity of $7.5 \times 10^{-4} \text{ m s}^{-1}$ in an electric field of $3 \times 10^{-10} \text{ Vm}^{-1}$, has a mobility in $\text{m}^2 \text{ V}^{-1} \text{ s}^{-1}$ of:
(1) $2.25 \times 10^{-15}$
(2) $2.25 \times 10^{15}$
(3) $2.5 \times 10^6$
(4) $2.5 \times 10^{-6}$
38. Which of the following graph represents the variation of resistivity ($\rho$) with temperature ($T$) for copper?

(1) ![Graph 1](image1.png)

(2) ![Graph 2](image2.png)

(3) ![Graph 3](image3.png)

(4) ![Graph 4](image4.png)

39. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is:

![Pulley Diagram](image5.png)

(1) g/10
(2) g
(3) g/2
(4) g/5

40. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is:

(1) 1.0 mm
(2) 0.01 mm
(3) 0.25 mm
(4) 0.5 mm

41. In Young's double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes:

(1) one-fourth
(2) double
(3) half
(4) four times

42. For the logic circuit shown, the truth table is:

![Logic Circuit](image6.png)

(1) $A \ B \ Y$
0 0 1
0 1 0
1 0 0
1 1 0

(2) $A \ B \ Y$
0 0 0
0 1 0
1 0 0
1 1 1

(3) $A \ B \ Y$
0 0 0
0 1 1
1 0 1
1 1 1

(4) $A \ B \ Y$
0 0 1
0 1 1
1 0 1
1 1 0

43. The energy equivalent of 0.5 g of a substance is:

(1) $0.5 \times 10^{13}$ J
(2) $4.5 \times 10^{16}$ J
(3) $4.5 \times 10^{13}$ J
(4) $1.5 \times 10^{13}$ J

44. For which one of the following, Bohr model is not valid?

(1) Singly ionised neon atom (Ne$^+$)
(2) Hydrogen atom
(3) Singly ionised helium atom (He$^+$)
(4) Deuteron atom
45. The quantities of heat required to raise the temperature of two solid copper spheres of radii \( r_1 \) and \( r_2 \) \((r_1 = 1.5 \times r_2)\) through 1 K are in the ratio:

(1) \( \frac{5}{3} \)

(2) \( \frac{27}{8} \)

(3) \( \frac{9}{4} \)

(4) \( \frac{3}{2} \)

46. The transverse section of a plant shows following anatomical features:

(a) Large number of scattered vascular bundles surrounded by bundle sheath.

(b) Large conspicuous parenchymatous ground tissue.

(c) Vascular bundles conjoint and closed.

(d) Phloem parenchyma absent.

Identify the category of plant and its part:

(1) Dicotyledonous root

(2) Monocotyledonous stem

(3) Monocotyledonous root

(4) Dicotyledonous stem

47. Which of the following would help in prevention of diuresis?

(1) Decrease in secretion of renin by JG cells

(2) More water reabsorption due to undersecretion of ADH

(3) Reabsorption of \( \text{Na}^+ \) and water from renal tubules due to aldosterone

(4) Atrial natriuretic factor causes vasoconstriction

48. Which of the following statements is not correct?

(1) Genetically engineered insulin is produced in E. Coli.

(2) In man insulin is synthesised as a proinsulin.

(3) The proinsulin has an extra peptide called C-peptide.

(4) The functional insulin has A and B chains linked together by hydrogen bonds.

49. Embryological support for evolution was disapproved by:

(1) Oparin

(2) Karl Ernst von Baer

(3) Alfred Wallace

(4) Charles Darwin

50. Goblet cells of alimentary canal are modified from:

(1) Compound epithelial cells

(2) Squamous epithelial cells

(3) Columnar epithelial cells

(4) Chondrocytes

51. The QRS complex in a standard ECG represents:

(1) Repolarisation of ventricles

(2) Repolarisation of auricles

(3) Depolarisation of auricles

(4) Depolarisation of ventricles

52. In light reaction, plastoquinone facilitates the transfer of electrons from:

(1) PS-I to ATP synthase

(2) PS-II to Cytb\(6f\) complex

(3) Cytb\(6f\) complex to PS-I

(4) PS-I to NADP\(^+\)

53. The product(s) of reaction catalyzed by nitrogenase in root nodules of leguminous plants is/are:

(1) Ammonia and hydrogen

(2) Ammonia alone

(3) Nitrate alone

(4) Ammonia and oxygen

54. Match the following with respect to meiosis:

(a) Zygotene  (i)  Terminalization

(b) Pachytene  (ii)  Chiasmata

(c) Diplotene  (iii)  Crossing over

(d) Diakinesis  (iv)  Synapsis

Select the correct option from the following:

\[
\begin{array}{cccc}
(a) & (b) & (c) & (d) \\
(1) & (ii) & (iv) & (i) \\
(2) & (iii) & (iv) & (i) \\
(3) & (iv) & (iii) & (i) \\
(4) & (i) & (ii) & (iv) \\
\end{array}
\]
55. Match the following columns and select the **correct** option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 6 - 15 pairs of gill slits</td>
<td>(i) <em>Trygon</em></td>
</tr>
<tr>
<td>(b) Heterocercal caudal fin</td>
<td>(ii) Cyclostomes</td>
</tr>
<tr>
<td>(c) Air Bladder</td>
<td>(iii) Chondrichthyes</td>
</tr>
<tr>
<td>(d) Poison sting</td>
<td>(iv) Osteichthyes</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)

1. (i) (iv) (iii) (ii)
2. (ii) (iii) (iv) (i)
3. (iii) (iv) (i) (ii)
4. (iv) (ii) (iii) (i)

56. Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells?

