Mock Test
(for NEET-2020)

Instructions:
(i) Use Blue/Black ballpoint pen only to darken the appropriate circle.
(ii) Mark should be dark and should completely fill the circle.
(iii) Dark only one circle for each entry.
(iv) Dark the circle in the space provided only.
(v) Rough work must not be done on the Answer sheet and do not use white-fluid or any other rubbing material on Answer sheet.
(vi) Each question carries 4 marks. For every wrong response 1 mark shall be deducted from total score.

Choose the correct answer:

1. To get five images of a point object, the angle between two plane mirrors may be
   (1) 30° (2) 60° (3) 45° (4) 90°

2. An object 2 cm tall is placed at distance of 5 cm in front of a mirror. In order to produce an upright image of 4 cm height, mirror required is
   (1) Convex mirror of radius of curvature 10 cm
   (2) Concave mirror of radius of curvature 10 cm
   (3) Concave mirror of radius of curvature 20 cm
   (4) Plane mirror of height 10 cm

3. A ray of light is incident at an angle of 60° on a prism of refracting angle 60°. If refractive index of the material of the prism is $\sqrt{3}$, then angle between incident ray and emergent ray will be
   (1) 45° (2) 60° (3) 37° (4) 30°

4. The focal length of the eyepiece and the objective of an astronomical telescope are 4 cm and 50 cm respectively. The length of the telescope for the adjustment in which eye is most strained will be about [least distance of distinct vision is 25 cm]
   (1) 63 cm (2) 45 cm (3) 53 cm (4) 40 cm

5. Light takes time ($t_1$) to travel a distance ‘a’ in medium (1) and takes time ($t_2$) to travel a distance ‘b’ in a medium (2). The critical angle for the pair of medium is [medium (2) is denser than medium (1)].
   (1) $\sin^{-1}\left(\frac{at_2}{bt_1}\right)$ (2) $\sin^{-1}\left(\frac{bt_1}{at_2}\right)$
   (3) $\sin^{-1}\left(\frac{at_1}{bt_2}\right)$ (4) $\sin^{-1}\left(\frac{bt_2}{at_1}\right)$

6. Diameter of aperture of a plano-convex lens is 8 cm and its thickness at center is 4 mm. If speed of light in the material of lens is $\frac{9}{5} \times 10^8$ m/s, then focal length of the lens will be
   (1) 30 cm (2) 20 cm (3) 10 cm (4) 15 cm

7. Dispersive power of a prism depends on
   (1) Angle of the prism
   (2) Size of the prism
   (3) Material of the prism
   (4) Both (1) and (2)
8. A ray of light falls on a transparent sphere with center at C as shown in figure. If refractive index of the sphere is \( \frac{4}{3} \). Then net deviation of the ray will be

(1) 16°  (2) 30°  (3) 32°  (4) 60°

9. A converging lens of power 4D is placed in contact with a diverging lens of power −2D. The nature and focal length of this combination will be

(1) Diverging, 50 cm  (2) Converging, 50 cm  (3) Converging, 25 cm  (4) Diverging, 25 cm

10. A point object is placed in front of a convex mirror of focal length \( f_0 \). Which one of the following graphs correctly represent the variation of magnification \( m \) of mirror with image distance \( v \) from the pole of mirror?

(1)  \[
m = \frac{1}{v - f_0}
\]

(2)  \[
m = \frac{1}{v + f_0}
\]

(3)  \[
m = \frac{1}{v - f_0}
\]

(4)  \[
m = \frac{1}{v + f_0}
\]

11. A point source of light at a finite distance from source produces

(1) Plane wavefront  (2) Spherical wavefront  (3) Cylindrical wavefront  (4) Depends on the colour of light

12. If the amplitude of transmitted polarised light through a polariser is \( \frac{A}{2} \), then the amplitude of unpolarised light incident on it is

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

13. A small aperture is illuminated with parallel beam of light having wavelength \( \lambda = 942 \text{ nm} \). If first minima is formed at an angular position of 1.5°, then size of aperture is

(1) 18 \( \mu \text{m} \)  (2) 36 \( \mu \text{m} \)  (3) 9 \( \mu \text{m} \)  (4) 27 \( \mu \text{m} \)

14. The displacement of two interfering light waves at \( x = 0 \) is given by \( y_1 = \frac{4}{5} \sin \omega t \) and \( y_2 = \frac{4}{5} \sin \left( \omega t + \frac{2\pi}{3} \right) \) respectively. The amplitude of resultant wave will be

(1) \( \frac{3}{5} \)  (2) \( \frac{2}{5} \)  (3) \( \frac{4}{5} \)  (4) \( \frac{1}{5} \)

15. In Young’s double-slit experiment, the intensity of light at a point on screen, where path difference is \( \frac{\lambda}{4} \) is \( I \). The intensity of the light where the path difference is \( \frac{\lambda}{6} \) will be

(1) \( I \)  (2) \( 2I \)  (3) \( \frac{I}{2} \)  (4) \( \frac{3I}{2} \)

16. Upto what distance is ray optics, a good approximation when the aperture is 4 mm wide and the wavelength is 800 nm?

(1) 20 m  (2) 10 m  (3) 8 m  (4) 18 m

17. In Young’s double slit experiment a mica plate of refractive index \( \mu \) is introduced in the path of light coming from one of the slit. If the central bright fringe shift to the point originally occupied by fourth bright fringe. Then thickness of the mica plate will be (Symbol have their usual meaning)

(1) \( \frac{2\lambda}{(\mu - 1)} \)  (2) \( \frac{4\lambda}{3(\mu - 1)} \)  (3) \( \frac{4\lambda}{(\mu - 1)} \)  (4) \( \frac{2\lambda}{3(\mu - 1)} \)
18. The critical angle for a transparent crystal-air medium is 60°. Then its polarising angle is
   \[ (1) \cot^{-1}(2) \quad (2) \cot^{-1}\left(\frac{1}{2}\right) \quad (3) \tan^{-1}\left(\frac{2}{\sqrt{3}}\right) \quad (4) \tan^{-1}\left(\frac{\sqrt{3}}{2}\right) \]

19. In a forward biased p-n junction diode
   (1) Net current in the diode only due to diffusion current
   (2) Net current in the diode only due to drift current
   (3) Net current is sum of magnitudes of diffusion current and drift current
   (4) Net current is difference of magnitudes of diffusion current and drift current

20. Which logic gate is represented by the following combination of logic gates?
   \[ A \left\rpar{\bar{B} \lor \hat{C}} \right. \]
   (1) OR gate \quad (2) AND gate \quad (3) NOR gate \quad (4) XOR gate

21. Which of the following diode is reverse biased?
   (1) \(+5\text{V}\) \quad (2) \(-2\text{V}\) \quad (3) \(-2\text{V}\) \quad (4) \(-3\text{V}\)

22. A p-n junction diode is connected in parallel to a 3 \(\Omega\) resistance in the circuit as shown in figure. If potential drop across the diode is 0.3 V. Then current through the 7 \(\Omega\) resistance will be
   \[ (1) 0.3 \text{ A} \quad (2) 0.7 \text{ A} \quad (3) 0.9 \text{ A} \quad (4) 0.5 \text{ A} \]

23. A rectifier circuit along with input is as shown in figure. The output waveform across \(R_L\) is given by (Consider diodes are ideal)

   \[ (1) V_{op} \quad (2) \quad (3) \quad (4) \]

24. The current gain of the common base n-p-n transistor is 0.96. If it is used as common-emitter amplifier, output resistance 4000 \(\Omega\) input resistance 1000 \(\Omega\), then voltage gain of the amplifier will be
   (1) 24 \quad (2) 96 \quad (3) 48 \quad (4) 72

25. The I-V characteristic of a photo diode is
   (1) \[ \]
   (2) \[ \]
   (3) \[ \]
   (4) \[ \]

26. For a transistor in active region
   (1) The base region must be very thick and highly doped
   (2) Both the emitter base junction as well as base-collector junction are forward biased
   (3) Base, emitter, and collector region should have similar size and doping concentration
   (4) The emitter-base junction is forward biased and base-collector junction is reversed biased

27. The real time variation of input signal A and B are as shown in figure. If the inputs are fed into NOR gate, then select the correct output signal.
   (1) \[ \]
   (2) \[ \]
   (3) \[ \]
   (4) \[ \]
28. An *P*-type semiconductor is
(1) Positively charged
(2) Electrically neutral
(3) Negatively charged
(4) Positively or negatively charged depending upon the amount of impurity

29. A point source of light is placed at a distance of 2 m from a photocell and cut-off potential is found to be $V_0$. If distance between point source and photocell is halved, then cut-off potential will be
(1) $V_0$
(2) $4V_0$
(3) $2V_0$
(4) $\frac{V_0}{2}$

30. A photon of energy $E_0$ falls normally on a perfectly absorbing surface. The momentum transferred to the surface is
(1) $\frac{2E_0}{c}$
(2) $\frac{E_0}{c}$
(3) $\frac{E_0}{2c}$
(4) $\frac{3E_0}{2c}$

31. A particle of mass $M$ at rest explodes into two parts $A$ and $B$ having masses $m$ and $2m$ respectively. The ratio of de-Broglie wavelength of part $A$ and $B$ will be
(1) $1 : 2$
(2) $2 : 1$
(3) $1 : 1$
(4) $1 : \sqrt{2}$

32. Graph of cut-off potential ($V_0$) versus frequency ($f$) for same intensity of light for metal plates $A$ and $B$ is as shown in figure. Choose the correct statement.

- Work function of metal $A$ is greater than work function of metal $B$
- Work function of metal $A$ is less than work function of metal $B$
- Work function of metal $A$ is equal to work function of metal $B$
- Both line have same intercept

33. In photoelectric effect, the electron are ejected from metals, if the incident light has a certain maximum
(1) Wavelength
(2) Amplitude
(3) Frequency
(4) Angle of incidence

34. If the kinetic energy of a proton gets doubled, then the de-Broglie wavelength associated with it change by a factor
(1) $\frac{1}{2}$
(2) $\frac{1}{3}$
(3) $\sqrt{2}$
(4) $\frac{1}{\sqrt{2}}$

35. The de-Broglie wavelength of a particle accelerated with 100 volt potential difference is $10^{-9}$ m. The de-Broglie wavelength of particle if it is accelerated by 1600 volt potential difference will be
(1) 25 Å
(2) 2.5 Å
(3) 5 Å
(4) 0.5 Å

36. The velocity of most energetic electron emitted from a metallic surface is tripled when the frequency $\nu$ of the incident radiation is doubled. The work function of this metal will be ($h$ is Planck's constant)
(1) $\frac{5h \nu}{8}$
(2) $\frac{3h \nu}{8}$
(3) $\frac{7h \nu}{8}$
(4) $\frac{h \nu}{4}$

37. In the $r^{th}$ state, energy of electron in hydrogen atom is $E_n = -\frac{13.6}{n^2}$ eV. The potential energy of electron in first excited state will be
(1) $-27.2$ eV
(2) $-3.4$ eV
(3) $-3.2$ eV
(4) $-6.8$ eV

38. The ratio of maximum to minimum wavelength in Lyman series is
(1) 9 : 5
(2) 4 : 3
(3) 36 : 5
(4) 4 : 1

39. When an electron is in $4^{th}$ excited energy state in hydrogen atom, the possible number of emission spectral lines is
(1) 6
(2) 10
(3) 8
(4) 20

40. In Rutherford's experiment the number of $\alpha$-particle scattered through an angle of 60° is 20 per minute. Then the number of $\alpha$-particle scattered through an angle of 90° per minute by the same nucleus is
(1) 12
(2) 10
(3) 5
(4) 16
41. The ratio of the nuclear density of two nuclei of mass number 27 and 64 will be
   (1) 3 : 4          (2) 1 : 1
   (3) \(\sqrt{3} : \sqrt{4}\)          (4) \(3^3 : (4)^3\)

