HAKAN

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 E4. 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. Identify the incorrect statement.

(1) \( \text{Cr}^{2+} (d^4) \) is a stronger reducing agent than \( \text{Fe}^{2+} (d^6) \) 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 \( \text{CrO}_4^{2-} \) and \( \text{Cr}_2\text{O}_7^{2-} \) are not the same.

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

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

3. Identify compound X in the following sequence of reactions:

\[
\begin{array}{ccc}
\text{CH}_3 & \text{CHO} \\
\text{Cl}_2/\text{hv} & \text{X} & \text{H}_2\text{O} \\
& & \text{373 K} \\
\text{Cl} & \text{CH}_2\text{Cl} & \text{CHCl}_2 & \text{CCl}_3
\end{array}
\]

(1) \( \text{CH}_3 \)

(2) \( \text{CH}_2\text{Cl} \)

(3) \( \text{CHCl}_2 \)

(4) \( \text{CCl}_3 \)

4. 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) (a), (i)

(2) (b), (ii)

(3) (c), (iii)

(4) (d), (iv)
5. 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.  

6. 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  

7. Paper chromatography is an example of:  
(1) Adsorption chromatography  
(2) Partition chromatography  
(3) Thin layer chromatography  
(4) Column chromatography  

8. 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.  

9. 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−  

10. 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  

11. 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  

12. The calculated spin only magnetic moment of Cr2+ ion is:  
(1) 3.87 BM  
(2) 4.90 BM  
(3) 5.92 BM  
(4) 2.84 BM  

13. Match the following and identify the **correct** option.  
(a) CO(g) + H2(g)  
(b) Temporary hardness of water  
(c) B2H6  
(d) H2O2  

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

14. For the reaction, 2Cl(g) → Cl2(g), the **correct** option is:  
(1) ΔrH > 0 and ΔrS > 0  
(2) ΔrH > 0 and ΔrS < 0  
(3) ΔrH < 0 and ΔrS > 0  
(4) ΔrH < 0 and ΔrS < 0  

15. 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) 9 bar  
(2) 12 bar  
(3) 15 bar  
(4) 18 bar
16. 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$_2$S gas
   (4) SO$_2$ gas

17. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following ?
   (1) −I effect of −CH$_3$ groups
   (2) +R effect of −CH$_3$ groups
   (3) −R effect of −CH$_3$ groups
   (4) Hyperconjugation

18. 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

19. 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) 1
   (2) 2
   (3) 3
   (4) 4

20. Sucrose on hydrolysis gives :
   (1) β-D-Glucose + α-D-Fructose
   (2) α-D-Glucose + β-D-Glucose
   (3) α-D-Glucose + β-D-Fructose
   (4) α-D-Fructose + β-D-Fructose

21. 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) 100 s
   (2) 200 s
   (3) 500 s
   (4) 1000 s

22. Anisole on cleavage with HI gives :

- OH\hspace{1cm}+\hspace{1cm}CH$_3$I

- I\hspace{1cm}+\hspace{1cm}CH$_3$OH

- OH\hspace{1cm}+\hspace{1cm}C$_2$H$_5$I

- I\hspace{1cm}+\hspace{1cm}C$_2$H$_5$OH

23. 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

24. Which of the following is a basic amino acid ?
   (1) Serine
   (2) Alanine
   (3) Tyrosine
   (4) Lysine
25. 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), (b), (c)
   (2) (a), (c), (d)
   (3) (b), (c), (d)
   (4) (a), (b), (d)

26. 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

27. 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

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

29. 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) Al(_2)O(_3)</td>
<td>(iii) Acidic</td>
</tr>
<tr>
<td>(d) Cl(_2)O(_7)</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)

30. Which of the following amine will give the carbylamine test?
   (1) \( \text{NH}_2 \)
   (2) \( \text{NHCH}_3 \)
   (3) \( \text{N(CH}_3)_2 \)
   (4) \( \text{NH}_2\text{C}_2\text{H}_5 \)

31. 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 \( w > 0 \)

32. Identify a molecule which does not exist.
   (1) \( \text{He}_2 \)
   (2) \( \text{Li}_2 \)
   (3) \( \text{C}_2 \)
   (4) \( \text{O}_2 \)
33. Which of the following is a natural polymer?
(1) cis-1,4-polyisoprene
(2) poly (Butadiene-styrene)
(3) polybutadiene
(4) poly (Butadiene-acrylonitrile)

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

\[
\text{CH} = \text{CH} - \text{CH}_3
\]

(1)

\[
\text{CH}_2 - \text{CH}_2 - \text{CH}_3
\]

(2)

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

(3)

\[
\text{CH}_2\text{CH}_2\text{CH}_3
\]

(4)

35. 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

36. 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

37. The mixture which shows positive deviation from Raoult’s law is:
(1) Ethanol + Acetone
(2) Benzene + Toluene
(3) Acetone + Chloroform
(4) Chloroethane + Bromoethane

38. 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 O\(_2\)(g) [Atomic mass of O = 16]
(4) 1 g of Li(s) [Atomic mass of Li = 7]

39. Identify the correct statements from the following:
(a) \( \text{CO}_2 \)(g) is used as refrigerant for ice-cream and frozen food.
(b) The structure of \( \text{C}_{60} \) 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

40. 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
41. An element has a body centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is:

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

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

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

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

42. Which of the following is a cationic detergent?

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

43. 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

44. 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) \(2 \times 10^{-13} \text{ M} \)
(2) \(2 \times 10^{-8} \text{ M} \)
(3) \(1 \times 10^{-13} \text{ M} \)
(4) \(1 \times 10^8 \text{ M} \)

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

(1) H\(_2\)SO\(_3\), sulphurous acid
(2) H\(_2\)SO\(_4\), sulphuric acid
(3) H\(_2\)S\(_2\)O\(_8\), peroxodisulphuric acid
(4) H\(_2\)S\(_2\)O\(_7\), pyrosulphuric acid

46. Bilaterally symmetrical and acoelomate animals are exemplified by:

(1) Ctenophora
(2) Platyhelminthes
(3) Aschelminthes
(4) Annelida

47. 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

48. 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 | (iii) Layer of the ovum glands
(d) Leydig cells | (iv) Lubrication of the Penis

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

49. 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

50. From his experiments, S.L. Miller produced amino acids by mixing the following in a closed flask:

(1) CH\(_4\), H\(_2\), NH\(_3\) and water vapor at 800°C
(2) CH\(_3\), H\(_2\), NH\(_4\) and water vapor at 800°C
(3) CH\(_4\), H\(_2\), NH\(_3\) and water vapor at 600°C
(4) CH\(_3\), H\(_2\), NH\(_3\) and water vapor at 600°C
51. 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) (ii) (iii) (i) (iv)
(2) (iii) (i) (iv) (ii)
(3) (iv) (ii) (i) (iii)
(4) (i) (ii) (iv) (iii)

52. 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>

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

53. 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

54. 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

55. The ovary is half inferior in:

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

56. In light reaction, plastoquinone facilitates the transfer of electrons from:

(1) PS-II to Cytb6f complex
(2) Cytb6f complex to PS-I
(3) PS-I to NADP+
(4) PS-I to ATP synthase

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. 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)

59. 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
60. 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.

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

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

63. 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.

64. 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.

65. 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.

66. 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

67. 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) (ii) (iii) (i) (iv)
(b) (i) (ii) (iii) (iv)
(c) (ii) (iv) (iii) (i)
(d) (iv) (i) (iii) (ii)

68. 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
69. Flippers of Penguins and Dolphins are examples of:
(1) Adaptive radiation
(2) Convergent evolution
(3) Industrial melanism
(4) Natural selection

70. 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'

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

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

73. 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

74. 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</td>
<td>(ii) Scorpion</td>
</tr>
<tr>
<td>larva with bilateral symmetry</td>
<td></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>

75. 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

76. 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>

77. 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
78. The roots that originate from the base of the stem are:
(1) Fibrous roots
(2) Primary roots
(3) Prop roots
(4) Lateral roots

79. 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

80. 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.

81. 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.

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

83. 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)

84. 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)

85. 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

86. Identify the basic amino acid from the following.
(1) Tyrosine
(2) Glutamic Acid
(3) Lysine
(4) Valine
87. 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.

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

89. The body of the ovule is fused within the funicle at:
(1) Hilum
(2) Micropyle
(3) Nucellus
(4) Chalaza

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

91. 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)

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

93. 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.