1. Polysomes
2. Endoplasmic reticulum
3. Peroxisomes
4. Golgi bodies

57. Match the organism with its use in biotechnology.

| (a) Bacillus thuringiensis      | (i) Cloning vector               |
| (b) Thermus aquaticus          | (ii) Construction of first rDNA molecule |
| (c) Agrobacterium tumefaciens  | (iii) DNA polymerase              |
| (d) Salmonella typhimurium     | (iv) Cry proteins                 |

Select the **correct** option from the following:

(a) (b) (c) (d)

1. (iii) (iv) (i) (ii)
2. (ii) (iv) (iii) (i)
3. (iii) (i) (iv) (ii)
4. (iii) (iv) (i) (ii)

59. Match the following:

(a) Inhibitor of catalytic activity
(b) Possess peptide bonds
(c) Cell wall material in fungi
(d) Secondary metabolite

Choose the **correct** option from the following:

(a) (b) (c) (d)

1. (ii) (iii) (i) (iv)
2. (ii) (iv) (iii) (i)
3. (iii) (i) (iv) (ii)
4. (iii) (iv) (i) (ii)

60. Bilaterally symmetrical and acelomate animals are exemplified by:

1. Annelida
2. Ctenophora
3. Platyhelminthes
4. Aschelminthes

61. Floridean starch has structure similar to:

1. Laminarin and cellulose
2. Starch and cellulose
3. Amylopectin and glycogen
4. Mannitol and algin

62. Identify the **correct** statement with regard to G1 phase (Gap 1) of interphase.

1. Nuclear Division takes place.
2. DNA synthesis or replication takes place.
3. Reorganisation of all cell components takes place.
4. Cell is metabolically active, grows but does not replicate its DNA.

63. If the head of cockroach is removed, it may live for few days because:

1. the head holds a 1/3rd of a nervous system while the rest is situated along the dorsal part of its body.
2. the supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen.
3. the cockroach does not have nervous system.
4. the head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.
The enzyme enterokinase helps in conversion of:
(1) pepsinogen into pepsin
(2) protein into polypeptides
(3) trypsinogen into trypsin
(4) casenogen into casein

Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Organ of Corti</td>
<td>(i) Connects middle ear and pharynx</td>
</tr>
<tr>
<td>(b) Cochlea</td>
<td>(ii) Coiled part of the labyrinth</td>
</tr>
<tr>
<td>(c) Eustachian tube</td>
<td>(iii) Attached to the oval window</td>
</tr>
<tr>
<td>(d) Stapes</td>
<td>(iv) Located on the basilar membrane</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (i) (ii) (iv) (iii)
(2) (ii) (iii) (i) (iv)
(3) (iii) (i) (iv) (ii)
(4) (iv) (ii) (i) (iii)

Identify the wrong statement with reference to transport of oxygen.
(1) Low pCO\textsubscript{2} in alveoli favours the formation of oxyhaemoglobin.
(2) Binding of oxygen with haemoglobin is mainly related to partial pressure of O\textsubscript{2}.
(3) Partial pressure of CO\textsubscript{2} can interfere with O\textsubscript{2} binding with haemoglobin.
(4) Higher H\textsuperscript{+} conc. in alveoli favours the formation of oxyhaemoglobin.

In water hyacinth and water lily, pollination takes place by:
(1) insects and water
(2) insects or wind
(3) water currents only
(4) wind and water

Bt cotton variety that was developed by the introduction of toxin gene of *Bacillus thuringiensis* (Bt) is resistant to:
(1) Insect predators
(2) Insect pests
(3) Fungal diseases
(4) Plant nematodes

Select the correct statement.
(1) Insulin is associated with hyperglycemia.
(2) Glucocorticoids stimulate gluconeogenesis.
(3) Glucagon is associated with hypoglycemia.
(4) Insulin acts on pancreatic cells and adipocytes.

Identify the basic amino acid from the following.
(1) Valine
(2) Tyrosine
(3) Glutamic Acid
(4) Lysine

Flippers of Penguins and Dolphins are examples of:
(1) Natural selection
(2) Adaptive radiation
(3) Convergent evolution
(4) Industrial melanism

From his experiments, S.L. Miller produced amino acids by mixing the following in a closed flask:
(1) CH\textsubscript{3}, H\textsubscript{2}, NH\textsubscript{3} and water vapor at 600°C
(2) CH\textsubscript{4}, H\textsubscript{2}, NH\textsubscript{3} and water vapor at 800°C
(3) CH\textsubscript{3}, H\textsubscript{2}, NH\textsubscript{4} and water vapor at 800°C
(4) CH\textsubscript{4}, H\textsubscript{2}, NH\textsubscript{3} and water vapor at 600°C

The specific palindromic sequence which is recognized by EcoRI is:
(1) 5' - GGATCC - 3'
   3' - CCTAGG - 5'
(2) 5' - GAATTC - 3'
   3' - CTTAAG - 5'
(3) 5' - GGAACC - 3'
   3' - CCTTGG - 5'
(4) 5' - CTTAAG - 3'
   3' - GAATTC - 5'