42. A nucleus of \(^{64}_{X} X^{220}\) originally at rest emits an \(\alpha\)-particle with speed \(v_0\). The speed of daughter nucleus will be
   (1) \(\frac{v_0}{216}\)          (2) \(\frac{4v_0}{27}\)
   (3) \(\frac{v_0}{54}\)          (4) \(\frac{3v_0}{108}\)

43. The number of nuclei of a radioactive sample becomes \(\frac{1}{8}\) part of its initial value \(N_0\) in period of 6 years. The mean life (in years) of the radioactive sample will be

44. The binding energies of the nuclei of element \(P\) and \(Q\) are \(E_P\) and \(E_Q\) respectively. Two nuclei of element \(P\) fuse to give one nuclei of element \(Q\). This fusion process is accompanied by release of energy \(e\). Then \(E_P\), \(E_Q\) and \(e\) are related to each other as
   (1) \(E_Q + e = 2E_P\)
   (2) \(2E_Q + e = E_P\)
   (3) \(E_P + e = 2E_Q\)
   (4) \(2E_P + e = E_Q\)

45. Two radioactive sample have decay constant \(12k\) and \(4k\). If they have the same number of nuclei initially, the ratio of respective number of nuclei after a time \(\frac{1}{4k}\) is
   (1) \(\frac{1}{e^3}\)
   (2) \(\frac{1}{e}\)
   (3) \(\frac{1}{e^3}\)
   (4) \(\frac{1}{e}\)

46. Which one is most reactive towards \(S_N^1\) reaction?
   (1) \(C_6H_5CH_2Br\)          (2) \((C_6H_5)_2CHBr\)
   (3) \((C_6H_5)_2CBr\)          (4) \(C_6H_5Br\)

47. 2-Bromo-3-methylpentane is heated with potassium ethoxide in ethanol. The major product obtained is
   (1) 3-Methylpent-2-ene
   (2) 2-Ethoxy-3-methylpentane
   (3) 2-Methylpent-2-ene
   (4) 4-Methylpent-2-ene

48. Consider the reaction.
   \[CH_3CH_2CH_2Br + CH_3MgBr \rightarrow CH_3CH_2CH_2CH_3 + MgBr_2\]
   The above reaction can occur in which of the solvent?
   (1) \(H_2O\)          (2) Acetone
   (3) Ethanol          (4) Tetrahydrofuran

49. The product C is
   (1) \[\begin{array}{c}
   CH_3 \\
   HO \\
   CH_3
   \end{array}\]
   (2) \[\begin{array}{c}
   CH_3 \\
   H \\
   OH
   \end{array}\]
   (3) \[\begin{array}{c}
   CH_3 \\
   HO \\
   CH_3
   \end{array}\]
   (4) \[\begin{array}{c}
   CH_3 \\
   H \\
   OH
   \end{array}\]

50. Which one is most acidic?
   (1) \[\begin{array}{c}
   OH \\
   \end{array}\]
   (2) \[\begin{array}{c}
   OH \\
   \end{array}\]
   (3) \[\begin{array}{c}
   NO_2 \\
   \end{array}\]
   (4) \[\begin{array}{c}
   NO_2 \\
   \end{array}\]

51. Propene on reaction with \(B_2H_6\) followed by \(H_2O_2/\text{OH}^-\) gives A. The compound A on treatment with Na gives B and with \(\text{PCl}_5\) gives C. B and C react together to form
   (1) \(CH_3CH_2CH_2OH\)
   (2) \(CH_3CH_2OCH_3\)
   (3) \(CH_3CH_2CH_2OCH_2CH_2CH_3\)
   (4) \(CH_3CH_2CH_2CH_2CH_2CH_3\)
52. On treating phenol with chloroform in the presence of sodium hydroxide, the intermediate formed is

(1) OHCHCl₂
(2) ONaCHCl₂
(3) ONaCHO
(4) ONaCOOH

53. Major product formed by the dehydration of

\[
\text{OH} \quad \text{in acidic medium is}
\]

(1) \[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]
(2) \[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]
(3) \[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]
(4) \[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]

54. \[
\text{CH}_3\text{OCH}_2\text{CH}_3 \xrightarrow{\text{HCl, conc., Excess, } \Delta} \text{A} + \text{B}
\]
Product A and B are

(1) \[
\begin{array}{c}
\text{CH}_3 \\
\text{OH}
\end{array}
\]
(2) \[
\begin{array}{c}
\text{CH}_3 \\
\text{H}
\end{array}
\]
(3) \[
\begin{array}{c}
\text{OH} \\
\text{H}
\end{array}
\]
(4) \[
\begin{array}{c}
\text{OH} \\
\text{H}
\end{array}
\]

55. \[
\text{A} \xrightarrow{(\text{R}, \text{MgBr})} \text{2° Alcohol}
\]
A can be

(1) HCHO
(2) RCHO
(3) RCOR
(4) RCOOR

56. In the reaction

\[
\text{OH} \xrightarrow{\text{NaOH}} \text{ONa} \xrightarrow{(i) \text{CO}_2} \text{OH} \xrightarrow{(ii) \text{H}^+} \text{COOH}
\]
The electrophile involved is

(1) \[
\text{CO}_2
\]
(2) \[
\text{CO}
\]
(3) \[
\text{H}^+
\]
(4) \[
\text{COOH}
\]

57. The boiling points of aldehydes and ketones are higher than corresponding hydrocarbons and ethers of comparable molecular masses. It is due to

(1) Formation of intramolecular H-bonding
(2) Weak molecular association arising out of the dipole-dipole interaction
(3) Formation of intermolecular H-bonding
(4) van der Waals force of attraction

58. The product formed when propanal undergoes aldol condensation

(1) \[
\begin{array}{c}
\text{CH}_3 \\
\text{C} = \text{CH} - \text{CH} - \text{CH} - \text{C} - \text{H}
\end{array}
\]
(2) \[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]
(3) \[
\begin{array}{c}
\text{OH} \\
\text{H}
\end{array}
\]
(4) \[
\begin{array}{c}
\text{OH} \\
\text{H}
\end{array}
\]

59. Most acidic compound among the following is

(1) \[
\text{NO}_2\text{CH}_2\text{COOH}
\]
(2) \[
\text{CH}_2 = \text{C} = \text{CHCOOH}
\]
(3) \[
\text{HCOOH}
\]
(4) \[
\text{CF}_3\text{COOH}
\]

60. Which of the following is not a barbiturate?

(1) Veronal
(2) Morphine
(3) Amytal
(4) Luminal

61. Optical isomerism is shown by

(1) Lactic acid
(2) Malonic acid
(3) Succinic acid
(4) Oxalic acid

62. Select the incorrect statement regarding acetophenone.

(1) Forms 2,4-DNP derivative
(2) Gives yellow precipitate on heating with iodine in the presence of sodium hydroxide
(3) Does not reduce Fehling's reagent
(4) Give positive Tollens's test

63. Acetone is treated with excess of ethylene glycol in the presence of hydrogen chloride. The product obtained is

(1) \[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]
(2) \[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]
(3) \[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]
(4) \[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_3
\end{array}
\]
64. Nucleophilic addition reaction will be most favoured in
   (1) CH₃CH₂COCH₃  (2) CH₃COCH₃
   (3) CH₃CHO  (4) HCHO

65. Reaction by which benzoic acid cannot be prepared is
   (1) CH₃ — CH — CH₃  (2) CH₃ — C — CH₃
   (3) CH₃ — CH — CH₃  (4) CH₃—C—CH₃

66. In the following sequence of reaction
   \[ \text{CH}_3\text{Br} \xrightarrow{\text{KCN}} \text{A} \xrightarrow{\text{H}_2\text{O}^+} \text{B} \xrightarrow{\text{PbSO}_4} \text{C} \xrightarrow{\text{H}_2\text{O}/\text{H}^+} \text{D} \]
   The end product (D) is
   (1) CH₃CH₂OH  (2) CH₃CHO
   (3) CH₃CH₃  (4) CH₃COCH₃

67. Wolff-Kishner reduction of ketone is carried out in the presence of
   (1) H₂/Pt
   (2) (i) NH₂ — NH₂, (ii) KOH/ethylene glycol/Δ
   (3) (i) Zn — Hg/HCℓ, (ii) H₂O/H⁺
   (4) LiAlH₄

68. CH₃CH₂CH₂ — C — O — CH₂CH₃ \xrightarrow{\text{H}_2\text{O}/\text{H}^+} \text{A} + \text{B}.
   A and B are
   (1) CH₃CH₂CH₂CH₂COOH + C₂H₅OH
   (2) CH₃CH₂CH₂CH₂COOH + C₂H₅OH
   (3) CH₃CH₂CH₂CH₂COOH + C₂H₅OH
   (4) CH₃CH₂CH₂CH₂COOH + C₂H₅OH

69. The correct increasing order of basic strength for the following compounds is
   \[ \text{CH}_3 — \text{N} — \text{CH}_3 \quad \text{NH} — \text{CH}_3 \quad \text{NH}_2 \]
   (1) (III) < (II) < (I)  (2) (II) < (III) < (I)
   (3) (II) < (I) < (III)  (4) (I) < (III) < (II)

70. For the reaction
   \[ \text{NH}_2 \quad \xrightarrow{\text{HNO}_3/\text{H}_2\text{SO}_4, 288\text{ K}} \]
   The correct increasing order of the amount of products formed is
   (1) Ortho < Para < Meta
   (2) Meta < Ortho < Para
   (3) Meta < Para < Ortho
   (4) Ortho < Meta < Para

71. Which of the following reaction is appropriate for converting primary amine to isocyanide?
   (1) Carbylamine reaction
   (2) Hoffmann bromamide reaction
   (3) Stephen’s reaction
   (4) Gattermann reaction

72. Which of the following amines will not form sulphonamides with benzene sulphonyl chloride?
   (1) CH₃NH₂  (2) CH₃ — C — NH₂
   (3) CH₃ — NH — CH₃  (4) CH₃ — N — CH₃

73. Benzene diazonium chloride on reaction with phenol in alkaline medium forms
   (1) p-Hydroxyazobenzene (Blue dye)
   (2) p-Hydroxyazobenzene (Orange dye)
   (3) p-Aminoazobenzene (Yellow dye)
   (4) p-Aminoazobenzene (Orange dye)
74. \[
\text{C} \quad \text{C} \quad \text{O} \quad \text{N} - \text{H} \quad \xrightarrow{\text{KOH}} \quad \text{A} \quad \xrightarrow{\text{C}_2\text{H}_5\text{Br}} \quad \text{B} \quad \xrightarrow{\text{NaOH}} \quad \text{C} + \text{D}
\]

Product C and D are
(1) \[
\begin{align*}
\text{COOH} & + \text{C}_2\text{H}_5\text{NH}_2 \\
\text{COOH}
\end{align*}
\]
(2) \[
\text{C} + \text{C}_2\text{H}_5\text{OH}
\]
(3) \[
\text{COONa} + \text{C}_2\text{H}_5\text{NH}_2
\]
(4) \[
\text{COOH} + \text{C}_2\text{H}_5\text{OH}
\]

75. Consider the following reaction sequence
\[
\text{C}_6\text{H}_5\text{N}_2\text{Cl} \xrightarrow{\text{CuCN}} \text{A} \xrightarrow{\text{H}_2\text{O}/\text{HCl}} \text{B} \xrightarrow{\text{NH}_3/\Delta} \text{C} \xrightarrow{\text{B}_{12}\text{NaOH}} \text{D}
\]

Product D is
(1) \[
\text{CONH}_2
\]
(2) \[
\text{CH}_2\text{NH}_2
\]
(3) \[
\text{NH}_2
\]
(4) \[
\text{COONa}
\]

76. \[
\text{H}_3\text{C} - \text{CH} - \text{CH}_2 - \text{CH} = \text{CH}_2 + \text{HBr} \rightarrow \text{A}
\]