94. 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

95. 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)

96. 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
97. 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) (ii) (iv) (iii) (i)
(2) (iii) (i) (iv) (ii)
(3) (iii) (iv) (i) (ii)
(4) (ii) (iii) (i) (iv)

98. 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</td>
<td>(ii) Cellular defence deficiency</td>
</tr>
<tr>
<td>(c) RNAi</td>
<td>(iii) Detection of HIV infection</td>
</tr>
<tr>
<td>(d) PCR</td>
<td>(iv) Bacillus thuringiensis</td>
</tr>
</tbody>
</table>

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

99. 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)

100. 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

101. 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

102. 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

103. 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

104. Which of the following is not an attribute of a population?
(1) Sex ratio
(2) Natality
(3) Mortality
(4) Species interaction
105. The infectious stage of *Plasmodium* that enters the human body is:

1. Trophozoites
2. Sporozoites
3. Female gametocytes
4. Male gametocytes

106. 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 $I^A$ and $I^B$ are present together, they express same type of sugar.
4. Allele ‘i’ does not produce any sugar.

107. 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*

108. 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.

109. 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) <em>Clostridium butylicum</em></td>
<td>(i) Cyclosporin-A</td>
</tr>
<tr>
<td>(b) <em>Trichoderma polysporum</em></td>
<td>(ii) Butyric Acid</td>
</tr>
<tr>
<td>(c) <em>Monascus purpureus</em></td>
<td>(iii) Citric Acid</td>
</tr>
<tr>
<td>(d) <em>Aspergillus niger</em></td>
<td>(iv) Blood cholesterol lowering agent</td>
</tr>
</tbody>
</table>

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


110. 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

111. 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

112. 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)

113. Experimental verification of the chromosomal theory of inheritance was done by:

1. Mendel
2. Sutton
3. Boveri
4. Morgan

114. 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
115. 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) (iv) (ii) (i)
(4) (iv) (i) (ii) (iii)

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) 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>

117. Goblet cells of alimentary canal are modified from:

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

119. The number of substrate level phosphorylations in one turn of citric acid cycle is:

(1) Zero
(2) One
(3) Two
(4) Three

120. Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells?

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

121. Strobili or cones are found in:

(1) Salvinia
(2) Pteris
(3) Marchantia
(4) Equisetum

122. 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>

123. 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
124. 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

125. Floridean starch has structure similar to:

(1) Starch and cellulose
(2) Amylopectin and glycogen
(3) Mannitol and algin
(4) Laminarin and cellulose

126. 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.

127. 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.

128. Identify the **correct** statement with regard to G₁ 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.

129. The enzyme enterokinase helps in conversion of:

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

130. 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

131. 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

132. 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

133. 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

134. 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
135. Embryological support for evolution was disapproved by:

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

136. 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

137. 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

138. 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 × 10⁻² m
(2) 1.0 × 10⁻¹ m
(3) 1.5 × 10⁻¹ m
(4) 1.5 × 10⁻² m

139. 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

140. 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

141. 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) 360 m
(2) 340 m
(3) 320 m
(4) 300 m

142. 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:

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

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

143. 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) \( 2.4\pi \times 10^{-4} \text{ T m A}^{-1} \)
(2) \( 8.0 \times 10^{-5} \text{ T m A}^{-1} \)
(3) \( 2.4\pi \times 10^{-5} \text{ T m A}^{-1} \)
(4) \( 2.4\pi \times 10^{-7} \text{ T m A}^{-1} \)

144. 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
145. 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?

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

\[
1.28 \times 10^4 \text{ N/C}
\]

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

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

\[
\frac{1}{\sqrt{2} n \pi d}
\]

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

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

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

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

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

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

149. 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) \(10 \times 10^4 \text{ J}\)
(2) \(12 \times 10^3 \text{ J}\)
(3) \(24 \times 10^4 \text{ J}\)
(4) \(48 \times 10^3 \text{ J}\)

150. 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:

\[
\frac{A}{2\mu}
\]

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

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

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

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

(1) \(^{144}\text{Ba}\)
(2) \(^{91}\text{Zr}\)
(3) \(^{101}\text{Kr}\)
(4) \(^{103}\text{Kr}\)
153. 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. 2.5 g
2. 5.0 g
3. 10.0 g
4. 20.0 g

154. 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

155. 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. \( 6.28 \times 10^{-4} \text{ T} \)
2. \( 3.14 \times 10^{-4} \text{ T} \)
3. \( 6.28 \times 10^{-5} \text{ T} \)
4. \( 3.14 \times 10^{-5} \text{ T} \)

156. 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. \( 3.66 \times 10^{-7} \text{ rad} \)
2. \( 1.83 \times 10^{-7} \text{ rad} \)
3. \( 7.32 \times 10^{-7} \text{ rad} \)
4. \( 6.00 \times 10^{-7} \text{ rad} \)

157. 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

158. Dimensions of stress are:

1. \([\text{M} \text{L}^{-1} \text{T}^{-2}]\)
2. \([\text{M} \text{L}^2 \text{T}^{-2}]\)
3. \([\text{M} \text{L}^0 \text{T}^{-2}]\)
4. \([\text{M} \text{L}^{-1} \text{T}^{-2}]\)

159. The capacitance of a parallel plate capacitor with air as medium is 6 \( \mu \text{F} \). With the introduction of a dielectric medium, the capacitance becomes 30 \( \mu \text{F} \). 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. \( 5.00 \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2} \)

160. 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. \( 1 : c^2 \)

161. 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\(^+\))

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

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

163. 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.
164. 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) $i_b = 90^\circ$

165. The average thermal energy for a mono-atomic gas is: ($k_B$ is Boltzmann constant and $T$, absolute temperature)
(1) $\frac{1}{2}k_BT$
(2) $\frac{3}{2}k_BT$
(3) $\frac{5}{2}k_BT$
(4) $\frac{7}{2}k_BT$

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

167. 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

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

169. 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) $0.6\hat{i}$ N m
(2) $6\hat{j}$ N m
(3) $-6\hat{i}$ N m
(4) $6\hat{k}$ N m

170. 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 $\pi/3$. If instead C is removed from the circuit, the phase difference is again $\pi/3$ between current and voltage. The power factor of the circuit is:
(1) zero
(2) 0.5
(3) 1.0
(4) $-1.0$

171. 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:

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

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. 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

176. 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

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

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

178. 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%

179. 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) $\frac{Mg}{AL}$  
(2) $\frac{Mg(L_1 - L)}{AL}$  
(3) $\frac{MgL}{AL_1}$  
(4) $\frac{MgL}{A(L_1 - L)}$

180. 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
Space For Rough Work
Space For Rough Work
Space For Rough Work
This Booklet contains 24 pages.

Do not open this Test Booklet until you are asked to do so.

**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 F4. 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 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:

   \[
   \begin{array}{l}
   (1) \quad \frac{3}{2} \\
   (2) \quad \frac{5}{3} \\
   (3) \quad \frac{27}{8} \\
   (4) \quad \frac{9}{4}
   \end{array}
   \]

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.

   \[
   \begin{array}{l}
   (1) \quad -6\hat{i} \text{ N m} \\
   (2) \quad 6\hat{k} \text{ N m} \\
   (3) \quad 6\hat{i} \text{ N m} \\
   (4) \quad 6\hat{j} \text{ N m}
   \end{array}
   \]

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

   \[
   \begin{array}{l}
   (1) \quad \text{Both emitter junction as well as the collector junction are forward biased.} \\
   (2) \quad \text{The base region must be very thin and lightly doped.} \\
   (3) \quad \text{Base, emitter and collector regions should have same doping concentrations.} \\
   (4) \quad \text{Base, emitter and collector regions should have same size.}
   \end{array}
   \]

4. 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: \((g = 10 \text{ m/s}^2)\)

   \[
   \begin{array}{l}
   (1) \quad 320 \text{ m} \\
   (2) \quad 300 \text{ m} \\
   (3) \quad 360 \text{ m} \\
   (4) \quad 340 \text{ m}
   \end{array}
   \]

5. The Brewster's angle \( i_b \) for an interface should be:

   \[
   \begin{array}{l}
   (1) \quad 45^\circ < i_b < 90^\circ \\
   (2) \quad i_b = 90^\circ \\
   (3) \quad 0^\circ < i_b < 30^\circ \\
   (4) \quad 30^\circ < i_b < 45^\circ
   \end{array}
   \]