Secondary metabolites such as nicotine, strychnine and caffeine are produced by plants for their:
(1) Effect on reproduction
(2) Nutritive value
(3) Growth response
(4) Defence action
75. Presence of which of the following conditions in urine are indicative of Diabetes Mellitus?
(1) Renal calculi and Hyperglycaemia
(2) Uremia and Ketonuria
(3) Uremia and Renal Calculi
(4) Ketonuria and Glycosuria

76. Which of the following statements are true for the phylum-Chordata?
(a) In Urochordata notochord extends from head to tail and it is present throughout their life.
(b) In Vertebrata notochord is present during the embryonic period only.
(c) Central nervous system is dorsal and hollow.
(d) Chordata is divided into 3 subphyla: Hemichordata, Tunicata and Cephalochordata.
(1) (b) and (c)
(2) (d) and (c)
(3) (c) and (a)
(4) (a) and (b)

77. Cuboidal epithelium with brush border of microvilli is found in:
(1) eustachian tube
(2) lining of intestine
(3) ducts of salivary glands
(4) proximal convoluted tubule of nephron

78. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Clostridium butylicum</td>
<td>(i) Cyclosporin-A</td>
</tr>
<tr>
<td>(b) Trichoderma polysporum</td>
<td>(ii) Butyric Acid</td>
</tr>
<tr>
<td>(c) Monascus purpureus</td>
<td>(iii) Citric Acid</td>
</tr>
<tr>
<td>(d) Aspergillus niger</td>
<td>(iv) Blood cholesterol</td>
</tr>
<tr>
<td></td>
<td>lowering agent</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (iv) (iii) (ii) (i)
(2) (iii) (iv) (ii) (i)
(3) (ii) (i) (iv) (iii)
(4) (i) (ii) (iv) (iii)

79. Which of the following is correct about viroids?
(1) They have free DNA without protein coat.
(2) They have RNA with protein coat.
(3) They have free RNA without protein coat.
(4) They have DNA with protein coat.

80. The body of the ovule is fused within the funicle at:
(1) Chalaza
(2) Hilum
(3) Micropyle
(4) Nucellus

81. The oxygenation activity of RuBisCo enzyme in photorespiration leads to the formation of:
(1) 1 molecule of 4-C compound and 1 molecule of 2-C compound
(2) 2 molecules of 3-C compound
(3) 1 molecule of 3-C compound
(4) 1 molecule of 6-C compound

82. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Eosinophils</td>
<td>(i) Immune response</td>
</tr>
<tr>
<td>(b) Basophils</td>
<td>(ii) Phagocytosis</td>
</tr>
<tr>
<td>(c) Neutrophils</td>
<td>(iii) Release histaminase, destructive enzymes</td>
</tr>
<tr>
<td>(d) Lymphocytes</td>
<td>(iv) Release granules containing histamine</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)
(1) (ii) (i) (iii) (iv)
(2) (iii) (iv) (ii) (i)
(3) (iv) (i) (ii) (iii)
(4) (i) (ii) (iv) (iii)

83. Which of the following hormone levels will cause release of ovum (ovulation) from the graffian follicle?
(1) Low concentration of FSH
(2) High concentration of Estrogen
(3) High concentration of Progesterone
(4) Low concentration of LH
84. Select the **correct** events that occur during inspiration.
   (a) Contraction of diaphragm
   (b) Contraction of external inter-costal muscles
   (c) Pulmonary volume decreases
   (d) Intra pulmonary pressure increases
   (1) only (d)
   (2) (a) and (b)
   (3) (c) and (d)
   (4) (a), (b) and (d)

85. In which of the following techniques, the embryos are transferred to assist those females who cannot conceive ?
   (1) GIFT and ICSI
   (2) ZIFT and IUT
   (3) GIFT and ZIFT
   (4) ICSI and ZIFT

86. The infectious stage of *Plasmodium* that enters the human body is :
   (1) Male gametocytes
   (2) Trophozoites
   (3) Sporozoites
   (4) Female gametocytes

87. Match the following columns and select the **correct** option.

   **Column - I** | **Column - II**
   (a) Placenta | (i) Androgens
   (b) Zona pellucida | (ii) Human Chorionic Gonadotropin (hCG)
   (c) Bulbo-urethral glands | (iii) Layer of the ovum
   (d) Leydig cells | (iv) Lubrication of the Penis

   (a) (b) (c) (d)
   (1) (ii) (iii) (iv) (i)
   (2) (iv) (iii) (i) (ii)
   (3) (i) (iv) (ii) (iii)
   (4) (iii) (ii) (iv) (i)

88. Select the **correct** match.
   (1) Thalassemia - X linked
   (2) Haemophilia - Y linked
   (3) Phenylketonuria - Autosomal dominant trait
   (4) Sickle cell anaemia - Autosomal recessive trait, chromosome-11

89. Which of the following statements is **correct**?
   (1) Adenine does not pair with thymine.
   (2) Adenine pairs with thymine through two H-bonds.
   (3) Adenine pairs with thymine through one H-bond.
   (4) Adenine pairs with thymine through three H-bonds.