A (predominantly) is
(1) \[
\begin{align*}
\text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{Br} \\
\text{CH}_3
\end{align*}
\]
(2) \[
\begin{align*}
\text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH} - \text{CH}_3 \\
\text{CH}_3 - \text{Br}
\end{align*}
\]
(3) \[
\begin{align*}
\text{CH}_3 - \text{CH} - \text{CH} - \text{CH}_2 - \text{CH}_3 \\
\text{CH}_3 - \text{Br}
\end{align*}
\]
(4) \[
\begin{align*}
\text{CH}_3 - \text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \\
\text{CH}_3
\end{align*}
\]

77. Monomer of Nylon-6 is
(1) Isoprene (2) Acrylonitrile
(3) Caprolactam (4) Styrene

78. Which among the following is a condensation polymer?
(1) PVC (2) Terylene
(3) Teflon (4) Buna-N

79. The polymer which is used in the manufacture of paints is
(1) Glyptal (2) Polypropene
(3) Nylon-2-nylon-6 (4) Polyacrylonitrile

80. Ziegler-Natta catalyst is
(1) Rh(PPh\textsubscript{3})\textsubscript{3}Cl (2) Et\textsubscript{3}Al and PdCl\textsubscript{2}
(3) Et\textsubscript{3}Al and TiCl\textsubscript{4} (4) Et\textsubscript{4}Pb

81. Structure of neoprene polymer is
(1) \[
\begin{align*}
\text{CH}_2 - \text{C} = \text{CH} - \text{CH}_2
\end{align*}
\]
(2) \[
\begin{align*}
\text{CH}_2 - \text{C} = \text{CH} - \text{CH}_2
\end{align*}
\]
(3) \[
\begin{align*}
\text{CH}_2 - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{CH}
\end{align*}
\]
(4) \[
\begin{align*}
\text{OCH}_2 - \text{CH}_2 - \text{O} - \text{C} - \text{C} - \text{C}
\end{align*}
\]

82. Which among the following is incorrect statement about polysaccharides?
(1) Cellulose is found exclusively in plants
(2) Cellulose is a straight chain polysaccharide composed only of \(\beta\)-D-glucose units
(3) Starch is polymer of \(\alpha\)-D-glucose units
(4) Amylose is water insoluble component of starch

83. The compound which will not react with Tollen’s reagent is
(1) D-Mannose (2) D-Fructose
(3) Lactose (4) Sucrose

84. Number of chiral centers in \(\alpha\)-D-(\text{\textendash})-fructofuranose is
(1) 5 (2) 6
(3) 4 (4) 3

85. Which amino acid has a five membered ring?
(1) Lysine (2) Proline
(3) Serine (4) Phenylalanine
86. Deficiency of which vitamin causes pernicious anaemia?
(1) Vitamin B₁  (2) Vitamin B₆  (3) Vitamin B₁₂  (4) Vitamin K

87. Which among the following is a purine base?
(1) Uracil  (2) Guanine  (3) Thymine  (4) Cytosine

88. Essential amino acid among the following is
(1) Alanine  (2) Methionine  (3) Tyrosine  (4) Glutamine

89. Which of the following is not a broad spectrum antibiotics?
(1) Ampicillin  (2) Chloramphenicol  (3) Vancomycin  (4) Penicillin G

90. Which of the following does not act as a food preservative?
(1) Table salt  (2) Sugar  (3) Blue vitriol  (4) Vegetable oil

91. Each organism has invariably defined range of conditions that it can tolerate, diversity in the resources it utilises and a distinct functional role in the ecological system, all these together comprises its
(1) Habitat  (2) Niche  (3) Biome  (4) Landscape

92. If ‘+’ sign represents beneficial interaction and ‘0’ sign neutral interaction then the population interaction represented by +, 0 is
(1) Commensalism  (2) Protocooperation  (3) Amensalism  (4) Brood parasitism

93. The desert lizards bask in the sun and absorb heat when their body temperature drops below the comfort zone, but moves into shade when the ambient temperature starts increasing. This type of management of body temperature occurs through
(1) Biochemical means  (2) Physiological means  (3) Behavioural means  (4) Migratory means

94. Primary productivity of an area depends on
a. Variety of environmental factors
b. Availability of nutrients
c. Plant species inhabiting that area
d. Photosynthetic capacity of plants
Choose the correct option.
(1) Only a and b  (2) Only c and d  (3) Only b, c and d  (4) All a, b, c and d

95. The most limiting nutrient of marine ecosystem is
(1) Carbon  (2) Hydrogen  (3) Nitrogen  (4) Oxygen

96. Biomagnification is
(1) The increase in concentration of toxicant at successive trophic levels
(2) Natural aging of lakes by nutrient enrichment of its water
(3) Breeding crops with higher levels of vitamins and minerals
(4) The search of plant and animal species from which medicinal drugs and other commercially valuable compounds can be obtained

97. Acid rain is due to the oxides of
(1) Sulphur and carbon  (2) Nitrogen and carbon  (3) Sulphur and oxygen  (4) Sulphur and nitrogen

98. Which one is odd w.r.t. ex-situ conservation strategies?
(1) Wildlife safari parks  (2) Aquaria  (3) Cryopreservation  (4) Hotspots

99. Read the statements and choose the correct option.
(a) In general, species diversity decreases as we move away from the equator towards the poles.
b. Within a region, species richness increases with increasing explored area, but only upto a limit.
(1) Only a is correct  (2) Only a is incorrect  (3) Both a and b are correct  (4) Both a and b are incorrect
100. Which one is the most important cause that leads to extinction of plants and animals?
   (1) Alien species invasions
   (2) Over-exploitation
   (3) Co-extinction
   (4) Habitat loss and fragmentation

101. Given below pie chart is representation of global biodiversity of vertebrates. In this pie chart A, B and C respectively represent

![Pie Chart]

A  B  C
(1) Fishes  Amphibians  Birds
(2) Birds  Reptiles  Mammals
(3) Mammals  Reptiles  Amphibians
(4) Reptiles  Amphibians  Birds

102. Which one is incorrect match?
   (1) Joint Forest Management – Started in 1980, in India
   (2) Good ozone – Troposphere
   (3) Snow-blindness – UV-B

103. Match the column I with column II and choose the correct option.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. BOD</td>
<td>(i) Severe respiratory problems</td>
</tr>
<tr>
<td>b. DDT</td>
<td>(ii) Unit is decibel</td>
</tr>
<tr>
<td>c. SO₂</td>
<td>(iii) Related to amount of organic waste in water</td>
</tr>
<tr>
<td>d. Noise</td>
<td>(iv) Primary pollutant</td>
</tr>
</tbody>
</table>

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

104. How many statement(s) is/are correct regarding CNG?
   a. CNG is cheaper than petrol or diesel
   b. CNG burns less efficiently, unlike petrol or diesel.
   c. It can neither be siphoned off by thieves nor adulterated like petrol or diesel.
   d. It is compressed natural gas.
   (1) 2  (2) 3  (3) 4  (4) 1

105. When two closely related species competing for the same resource, cannot co-exist indefinitely and the competitively inferior one is eventually eliminated, then the interaction is known as
   (1) Competition release
   (2) Interference competition
   (3) Competitive exclusion
   (4) Camouflage

106. Integral form of the exponential growth equation is
   (1) \( \frac{dN}{dt} = rN \)
   (2) \( N(t) = N_0 e^{rt} \)
   (3) \( \frac{dN}{dt} = (b - d) \times N \)
   (4) \( \frac{dN}{dt} = rN \left(1 - \frac{N}{K}\right) \)

107. “Mammals from colder climates generally have shorter ears and limbs to minimise heat loss”. This is called
   (1) Allen’s rule
   (2) Jordan’s rule
   (3) Bergman’s rule
   (4) Rensch’s rule

108. Match the column I with the column II and choose the correct option.

<table>
<thead>
<tr>
<th>Column I (Age Pyramid)</th>
<th>Column II (Population growth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Um shaped</td>
<td>(i) Growing population</td>
</tr>
<tr>
<td>b. Triangular</td>
<td>(ii) Stable population</td>
</tr>
<tr>
<td>c. Bell shaped</td>
<td>(iii) Declining population</td>
</tr>
</tbody>
</table>

(1) a(i), b(ii), c(iii)
(2) a(ii), b(i), c(iii)
(3) a(iii), b(ii), c(i)
(4) a(iii), b(i), c(ii)
109. Which one is not a key functional aspect of an ecosystem?
(1) Decomposition  (2) Energy flow  
(3) Species composition  (4) Nutrient cycle

110. Identify true (T) or false (F) statements and select the correct option.

a. Tropical rainforest and sugarcane field are the most productive ecosystems.
   (1) T
   (2) T
   (3) T
   (4) T

b. Secondary productivity is the rate of formation of new organic matter by consumers.
   (1) T
   (2) T
   (3) T
   (4) F

c. Humus is colourless and partly decomposed organic matter.
   (1) T
   (2) F
   (3) F
   (4) F

111. Select the true statement(s) for reducers.

a. They are natural scavengers.
   (1) Only a
   (2) Only a and b
   (3) Only b and c
   (4) All a, b and c

b. Replenish the soil naturally with minerals
   (1) Only a
   (2) Only a and b
   (3) Only b and c
   (4) All a, b and c

112. What is incorrect about primary succession?

(1) It starts at barren area
(2) Climax reaches very quickly
(3) Pioneer community does not get established easily
(4) Cooled volcanic lava, igneous rocks etc. are areas where it starts

113. Hydrarch succession proceeds from

(1) Hydric to xeric conditions
(2) Xeric to hydric conditions
(3) Mesic to hydric conditions
(4) Hydric to mesic conditions

114. Which one is odd w.r.t. gaseous cycle?

(1) Carbon cycle
(2) Hydrogen cycle
(3) Phosphorus cycle
(4) Nitrogen cycle

115. Read the following statements and select the correct one(s).

a. A trophic level represents a functional level not a species as such.
   (1) Only a
   (2) Only a and b
   (3) Only b and c
   (4) All a, b and c

b. A given species may occupy more than one trophic levels in the same ecosystem at the same time.
   (1) Only a
   (2) Only a and b
   (3) Only b and c
   (4) All a, b and c

c. Energy at a lower trophic level is always less than at a higher level
   (1) Only a
   (2) Only a and b
   (3) Only b and c
   (4) All a, b and c

116. Match the column I with column II and choose the correct option.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Earth summit</td>
<td>(i) Direct economic benefits from nature</td>
</tr>
<tr>
<td>c. Narrowly utilitarian</td>
<td>(iii) Replenishment of atmospheric O₂ by plants</td>
</tr>
</tbody>
</table>

117. How many hotspots are present in India?

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

118. Which one of the following is the largest tiger reserve?

(1) Corbett National Park
(2) Kanha National Park
(3) Bandipur National Park
(4) Nagarjunasagar Srisailam

119. Van Mahotsav is being carried out in India since 1950. Under this movement, government and private agencies perform the plantation every year, during

(1) January and March
(2) July and February
(3) April and July
(4) October and December
120. Government of India has passed Water (Prevention and Control of Pollution) Act, in
   (1) 1986    (2) 2002
   (3) 1990    (4) 1974

121. Select the mismatched pair.
   Elements    Effects
   (1) Mercury  – Minimata disease
   (2) Lead     – Damage to liver
   (3) Cadmium  – Black foot disease
   (4) Copper   – Hypertension

122. Photochemical smog is formed in traffic congested cities. It has mainly
   (1) O₃, PAN and NOₓ   (2) H₂S and SO₂
   (3) H₂S, PAN and NOₓ  (4) SO₂, O₃ and NOₓ

123. To reduce noise pollution some trees were planted under green muffler scheme, such as
   a. Neem
   b. Ashoka
   c. Rice
   Choose the correct option.
   (1) Only a   (2) Only a and b
   (3) Only b and c  (4) All a, b and c

124. Which one of the following statements is correct about Bhopal gas tragedy?
   (1) It occurred in 1987
   (2) It was due to leakage of poisonous gas MIC
   (3) It was due to radioactive fall out
   (4) It occurred due to eutrophication of lakes