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

   \[
   \begin{array}{l}
   \text{A} \quad \text{B} \quad \text{Y} \\
   (1) \quad 0 \quad 0 \quad 1 \\
   (2) \quad 0 \quad 1 \quad 1 \\
   (3) \quad 1 \quad 0 \quad 1 \\
   (4) \quad 1 \quad 1 \quad 0
   \end{array}
   \]

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

   \[
   \begin{array}{l}
   (1) \quad \text{semiconductors only} \\
   (2) \quad \text{insulators and semiconductors} \\
   (3) \quad \text{metals} \\
   (4) \quad \text{insulators only}
   \end{array}
   \]

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

   \[
   \begin{array}{l}
   (1) \quad \text{both forward bias and reverse bias} \\
   (2) \quad \text{increase in forward current} \\
   (3) \quad \text{forward bias only} \\
   (4) \quad \text{reverse bias only}
   \end{array}
   \]

9. Dimensions of stress are:

   \[
   \begin{array}{l}
   (1) \quad [\text{ML}^0\text{T}^{-2}] \\
   (2) \quad [\text{ML}^{-1}\text{T}^{-2}] \\
   (3) \quad [\text{MLT}^{-2}] \\
   (4) \quad [\text{ML}^2\text{T}^{-2}]
   \end{array}
   \]
10. Taking into account of the significant figures, what is the value of \(9.99\ m - 0.0099\ m\) ?
   (1) \(9.980\ m\)
   (2) \(9.9\ m\)
   (3) \(9.9801\ m\)
   (4) \(9.98\ m\)

11. 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) \(524\ Hz\)

12. 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) \(\frac{\mu A}{2 \mu}\)
   (3) \(\frac{A}{2 \mu}\)
   (4) \(\frac{2A}{\mu}\)

13. 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:
   \(\epsilon_0 = 8.85 \times 10^{-12}\ \text{C}^2\ \text{N}^{-1}\ \text{m}^{-2}\)
   (1) \(0.44 \times 10^{-10}\ \text{C}^2\ \text{N}^{-1}\ \text{m}^{-2}\)
   (2) \(5.00\ \text{C}^2\ \text{N}^{-1}\ \text{m}^{-2}\)
   (3) \(0.44 \times 10^{-13}\ \text{C}^2\ \text{N}^{-1}\ \text{m}^{-2}\)
   (4) \(1.77 \times 10^{-12}\ \text{C}^2\ \text{N}^{-1}\ \text{m}^{-2}\)

14. 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) \(50\ cm\)

15. 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) \(0.25\ mm\)

16. 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

17. An iron rod of susceptibility \(599\) is subjected to a magnetising field of \(1200\ \text{A m}^{-1}\). The permeability of the material of the rod is:
   \(\mu_0 = 4\pi \times 10^{-7}\ \text{T m A}^{-1}\)
   (1) \(2.4\pi \times 10^{-5}\ \text{T m A}^{-1}\)
   (2) \(2.4\pi \times 10^{-7}\ \text{T m A}^{-1}\)
   (3) \(2.4\pi \times 10^{-4}\ \text{T m A}^{-1}\)
   (4) \(8.0 \times 10^{-5}\ \text{T m A}^{-1}\)

18. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is: \(c = \text{speed of electromagnetic waves}\)
   (1) \(1 : c\)
   (2) \(1 : c^2\)
   (3) \(c : 1\)
   (4) \(1 : 1\)

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

\[
\frac{\Delta L}{L_1} = \frac{Mg}{AL}
\]

\[
\frac{\Delta L}{L_1} = \frac{Mg(L_1 - L)}{AL}
\]

\[
\frac{MgL}{AL}
\]

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

\[
\frac{1}{\sqrt{2} \pi n^2 \pi d^2}
\]

\[
\frac{1}{\sqrt{2} \pi n^2 \pi d^2}
\]

\[
\frac{1}{\sqrt{2} n \pi d}
\]

\[
\frac{1}{\sqrt{2} n \pi d}
\]

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

\[
1.5 \times 10^{13} \text{ J}
\]

\[
0.5 \times 10^{13} \text{ J}
\]

\[
4.5 \times 10^{16} \text{ J}
\]

\[
4.5 \times 10^{13} \text{ J}
\]

23. 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:

\[
10^3 \text{ V}
\]

\[
10^4 \text{ V}
\]

\[
10 \text{ V}
\]

\[
10^2 \text{ V}
\]

24. 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:

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

\[
400 \text{ V}
\]

\[
\text{zero}
\]

\[
50 \text{ V}
\]

\[
200 \text{ V}
\]

25. 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:

\[
2.5 \text{ A}
\]

\[
25.1 \text{ A}
\]

\[
1.7 \text{ A}
\]

\[
2.05 \text{ A}
\]

26. The average thermal energy for a mono-atomic gas is:

\[
\frac{5}{2} k_B T
\]

\[
\frac{7}{2} k_B T
\]

\[
\frac{1}{2} k_B T
\]

\[
\frac{3}{2} k_B T
\]

27. 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:

\[
4 \text{ kg}
\]

\[
6 \text{ kg}
\]

\[
g/5
\]

\[
g/10
\]

\[
g
\]

\[
g/2
\]

28. 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:

\[
7.32 \times 10^{-7} \text{ rad}
\]

\[
6.00 \times 10^{-7} \text{ rad}
\]

\[
3.66 \times 10^{-7} \text{ rad}
\]

\[
1.83 \times 10^{-7} \text{ rad}
\]
29. 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) 0.1 kg/m$^3$
(2) 0.02 kg/m$^3$
(3) 0.5 kg/m$^3$
(4) 0.2 kg/m$^3$

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

Yellow  Violet  Brown  Gold

The values of resistance and tolerance, respectively, are:

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

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

(1) \[ \text{graph}\]
(2) \[ \text{graph}\]
(3) \[ \text{graph}\]
(4) \[ \text{graph}\]

32. 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

33. 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

34. 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) $1.5 \times 10^{-1}$ m
(2) $1.5 \times 10^{-2}$ m
(3) $1.0 \times 10^{-2}$ m
(4) $1.0 \times 10^{-1}$ m

35. 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 m$^2$ V$^{-1}$ s$^{-1}$ of:

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

36. 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
37. For which one of the following, Bohr model is not valid?
   (1) Deuteron atom
   (2) Singly ionised neon atom \((\text{Ne}^+)\)
   (3) Hydrogen atom
   (4) Singly ionised helium atom \((\text{He}^+)\)

38. 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?
   
   \[
   \left( \frac{1}{4\pi \varepsilon_0} \right) = 9 \times 10^9 \text{ N m}^2/\text{C}^2 
   \]
   (1) \(1.28 \times 10^6 \text{ N/C}\)
   (2) \(1.28 \times 10^7 \text{ N/C}\)
   (3) \(1.28 \times 10^4 \text{ N/C}\)
   (4) \(1.28 \times 10^5 \text{ N/C}\)

39. The energy required to break one bond in DNA is \(10^{-20} \text{ J}\). This value in eV is nearly:
   (1) 0.06
   (2) 0.006
   (3) 6
   (4) 0.6

40. In a certain region of space with volume \(0.2 \text{ m}^3\), the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is:
   (1) 1 \text{ N/C}
   (2) 5 \text{ N/C}
   (3) zero
   (4) 0.5 \text{ N/C}

41. 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) \(3.14 \times 10^{-4} \text{ T}\)

42. 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

43. 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

44. 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

45. 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

46. The ovary is half inferior in:
   (1) Sunflower
   (2) Plum
   (3) Brinjal
   (4) Mustard
47. 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.

48. 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.

49. 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

50. 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

51. Dissolution of the synaptonemal complex occurs during:

(1) Diplotene
(2) Leptotene
(3) Pachytene
(4) Zygote

52. 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) (iii) (iv) (ii) (i)
(2) (iv) (i) (ii) (iii)
(3) (ii) (i) (iv) (iii)
(4) (iv) (iii) (ii) (i)

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

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

54. 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.

55. 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)
56. 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.

57. 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

58. 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

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

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

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

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

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

64. 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)

65. 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
66. 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

67. 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)

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

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

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

70. Identify the wrong statement with reference to the gene 'I' that controls ABO blood groups.
   (1) When I^A and I^B 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.

71. 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

72. 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

73. 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

74. 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
75. 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.

76. 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.

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

78. 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”.

79. 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</td>
<td>(ii) Cellular defence</td>
</tr>
<tr>
<td>deaminase deficiency</td>
<td></td>
</tr>
<tr>
<td>(c) RNAi</td>
<td>(iii) Detection of HIV</td>
</tr>
<tr>
<td></td>
<td>infection</td>
</tr>
<tr>
<td>(d) PCR</td>
<td>(iv) <em>Bacillus thuringiensis</em></td>
</tr>
</tbody>
</table>

80. 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.