90. Which one of the following is the most abundant protein in the animals ?
   (1) Insulin
   (2) Haemoglobin
   (3) Collagen
   (4) Lectin

91. Which of the following pairs is of unicellular algae ?
   (1) *Chlorella* and *Spirulina*
   (2) *Laminaria* and *Sargassum*
   (3) *Gelidium* and *Gracilaria*
   (4) *Anabaena* and *Volvox*

92. The plant parts which consist of two generations - one within the other :
   (a) Pollen grains inside the anther
   (b) Germinated pollen grain with two male gametes
   (c) Seed inside the fruit
   (d) Embryo sac inside the ovule

   (1) (a) and (d)
   (2) (a) only
   (3) (a), (b) and (c)
   (4) (c) and (d)

93. Identify the **incorrect** statement.
   (1) Due to deposition of tannins, resins, oils etc., heart wood is dark in colour.
   (2) Heart wood does not conduct water but gives mechanical support.
   (3) Sapwood is involved in conduction of water and minerals from root to leaf.
   (4) Sapwood is the innermost secondary xylem and is lighter in colour.
112. By which method was a new breed ‘Hisardale’ of sheep formed by using Bikaneri ewes and Marino rams?

(1) Inbreeding
(2) Out crossing
(3) Mutational breeding
(4) Cross breeding

113. Some dividing cells exit the cell cycle and enter vegetative inactive stage. This is called quiescent stage (G_0). This process occurs at the end of:

(1) G_2 phase
(2) M phase
(3) G_1 phase
(4) S phase

114. Identify the correct statement with reference to human digestive system.

(1) Vermiform appendix arises from duodenum.
(2) Ileum opens into small intestine.
(3) Serosa is the innermost layer of the alimentary canal.
(4) Ileum is a highly coiled part.

115. Which of the following refer to correct example(s) of organisms which have evolved due to changes in environment brought about by anthropogenic action?

(a) Darwin’s Finches of Galapagos islands.
(b) Herbicide resistant weeds.
(c) Drug resistant eukaryotes.
(d) Man-created breeds of domesticated animals like dogs.

(1) only (d)
(2) only (a)
(3) (a) and (c)
(4) (b), (c) and (d)

116. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Pituitary gland</td>
<td>(i) Grave’s disease</td>
</tr>
<tr>
<td>(b) Thyroid gland</td>
<td>(ii) Diabetes mellitus</td>
</tr>
<tr>
<td>(c) Adrenal gland</td>
<td>(iii) Diabetes insipidus</td>
</tr>
<tr>
<td>(d) Pancreas</td>
<td>(iv) Addison’s disease</td>
</tr>
</tbody>
</table>

117. Select the option including all sexually transmitted diseases.

(1) Cancer, AIDS, Syphilis
(2) Gonorrhoea, Syphilis, Genital herpes
(3) Gonorrhoea, Malaria, Genital herpes
(4) AIDS, Malaria, Filaria

118. The number of substrate level phosphorylations in one turn of citric acid cycle is:

(1) Three
(2) Zero
(3) One
(4) Two

119. Montreal protocol was signed in 1987 for control of:

(1) Disposal of e-wastes
(2) Transport of Genetically modified organisms from one country to another
(3) Emission of ozone depleting substances
(4) Release of Green House gases
102. Match the following concerning essential elements and their functions in plants:

(a) Iron (i) Photolysis of water
(b) Zinc (ii) Pollen germination
(c) Boron (iii) Required for chlorophyll biosynthesis
(d) Manganese (iv) IAA biosynthesis

Select the correct option:

(a) (b) (c) (d)

(1) (iv) (i) (ii) (iii)
(2) (ii) (i) (iv) (iii)
(3) (iv) (iii) (ii) (i)
(4) (iii) (iv) (ii) (i)

103. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Gregarious, polyphagous (i) Asterias pest</td>
<td></td>
</tr>
<tr>
<td>(b) Adult with radial symmetry and larva with bilateral symmetry (ii) Scorpion</td>
<td></td>
</tr>
<tr>
<td>(c) Book lungs (iii) Ctenoplana</td>
<td></td>
</tr>
<tr>
<td>(d) Bioluminescence (iv) Locusta</td>
<td></td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)

(1) (ii) (i) (iii) (iv)
(2) (i) (iii) (ii) (iv)
(3) (iv) (i) (ii) (iii)
(4) (iii) (ii) (i) (iv)

104. According to Robert May, the global species diversity is about:

(1) 7 million
(2) 1.5 million
(3) 20 million
(4) 50 million

105. Ray florets have:

(1) Half inferior ovary
(2) Inferior ovary
(3) Superior ovary
(4) Hypogynous ovary

106. If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is $6.6 \times 10^9$ bp, then the length of the DNA is approximately:

(1) 2.7 meters
(2) 2.0 meters
(3) 2.5 meters
(4) 2.2 meters

107. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Bt cotton (i)</td>
<td>Gene therapy</td>
</tr>
<tr>
<td>(b) Adenosine deaminase deficiency (ii)</td>
<td>Cellular defence</td>
</tr>
<tr>
<td>(c) RNAi (iii)</td>
<td>Detection of HIV infection</td>
</tr>
<tr>
<td>(d) PCR (iv)</td>
<td>Bacillus thuringiensis</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)

(1) (i) (ii) (iii) (iv)
(2) (iv) (i) (ii) (iii)
(3) (iii) (ii) (i) (iv)
(4) (ii) (iii) (iv) (i)

108. Match the trophic levels with their correct species examples in grassland ecosystem.

(a) Fourth trophic level (i) Crow
(b) Second trophic level (ii) Vulture
(c) First trophic level (iii) Rabbit
(d) Third trophic level (iv) Grass

Select the correct option:

(a) (b) (c) (d)

(1) (i) (ii) (iii) (iv)
(2) (ii) (iii) (iv) (i)
(3) (iii) (ii) (i) (iv)
(4) (iv) (iii) (ii) (i)
109. Match the following diseases with the causative organism and select the correct option.