125. Choose the incorrect statement.
   (1) A scrubber can remove gases like SO₂
   (2) Electrostatic precipitator can remove over 99% particulate matter present in the exhaust from thermal power plant
   (3) Motor vehicles equipped with catalytic converter, should use leaded petrol
   (4) Euro III norms stipulate that sulphur should be controlled at 350 ppm in diesel

126. Two major green house gases w.r.t. their global warming potential are
   (1) CH₄ and N₂O
   (2) CFCs and N₂O
   (3) CO₂ and CFCs
   (4) CO₂ and CH₄

127. Which one does not play role in determining hot spot?
   (1) Very high levels of species richness
   (2) High degree of endemism
   (3) Low genetic diversity
   (4) Degree of threat in terms of habitat loss

128. Which one is not an ‘Evil Quartet’?
   (1) Habitat loss and fragmentation
   (2) Sacred groves
   (3) Co-extinction
   (4) Over-exploitation

129. Loss of biodiversity in a region may lead to
   a. Increased variability in certain ecosystem processes.
   b. Lowered resistance to environmental perturbations.
   c. Decline in productivity.
   (1) Only a   (2) Only a and b
   (3) Only b and c  (4) All a, b and c

130. What is the proportion of photosynthetically active radiation (PAR) in total incident solar radiation?
   (1) Less than 50%   (2) More than 50%
   (3) Only 1-5%   (4) 100%

131. In an ecosystem, flow of energy is
   Solar radiation → A → Herbivores → B
   Fill in blanks with suitable option for A and B.
   A       B
   (1) Decomposer Secondary carnivores
   (2) Primary carnivore Secondary carnivores
   (3) Producers Secondary consumers
   (4) Primary consumer Tertiary consumer

132. State true (T) or false (F) for the following statements and choose the correct option.
   a. Detritus is the raw material for decomposition.
   b. Pyramid of biomass of an aquatic ecosystem may be inverted.
   c. Least productive ecosystem is desert and deep sea.
   a    b    c
   (1) F  F  F
   (2) F  T  T
   (3) T  T  T
   (4) T  F  T
133. Characteristics of man-made ecosystems are
   a. Huge cycling of nutrients
   b. Simple food chain
   c. Little diversity
   d. Low productivity
   (1) Only a and b  (2) Only b and c
   (3) Only c and d  (4) Only a and d

134. For ecosystem, term ‘biocoenosis’ was used by
   (1) Forbes  (2) A.G. Tansley
   (3) C. Mobius  (4) Friederich

135. Equation $\frac{dN}{dt} = rN$ describes a growth model, that
    results in
   (1) Sigmoid curve  (2) Straight line
   (3) Zig-Zag curve  (4) J-shaped curve

136. Which one is correctly matched?
    (1) Sericulture – Lac insect
    (2) Bee-keeping – House fly
    (3) Poultry farming – Ducks
    (4) Pisciculture – Shellfish

137. The breed Karan Swiss has been developed by crossing indigenous Sahiwal cows with exotic Brown Swiss bulls at
    (1) ICAR  (2) NDRI
    (3) CDRI  (4) GEAC

138. Choose the incorrect statement w.r.t. MOET.
    (1) Hormones with FSH like activity are administered to induce follicular maturation and super ovulation
    (2) The superior cow is either mated with an elite bull or artificially inseminated
    (3) This technology has been demonstrated for cattles, rabbits, sheeps, goats and chicken
    (4) The fertilized eggs at 8-32 celled stage are transferred to surrogate mothers

139. Read the following statements A and B. Choose the correct option.
    **Statement A:** Leghorn is exotic variety of poultry birds categorised as a ‘Layer’.
    **Statement B:** Ranikhet is viral disease of poultry.
    (1) Statement A is correct but statement B is incorrect
    (2) Statement A is incorrect but statement B is correct
    (3) Both statements are incorrect
    (4) Both statements are correct

140. Select the correct option w.r.t. fresh water fishes.
    (1) **Catla**, **Rohu** and **Hilsa**
    (2) Sardines, Mackerel and Pomfrets
    (3) **Rohu**, Pomfrets and Catla
    (4) **Rohu**, Catla and Magur

141. Select the correct match between column I and column II.
    **Column I**  **Column II**
    a. $H_{2}N_{1}$  (i) **Pasteurella**
    b. Pullorum  (ii) **Eimeria**
    c. Coccidosis  (iii) **Salmonella**
    d. Fowl cholera  (iv) **Bird flu**
    (1) a(i), b(ii), c(iii), d(iv)  (2) a(iv), b(iii), c(ii), d(i)
    (3) a(ii), b(iii), c(i), d(iv)  (4) a(iii), b(iv), c(i), d(ii)

142. **Hisardale** is a resultant of crossbreeding between
    (1) Holstein-Friesian and Sahiwal
    (2) Holstein - Friesian and Tharparkar
    (3) Bikaneri ewes and Merino rams
    (4) Male donkey and female horse

143. Enhancement in agricultural yield by efforts of Norman Borlaug and others led to
    (1) White revolution  (2) Green revolution
    (3) Blue revolution  (4) Operation flood

144. It is estimated that more than ___ percent of the world livestock population is in India and China. Select the option which fills the blank correctly.
    (1) 25%  (2) 50%
    (3) 70%  (4) 90%

145. Choose the incorrect statement w.r.t. inbreeding.
    (1) Increases homozygosity
    (2) Exposes harmful recessive traits that are eliminated by selection process
    (3) Refers to the mating of the unrelated individuals within the same breed for 4-6 generations
    (4) Is necessary if we want to evolve pureline in an animal breed
146. Breeds of cattle and chicken are respectively
(1) Brown swiss and Marwari
(2) Jersey and Leghorn
(3) Rhode island Red and Ayrshire
(4) Hisardale and Mule

147. ‘The integration of natural science and organisms, cells, parts thereof and molecular analogues for products and services.’
The above definition of biotechnology was given by
(1) Genetic Engineering Approval Committee
(2) European Federation of Biotechnology
(3) US Patent and Trademark Office
(4) International Union of Biochemistry

148. The linking of antibiotic resistance gene with the plasmid vector became possible through the help of
(1) Restriction endonuclease
(2) DNA ligase
(3) DNA polymerase
(4) Exonuclease

149. The antibiotic resistance gene isolated by Cohen and Boyer was inserted in plasmid native to which organism?
(1) Salmonella typhimurium
(2) Bacillus amyloliquefaciens
(3) Escherichia coli
(4) Bacillus thuringiensis

150. Plasmid DNA cannot
(1) Be double stranded
(2) Be coated with histone proteins
(3) Replicate independent of chromosomal DNA
(4) Circular in shape

151. In gel electrophoresis, the separated band of DNA containing the gene of interest is cut and extracted from the gel piece. This step is known as
(1) Denaturation
(2) Spooling
(3) DNA Isolation
(4) Elution

152. While isolation of DNA from tomato, RNA can be removed by the treatment with ____ whereas proteins can be removed by treatment with ______.
Select the option which fills the blanks correctly.

153. Select the incorrect statement w.r.t. gel electrophoresis.
(1) DNA fragments can be separated by forcing them to move towards the ‘cathode’ under an electric field through a medium
(2) Commonly used matrix for gel electrophoresis of DNA is agarose extracted from sea weeds
(3) The DNA fragments separate according to their size through sieving effect provided by the agarose gel
(4) We cannot see pure stained DNA fragments even in visible light

154. Intercalating dye ethidium bromide, stacks between base pairs of DNA and stains it. Upon exposure to UV light DNA appears
(1) Dull blue
(2) Bright green
(3) Bright orange
(4) Yellow

155. Select the first restriction endonuclease, isolated and characterised from Haemophilus influenzae
(1) Eco RI
(2) Hind I
(3) Hae I
(4) Hind II

156. If a ‘4 kb’ fragment of DNA is to be amplified from 8 kb plasmid then, how many copies are obtained at the end of 30 PCR cycles approximately?
(1) 1 billion
(2) 1 million
(3) 2 billion
(4) 2 million

157. Part of the plasmid pBR322 that controls copy number of foreign DNA linked to it is
(1) Rop
(2) Multiple cloning sites
(3) Selectable marker
(4) Origin of replication

158. A single PCR reaction involves three temperature dependent steps. Their correct sequence is
(1) Annealing → Denaturation → Amplification
(2) Denaturation → Annealing → Extension
(3) Extension → Annealing → Denaturation
(4) Annealing → Extension → Denaturation

159. Treatment with salts of which ion facilitates efficiency of transfer of foreign DNA into host cells?
(1) $O^{2-}$
(2) $Ca^{2+}$
(3) $K^+$
(4) $Na^+$
160. Recombinant DNA is directly injected into the nucleus of an animal cell. This method is known as
(1) Transformation
(2) Microinjection
(3) Biolistic
(4) Electroporation

161. Select the odd one w.r.t. direct gene transfer in plant protoplasts.
(1) Electroporation
(2) Disarmed Ti plasmid
(3) Microinjection
(4) Particle gun

162. Downstream processing of desired product does not involve
(1) Isolation of product
(2) Purification of expressed protein
(3) Marketing of extracted product
(4) Expression of foreign gene

163. Choose the option that represents an incorrect statement w.r.t. bioreactors.
(1) Also known as fermenters for growth of microbes under a controlled environment
(2) Large volumes i.e. 100 – 1000 L of culture can be processed
(3) Anti-foaming agents are required to increase the foaming caused by presence of proteins in the culture medium
(4) Bubbles dramatically increase the oxygen transfer area

164. Read the following statements and choose the correct option.
Statement A: In batch fermentation, the conditions once set are not changed from outside after the process of fermentation starts.
Statement B: Batch fermentation is called an open culture system.
(1) Statement A is correct
(2) Statement B is correct
(3) Statement B is correct explanation of A
(4) Both statements are correct

165. In simple stirred tank type of bioreactor, stirrer is responsible for
(1) Increase in the pH
(2) Decrease in temperature
(3) Extraction of product
(4) Uniform availability of oxygen

166. Transgenic plants have been useful in all except
(1) Increased reliance on chemical pesticides
(2) Made crops more tolerant to abiotic stresses
(3) Increased efficiency of mineral usage by plants
(4) Helped to reduce post-harvest losses

167. Select the incorrect statement w.r.t. Golden rice.
(1) It is a transgenic variety of wild type rice
(2) Grains of the rice are red in colour due to β-carotene
(3) Gene for β-carotene has been taken from the flower Daffodils
(4) Gene for synthesis of β-carotene was inserted into the genome of wildtype rice using Agrobacterium tumefaciens.

168. Which gene encodes the protein to control lepidopteran corn borer’s infection in corn plants?
(1) cry IAb
(2) cry IAc
(3) cry IIAb
(4) cry IIAd

169. A nematode named _____ infects the roots of tobacco plants and causes a great reduction in its yield. Select the option which fills the blank correctly.
(1) Meloidogyne incognita
(2) Bacillus thuringiensis
(3) Ascaris lumbricoides
(4) Escherichia coli

170. Select the mismatch.
(1) Rosie – Transgenic cow
(2) Emphysema – α-1- antitrypsin
(3) Dolly – Transgenic sheep
(4) ANDi – Transgenic monkey

171. Select the correct statement w.r.t. SCID.
(1) Is caused due to absence of gene for adenosine deaminase
(2) Cannot be treated by bone marrow transplantation at early stage
(3) In presence of adenosine deaminase, lymphocyte proliferation is inhibited
(4) Without RBCs, ADA deficient children are wide open to attacks of viruses and bacteria
172. The main challenge for production of insulin using rDNA techniques was getting insulin assembled in mature form by
   (1) Obtaining correct sequence of amino acids in chain A and B
   (2) Removal of chain ‘A’ from proinsulin
   (3) Formation of disulfide bonds between correct amino acids
   (4) Transformation of *E.coli* with cDNA of chain A and B.