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

82. 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
83. 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

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

85. 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>

86. 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

87. 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

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>

89. 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.

90. 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

91. 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.
92. 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

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

94. 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)     (ii)    (iii)   (iv)  (i)
(2)     (i)     (ii)    (iv)  (i)
(3)     (iv)    (iii)   (i)   (ii)
(4)     (i)     (iv)    (ii)  (iii)

95. 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) (iv) (iii) (ii) (i)
(2) (i) (ii) (iv) (i)
(3) (ii) (iii) (iv) (i)
(4) (iii) (ii) (i) (iv)

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

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

98. 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.

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) 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)    (iii)   (i)   (ii)
(2)     (i)     (ii)    (iv)  (iii)
(3)     (ii)    (iii)   (i)   (iv)
(4)     (iii)   (i)     (iv)  (ii)
100. 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) S phase
(2) G₂ phase
(3) M phase
(4) G₁ phase

101. The process of growth is maximum during:

(1) Senescence
(2) Dormancy
(3) Log phase
(4) Lag phase

102. The QRS complex in a standard ECG represents:

(1) Depolarisation of ventricles
(2) Repolarisation of ventricles
(3) Repolarisation of auricles
(4) Depolarisation of auricles

103. 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

104. 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

105. Floridean starch has structure similar to:

(1) Mannitol and algin
(2) Laminarin and cellulose
(3) Starch and cellulose
(4) Amylopectin and glycogen

106. 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

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) Gregarious, polyphagous</td>
<td>(i) Asterias</td>
</tr>
<tr>
<td>(b) Adult with radial</td>
<td>(ii) Scorpion</td>
</tr>
<tr>
<td>symmetry and larva</td>
<td>with bilateral</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>

108. 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.

109. 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
Identify the basic amino acid from the following.

1. Lysine
2. Valine
3. Tyrosine
4. Glutamic Acid

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

1. Female gametocytes
2. Male gametocytes
3. Trophozoites
4. Sporozoites

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.

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 Cyt b6f complex
4. Cyt b6f complex to PS-I

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

Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells?

1. Golgi bodies
2. Polysomes
3. Endoplasmic reticulum
4. Peroxisomes

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)

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

Experimental verification of the chromosomal theory of inheritance was done by:

1. Boveri
2. Morgan
3. Mendel
4. Sutton

The specific palindromic sequence which is recognized by EcoRI is:

1. 5' - CTTAAG - 3'
   3' - GAATTC - 5'
2. 5' - GGATCC - 3'
   3' - CCTAGG - 5'
3. 5' - GAATTC - 3'
   3' - CTTCAG - 5'
4. 5' - GGAACC - 3'
   3' - CCTTGG - 5'

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

1. DNA polymerase
2. RNA polymerase
3. DNA ligase
4. DNA helicase
121. 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

122. 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

123. 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) (i) (iv) (ii)
(2) (ii) (i) (iv) (iii)
(3) (iv) (iii) (i) (ii)
(4) (iii) (ii) (i) (iv)

124. 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

125. Strobili or cones are found in:

(1) *Marchantia*
(2) *Equisetum*
(3) *Salvinia*
(4) *Pteris*

126. 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

127. 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) Filariasis</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) (ii) (i) (iii) (iv)
(2) (iv) (i) (ii) (iii)
(3) (i) (iii) (ii) (iv)
(4) (iii) (iv) (i) (ii)

128. 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

129. 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.
130. 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)

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

132. 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) (i) (ii) (iv) (iii)
(2) (ii) (iv) (iii) (i)
(3) (iii) (iv) (i) (ii)
(4) (iv) (iii) (i) (ii)

133. 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

134. 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) (i) (ii)

135. 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

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

137. On electrolysis of dil. sulphuric acid using Platinum (Pt) electrode, the product obtained at anode will be:
(1) H₂S gas
(2) SO₂ gas
(3) Hydrogen gas
(4) Oxygen gas

138. An element has a body centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is:
(1) \( \frac{4}{\sqrt{3}} \times 288 \text{ pm} \)
(2) \( \frac{4}{\sqrt{2}} \times 288 \text{ pm} \)
(3) \( \frac{\sqrt{3}}{4} \times 288 \text{ pm} \)
(4) \( \frac{\sqrt{2}}{4} \times 288 \text{ pm} \)
139. 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 $w > 0$

140. 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

141. 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) 15 bar
(2) 18 bar
(3) 9 bar
(4) 12 bar

142. 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

143. Anisole on cleavage with HI gives:

(1) $\text{OH}$
(2) $\text{I}$
(3) $\text{OH}$
(4) $\text{I}$

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

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

145. Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?

(1) $\text{F}^- < \text{SCN}^- < C_2\text{O}_4^{2-} < \text{CN}^-$
(2) $\text{CN}^- < C_2\text{O}_4^{2-} < \text{SCN}^- < \text{F}^-$
(3) $\text{SCN}^- < \text{F}^- < C_2\text{O}_4^{2-} < \text{CN}^-$
(4) $\text{SCN}^- < \text{F}^- < \text{CN}^- < C_2\text{O}_4^{2-}$

146. 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]
147. Which of the following alkane cannot be made in good yield by Wurtz reaction?  
(1) n-Heptane  
(2) n-Butane  
(3) n-Hexane  
(4) 2,3-Dimethylbutane

148. 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.

149. 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 $\Delta_S < 0$

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

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

151. 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$_3$)$_4$]$^{2+}$

152. 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 $\Delta_G^0$ at the same temperature will be:  
(1) $8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})$  
(2) $-8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(4 \times 10^{13})$  
(3) $-8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$  
(4) $8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$

153. 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

154. 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

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

156. 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
157. Identify compound X in the following sequence of reactions:

\[
\begin{align*}
\text{CH}_3 & \xrightarrow{\text{Cl}_2/\text{hv}} \text{X} \xrightarrow{\text{H}_2\text{O}} \text{CHO} \\
\text{CHCl}_3 & \xrightarrow{\text{Cl}} \text{CCl}_3 \\
\text{Cl} & \xrightarrow{\text{CH}_2\text{Cl}} \text{CH}_2\text{Cl}
\end{align*}
\]

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

158. 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

159. 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

160. 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) 500 s
(2) 1000 s
(3) 100 s
(4) 200 s

161. 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

162. 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 \(\text{CO}_2\).

163. Identify a molecule which does not exist.

(1) \(\text{C}_2\)
(2) \(\text{O}_2\)
(3) \(\text{He}_2\)
(4) \(\text{Li}_2\)

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

(1) \(-R\) effect of \(-\text{CH}_3\) groups
(2) Hyperconjugation
(3) \(-I\) effect of \(-\text{CH}_3\) groups
(4) \(+R\) effect of \(-\text{CH}_3\) groups

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

(1) Only \(\text{MgCl}_2\)
(2) \(\text{NaCl, MgCl}_2\) and \(\text{CaCl}_2\)
(3) Both \(\text{MgCl}_2\) and \(\text{CaCl}_2\)
(4) Only \(\text{NaCl}\)
166. Which of the following amine will give the carbylamine test?

(1) \( \text{N(CH}_3\text{)}_2 \)

(2) \( \text{NHC}_2\text{H}_5 \)

(3) \( \text{NH}_2 \)

(4) \( \text{NHCH}_3 \)

167. 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)  

169. Sucrose on hydrolysis gives:

(1) \( \alpha\text{-D-Glucose} + \beta\text{-D-Fructose} \)

(2) \( \alpha\text{-D-Fructose} + \beta\text{-D-Fructose} \)

(3) \( \beta\text{-D-Glucose} + \alpha\text{-D-Fructose} \)

(4) \( \alpha\text{-D-Glucose} + \beta\text{-D-Glucose} \)

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

(1) \( \text{CH}_2 = \text{CH} = \text{CH}_2 \)

(2) \( \text{CH}_2\text{CH}_2\text{CH}_3 \)

(3) \( \text{CH} = \text{CH} - \text{CH}_3 \)

(4) \( \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \)

168. 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

171. 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.
172. Which of the following is a basic amino acid?
(1) Tyrosine
(2) Lysine
(3) Serine
(4) Alanine

173. Which of the following oxoacid of sulphur has \(-\text{O} - \text{O}\) linkage?
(1) \(\text{H}_2\text{S}_2\text{O}_8\), peroxodisulphuric acid
(2) \(\text{H}_2\text{S}_2\text{O}_7\), pyrosulphuric acid
(3) \(\text{H}_2\text{SO}_3\), sulphurous acid
(4) \(\text{H}_2\text{SO}_4\), sulphuric acid

174. 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)

175. 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) Al(_2)O(_3)</td>
<td>(iii) Acidic</td>
</tr>
<tr>
<td>(d) Cl(_2)O(_7)</td>
<td>(iv) Amphoteric</td>
</tr>
</tbody>
</table>

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

176. 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

177. Paper chromatography is an example of:
(1) Thin layer chromatography
(2) Column chromatography
(3) Adsorption chromatography
(4) Partition chromatography

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

179. 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

180. 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
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/markig 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 G4. 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. Strobili or cones are found in:
   (1) *Pteris*
   (2) *Marchantia*
   (3) *Equisetum*
   (4) *Salvinia*

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

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

<table>
<thead>
<tr>
<th>Column - I</th>
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</tr>
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<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) (iii) (ii) (iv) (i)
   (3) (ii) (iii) (iv) (i)
   (4) (iv) (iii) (i) (ii)

4. 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

5. 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

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

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

8. 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

9. 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.