<table>
<thead>
<tr>
<th>Column - I (a)</th>
<th>Typhoid</th>
<th>(b)</th>
<th>Pneumonia</th>
<th>(c)</th>
<th>Filariasis</th>
<th>(d)</th>
<th>Malaria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column - II (i)</td>
<td>Wuchereria</td>
<td>(ii)</td>
<td>Plasmodium</td>
<td>(iii)</td>
<td>Salmonella</td>
<td>(iv)</td>
<td>Haemophilus</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)

(1) (iv) (i) (ii) (iii)
(2) (i) (iii) (ii) (iv)
(3) (iii) (iv) (i) (ii)
(4) (ii) (i) (iii) (iv)

110. The roots that originate from the base of the stem are:
(1) Lateral roots
(2) Fibrous roots
(3) Primary roots
(4) Prop roots

111. Meiotic division of the secondary oocyte is completed:
(1) At the time of fusion of a sperm with an ovum
(2) Prior to ovulation
(3) At the time of copulation
(4) After zygote formation

112. Identify the wrong statement with regard to Restriction Enzymes.
(1) Sticky ends can be joined by using DNA ligases.
(2) Each restriction enzyme functions by inspecting the length of a DNA sequence.
(3) They cut the strand of DNA at palindromic sites.
(4) They are useful in genetic engineering.

113. In relation to Gross primary productivity and Net primary productivity of an ecosystem, which one of the following statements is correct?
(1) There is no relationship between Gross primary productivity and Net primary productivity.
(2) Gross primary productivity is always less than net primary productivity.
(3) Gross primary productivity is always more than net primary productivity.
(4) Gross primary productivity and Net primary productivity are one and same.

114. The process of growth is maximum during:
(1) Dormancy
(2) Log phase
(3) Lag phase
(4) Senescence

115. The sequence that controls the copy number of the linked DNA in the vector, is termed:
(1) Recognition site
(2) Selectable marker
(3) Ori site
(4) Palindromic sequence

116. Name the enzyme that facilitates opening of DNA helix during transcription.
(1) RNA polymerase
(2) DNA ligase
(3) DNA helicase
(4) DNA polymerase

117. Snow-blindness in Antarctic region is due to:
(1) Damage to retina caused by infra-red rays
(2) Freezing of fluids in the eye by low temperature
(3) Inflammation of cornea due to high dose of UV-B radiation
(4) High reflection of light from snow

118. Strobili or cones are found in:
(1) *Equisetum*
(2) *Salvinia*
(3) *Pteris*
(4) *Marchantia*

119. Match the following columns and select the correct option.

<table>
<thead>
<tr>
<th>Column - I (a)</th>
<th>Floating Ribs</th>
<th>(i)</th>
<th>Located between second and seventh ribs</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>Acromion</td>
<td>(ii)</td>
<td>Head of the Humerus</td>
</tr>
<tr>
<td>(c)</td>
<td>Scapula</td>
<td>(iii)</td>
<td>Clavicle</td>
</tr>
<tr>
<td>(d)</td>
<td>Glenoid cavity</td>
<td>(iv)</td>
<td>Do not connect with the sternum</td>
</tr>
</tbody>
</table>

(a) (b) (c) (d)

(1) (iv) (iii) (i) (ii)
(2) (ii) (iv) (i) (iii)
(3) (i) (iii) (ii) (iv)
(4) (iii) (i) (iv) (i)
120. Which of the following is put into Anaerobic sludge digester for further sewage treatment?

(1) Activated sludge  
(2) Primary sludge  
(3) Floating debris  
(4) Effluents of primary treatment

121. Identify the **wrong** statement with reference to the gene ‘I’ that controls ABO blood groups.

(1) Allele ‘i’ does not produce any sugar.  
(2) The gene (I) has three alleles.  
(3) A person will have only two of the three alleles.  
(4) When IA and IB are present together, they express same type of sugar.

122. The ovary is half inferior in:

(1) Plum  
(2) Brinjal  
(3) Mustard  
(4) Sunflower

123. The first phase of translation is:

(1) Recognition of an anti-codon  
(2) Binding of mRNA to ribosome  
(3) Recognition of DNA molecule  
(4) Aminoacylation of tRNA

124. In gel electrophoresis, separated DNA fragments can be visualized with the help of:

(1) Ethidium bromide in infrared radiation  
(2) Acetocarmine in bright blue light  
(3) Ethidium bromide in UV radiation  
(4) Acetocarmine in UV radiation

125. Dissolution of the synaptonemal complex occurs during:

(1) Leptotene  
(2) Pachytene  
(3) Zygotene  
(4) Diplotene

126. Identify the substances having glycosidic bond and peptide bond, respectively in their structure:

(1) Inulin, insulin  
(2) Chitin, cholesterol  
(3) Glycerol, trypsin  
(4) Cellulose, lecithin

127. Name the plant growth regulator which upon spraying on sugarcane crop, increases the length of stem, thus increasing the yield of sugarcane crop.

(1) Abscisic acid  
(2) Cytokinin  
(3) Gibberellin  
(4) Ethylene

128. Which of the following statements about inclusion bodies is **incorrect**?

(1) These represent reserve material in cytoplasm.  
(2) They are not bound by any membrane.  
(3) These are involved in ingestion of food particles.  
(4) They lie free in the cytoplasm.