173. The term, used to refer to the use of bio-resources by multinational companies and other organisation without proper authorisation from the countries and people concerned without compensatory payment is
   (1) Biopatent
   (2) Bioethics
   (3) Bioweapon
   (4) Biopiracy

174. Choose the **odd** one w.r.t. technique used for early detection of diseases.
   (1) Enzyme Linked Immuno-sorbent Assay
   (2) Recombinant DNA technology
   (3) Urine analysis
   (4) Polymerase chain reaction

175. How many recombinant therapeutic are currently being marketed in India?
   (1) 10
   (2) 12
   (3) 15
   (4) 30

176. Choose the organism, whose natural product is used as a clot buster for removing thrombus
   (1) *Entamoeba coli*
   (2) *Streptococcus*
   (3) *Methanococcus*
   (4) *Vibrio cholerae*

177. Which of the following enzyme is thermally stable?
   (1) Pancreatic lipase
   (2) Taq polymerase
   (3) Gastric protease
   (4) *E.coli* DNA polymerase

178. Which of the following is a source of energy during a PCR?
   (1) ATP
   (2) dNTPs
   (3) DNA polymerase
   (4) Thermal cycler

179. There is a restriction endonuclease called *EcoRI*. What does alphabet ‘R’ in it stand for?
   (1) Genus
   (2) Species
   (3) Strain
   (4) Order in which the enzyme was isolated from the source bacteria

180. Insertion of gene of interest in pBR322 at which restriction enzyme site results in susceptibility to ampicillin in recombinant *E.coli*?
   (1) *Pvu II*
   (2) *Pst I*
   (3) *BamHI*
   (4) *Cla I*
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<td>1.</td>
<td>(2)</td>
<td>37.</td>
<td>(4)</td>
<td>73.</td>
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<tr>
<td>2.</td>
<td>(3)</td>
<td>38.</td>
<td>(2)</td>
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PHYSICS

1. Answer (2)

**Hint:** \( N = \left\lfloor \frac{360}{\theta} \right\rfloor \).

**Sol.:** If \( N \) is even, number of image = \( N - 1 \).

If \( N \) is odd and object is placed symmetrical, number of image = \( N - 1 \).

If \( N \) is odd and object is placed unsymmetrical, number of image = \( N \).

For \( \theta = 60^\circ \)

\( N = 6 \)

Number of image = \( 6 - 1 = 5 \).

2. Answer (3)

**Hint:** Use \( \frac{v}{u} + \frac{1}{f} = 1 \).

**Sol.:**

\[
\begin{align*}
-\frac{v}{u} &= 2 \Rightarrow [v = -2u] \\
v &= +10 \text{ cm} \\
\frac{1}{v} + \frac{1}{u} &= \frac{1}{f} \\
\frac{1}{-2} + \frac{1}{10} &= \frac{1}{f} \\
\frac{1}{10} &= \frac{1}{f} \\
f &= -10 \text{ cm} \\
R &= 2f \\
R &= -20 \text{ cm}
\end{align*}
\]

3. Answer (2)

**Hint:** Use Snell's law and prism formula.

**Sol.:**

\[
\begin{align*}
sin \theta &= \frac{1}{\sqrt{3}} \\
sin \Theta &= \frac{\sqrt{3}}{3} \\
r_1 + r_2 &= A \\
r_2 &= 30^\circ \\
sin \frac{r_2}{\sin e} &= \frac{1}{\sqrt{3}}
\end{align*}
\]

4. Answer (3)

**Hint:** Length of the telescope for near point adjustment (at near point, eye is most strained) is

\[
L = f_o + Df_o \frac{D}{D + f_o}.
\]

**Sol.:**

\[
L = f_o + \frac{Df_o}{D + f_o} = 50 + \frac{4 \times 25}{4 + 25} = 53 \text{ cm}.
\]

5. Answer (2)

**Hint:** \( i_c = \sin^{-1} \left( \frac{\mu_1}{\mu_2} \right) \).

**Sol.:**

\[
\begin{align*}
\mu_1 &= \frac{ct_1}{a} \\
\mu_2 &= \frac{ct_2}{b} \\
i_c &= \sin^{-1} \left( \frac{\mu_1}{\mu_2} \right) \\
i_c &= \sin^{-1} \left( \frac{bt_1}{at_2} \right)
\end{align*}
\]

6. Answer (1)

**Hint:** \( \frac{1}{f} = (\mu - 1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right) \).

**Sol.:**

\[
\begin{align*}
(R - d)^2 + (4)^2 &= R^2 \\
d^2 - 2Rd + 16 &= 0 \\
R &= \frac{16}{2d} \quad \text{(neglecting } d^2) \\
R &= \frac{16}{2 \times 4 \times 10^{-1}} = 20 \text{ cm}
\end{align*}
\]
\[
\mu = \frac{3 \times 10^8}{9 \times 10^8} = \frac{5}{3}
\]

\[
\frac{1}{f} = (\mu - 1) \left( \frac{1}{R} \right)
\]

\[
f = \frac{20}{\left( \frac{5}{3} - 1 \right)} = 30 \text{ cm}
\]

7. Answer (3)

**Hint:** \( \omega = \frac{\mu_v - \mu_R}{\mu_v - 1} \).

**Sol.:** \( \mu_v, \mu_R \) and \( \mu_y \) are refractive indexes for violet light, red light and yellow light. It is different for different materials therefore dispersive power depends on material.

8. Answer (3)

**Hint:** Use Snell’s law.

**Sol.:**

\[
\begin{align*}
\delta_{\text{net}} &= (i - r) + (i - r) = 2(i - r) \\
\frac{\sin i}{\sin r} &= \mu \\
\sin 53^\circ &= \sin r \\
\sin r &= \frac{4}{5} \\
\sin r &= \frac{3}{5} \\
\therefore r &= 37^\circ \\
\delta_{\text{net}} &= 2(53^\circ - 37^\circ) = 2 \times 16^\circ = 32^\circ.
\end{align*}
\]

9. Answer (2)

**Hint:** \( P_{\text{eff}} = P_1 + P_2 \)

**Sol.:**

\[
\frac{1}{f_{\text{eff}}} = 2 \\
f_{\text{eff}} = \frac{1}{2} \times 100 \text{ cm} \\
f_{\text{eff}} = 50 \text{ cm}
\]

10. Answer (2)

**Hint:** \( \frac{1}{v} + \frac{1}{u} = \frac{1}{f} \).

\[
m = -\frac{v}{u}. \\
\text{Sol.:} \quad \frac{1}{v} + \frac{1}{u} = \frac{1}{f} \\
1 + \frac{v}{u} = \frac{v}{f} \\
-m = \frac{v}{f} - 1 \\
m = 1 - \frac{v}{f}
\]

11. Answer (2)

**Hint and Sol.:**

A point source of light at finite distance produce spherical wavefront.

12. Answer (1)

**Hint:** \( I \propto A^2 \)

**Sol.:**

\[
\begin{align*}
\frac{l_0}{2} &= c \cdot A^2 \\
l_0 &= c \cdot A^2 \times 2 \\
CA_i^2 &= c \left( \frac{A}{\sqrt{2}} \right)^2 \\
A_i &= \frac{A}{\sqrt{2}}.
\end{align*}
\]

13. Answer (2)

**Hint:** \( a \sin \theta = \lambda \).

**Sol.:**

For small value of \( \theta \)

\[
\sin \theta = \theta \\
3 \times \frac{\pi}{180} = \frac{\lambda}{a} \\
942 \times 360 \times 10^{-9} = \frac{\lambda}{a} \\
a = 9.42 \\
a = 36 \times 10^{-9} \times 10^2 \\
a = 36 \times 10^{-6} \\
a = 36 \mu m
14. Answer (3)  
**Hint:** \( A_R = \sqrt{A_1^2 + A_2^2 + 2A_1A_2 \cos \phi} \).  
**Sol.:** \( A_R = \sqrt{\left(\frac{4}{5}\right)^2 + \left(\frac{4}{5}\right)^2 + 2 \cdot \frac{4}{5} \cdot \frac{4}{5} \cdot \left(-\frac{1}{2}\right)} = \frac{4}{5} \).  
15. Answer (4)  
**Hint:** \( I = I_0 \cos^2 \frac{\Delta \phi}{2} \).  
**Sol.:** \( I = I_0 \cos^2 \left(\frac{2\pi}{\lambda} \times \frac{\lambda}{4 \times 2}\right) \)  
\( I = I_0 \cos^2 \frac{\pi}{4} \)  
\( I = \frac{I}{2} \)  
\( I_0 = 2I \)  
\( I = 2I \cos^2 \left(\frac{2\pi}{\lambda} \times \frac{\lambda}{6 \times 2}\right) \)  
\( I = 2I \left(\frac{\sqrt{3}}{2}\right)^2 \)  
\( I = \frac{3I}{2} \).  
16. Answer (1)  
**Hint:** \( Z_f = \frac{a^2}{\lambda} \).  
**Sol.:** \( Z_f = \frac{a^2}{\lambda} \)  
\( Z = \frac{(4 \times 10^{-3})^2}{800 \times 10^{-3}} = 20 \text{ m} \)  
17. Answer (3)  
**Hint:** Fringe shift due to introduction of mica plate in front of one slit is \( \frac{(\mu - 1) tD}{d} \).  
**Sol.:** Position of fourth bright is \( \frac{4\lambda D}{d} \).  
According to given condition  
\( \frac{(\mu - 1) tD}{d} = \frac{4\lambda D}{d} \)  
\( t = \frac{4\lambda}{\mu - 1} \)  
18. Answer (3)  
**Hint:** Concept of Snell’s law and Brewster’s law.  
**Sol.:** \( \sin C = \frac{1}{\mu} \)  
\( \mu = \frac{1}{\sin 60^\circ} \)  
\( \mu = \frac{2}{\sqrt{3}} \)  
\( I_p = \tan^{-1}\left(\frac{2}{\sqrt{3}}\right) \).  
19. Answer (4)  
**Hint:** Effect of biasing on diode.  
**Sol.:** In unbiased diode drift and diffusion current flow equal and opposite direction so,  
\( I_{\text{net}} = |I_{\text{diffusion}}| - |I_{\text{drift}}| = 0 \).  
If diodes becomes forward bias then diffusion current increase drift current remain same  
\( I_{\text{net}} = |I_{\text{diffusion}}| - |I_{\text{drift}}| \)  
\( |I_{\text{diffusion}}| >> |I_{\text{drift}}| \).  
20. Answer (1)  
**Hint:** Use concept of Boolean algebra.  
**Sol.:** \( Y = A \times B \)  
\( Y = A + B \)  
\( Y = A + B \) OR Gate.  
21. Answer (4)  
**Hint and Sol.:** For forward biasing of diode potential of \( p \)-type should be greater than potential of \( n \)-type \( -3 \text{ V} < -2 \text{ V} \)  
Only diode in option (4) is reversed biased.  
22. Answer (3)  
**Hint:** \( V_{\text{diode}} = V_{R(3 \Omega)} \)  
**Sol.:**  
\[ \begin{align*} 6.6 \text{ V} & \quad \text{P.d. across } 3 \Omega \text{ is } 0.3 \text{ V} \\ 6.6 = 0.3 + 7I \\ 6.3 = 7I \\ I = 0.9 \text{ A} \end{align*} \]  
23. Answer (1)  
**Hint:** If diode is in forward biased condition. Then it act as short. If diode is in reverse bias condition. It will act as open.
24. Answer (2)

**Hint:** \[ A_y = \beta \frac{R_{\text{output}}}{R_{\text{input}}} \]

**Sol.:** \[ \beta = \frac{\alpha}{1-\alpha} \]
\[ \beta = \frac{0.96}{1-0.96} \]
\[ \beta = 24 \]
\[ A_y = 24 \times \frac{4000}{1000} \]
\[ A_y = 96 \]

25. Answer (1)

**Hint:** Photo diode works in reverse biased.

**Sol.:** \[ I = I_1 + I_2 < I_3 \]

26. Answer (4)

**Hint and Sol.:** For transistor in active region collector-base junction should be reverse biased and emitter-base junction should be forward biased.