10. 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.

11. Goblet cells of alimentary canal are modified from:
    (1) Columnar epithelial cells
    (2) Chondrocytes
    (3) Compound epithelial cells
    (4) Squamous epithelial cells
12. 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

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

14. 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

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

16. 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.

17. 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

18. 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.

19. Some dividing cells exit the cell cycle and enter vegetativeinactive stage. This is called quiescent stage (G₀). This process occurs at the end of:
(1) G₁ phase
(2) S phase
(3) G₂ phase
(4) M phase

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

21. 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
22. 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

23. 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) (iv) (iii) (i) (ii)
(2) (iii) (ii) (i) (iv)
(3) (ii) (iv) (i) (ii)
(4) (ii) (iv) (iii) (i)

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

25. 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) Filariaasis</td>
<td>(iii) Salmonella</td>
</tr>
<tr>
<td>(d) Malaria</td>
<td>(iv) Haemophilus</td>
</tr>
</tbody>
</table>

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

26. 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

27. 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

28. 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

29. 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.

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

31. Bilaterally symmetrical and acoelomate animals are exemplified by:
(1) Platyhelminthes
(2) Aschelminthes
(3) Annelida
(4) Ctenophora
32. Identify the substances having glycosidic bond and peptide bond, respectively in their structure:
   (1) Glycerol, trypsin
   (2) Cellulose, lecithin
   (3) Inulin, insulin
   (4) Chitin, cholesterol

33. 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)

34. 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

35. 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) (iv) (i) (ii) (iii)
   (2) (i) (ii) (iv) (iii)
   (3) (ii) (i) (iii) (iv)
   (4) (iii) (iv) (ii) (i)

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

37. 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

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

   Column - I                   | Column - II                  |
   (a) 6 - 15 pairs of gill slits | (i) Trygon                   |
   (b) Heterocercal caudal fin   | (ii) Cyclostomes             |
   (c) Air Bladder               | (iii) Chondrichthyes         |
   (d) Poison sting              | (iv) Osteichthyes            |

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

39. 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

40. 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

41. Which one of the following is the most abundant protein in the animals?
   (1) Collagen
   (2) Lectin
   (3) Insulin
   (4) Haemoglobin
42. 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' - GAATTC - 3'
    3' - CTTAAG - 5'

43. 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

44. 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

45. 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)

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

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

48. 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

49. 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) (i) (iii) (ii) (iv)
(2) (ii) (i) (iv) (iii)
(3) (iv) (i) (ii)
(4) (ii) (iv) (i) (iii)

50. 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

51. 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.
52. 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) <strong>Clostridium</strong></td>
<td>(i) Cyclosporin-A</td>
</tr>
<tr>
<td>(b) <strong>Trichoderma</strong></td>
<td>(ii) Butyric Acid</td>
</tr>
<tr>
<td>(c) <strong>Monascus</strong></td>
<td>(iii) Citric Acid</td>
</tr>
<tr>
<td>(d) <strong>Aspergillus</strong></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) (i) (ii)

53. 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)

54. Identify the **wrong** statement with reference to transport of oxygen.

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

55. 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

56. 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.

57. 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

58. 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

59. 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) (c) and (a)
(2) (a) and (b)
(3) (b) and (c)
(4) (d) and (c)
60. 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.

61. 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) Gregarious, polyphagous</td>
<td>Asterias pest</td>
</tr>
<tr>
<td>(b) Adult with radial</td>
<td>Scorpion with bilateral</td>
</tr>
<tr>
<td>symmetry and larva</td>
<td>symmetry</td>
</tr>
<tr>
<td>(c) Book lungs</td>
<td>Ctenopla</td>
</tr>
<tr>
<td>(d) Bioluminescence</td>
<td>Locusta</td>
</tr>
</tbody>
</table>

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

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

62. 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)

63. 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

64. 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

65. 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.

66. The enzyme enterokinase helps in conversion of:

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

67. 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) Bt cotton</td>
<td>(i) Gene therapy</td>
</tr>
<tr>
<td>(b) Adenosine</td>
<td>(ii) Cellular defence</td>
</tr>
<tr>
<td>(c) RNAi</td>
<td>(iii) Detection of HIV</td>
</tr>
<tr>
<td>(d) PCR</td>
<td>(iv) Bacillus thuringiensis</td>
</tr>
</tbody>
</table>

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

(1) (iii) (ii) (i) (iv)
(2) (ii) (iii) (iv) (i)
(3) (i) (ii) (iii) (iv)
(4) (iv) (i) (ii) (iii)
68. Identify the basic amino acid from the following.
   (1) Glutamic Acid
   (2) Lysine
   (3) Valine
   (4) Tyrosine

69. 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)

70. 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

72. 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>

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

73. 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

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

75. The body of the ovule is fused within the funicle at:
   (1) Micropyle
   (2) Nucellus
   (3) Chalaza
   (4) Hilum

76. 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.
77. 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”.

78. The roots that originate from the base of the stem are:

(1) Primary roots
(2) Prop roots
(3) Lateral roots
(4) Fibrous roots

79. The number of substrate level phosphorylations in one turn of citric acid cycle is:

(1) One
(2) Two
(3) Three
(4) Zero

80. Experimental verification of the chromosomal theory of inheritance was done by:

(1) Sutton
(2) Boveri
(3) Morgan
(4) Mendel

82. 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

83. 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.

84. 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

85. Embryological support for evolution was disapproved by:

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

86. Floridean starch has structure similar to:

(1) Amylopectin and glycogen
(2) Mannitol and algin
(3) Laminarin and cellulose
(4) Starch and cellulose
87. 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) (i) (iv) (ii)
   (2) (iii) (iv) (i) (ii)
   (3) (ii) (iii) (i) (iv)
   (4) (ii) (iv) (iii) (i)

88. 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>

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

89. The transverse section of a plant shows the 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

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

91. 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 × 10^{-7} rad
   (2) 7.32 × 10^{-7} rad
   (3) 6.00 × 10^{-7} rad
   (4) 3.66 × 10^{-7} rad

92. When a uranium isotope \(^{235}_{92}U\) is bombarded with a neutron, it generates \(^{89}_{36}Kr\), three neutrons and:
   (1) \(^{91}_{40}Zr\)
   (2) \(^{101}_{36}Kr\)
   (3) \(^{103}_{36}Kr\)
   (4) \(^{144}_{56}Ba\)

93. 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:
   \[
   \left(\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2\right) \]
   (1) 200 V
   (2) 400 V
   (3) zero
   (4) 50 V

94. 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:
   \[
   \frac{2A}{\mu} = \frac{\mu A}{\sqrt{2}}
   \]
   (1) \(\frac{2A}{\mu}\)
   (2) \(\mu A\)
   (3) \(\frac{\mu A}{\sqrt{2}}\)
   (4) \(\frac{A}{2\mu}\)
95. 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

96. For which one of the following, Bohr model is not valid?

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

97. 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) 5.0 g  
(2) 10.0 g  
(3) 20.0 g  
(4) 2.5 g

98. 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

99. 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) \( 2.4\pi \times 10^{-4} \text{ T m A}^{-1} \)

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

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

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

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

102. 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) \( 1.0 \times 10^{-1} \text{ m} \)  
(2) \( 1.5 \times 10^{-1} \text{ m} \)  
(3) \( 1.5 \times 10^{-2} \text{ m} \)  
(4) \( 1.0 \times 10^{-2} \text{ m} \)

103. 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) \( \frac{1}{2} k_B T \)

104. 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
105. 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

106. 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) \( 6.28 \times 10^{-4} \text{ T} \)

107. 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

108. 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

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

Yellow  Violet  Brown  Gold

The values of resistance and tolerance, respectively, are:

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

110. 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

111. 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.