129. Which of the following regions of the globe exhibits highest species diversity?

(1) Amazon forests  
(2) Western Ghats of India  
(3) Madagascar  
(4) Himalayas

130. How many true breeding pea plant varieties did Mendel select as pairs, which were similar except in one character with contrasting traits?

(1) 8  
(2) 4  
(3) 2  
(4) 14
131. Identify the **wrong** statement with reference to immunity.

(1) Foetus receives some antibodies from mother, it is an example for passive immunity.
(2) When exposed to antigen (living or dead) antibodies are produced in the host’s body. It is called “Active immunity”.
(3) When ready-made antibodies are directly given, it is called “Passive immunity”.
(4) Active immunity is quick and gives full response.

132. Which of the following is **not** an attribute of a population?

(1) Species interaction
(2) Sex ratio
(3) Natality
(4) Mortality

133. Choose the **correct** pair from the following:

(1) Exonucleases - Make cuts at specific positions within DNA
(2) Ligases - Join the two DNA molecules
(3) Polymerases - Break the DNA into fragments
(4) Nucleases - Separate the two strands of DNA

134. The process responsible for facilitating loss of water in liquid form from the tip of grass blades at night and in early morning is:

(1) Plasmolysis
(2) Transpiration
(3) Root pressure
(4) Imbibition

135. Which of the following is **not** an inhibitory substance governing seed dormancy?

(1) Para-ascorbic acid
(2) Gibberellic acid
(3) Abscisic acid
(4) Phenolic acid

136. Match the following and identify the **correct** option.

<table>
<thead>
<tr>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
<th>(d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO(g) + H₂(g)</td>
<td>Mg(HCO₃)₂ + Ca(HCO₃)₂</td>
<td>Temporary hardness of water</td>
<td>An electron deficient hydride</td>
</tr>
<tr>
<td>B₂H₆</td>
<td>Synthesis gas</td>
<td>H₂O₂</td>
<td>Non-planar structure</td>
</tr>
</tbody>
</table>

137. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following?

(1) Hyperconjugation
(2) −I effect of −CH₃ groups
(3) +R effect of −CH₃ groups
(4) −R effect of −CH₃ groups

138. What is the change in oxidation number of carbon in the following reaction?

CH₄(g) + 4Cl₂(g) → CCl₄(l) + 4HCl(g)

(1) 0 to −4
(2) +4 to +4
(3) 0 to +4
(4) −4 to +4

139. Sucrose on hydrolysis gives:

(1) α-D-Fructose + β-D-Fructose
(2) β-D-Glucose + α-D-Fructose
(3) α-D-Glucose + β-D-Glucose
(4) α-D-Glucose + β-D-Fructose

140. The calculated spin only magnetic moment of Cr²⁺ ion is:

(1) 2.84 BM
(2) 3.87 BM
(3) 4.90 BM
(4) 5.92 BM
141. Identify a molecule which does not exist.
(1) O₂
(2) He₂
(3) Li₂
(4) C₂

142. Which of the following oxoacid of sulphur has −O−O− linkage?
(1) H₂S₂O₇, pyrosulphuric acid
(2) H₂SO₃, sulphurous acid
(3) H₂SO₄, sulphuric acid
(4) H₂S₂O₈, peroxodisulphuric acid

143. Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?
(1) CN⁻ < C₂O₄²⁻ < SCN⁻ < F⁻
(2) SCN⁻ < F⁻ < C₂O₄²⁻ < CN⁻
(3) SCN⁻ < F⁻ < CN⁻ < C₂O₄²⁻
(4) F⁻ < SCN⁻ < C₂O₄²⁻ < CN⁻

144. The number of Faradays (F) required to produce 20 g of calcium from molten CaCl₂ (Atomic mass of Ca = 40 g mol⁻¹) is:
(1) 4
(2) 1
(3) 2
(4) 3

145. Reaction between acetone and methylmagnesium chloride followed by hydrolysis will give:
(1) Isobutyl alcohol
(2) Isopropyl alcohol
(3) Sec. butyl alcohol
(4) Tert. butyl alcohol

146. Which of the following is a cationic detergent?
(1) Sodium dodecylbenzene sulphonate
(2) Sodium lauryl sulphate
(3) Sodium stearate
(4) Cetyltrimethyl ammonium bromide

147. Identify the incorrect statement.
(1) The oxidation states of chromium in CrO₄²⁻ and Cr₂O₇²⁻ are not the same.
(2) Cr²⁺ (d⁴) is a stronger reducing agent than Fe²⁺ (d⁶) in water.
(3) The transition metals and their compounds are known for their catalytic activity due to their ability to adopt multiple oxidation states and to form complexes.
(4) Interstitial compounds are those that are formed when small atoms like H, C or N are trapped inside the crystal lattices of metals.