27. Answer (4)

**Hint:** \[ Y = A + B \]

**Sol.:** \[ Y = A + B = \overline{A} \cdot \overline{B} \]

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28. Answer (2)

**Hint and Sol.:** All types of semiconductors are electrically neutral.

29. Answer (1)

**Hint:** Cut off potential depends on the frequency.

**Sol.:** On changing the distance between target and source number of photons hitting the source increases or decreases, frequency of photons remain same therefore, cut-off potential will be same.

30. Answer (2)

**Hint:** \[ E_0 = \frac{hc}{\lambda} \]

**Sol.:** \[ P = \frac{h}{\lambda} \]
\[ E_0 = Pc \]
\[ P = \frac{E_0}{c} \]
\[ \bar{P}_{\text{transfer}} = \bar{P}_1 - \bar{P}_2 \]
\[ |\bar{P}_{\text{transfer}}| = \frac{E_0}{c} \]

31. Answer (3)

**Hint:** \[ P = \frac{h}{\lambda} \]

**Sol.:** \[ \bar{P}_1 = \bar{P}_2 \]
\[ 0 = \bar{P}_1 + \bar{P}_2 \]
\[ |\bar{P}_1| = |\bar{P}_2| \]
\[ \frac{\lambda_1}{\lambda_2} = \frac{P_2}{P_1} = 1:1 \]

32. Answer (2)

**Hint:** Use Einstein's equation.

**Sol.:** \[ hf = hf_0 + eV_0 \]
\[ eV_0 = hf - hf_0 \]
\[ V_0 = \frac{hf - hf_0}{e} \]

As (Intercept) \( B \) > (Intercept) \( A \)
\[ \left( \frac{hf_0}{e} \right)_B > \left( \frac{hf_0}{e} \right)_A \]
\[ \phi_A < \phi_B \]

33. Answer (1)

**Hint:** \[ \phi \geq \phi_0 \] (\( \phi_0 \) is work function of metal surface).

**Sol.:** \[ \frac{hc}{\lambda} \leq \frac{ch}{\lambda_0} \]
\[ \lambda \leq \lambda_0 \]
\[ \lambda_{\text{max}} = \lambda_0 \]

34. Answer (4)

**Hint:** \[ P = \sqrt{2mK} \]

**Sol.:** \[ P_1 = \sqrt{2mK} \]
\[ P_2 = \sqrt{4mK} \]
\[
\frac{1}{\lambda} = \frac{1}{R} \left( \frac{1}{n^2_1} - \frac{1}{n^2_2} \right).
\]

For minimum wavelength \( \lambda_{\text{min}} \), \( n_1 = 1, n_2 = \infty \)
\[
\frac{1}{\lambda_{\text{min}}} = \frac{1}{R} \Rightarrow \lambda_{\text{min}} = \frac{1}{R}.
\]
\[
\frac{\lambda_{\text{max}}}{\lambda_{\text{min}}} = \frac{4}{3R} = (\frac{4}{3}) \text{ for } R = 10^4 \text{ Å}.
\]

39. Answer (2)

Hint and Sol.:

No. of spectral lines = \( \frac{n(n-1)}{2} \ast (5-1) = 10 \).

40. Answer (3)

Hint: \( N \propto \frac{Z^2}{\sin^4 \left( \frac{\theta}{2} \right)} \)

Sol.:
\[
\frac{N_1}{N_2} = \frac{\sin^4 \left( \frac{\theta_1}{2} \right)}{\sin^4 \left( \frac{\theta_2}{2} \right)}
\]
\[
N_1 = \sin^4 45^\circ, \quad N_2 = \sin^4 30^\circ \Rightarrow N_1 = 4, \quad N_2 = \frac{20}{4} = 5.
\]

41. Answer (2)

Hint and sol.: Density of nucleus is independent of mass number
\[
\rho_1 = \frac{1}{\rho_2} = \frac{1}{7}.
\]

42. Answer (3)

Hint: Apply conservation of linear momentum.

Sol.: \( P_f = P_i \)
\[4\bar{v}_0 + (220 - 4)\bar{v} = 0.\]
\[\bar{v} = -4\bar{v}_0 \Rightarrow |\bar{v}| = \frac{4v_0}{216} = \frac{v_0}{54}.
\]

43. Answer (4)

Hint: \( N = \frac{N_0}{2^n} \)

Sol.:
\[
\frac{N_0}{8} = \frac{N_0}{2^n}.
\]
\[ n = 3 \]

\[ T_1 = \frac{6}{3} = 2 \text{ year} \]

\[ T_1 = \frac{\ln 2}{\lambda} \]

Mean life = \[ \frac{1}{\lambda} = \left( \frac{2}{\ln 2} \right) \]

44. Answer (4)

Hint: Energy released = (BE)\text{product} - (BE)\text{react}

Sol.: \[ e = E_Q - 2E_P \]

\[ e + 2E_P = E_Q \]

45. Answer (2)

Hint: \[ N = Ne^{-kt} \]

Sol.: \[ \frac{N_t}{N_e} = \frac{e^{-12k + \frac{1}{4k}}}{e^{-4k + \frac{1}{4k}}} = e^{-3} = \frac{e^{-2}}{e^2}. \]

CHEMISTRY

46. Answer (3)

Hint: \( S_{N1} \) reaction takes place via carbocation mechanism.

Sol.: \( \text{(C}_6\text{H}_5\text{)}_3\text{CBr} \) forms most stable carbocation among the given options hence most reactive

47. Answer (1)

Hint: Alc KOH shows dehydrohalogenation reactions.

Sol.:

\[ \text{Br} \quad \text{CH}_3 \]

\[ \text{CH}_3 - \text{CH} - \text{CH} - \text{CH}_2 - \text{CH}_3 \xrightarrow{\text{C}_2\text{H}_5\text{OK}} \text{C}_2\text{H}_5\text{OH} \]

\[ \text{CH}_3 \quad \text{CH}_3 - \text{CH} = \text{C} - \text{CH}_2 - \text{CH}_3 \]

Major (Saytzeff product)

\[ + \quad \text{CH}_3 \]

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

Minor (Hoffmann product)

48. Answer (4)

Hint: Grignard reagent readily reacts with polar protic solvents and forms alkane.

Sol.: Grignard reagent reacts with acetone to form 3° alcohol therefore we use tetrahydrofuran (T.H.F).

49. Answer (3)

Hint: \( \text{Br}_2/\text{CCl}_4 \) shows anti addition, Zn/ether show anti elimination, \( \text{OsO}_4/\text{NaHSO}_3 \) shows syn addition.

Sol.: 

50. Answer (4)

Hint: Electron withdrawing group increases the acidic strength of phenol.

Sol.: Picric acid is the strongest acid due to three electron withdrawing group (i.e. \(-\text{NO}_2\)) at ortho and para positions.

51. Answer (3)

Hint: \( \text{B}_2\text{H}_6 \) followed by \( \text{H}_2\text{O}_2/\text{OH}^- \) shows anti Markovnikov addition.

Sol.:
52. Answer (2)  
**Hint:** Given reaction is Reimer–Tiemann reaction.  
**Sol.:**

\[
\begin{align*}
\text{CHCl}_3 + \text{aq. NaOH} \rightarrow \text{(Intermediate)} \\
\text{NaOH} \\
\text{CHCl}_2 \text{Na} \leftrightarrow \text{CHO} \\
\text{ONa} \rightarrow \text{H} \\
\end{align*}
\]

53. Answer (3)  
**Hint:** Dehydration take place via carbocation intermediate  
**Sol.:**

\[
\begin{align*}
\text{H}^+ \rightarrow \text{H}_2 \text{O} \\
\text{Hydride Shift} \\
\end{align*}
\]

54. Answer (4)  
**Hint:** Excess of HI will also react with alcohol formed to give alkyl iodide.  
**Sol.:**

\[
\begin{align*}
\text{CH}_3 - \text{O} - \text{CH}_2 - \text{CH}_3 \rightarrow \text{CH}_3 - \text{O} + \text{CH}_2 - \text{CH}_3 \\
\text{HCl(g)} \\
\text{Cyclic ketal}
\end{align*}
\]

55. Answer (2)  
**Hint:** Formaldehyde on reaction with Grignard reagent followed by hydrolysis gives primary alcohol.  
**Sol.:**

\[
\begin{align*}
\text{HCHO} \rightarrow \text{RCH}_2\text{OH} \quad 1^\circ \text{Alcohol} \\
\text{RCHO} \rightarrow \text{R}_2\text{CHOH} \quad 2^\circ \text{Alcohol} \\
\text{RCOR} \rightarrow \text{R}_2\text{COH} \quad 3^\circ \text{Alcohol} \\
\text{RCOOR} \rightarrow \text{R}_3\text{COH} \quad 3^\circ \text{Alcohol}
\end{align*}
\]

56. Answer (1)  
**Hint:** CO\textsubscript{2} is the electrophile in the given reaction.  
57. Answer (2)  
**Hint:** Aldehydes and ketones are more polar than corresponding ethers or hydrocarbons.

58. Answer (2)  
**Hint:** \(\alpha\)-H atom of propanal is acidic in nature.  
**Sol.:**

\[
2\text{CH}_3\text{CH}_2\text{CHO} \rightarrow \text{CH}_3\text{CH}_2\text{CHCHCHO} \\
\Delta \rightarrow \text{H}_2\text{O} \\
\text{CH}_3\text{CH}_2\text{CH} = \text{CCHO} \\
\]

59. Answer (4)  
**Hint:** Negative inductive effect favours acidic strength.  
**Sol.:** CF\textsubscript{3}COOH has minimum pKa among the given options therefore most acidic.

60. Answer (2)  
**Hint:** Derivative of barbituric acid are called barbiturate.  
**Sol.:** Morphine is a narcotic analgesic.

61. Answer (1)  
**Hint:** For optical isomerism molecule must be chiral.

62. Answer (4)  
**Hint:** Acetophenone: CH\textsubscript{3}CO\textsubscript{6}H\textsubscript{5}  
**Sol.:** Ketones do not give positive Tollens' test.

63. Answer (1)  
**Hint:** Ketone with ethylene glycol forms cyclic ketal.  
**Sol.:**

\[
\begin{align*}
\text{CH}_3 - \text{C} - \text{COOH} \\
\text{H} \\
\text{Lactic acid}
\end{align*}
\]

64. Answer (4)  
**Hint:** Bigger the alkyl group on \(-\text{C}\) —, lesser is the rate of nucleophilic addition reaction.  
**Sol.:**

\[
\begin{align*}
\text{CH}_3 - \text{CH}_2 - \text{C} - \text{CH}_3 < \text{CH}_3 - \text{C} - \text{CH}_3 \\
\text{CH}_3 - \text{H} < \text{H} - \text{H} - \text{C}
\end{align*}
\]

(Order of rate of nucleophilic addition)

65. Answer (4)  
**Hint:** Alkyl benzene containing benzylic H-atom on vigorous oxidation with acid or alkaline KMnO\textsubscript{4} gives aromatic carboxylic acids.
9/16

Sol.: Tertiary alkyl group gives no reaction with alkaline or acidified KMnO₄.

\[
\begin{align*}
\text{CH₃} & \xrightarrow{(i) \text{KMnO}_4/\text{OH}^-} \text{COOH} \\
\text{CH₃CH₂} & \xrightarrow{(i) \text{KMnO}_4/\text{OH}^-} \text{COOH} \\
\text{CH₃CH₂CH₃} & \xrightarrow{(i) \text{KMnO}_4/\text{OH}^-} \text{COOH} \\
\text{CH₃} & \xrightarrow{(i) \text{KMnO}_4/\text{OH}^-} \text{COOH} \\
\text{CH₃CH₂CH₂CH₃} & \xrightarrow{(i) \text{KMnO}_4/\text{OH}^-} \text{COOH} \\
\end{align*}
\]

No reaction.

66. Answer (2)

Hint: CH₃Br \xrightarrow{\text{KCN}} \text{CH₃CN} \xrightarrow{\text{H₂O}^+} \text{CH₃COOH}

67. Answer (2)

Hint: Zn-Hg/HCl is used in Clemmensen reduction.