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

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

113. 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) 0.2 kg/m\(^3\)  
(2) 0.1 kg/m\(^3\)  
(3) 0.02 kg/m\(^3\)  
(4) 0.5 kg/m\(^3\)

114. 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 m\(^2\) V\(^{-1}\) s\(^{-1}\) of:

(1) \( 2.5 \times 10^6 \)  
(2) \( 2.5 \times 10^{-6} \)  
(3) \( 2.25 \times 10^{-15} \)  
(4) \( 2.25 \times 10^{15} \)
115. Dimensions of stress are:
(1) [ML^2T^{-2}]
(2) [ML^0T^{-2}]
(3) [ML^{-1}T^{-2}]
(4) [MLT^{-2}]

116. 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{Mg(L - L_1)}{AL}
(2) \frac{MgL}{AL}
(3) \frac{MgL}{A(L_1 - L)}
(4) \frac{MgL_1}{AL}

117. 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) 524 Hz
(2) 536 Hz
(3) 537 Hz
(4) 523 Hz

118. 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:

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

120. 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

121. 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) 12 \times 10^3 J
(2) 24 \times 10^3 J
(3) 48 \times 10^3 J
(4) 10 \times 10^3 J

122. Which of the following graph represents the variation of resistivity (\rho) with temperature (T) for copper?
123. The quantities of heat required to raise the temperature of two solid copper spheres of radii $r_1$ and $r_2$ ($r_1 = 1.5 \cdot r_2$) through 1 K are in the ratio:

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

124. 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) $6\ \hat{j}$ N m  
(2) $-6\ \hat{i}$ N m  
(3) $6\ \hat{k}$ N m  
(4) $6\ \hat{i}$ N m

125. 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) 0.5 N/C  
(2) 1 N/C  
(3) 5 N/C  
(4) zero

126. The Brewster's 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) $0^\circ < i_b < 30^\circ$

127. 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

128. 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) $1.28 \times 10^5$ N/C  
(2) $1.28 \times 10^6$ N/C  
(3) $1.28 \times 10^7$ N/C  
(4) $1.28 \times 10^4$ N/C

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

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

130. 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) 2.05 A  
(2) 2.5 A  
(3) 25.1 A  
(4) 1.7 A

131. 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) $10^2$ V  
(2) $10^3$ V  
(3) $10^4$ V  
(4) 10 V

132. 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
133. For the logic circuit shown, the truth table is:

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134. The solids which have the negative temperature coefficient of resistance are:
(1) insulators only
(2) semiconductors only
(3) insulators and semiconductors
(4) metals

135. 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

136. 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) \( 8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13}) \)
(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) \(-8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13}) \)

137. 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 O\(_2\)(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]

138. 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.

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

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

141. Which of the following is a basic amino acid?
(1) Alanine
(2) Tyrosine
(3) Lysine
(4) Serine
142. 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) 12 bar
(2) 15 bar
(3) 18 bar
(4) 9 bar

143. Paper chromatography is an example of:

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

144. For the reaction, $2Cl(g) \rightarrow Cl_2(g)$, 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 $\Delta S > 0$

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

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

(1) Oxygen gas
(2) H$_2$S gas
(3) SO$_2$ gas
(4) Hydrogen gas

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

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

148. 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

149. 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

150. 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 CrO$_{4}^{2-}$ and Cr$_2$O$_7^{2-}$ are not the same.
(4) Cr$^{2+}$($d^4$) is a stronger reducing agent than Fe$^{2+}$($d^6$) in water.

151. Which of the following is a cationic detergent?

(1) Sodium stearate
(2) Cetyltrimethyl ammonium bromide
(3) Sodium dodecylbenzene sulphonate
(4) Sodium lauryl sulphate
152. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following?
(1) $R$ effect of $-\text{CH}_3$ groups
(2) $-R$ effect of $-\text{CH}_3$ groups
(3) Hyperconjugation
(4) $-I$ effect of $-\text{CH}_3$ groups

153. Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?
(1) $\text{SCN}^- < F^- < \text{CN}^- < \text{CO}_2^-$
(2) $F^- < \text{SCN}^- < \text{CO}_2^- < \text{CN}^-$
(3) $\text{CN}^- < \text{CO}_2^- < \text{SCN}^- < F^-$
(4) $\text{SCN}^- < F^- < \text{CO}_2^- < \text{CN}^-$

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. 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

156. 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

157. The number of protons, neutrons and electrons in $^{175}_{71}\text{Lu}$, respectively, are:
(1) 104, 71 and 71
(2) 71, 104 and 71
(3) 175, 104 and 71
(4) 71, 104 and 71

158. 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

159. 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

160. 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.

161. Identify the incorrect match.

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162. 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

163. 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.
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162. 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

163. What is the change in oxidation number of carbon in the following reaction?

\[ \text{CH}_4(\text{g}) + 4\text{Cl}_2(\text{g}) \rightarrow \text{CCl}_4(\text{l}) + 4\text{HCl}(\text{g}) \]

(1) 0 to +4
(2) −4 to +4
(3) 0 to −4
(4) +4 to +4

164. 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) 200 s
(2) 500 s
(3) 1000 s
(4) 100 s

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

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

166. Which of the following oxoacid of sulphur has −O−O− linkage?

(1) \( \text{H}_2\text{SO}_4 \), sulphuric acid
(2) \( \text{H}_2\text{S}_2\text{O}_8 \), peroxodisulphuric acid
(3) \( \text{H}_2\text{S}_2\text{O}_7 \), pyrosulphuric acid
(4) \( \text{H}_2\text{SO}_3 \), sulphurous acid

167. 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

168. Sucrose on hydrolysis gives:

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

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

(1) \( 2 \times 10^{-8} \text{ M} \)
(2) \( 1 \times 10^{-13} \text{ M} \)
(3) \( 1 \times 10^8 \text{ M} \)
(4) \( 2 \times 10^{-13} \text{ M} \)

170. 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 \( w = 0 \)

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

\[ \text{NHCH}_3 \]

(1) \[ \text{N(CH}_3)_2 \]
(2) \[ \text{NH}_2\text{C}_2\text{H}_5 \]
(3) \[ \text{NH}_2 \]
(4)
172. Identify compound X in the following sequence of reactions:

\[
\text{CH}_3\text{Cl}_2/hv \xrightarrow{X, 373 \text{ K}} \text{CHO}
\]

(1) CH₂Cl

(2) CHCl₂

(3) CCl₃

(4) Cl

173. 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

174. Identify a molecule which does not exist.

(1) Li₂

(2) C₂

(3) O₂

(4) He₂

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

\[
\text{CH}_2-\text{CH}_2-\text{CH}_3
\]

(1) CH₂ - CH₂ - CH₃

(2) CH₂ - CH = CH₂

(3) CH₂CH₂CH₃

(4) CH = CH - CH₃

176. 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
177. Anisole on cleavage with HI gives:

(1) \[
\text{I} + \text{CH}_3\text{OH}
\]

(2) \[
\text{OH} + \text{C}_2\text{H}_5\text{I}
\]

(3) \[
\text{I} + \text{C}_2\text{H}_5\text{OH}
\]

(4) \[
\text{OH} + \text{CH}_3\text{I}
\]

178. 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) Al$_2$O$_3$</td>
<td>(iii) Acidic</td>
</tr>
<tr>
<td>(d) Cl$_2$O$_7$</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)

179. 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$_2$

180. 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
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 H4. 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 average thermal energy for a mono-atomic gas is: \( k_B \) is Boltzmann constant and \( T \), absolute temperature

\[
\begin{align*}
(1) &\quad \frac{7}{2} k_B T \\
(2) &\quad \frac{1}{2} k_B T \\
(3) &\quad \frac{3}{2} k_B T \\
(4) &\quad \frac{5}{2} k_B T 
\end{align*}
\]

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

\[
\begin{align*}
(1) &\quad \rho \quad T \\
(2) &\quad \rho \quad T \\
(3) &\quad \rho \quad T \\
(4) &\quad \rho \quad T 
\end{align*}
\]