148. Which of the following alkane cannot be made in good yield by Wurtz reaction?
(1) n-Butane
(2) n-Hexane
(3) 2,3-Dimethylbutane
(4) n-Heptane

149. Urea reacts with water to form A which will decompose to form B. B when passed through Cu²⁺ (aq), deep blue colour solution C is formed. What is the formula of C from the following?
(1) CuCO₃⋅Cu(OH)₂
(2) CuSO₄
(3) [Cu(NH₃)₄]²⁺
(4) Cu(OH)₂

150. The freezing point depression constant (K_f) of benzene is 5.12 K kg mol⁻¹. The freezing point depression for the solution of molality 0.078 m containing a non-electrolyte solute in benzene is (rounded off upto two decimal places):
(1) 0.60 K
(2) 0.20 K
(3) 0.80 K
(4) 0.40 K

151. The number of protons, neutrons and electrons in ¹⁷⁵⁷²⁵²⁵⁷¹ Lu, respectively, are:
(1) 175, 104 and 71
(2) 71, 104 and 71
(3) 104, 71 and 71
(4) 71, 71 and 104
152. Identify compound X in the following sequence of reactions:

\[ \text{CH}_3 \text{Cl}_2/\text{hv} \xrightarrow{X} \text{H}_2\text{O} \xrightarrow{373 \text{ K}} \text{CHO} \]

153. Identify the correct statement from the following:

(1) Pig iron can be moulded into a variety of shapes.
(2) Wrought iron is impure iron with 4% carbon.
(3) Blister copper has blistered appearance due to evolution of CO\(_2\).
(4) Vapour phase refining is carried out for Nickel by Van Arkel method.

154. Which of the following set of molecules will have zero dipole moment?

(1) Boron trifluoride, beryllium difluoride, carbon dioxide, 1,4-dichlorobenzene
(2) Ammonia, beryllium difluoride, water, 1,4-dichlorobenzene
(3) Boron trifluoride, hydrogen fluoride, carbon dioxide, 1,3-dichlorobenzene
(4) Nitrogen trifluoride, beryllium difluoride, water, 1,3-dichlorobenzene

155. Paper chromatography is an example of:

(1) Column chromatography
(2) Adsorption chromatography
(3) Partition chromatography
(4) Thin layer chromatography

156. Identify the incorrect match.

<table>
<thead>
<tr>
<th>Name</th>
<th>IUPAC Official Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Unnilunium</td>
<td>(i) Mendelevium</td>
</tr>
<tr>
<td>(b) Unniltrium</td>
<td>(ii) Lawrenceium</td>
</tr>
<tr>
<td>(c) Unnilhexium</td>
<td>(iii) Seaborgium</td>
</tr>
<tr>
<td>(d) Unununnium</td>
<td>(iv) Darmstadtium</td>
</tr>
</tbody>
</table>

(1) (d), (iv)
(2) (a), (i)
(3) (b), (ii)
(4) (c), (iii)

157. Find out the solubility of Ni(OH)_2 in 0.1 M NaOH. Given that the ionic product of Ni(OH)_2 is \(2 \times 10^{-15}\).

(1) \(1 \times 10^8\) M
(2) \(2 \times 10^{-13}\) M
(3) \(2 \times 10^{-8}\) M
(4) \(1 \times 10^{-13}\) M

158. Which of the following is a natural polymer?

(1) poly (Butadiene-acrylonitrile)
(2) cis-1,4-polyisoprene
(3) poly (Butadiene-styrene)
(4) polybutadiene

159. Reaction between benzaldehyde and acetophenone in presence of dilute NaOH is known as:

(1) Cross Aldol condensation
(2) Aldol condensation
(3) Cannizzaro’s reaction
(4) Cross Cannizzaro’s reaction
160. The mixture which shows positive deviation from Raoult's law is:
(1) Chloroethane + Bromoethane
(2) Ethanol + Acetone
(3) Benzene + Toluene
(4) Acetone + Chloroform

161. The rate constant for a first order reaction is $4.606 \times 10^{-3} \text{s}^{-1}$. The time required to reduce 2.0 g of the reactant to 0.2 g is:
(1) 1000 s
(2) 100 s
(3) 200 s
(4) 500 s

162. HCl was passed through a solution of CaCl$_2$, MgCl$_2$ and NaCl. Which of the following compound(s) crystallise(s)?
(1) NaCl, MgCl$_2$ and CaCl$_2$
(2) Both MgCl$_2$ and CaCl$_2$
(3) Only NaCl
(4) Only MgCl$_2$

163. The correct option for free expansion of an ideal gas under adiabatic condition is:
(1) $q > 0$, $\Delta T > 0$ and $w > 0$
(2) $q = 0$, $\Delta T = 0$ and $w = 0$
(3) $q = 0$, $\Delta T < 0$ and $w > 0$
(4) $q < 0$, $\Delta T = 0$ and $w = 0$

164. Identify the correct statements from the following:
(a) CO$_2$(g) is used as refrigerant for ice-cream and frozen food.
(b) The structure of C$_{60}$ contains twelve six carbon rings and twenty five carbon rings.
(c) ZSM-5, a type of zeolite, is used to convert alcohols into gasoline.
(d) CO is colorless and odourless gas.
(1) (c) and (d) only
(2) (a), (b) and (c) only
(3) (a) and (c) only
(4) (b) and (c) only

165. Hydrolysis of sucrose is given by the following reaction.
\[
\text{Sucrose} + \text{H}_2\text{O} \rightleftharpoons \text{Glucose} + \text{Fructose}
\]
If the equilibrium constant ($K_c$) is $2 \times 10^{13}$ at 300 K, the value of $\Delta_r G^\circ$ at the same temperature will be:
(1) $-8.314 \text{ J mol}^{-1} \text{K}^{-1} \times 300 \text{ K} \times \ln(4 \times 10^{13})$
(2) $-8.314 \text{ J mol}^{-1} \text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
(3) $8.314 \text{ J mol}^{-1} \text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
(4) $8.314 \text{ J mol}^{-1} \text{K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})$