Sol.: C = O \xrightarrow{(i) \text{NH}_2 — \text{NH}_2} \xrightarrow{(ii) \text{KOH/Ethylene glycol}} \text{CH₂}

Wolff-Kishner reduction.

68. Answer (2)

Hint: On hydrolysis of ester acid and alcohol are formed.

Sol.:\[
\begin{align*}
\text{CH₃CH₂COH} & \xrightarrow{\text{H₂, Pd}} \text{CH₃CH₂COCl} \xrightarrow{\text{PCl₃}} \text{CH₃CH₂COCl} \\
\end{align*}
\]

69. Answer (1)

Hint: Lesser is the pKₐ, stronger is the base.

\[
\begin{align*}
\text{N(CH₃)₂} & \quad \text{pKₐ} = 8.92 \\
\text{HN — CH₃} & \quad \text{pKₐ} = 9.30 \\
\text{NH₂} & \quad \text{pKₐ} = 9.38
\end{align*}
\]

Basic strength: I > II > III

70. Answer (4)

Hint: Anilinium ion is meta directing.

Sol.:\[
\begin{align*}
\text{HNO}_3, \text{H}_2\text{SO}_4, 288 \text{ K} & \rightarrow \\
\text{NH₂} & \quad \text{NH₂NO₂} \\
\text{NH₂NO₂} & \quad \text{NH₂NO₂} \\
\text{NH₂NO₂} & \quad \text{NH₂NO₂}
\end{align*}
\]

(51%) (47%) (2%)
74. Answer (3)  
**Hint:** Gabriel phthalimide synthesis.  
**Sol.:**

![Chemical structure of Gabriel phthalimide synthesis](image)

75. Answer (3)  
**Hint:** Reaction of CuCN and benzenediazonium chloride is Sandmeyer reaction.  
**Sol.:**

![Chemical structure of Sandmeyer reaction](image)

76. Answer (2)  
**Hint:** Carbocations can rearrange via hydride shift or alkyl shift only to gain stability.  
**Sol.:**

![Chemical structure of carbocation rearrangement](image)

77. Answer (3)  
**Hint:** Nylon 6 is \[ \text{—C—(CH}_2\text{)}_5—\text{N—} \]

78. Answer (2)  
**Hint:** Condensation polymerisation involves loss of some simple molecules like CH$_3$OH, H$_2$O during the polymerisation.  
**Sol.:**

![Chemical structure of nylon 6 synthesis](image)

79. Answer (1)  
**Hint:** When glyptal solution having a suitable solvent is evaporated, it leaves a tough but non flexible film therefore used in manufacture of paints.

80. Answer (3)  
**Hint:** Ziegler-Natta catalyst (Et$_3$Al and TiCl$_4$) at a temperature of 333 K to 343 K and under a pressure of 6–7 atmosphere used to produce high density polythene.

81. Answer (2)  
**Hint:** Neoprene is a polymer of 2-chloro-buta-1,3-diene.

**Sol.:**

![Chemical structure of neoprene polymerisation](image)

82. Answer (4)  
**Hint:** Amylose is a water soluble component which constitutes about 15 – 20% of starch.

83. Answer (4)  
**Hint:** Ammonical AgNO$_3$ solution is Tollen's reagent.  
**Sol.:** Sucrose is a non reducing sugar.

84. Answer (3)  
**Hint:** Chiral centre is a centre from which no plane of symmetry is passing.
85. Answer (2)  
**Hint:** Proline is $\text{HN}$

86. Answer (3)  
**Hint:** RBC deficiency in haemoglobin is pernicious anaemia.

87. Answer (2)  
**Hint:** Guanine is $\text{H} \quad \text{C} \quad \text{N} \quad \text{C} \quad \text{N} \quad \text{C} \quad \text{NH}_2$.

88. Answer (2)  
**Hint:** Those amino acids which cannot be synthesised in the body and must be obtained through diet are known as essential amino acids.

89. Answer (4)  
**Hint:** Those antibiotics which are effective mainly against gram-positive or gram-negative bacteria are narrow spectrum antibiotics.  
**Sol.:**  
- Penicillin G has a narrow spectrum.  
- Amoxicillin, chloramphenicol and vancomycin are broad spectrum antibiotics.

90. Answer (3)  
**Hint:** Blue vitriol is a poisonous substance.

91. Answer (2)  
**Hint:** This concept was given by J. Grinnel.  
**Sol.:** Ecological niche of an organism represents the range of conditions that it can tolerate, the resources it utilises and its functional role in the ecological system.

92. Answer (1)  
**Hint:** In this interaction, one species is benefitted and other is neither harmed nor benefitted.  
**Sol.:** The species which is benefitted is termed commensal and other species is host. This interaction is known as commensalism.

93. Answer (3)  
**Sol.:** Some organisms like desert lizard show behavioural adaptation to cope up with variation in their environment.

94. Answer (4)  
**Hint:** Several biotic and abiotic factors affect magnitude of primary productivity.  
**Sol.:** Variety of environmental factors, availability of nutrients, photosynthetic capacity of plants and plant species of a particular area all affect primary productivity of that area.

95. Answer (3)  
**Sol.:** In deep marine habitat, most limiting nutrient is nitrogen.

96. Answer (1)  
**Hint:** To search for plant and animal species for product of economic importance is called bioprospecting.  
**Sol.:**  
- Biomagnification is the increase in concentration of toxicants at successive trophic levels.  
- Natural aging of lakes by nutrient enrichment of its water is known as eutrophication.  
- Breeding of crops with higher levels of vitamins, minerals *etc.*, is known as biofortification.

97. Answer (4)  
**Hint:** Acid rain is a cocktail of $\text{H}_2\text{SO}_4$ and $\text{HNO}_3$.  
**Sol.:** $\text{H}_2\text{SO}_4$ and $\text{HNO}_3$ are formed by oxides of sulphur and nitrogen respectively.

98. Answer (4)  
**Hint:** These are the richest and the most threatened reservoirs of plants and animals on Earth.  
**Sol.:** These are hotspots, a kind of *in-situ* conservation strategy.

99. Answer (3)  
**Hint:** Latitudinal pattern decides diversity of plants and animals throughout the world.  
**Sol.:**  
- In general, species diversity decreases as we move from low to high latitude. Biodiversity is minimum in arctic region, moderate in temperate area and maximum in tropical region.  
- Alexander von Humboldt observed that within a region species richness increased with increasing explored area, but only upto a limit.

100. Answer (4)  
**Sol.:** The most important cause driving plant and animal extinction is habitat loss and fragmentation.
101. **Answer (1)**

**Sol.:** A → Fishes  
    B → Amphibians  
    C → Birds

102. **Answer (2)**

**Hint:** Good ozone is found in upper part of the atmosphere and act as shield, absorbing UV-radiation.

**Sol.:**  
- Upper part of atmosphere is stratosphere.  
- High dose of UV-B causes snow-blindness.  
- JFM was started in India in 1980.  
- Montreal Protocol was signed in Canada (1987).

103. **Answer (2)**

**Sol.:**  
- Biological Oxygen Demand (BOD) is directly related to amount of organic waste present in water.  
- DDT is a primary pollutant.  
- SO₂ (Pollutant) causes severe respiratory problems.  
- Noise is measured in a unit called decibel (dB).

104. **Answer (2)**

**Sol.:** CNG burns more efficiently, than petrol or diesel.

105. **Answer (3)**

**Hint:** The feeding efficiency of one species might be reduced due to inhibitory presence of the other species. This is called “interference competition”.

**Sol.:** If in a competition, inferior species is eliminated when two closely related species are competing for the same resource, is called “Competitive exclusion”.

106. **Answer (2)**

**Sol.:** Integral form of the exponential growth equation is

\[ N_t = N_0 e^{rt} \]

107. **Answer (1)**

**Hint:** This rule explains adaptation strategy of mammals in colder areas.

**Sol.:** It is Allen’s rule which explains that mammals from colder area minimise heat loss by having shorter ears and limbs.

108. **Answer (4)**

**Hint:** An age pyramid is a graphic representation of proportion of various age groups of a population. Number of pre-reproductive individuals decide size of population.

**Sol.:**  
- Um shaped – Declining population  
- Triangular – Growing population  
- Bell shaped – Stable population

109. **Answer (3)**

**Hint:** It is the identification and enumeration of plant and animal species of an ecosystem.

**Sol.:** Species composition is an important structural feature. Decomposition, energy flow and nutrient cycle are key functional aspects of an ecosystem.

110. **Answer (1)**

**Hint:** Humus is dark coloured, more or less decomposed organic matter.

**Sol.:**  
- Tropical rainforests and sugarcane fields are most productive ecosystems.  
- Secondary productivity – Rate of formation of new organic matter by consumers.

111. **Answer (2)**

**Hint:** Decomposers are also called reducers.

**Sol.:** Decomposers are natural scavengers and they replenish soil naturally with minerals. They are saprophytic microorganisms.

112. **Answer (2)**

**Hint:** Primary succession takes several hundred to several thousand years to produce fertile soil on bare rocks, therefore succession is slower.

**Sol.:** Being slower, it takes very long time to reach the climax.

113. **Answer (4)**

**Sol.:** Hydrarch succession starts in wetter areas (hydric) and proceeds from hydric to mesic condition.

114. **Answer (3)**

**Hint:** Its reservoir pool is earth’s crust.

**Sol.:**  
- Phosphorus cycle is sedimentary cycle.  
- Carbon, hydrogen and nitrogen cycles are gaseous cycles and their reservoir pool is atmosphere.

115. **Answer (2)**

**Hint:** When energy flows from a particular trophic level to the next trophic level, some energy is always lost.

**Sol.:** Thus, energy at a lower trophic level is always more than at a higher level.

116. **Answer (2)**

**Sol.:**  
Narrowly utilitarian – Direct economic benefits from nature
Broadly utilitarian – Replenishment of atmospheric O₂ by plants

117. Answer (2)
   Sol.: Three hotspots are present in India. These are
   (i) Western Ghats and Sri Lanka.
   (ii) Indo-Burma.
   (iii) Himalaya.

118. Answer (4)
   Hint: This tiger reserve is situated at Guntur, Andhra Pradesh (India).
   Sol.: The largest tiger reserve is Nagarjunsagar Srisailam.

119. Answer (2)
   Sol.: Van Mahotsava is being carried out every year in India, during July and February months.

120. Answer (4)

121. Answer (3)
   Hint: Cadmium causes painful skeletal deformities.
   Sol.: – These painful skeletal deformities are called Itai-itai disease.
   – Arsenic causes blackfoot disease.

122. Answer (1)
   Sol.: Photochemical smog mainly has O₃, PAN & NOₓ.

123. Answer (2)
   Hint: These trees absorb sound vibrations to a great extent.
   Sol.: These are neem & ashoka.

124. Answer (2)
   Sol.: It was due to leakage of poisonous gas Methyl isocyanate (MIC) from pesticide plant of Union Carbide factory.

125. Answer (3)
   Sol.: Motor vehicles equipped with catalytic converter should use unleaded petrol because lead in the petrol inactivates the catalyst.

126. Answer (4)
   Sol.: CO₂ and CH₄ are commonly known as greenhouse gases.
   CO₂ – 60% contribution for greenhouse effect
   CH₄ – 20% contribution for greenhouse effect

127. Answer (3)
   Hint: Concept of hotspot was developed to designate priority areas for in-situ conservation.
   Sol.: – In designated priority area, there should be very high degree of species richness, high degree of endemism and degree of threat in terms of habitat loss.
   – Low genetic diversity is not a criteria for hotspot determination.

128. Answer (2)
   Sol.: Sacred groves are in-situ conservation strategy while others are cause of biodiversity loss (Evil Quartet).

129. Answer (4)
   Sol.: In a region, biodiversity loss may lead to decline in productivity, reduced resistance to environmental perturbation like drought and increased variability of ecosystem processes.

130. Answer (1)
   Hint: A part of incident solar radiation get reflected by clouds, scattered by dust particles etc.
   Sol.: Thus, PAR cannot be 100% of incident solar radiation. It is < 50% of incident solar radiation.