3. For which one of the following, Bohr model is not valid?

\[
\begin{align*}
(1) &\quad \text{Singly ionised neon atom (Ne}^+) \\
(2) &\quad \text{Hydrogen atom} \\
(3) &\quad \text{Singly ionised helium atom (He}^+) \\
(4) &\quad \text{Deuteron atom} 
\end{align*}
\]

4. 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:

\[
\begin{align*}
(1) &\quad \frac{5}{3} \\
(2) &\quad \frac{27}{8} \\
(3) &\quad \frac{9}{4} \\
(4) &\quad \frac{3}{2} 
\end{align*}
\]

5. 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:

\[
\begin{align*}
(1) &\quad 20.0 \text{ g} \\
(2) &\quad 2.5 \text{ g} \\
(3) &\quad 5.0 \text{ g} \\
(4) &\quad 10.0 \text{ g} 
\end{align*}
\]

6. 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:

\[
\begin{align*}
(1) &\quad 80 \text{ cm} \\
(2) &\quad 33 \text{ cm} \\
(3) &\quad 50 \text{ cm} \\
(4) &\quad 67 \text{ cm} 
\end{align*}
\]

7. 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:

\[
\begin{align*}
(\mu_0) = 4\pi \times 10^{-7} \text{ T m A}^{-1} \\
(1) &\quad 2.4\pi \times 10^{-7} \text{ T m A}^{-1} \\
(2) &\quad 2.4\pi \times 10^{-4} \text{ T m A}^{-1} \\
(3) &\quad 8.0 \times 10^{-5} \text{ T m A}^{-1} \\
(4) &\quad 2.4\pi \times 10^{-5} \text{ T m A}^{-1} 
\end{align*}
\]

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

\[
\begin{align*}
(1) &\quad ^{103}\text{Kr} \\
(2) &\quad ^{144}\text{Ba} \\
(3) &\quad ^{91}\text{Zr} \\
(4) &\quad ^{101}\text{Kr} \\
\end{align*}
\]
3. 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) 0.02 kg/m³
(2) 0.5 kg/m³
(3) 0.2 kg/m³
(4) 0.1 kg/m³

10. 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

11. An electron is accelerated from rest through a potential difference of V volt. If the de Broglie wavelength of the electron is 1.227 × 10⁻² nm, the potential difference is:

(1) 10¹ V
(2) 10 V
(3) 10² V
(4) 10³ V

12. A short electric dipole has a dipole moment of 16 × 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° 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) zero
(2) 50 V
(3) 200 V
(4) 400 V

13. 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/s²)

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

14. 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) 1.5 × 10⁻² m
(2) 1.0 × 10⁻² m
(3) 1.0 × 10⁻¹ m
(4) 1.5 × 10⁻¹ m

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

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

16. A spherical conductor of radius 10 cm has a charge of 3.2 × 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 × 10⁷ N/C
(2) 1.28 × 10⁴ N/C
(3) 1.28 × 10⁵ N/C
(4) 1.28 × 10⁶ N/C

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

(1) 1 : c²
(2) c : 1
(3) 1 : 1
(4) 1 : c

18. 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
19. 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) 537 Hz
   (2) 523 Hz
   (3) 524 Hz
   (4) 536 Hz

20. The increase in the width of the depletion region in a p-n junction diode is due to:
   (1) increase in forward current
   (2) forward bias only
   (3) reverse bias only
   (4) both forward bias and reverse bias

21. 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) \( \frac{MgL}{A(L_1 - L)} \)
   (2) \( \frac{MgL_1}{AL} \)
   (3) \( \frac{Mg(L_1 - L)}{AL} \)
   (4) \( \frac{MgL}{AL_1} \)

22. The energy required to break one bond in DNA is \( 10^{-20} \) J. This value in eV is nearly:
   (1) 0.006
   (2) 6
   (3) 0.6
   (4) 0.06

23. 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

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

25. 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 m\(^2\) V\(^{-1}\) s\(^{-1}\) of:
   (1) \( 2.25 \times 10^{-15} \)
   (2) \( 2.25 \times 10^{15} \)
   (3) \( 2.5 \times 10^6 \)
   (4) \( 2.5 \times 10^{-6} \)

26. 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

27. 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) \( \frac{A}{2\mu} \)
   (3) \( \frac{2A}{\mu} \)
   (4) \( \mu A \)

28. 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) 25.1 A
   (2) 1.7 A
   (3) 2.05 A
   (4) 2.5 A
29. 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.

30. 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

31. 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

32. 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:

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

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

33. 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

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

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

35. 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) $6.00 \times 10^{-7}$ rad
(2) $3.66 \times 10^{-7}$ rad
(3) $1.83 \times 10^{-7}$ rad
(4) $7.32 \times 10^{-7}$ rad

36. 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) $5.00 \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
(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) $0.44 \times 10^{-10} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
37. 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%

38. 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) 5 N/C
(2) zero
(3) 0.5 N/C
(4) 1 N/C

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

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

40. 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) 48 \times 10^3 J
(2) 10 \times 10^3 J
(3) 12 \times 10^3 J
(4) 24 \times 10^3 J

41. 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) $45^\circ < i_b < 90^\circ$

42. 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:

$\mu_0 = 4\pi \times 10^{-7}$ T m A⁻¹

(1) $3.14 \times 10^{-5}$ T
(2) $6.28 \times 10^{-4}$ T
(3) $3.14 \times 10^{-4}$ T
(4) $6.28 \times 10^{-5}$ T

43. 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

44. 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

45. 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) $6\hat{j}$ N m
(3) $6\hat{i}$ N m
(4) $-6\hat{i}$ N m

46. 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
47. 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

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

\( \text{CH}_2\text{CH}_2\text{CH}_3 \)

(1)  

\( \text{CH} = \text{CH} - \text{CH}_3 \)

(2)  

\( \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \)

(3)  

\( \text{CH}_2 - \text{CH} = \text{CH}_2 \)

(4)

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

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

50. 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) Unununium</td>
<td>(iv) Darmstadtium</td>
</tr>
</tbody>
</table>

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

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

(1) \( \beta \)-Elimination reaction  
(2) Follows Zaitsev rule  
(3) Dehydrohalogenation reaction  
(4) Dehydration reaction

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

52. 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 O\(_2\)(g) [Atomic mass of O = 16]

53. 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.

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

(1) Hyperconjugation  
(2) −I effect of −CH\(_3\) groups  
(3) +R effect of −CH\(_3\) groups  
(4) −R effect of −CH\(_3\) groups
55. Anisole on cleavage with HI gives:

(1) \[ \text{I} + \text{C}_2\text{H}_5\text{OH} \]

(2) \[ \text{OH} + \text{CH}_3\text{I} \]

(3) \[ \text{I} + \text{CH}_3\text{OH} \]

(4) \[ \text{OH} + \text{C}_2\text{H}_5\text{I} \]

56. 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) 18 bar
(2) 9 bar
(3) 12 bar
(4) 15 bar

57. 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

58. Match the following:

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<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?

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

59. 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

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

(1) \[ \text{NHC}_2\text{H}_5 \]
(2) \[ \text{NH}_2 \]
(3) \[ \text{NHCH}_3 \]
(4) \[ \text{N(CH}_3)_2 \]
61. 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

62. 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

63. 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

64. On electrolysis of dil. sulphuric acid using Platinum (Pt) electrode, the product obtained at anode will be:
   (1) SO₂ gas
   (2) Hydrogen gas
   (3) Oxygen gas
   (4) H₂S gas

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

66. 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

67. 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

68. Hydrolysis of sucrose is given by the following reaction.
   \[ \text{Sucrose} + H_2O \rightleftharpoons \text{Glucose} + \text{Fructose} \]
   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) \(8.314 \text{ J mol}^{-1} \text{K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})\)

69. The mixture which shows positive deviation from Raoult’s law is:
   (1) Chloroethane + Bromoethane
   (2) Ethanol + Acetone
   (3) Benzene + Toluene
   (4) Acetone + Chloroform

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

71. Paper chromatography is an example of:
   (1) Column chromatography
   (2) Adsorption chromatography
   (3) Partition chromatography
   (4) Thin layer chromatography
72. Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?