166. Which of the following amine will give the carbylamine test?
(1) 
(2) 
(3) 
(4)
167. An alkene on ozonolysis gives methanal as one of the product. Its structure is:

\[
\text{CH}_2\text{CH}_2\text{CH}_3
\]

(a) \[
\begin{array}{c}
\text{CH} = \text{CH} - \text{CH}_3 \\
\end{array}
\]  
(b) \[
\begin{array}{c}
\text{CH}_2 - \text{CH}_2 - \text{CH}_3 \\
\end{array}
\]  
(c) \[
\begin{array}{c}
\text{CH}_2 - \text{CH} = \text{CH}_2 \\
\end{array}
\]  
(d) \[
\begin{array}{c}
\text{CH}_3
\end{array}
\]  

168. Anisole on cleavage with HI gives:

\[
\begin{array}{c}
\text{I} + \text{C}_2\text{H}_5\text{OH} \\
\end{array}
\]  
(a) \[
\begin{array}{c}
\text{I} + \text{CH}_3\text{I} \\
\text{OH} \\
\end{array}
\]  
(b) \[
\begin{array}{c}
\text{I} + \text{CH}_3\text{OH} \\
\text{OH} \\
\end{array}
\]  
(c) \[
\begin{array}{c}
\text{I} + \text{C}_2\text{H}_5\text{I} \\
\end{array}
\]  

169. Elimination reaction of 2-Bromo-pentane to form pent-2-ene is:

(a) \(\beta\)-Elimination reaction  
(b) Follows Zaitsev rule  
(c) Dehydrohalogenation reaction  
(d) Dehydration reaction 

170. An increase in the concentration of the reactants of a reaction leads to change in:

(1) collision frequency  
(2) activation energy  
(3) heat of reaction  
(4) threshold energy

171. Which of the following is a basic amino acid?

(1) Lysine  
(2) Serine  
(3) Alanine  
(4) Tyrosine

172. The following metal ion activates many enzymes, participates in the oxidation of glucose to produce ATP and with Na, is responsible for the transmission of nerve signals.

(1) Potassium  
(2) Iron  
(3) Copper  
(4) Calcium

173. For the reaction, \(2\text{Cl}(g) \rightarrow \text{Cl}_2(g)\), the correct option is:

(1) \(\Delta H < 0 \) and \(\Delta S < 0\)  
(2) \(\Delta H > 0 \) and \(\Delta S > 0\)  
(3) \(\Delta H > 0 \) and \(\Delta S < 0\)  
(4) \(\Delta H < 0 \) and \(\Delta S > 0\)
174. Match the following:

<table>
<thead>
<tr>
<th>Oxide</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) CO</td>
<td>(i) Basic</td>
</tr>
<tr>
<td>(b) BaO</td>
<td>(ii) Neutral</td>
</tr>
<tr>
<td>(c) Al₂O₃</td>
<td>(iii) Acidic</td>
</tr>
<tr>
<td>(d) Cl₂O₇</td>
<td>(iv) Amphoteric</td>
</tr>
</tbody>
</table>

Which of the following is correct option?

(a) (b) (c) (d)
(1) (iv) (iii) (ii) (i)
(2) (i) (ii) (iii) (iv)
(3) (ii) (i) (iv) (iii)
(4) (iii) (iv) (i) (ii)

175. Measuring Zeta potential is useful in determining which property of colloidal solution?

(1) Size of the colloidal particles
(2) Viscosity
(3) Solubility
(4) Stability of the colloidal particles

176. A mixture of N₂ and Ar gases in a cylinder contains 7 g of N₂ and 8 g of Ar. If the total pressure of the mixture of the gases in the cylinder is 27 bar, the partial pressure of N₂ is:

[Use atomic masses (in g mol⁻¹): N = 14, Ar = 40]

(1) 18 bar
(2) 9 bar
(3) 12 bar
(4) 15 bar

177. Which of the following is not correct about carbon monoxide?

(1) It is produced due to incomplete combustion.
(2) It forms carboxyhaemoglobin.
(3) It reduces oxygen carrying ability of blood.
(4) The carboxyhaemoglobin (haemoglobin bound to CO) is less stable than oxyhaemoglobin.

178. An element has a body centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is:

(1) \(\frac{4}{\sqrt{2}}\ \times\ 288\ \text{pm}\)
(2) \(\frac{\sqrt{3}}{4}\ \times\ 288\ \text{pm}\)
(3) \(\frac{\sqrt{2}}{4}\ \times\ 288\ \text{pm}\)
(4) \(\frac{4}{\sqrt{3}}\ \times\ 288\ \text{pm}\)

179. Which one of the followings has maximum number of atoms?

(1) 1 g of Li(s) [Atomic mass of Li = 7]
(2) 1 g of Ag(s) [Atomic mass of Ag = 108]
(3) 1 g of Mg(s) [Atomic mass of Mg = 24]
(4) 1 g of O₂(g) [Atomic mass of O = 16]

180. On electrolysis of dil.sulphuric acid using Platinum (Pt) electrode, the product obtained at anode will be:

(1) SO₂gas
(2) Hydrogen gas
(3) Oxygen gas
(4) H₂S gas
Space For Rough Work
Space For Rough Work
Space For Rough Work