131. Answer (3)
   Hint: Herbivores are primary consumers.
   Sol.: Solar radiation → Producers → Herbivores → ¹ˢ Consumer → ²ˢ Consumer

132. Answer (3)
   Sol.: Detritus is dead remains of leaves, bark, flowers and animals including faecal matter.

133. Answer (2)
   Hint: In man-made ecosystems, productivity is high.
   Sol.: – In this ecosystem, little cycling of nutrients occur.
   – Simple food chain is also found.

134. Answer (3)
   Hint: For ecosystem, term ‘biocoenosis’ was used by C. Mobius.

135. Answer (4)
   Hint: Equation \( \frac{dN}{dt} = rN \) describes geometric growth.
   Sol.: Geometric growth results J-shaped curve.
136. Answer (3)
Hint: The word is often used to refer to the meat of birds.
Sol.: Sericulture – Silkworm.
Apiculture/Bee-keeping – Honey bee.
Pisciculture – Fishes; Shellfish – Aquaculture

137. Answer (2)
Hint: This institute is situated at Karnal, (Haryana).
Sol.: Karan Swiss is a cross breed.
ICAR : Indian council of Agriculture Research New Delhi.
NDRI : National Dairy Research Institute, Karnal.
CDRI : Central Drug Research Institute, Lucknow (U.P.)
GEAC : Genetic Engineering Approval Committee.

138. Answer (3)
Hint: MOET cannot be performed for oviparous organisms.
Sol.: MOET has been demonstrated for cattle, sheep, rabbits, buffaloes, mares, etc. but not chicken.

139. Answer (4)
Hint: 'Layers' are known for increased egg yield.
Sol.: Layers are female fowls raised for egg production eg., White leghorn. Ranikhet is also known as New Castle’s disease.

140. Answer (4)
Hint: Identify Labeo and Clarius.
Sol.: Fresh water fishes include Catla, Rohu, Singhara, Magur, Singh and Calbasu.
Marine fish are Hilsa, Sardines, Mackerel, Pomfrets, and Salmon.

141. Answer (2)
Hint: Fowl cholera and Pullorum are bacterial diseases of poultry.
Sol.: Eimeria causes Coccidiosis in fowls that results in bloody diarrhoea.
Salmonella pullorum causes poultry disease i.e., pullorum.

142. Answer (3)
Hint: Identify a new breed of sheep developed in Punjab.
Sol.: Cross breeds of cow are
(i) Frieswal – Holstein-Friesian and Sahiwal.
(ii) Karan Fries – Tharparkar and Holstein Friesian.
(iii) Mule – Male donkey and female horse.

143. Answer (2)
Hint: This change led to tripling the food supply in many developing countries.
Sol.: – Green revolution aimed at increasing grain production by using agrochemicals etc. Operation flood was designed and implemented by Dr. V. Kurien, the founder chairman of National Dairy Development Board (NDDB).

144. Answer (3)
Hint: Maximum livestock is present in Asian countries.
Sol.: India and China’s contribution to the world farm produce is only 25% despite presence of maximum livestock population.

145. Answer (3)
Hint: Inbreeding depression.
Sol.: Inbreeding refers to the mating of more closely related individuals within the same breed for 4-6 generations.

146. Answer (2)
Hint: Identify exotic breeds cow and chicken.
Sol.: Hisardale is an cross breed of sheep. Mule is an example of interspecific hybridization. Rhode Island Red is American breed of poultry while Ayrshire is an exotic cattle breed.

147. Answer (2)
Hint: Identify a body whose definition encompasses both traditional and modern view of biotechnology.
Sol.: Genetic Engineering Approval Committee (GEAC) makes decisions regarding the validity to GM research and safety US Patent and Trademark Office gives patent rights.

148. Answer (2)
Hint: This enzyme is commonly known as ‘molecular glue’.
Sol.: Restriction enzymes serve as ‘chemical knives’ to cut genes/DNA into defined fragments. DNA polymerase synthesizes a new strand of DNA complementary to an existing DNA template in 5’ to 3’ direction. Exonucleases can digest DNA in a non specific manner.

149. Answer (1)
Hint: Identify a typhoid causing bacterium in mice.
Sol.: First recombinant DNA was prepared by Cohen and Boyer by inserting gene encoding antibiotic resistance into a plasmid of Salmonella typhimurium.

150. Answer (2)
Hint: Plasmids are obtained from prokaryotes.
Sol.: Chromosomal DNA is coated with histone proteins while plasmid DNA is naked i.e. it lacks histone proteins.
151. **Answer (4)**

**Hint:** Process of extracting one material from another.

**Sol.:** Spooling is the process by which precipitated DNA can be removed from suspension. Denaturation is separation of DNA strands at high temperatures.

152. **Answer (2)**

**Hint:** Enzymes are named after the substrates they act upon.

**Sol.:** Lysozyme, chitinase and cellulase act on bacterial, fungal and plant cell walls respectively.

153. **Answer (1)**

**Hint:** DNA is a negatively charged molecule.

**Sol.:** DNA can be separated by forcing them to move towards the positive electrode named anode. The separated DNA fragments can be visualized only after staining the DNA with ethidium bromide followed by exposure of UV rays.

154. **Answer (3)**

**Hint:** Colour depends on type of dye used for staining.

**Sol.:** We can see bright orange coloured bands of DNA fragments when stained with ethidium bromide upon exposed to UV rays. Bands appear bright orange pink in color.

155. **Answer (4)**

**Hint:** Identify a type II restriction enzyme.

**Sol.:** *HindII* always cuts DNA molecules at a particular position by recognising a specific sequence of six base pairs.

156. **Answer (1)**

**Hint:** Plasmid is a dsDNA molecule.

**Sol.:** In PCR, it is possible to generate \(2^n\) molecules after ‘n’ number of cycles. i.e. \(2^{30} \sim 1\) billion

157. **Answer (4)**

**Hint:** This region lies close to region coding for proteins involved in replication of plasmid.

**Sol.:** The nucleotide sequence of ‘Ori’ is also responsible for controlling the copy number of the plasmid and linked DNA. So, if we want to obtain multiple copies of desired DNA, it should be cloned in a vector whose origin supports high copy number.

158. **Answer (2)**

**Hint:** The first step of PCR requires 94°C for separation of DNA strands.

**Sol.:** In denaturation, the high temperature breaks the hydrogen bonds present between the two strands of the template DNA. During annealing, the primers bind to their complementary sequences on the single stranded template. During extension, the DNA polymerase adds nucleotides to the primer, synthesizing a new DNA strand.

159. **Answer (2)**

**Hint:** Identify a divalent cation.

**Sol.:** Possibly, CaCl\(_2\) causes the DNA to precipitate onto the surface of the host cells, thereby enhancing chances of entry of rDNA into host cell at 42°C.

160. **Answer (2)**

**Hint:** Identify the method applicable for animal cells.

**Sol.:** Transformation is a procedure through which a piece of DNA is introduced into a host bacterium. In biolistic/gene gun method, cells are bombarded with high velocity microparticles of gold or tungsten coated with DNA. In electroporation, short electrical impulses of high field strength are given to the target host cells.

161. **Answer (2)**

**Hint:** Disarmed Ti plasmid is a vector.

**Sol.:** Disarmed Ti plasmid of *Agrobacterium tumefaciens* is a method of indirect gene transfer.

162. **Answer (4)**

**Hint:** This involves translation of desired mRNA.

**Sol.:** Isolation, purification, formulation, packaging, storage and marketing of product are parts of downstream processing.

163. **Answer (3)**

**Hint:** These structures are attached alongside impellers in a bioreactor.

**Sol.:** Anti-foaming agents are required to reduce the foaming caused by proteins or some molecules produced by the microbes.

164. **Answer (1)**

**Hint:** This culture contains initial limited amount of nutrients.

**Sol.:** In continuous culture system, the used medium is drained out from one side, while fresh medium is added from other side to maintain the cells in their physiologically most active log/expontial phase. Batch culture system is a closed type culture while continuous culture system is open type.

165. **Answer (4)**

**Hint:** The agitator facilitates even mixing of nutrients.

**Sol.:** The stirrer facilitates proper mixing and oxygen availability throughout the bioreactor.

166. **Answer (1)**

**Hint:** Pest-resistant crops.
Genetic modifications have reduced reliance on chemical pesticides.

167. Answer (2)

**Hint:** Colour of \( \beta \)-carotene.

**Sol.:** The grains of rice are yellow in colour due to \( \beta \)-carotene. The rice is commonly called golden rice due to its appearance. \( \beta \)-carotene is precursor of vitamin A.

168. Answer (1)

**Hint:** Gene in maize that affects corn borer.

**Sol.:** The protein encoded by gene \( cry^{AIc} \) and \( cry^{IIAb} \) controls cotton bollworm while, that of \( cry^{IAb} \) controls corn borer.

169. Answer (1)

**Hint:** Identify an Aschelminth.

**Sol.:** \( M. \ incognita \) attacks tobacco plant. It attacks the roots cells causing roots to grow into large galls/knots, damaging the crop and reducing its yield. Hence, called root-knot nematode.

170. Answer (3)

**Hint:** Select a cloned animal.

**Sol.:** Dolly is not a transgenic animal. ANDi was the first genetically modified monkey. \( \alpha \)-1- antitrypsin (human protein), is being used to treat emphysema.

171. Answer (1)

**Hint:** The first successful clinical gene therapy in humans.

**Sol.:** SCID can be treated by early bone marrow transplantation. Without T cells, ADA deficient children are wide open to attacks of viruses and bacteria. In the absence of adenosine deaminase, lymphocyte proliferation is inhibited.

172. Answer (3)

**Hint:** Tertiary structure of humulin.

**Sol.:** Removal of C chain from proinsulin is required to form mature insulin. In 1983, Eli Lilly an American company prepared two DNA sequences corresponding to A and B, chains of human insulin, introduced them in plasmid pBR322 and then transformed \( E. coli \) to produce humulin. Disulfide bonds are formed between cysteine residues on chain A and B in correct orientation.

173. Answer (4)

**Hint:** The Indian Parliament cleared the II\textsuperscript{nd} amendment of the Indian Patent Bills.

**Sol.:** Bioethics may be viewed as a set of standards that may be used to regulate our activities in relation to biological world. Patents which are being granted for biological entities and for products derived from them, are known as biopatents.

174. Answer (3)

**Hint:** Identify the conventional method of diagnosis.

**Sol.:** Modern methods of diagnosis serve purpose of early diagnosis which are RDT, PCR and ELISA.

175. Answer (2)

**Hint:** A dozen of recombinant therapeutics are permitted to be marketed in India.

**Sol.:** At present, about 30 recombinant therapeutics have been approved globally and 12 of these are presently being marketed in India.

176. Answer (2)

**Hint:** Organism which produces streptokinase.

**Sol.:** Streptokinase produced by \( Streptococcus \) bacterium and modified by genetic engineering is used as a 'Clot buster' for removing clots from blood vessels of patients who have undergone myocardial infarction.

177. Answer (2)

**Hint:** Enzyme obtained from bacterium \( Thermus aquaticus \).

**Sol.:** It can survive temperatures upto 95°C. It is a type of thermostable DNA polymerase.

178. Answer (2)

**Hint:** Triphosphate nucleotides are a source of energy.

**Sol.:** ATP is not needed as deoxyribonucleotide triphosphates (dNTPs) can themselves provide energy.

179. Answer (3)

**Hint:** \( Escherichia coli \) Ry13.

**Sol.:** The convention for naming these enzyme is that the first letter comes from name of the genus and second two letters come from the species of the prokaryotic cell from which they were isolated. \( EcoRI \) comes from \( Escherichia coli \) Ry13. In \( EcoRI \), the letter ‘R’ is derived from the name of strain ‘Rough’. Roman number following the name indicates the order in which the enzymes were isolated from that strain of bacteria.

180. Answer (2)

**Hint:** Insertional inactivation.

**Sol.:** \( Pst I \) lies in coding sequence of ampicillin resistance gene.