(1) $\text{CN}^- < C_2\text{O}_4^{2-} < \text{SCN}^- < F^-$

(2) $\text{SCN}^- < F^- < C_2\text{O}_4^{2-} < \text{CN}^-$

(3) $\text{SCN}^- < F^- < \text{CN}^- < C_2\text{O}_4^{2-}$

(4) $F^- < \text{SCN}^- < C_2\text{O}_4^{2-} < \text{CN}^-$

73. 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 $w = 0$

74. 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 $\Delta_S > 0$

75. 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

76. Identify compound X in the following sequence of reactions:

HCHO $\text{Cl}_2/\text{hv}$ $\rightarrow$ CH$_3$CHO $\rightarrow$ CH$_3$CHO

CCl$_3$

Cl

CH$_2$Cl

CHCl$_2$

(1)

(2)

(3)

(4)

77. 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) 4

(2) 1

(3) 2

(4) 3

78. Which of the following is a cationic detergent?

(1) Sodium dodecylbenzene sulphonate

(2) Sodium lauryl sulphate

(3) Sodium stearate

(4) Cetyltrimethyl ammonium bromide
79. Which of the following is a natural polymer?
   (1) poly (Butadiene-acrylonitrile)
   (2) cis-1,4-polysoprene
   (3) poly (Butadiene-styrene)
   (4) polybutadiene

80. Which of the following oxoacid of sulphur has $\text{O} - \text{O} -$ linkage?
   (1) $\text{H}_2\text{S}_2\text{O}_7$, pyrosulphuric acid
   (2) $\text{H}_2\text{SO}_3$, sulphurous acid
   (3) $\text{H}_2\text{SO}_4$, sulphuric acid
   (4) $\text{H}_2\text{S}_2\text{O}_8$, peroxodisulphuric acid

81. 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

82. Identify a molecule which does not exist.
   (1) O$_2$
   (2) He$_2$
   (3) Li$_2$
   (4) C$_2$

83. 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) 0.60 K
   (2) 0.20 K
   (3) 0.80 K
   (4) 0.40 K

84. 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$_2$

85. The number of protons, neutrons and electrons in $^{175}_{71}$Lu, respectively, are:
   (1) 175, 104 and 71
   (2) 71, 104 and 71
   (3) 104, 71 and 71
   (4) 71, 71 and 104

86. 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.

87. Match the following and identify the correct option.
   (a) CO(g) + $\text{H}_2$(g) (i) Mg(HCO$_3$)$_2$ + Ca(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) (i) (iii) (ii) (iv)
   (2) (iii) (i) (ii) (iv)
   (3) (iii) (ii) (i) (iv)
   (4) (iii) (iv) (ii) (i)

88. Identify the incorrect statement.
   (1) The oxidation states of chromium in $\text{CrO}_4^{2-}$ and $\text{Cr}_2\text{O}_7^{2-}$ are not the same.
   (2) $\text{Cr}^{2+}$($d^4$) is a stronger reducing agent than $\text{Fe}^{2+}$($d^6$) 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.
89. 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) \( \frac{4}{\sqrt{3}} \times 288 \text{ pm} \)

90. 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

91. 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)

92. Which of the following is not an attribute of a population?

(1) Species interaction

(2) Sex ratio

(3) Natality

(4) Mortality

93. 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

94. The roots that originate from the base of the stem are:

(1) Lateral roots

(2) Fibrous roots

(3) Primary roots

(4) Prop roots

95. Floridean starch has structure similar to:

(1) Laminarin and cellulose

(2) Starch and cellulose

(3) Amylopectin and glycogen

(4) Mannitol and algin

96. Dissolution of the synaptonemal complex occurs during:

(1) Leptotene

(2) Pachytene

(3) Zygotene

(4) Diplotene

97. 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.
98. 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

99. The body of the ovule is fused within the funicle at:
   (1) Chalaza
   (2) Hilum
   (3) Micropyle
   (4) Nucellus

100. 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

101. 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)

102. 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

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

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

105. 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’ - CTAAAG - 3’
        3’ - GAATTC - 5’

106. 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) (iv) (iii) (i) (ii)
(2) (ii) (iv) (i) (iii)
(3) (i) (iii) (ii) (iv)
(4) (iii) (ii) (iv) (i)
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) 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)

108. 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</td>
<td>(ii) Cellular defence deficiency</td>
</tr>
<tr>
<td>(c) RNAi</td>
<td>(iii) Detection of HIV infection</td>
</tr>
<tr>
<td>(d) PCR</td>
<td>(iv) Bacillus thuringiensis</td>
</tr>
</tbody>
</table>

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

109. 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

110. 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

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

(1) RNA polymerase
(2) DNA ligase
(3) DNA helicase
(4) DNA polymerase

112. 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.

113. 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)

114. 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

115. 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) G₂ phase
(2) M phase
(3) G₁ phase
(4) S phase
116. 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) (iv) (iii) (i) (ii)
(4) (iii) (ii) (iv) (i)

117. Strobili or cones are found in:

(1) *Equisetum*
(2) *Salvinia*
(3) *Pteris*
(4) *Marchantia*

118. 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.

119. 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

120. 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) <em>Asterias</em> pest</td>
</tr>
<tr>
<td>(b) Adult with radial</td>
<td>(ii) <em>Scorpion</em></td>
</tr>
<tr>
<td>symmetry and larva</td>
<td>with bilateral symmetry</td>
</tr>
<tr>
<td>with bilateral symmetry</td>
<td>with bilateral symmetry</td>
</tr>
<tr>
<td>(c) Book lungs</td>
<td>(iii) <em>Ctenopelana</em></td>
</tr>
<tr>
<td>(d) Bioluminescence</td>
<td>(iv) <em>Locusta</em></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)

121. The enzyme enterokinase helps in conversion of:

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

122. 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

123. 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) Filariasis</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) (iv) (i) (ii) (iii)
(2) (i) (iii) (ii) (iv)
(3) (iii) (iv) (i) (ii)
(4) (ii) (i) (iii) (iv)
124. Ray florets have:
   (1) Half inferior ovary
   (2) Inferior ovary
   (3) Superior ovary
   (4) Hypogynous ovary

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

126. 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) Cytokinlin
   (3) Gibberellin
   (4) Ethylene

127. 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)

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

129. 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

130. 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.

131. 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 Na+ and water from renal tubules due to aldosterone
   (4) Atrial natriuretic factor causes vasoconstriction

132. 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

133. 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.
134. Identify the **wrong** statement with reference to transport of oxygen.

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

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

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

136. 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

137. In light reaction, plastoquinone facilitates the transfer of electrons from:

   (1) PS-I to ATP synthase
   (2) PS-II to Cyt$b_6f$ complex
   (3) Cyt$b_6f$ complex to PS-I
   (4) PS-I to NADP$^+$

138. 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) (ii) (c) (d) (i)
   (2) (ii) (iii) (i) (c)
   (3) (iii) (iv) (i) (ii)
   (4) (iv) (ii) (iii) (i)

139. Flippers of Penguins and Dolphins are examples of:

   (1) Natural selection
   (2) Adaptive radiation
   (3) Convergent evolution
   (4) Industrial melanism

140. 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

141. The ovary is half inferior in:

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

142. The process of growth is maximum during:

   (1) Dormancy
   (2) Log phase
   (3) Lag phase
   (4) Senescence

143. 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

144. 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
145. 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) <em>Clostridium butylicum</em></td>
<td>(i) Cyclosporin-A</td>
</tr>
<tr>
<td>(b) <em>Trichoderma polysporum</em></td>
<td>(ii) Butyric Acid</td>
</tr>
<tr>
<td>(c) <em>Monascus purpureus</em></td>
<td>(iii) Citric Acid</td>
</tr>
<tr>
<td>(d) <em>Aspergillus niger</em></td>
<td>(iv) Blood cholesterol</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)

146. 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

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

148. 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.

149. 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

150. 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

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

152. 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

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

154. 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
155. 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.

156. 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)

157. 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.

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

159. 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>

160. 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.

161. 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</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>

162. 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 I^A and I^B are present together, they express same type of sugar.
163. 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.

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

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

166. 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)

167. 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

168. 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

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

170. 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

171. 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) 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>
(1) (i) (ii) (iv) (iii)
(2) (i) (iii) (ii) (iv)
(3) (iii) (i) (iv) (ii)
(4) (iv) (ii) (i) (iii)
172. Identify the basic amino acid from the following.
   (1) Valine 
   (2) Tyrosine 
   (3) Glutamic Acid 
   (4) Lysine 

173. 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) (ii) (iv) (iii) (i)
   (2) (iii) (iv) (i) (ii)
   (3) (iv) (iii) (ii) (i)
   (4) (i) (ii) (iv) (iii)

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

175. 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.

176. 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 depletion substances
   (4) Release of Green House gases

177. 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

178. 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

179. 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

180. 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.
Space For Rough Work
23
Space For Rough Work
Space For Rough Work