1. 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.

2. The question paper contains three parts A, B and C of Physics, Chemistry and Biology respectively.


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 handover the Answer Sheet to the invigilator in the Room/Hall. The candidates are allowed to take away this Test Booklet with them.

6. Immediately fill the particulars on this page of the test booklet with blue/black ball point pen. Use of pencil is strictly prohibited.

7. Blank papers, clipboards, log tables, slide rules, calculators, cameras, cellular phones, pagers and electronic gadgets are not allowed.

8. You are not allowed to go anywhere before the end of the test.

9. Write your name and roll number in the space provided on the bottom of this page.
1. The source $S$ of unknown frequency produces 8 beats with a source of 250 Hz and 12 beats with a source of 270 Hz. The frequency of source $S$ is
   a. 248 Hz  
   b. 258 Hz  
   c. 272 Hz  
   d. 262 Hz

2. For a coil having $L = 2$ mH, current flows through it is $i = t^2 e^{-t}$ then, the time at which emf become zero
   a. 1 s  
   b. 3 s  
   c. 4 s  
   d. 2 s

3. The energy required to charge a parallel plate capacitor having plate separation $d$ and plate area of cross-section $A$ and the uniform electric field $E$ between plates is given by
   a. $\frac{1}{2} \varepsilon_0 E^2 Ad$  
   b. $\varepsilon_0 E^2 Ad$  
   c. $\frac{1}{2} \varepsilon_0 E^2 / Ad$  
   d. $\varepsilon_0 E^2 / Ad$

4. To get an output $O = 1$ in the given circuit, which of the following input will be correct?
   a. 1 0 0  
   b. 1 0 1  
   c. 1 1 0  
   d. 0 1 0

5. If a concave mirror of focal length $f_1$ is placed at a distance of $d$ from a convex lens of focal length $f_2$. A light ray coming from infinity is falling on this combination and returns to infinity. The distance $d$ must equal
   a. $- f_1 + f_2$  
   b. $f_1 + f_2$  
   c. $- 2 f_1 + f_2$  
   d. $2 f_1 + f_2$

6. The wavelength of frequency of electromagnetic waves employed in space communication vary over a range of
   a. 1 Hz to $10^{11}$ Hz  
   b. 1 Hz to $10^4$ Hz  
   c. 10 Hz to $10^7$ Hz  
   d. $10^4$ Hz to $10^{11}$ Hz

7. If a monochromatic light of frequency $6.0 \times 10^{14}$ Hz is produced by a source and the power emitted is $2.0 \times 10^{-3}$ W, then the number of photons emitted per second by the source is
   a. $3 \times 10^{10}$  
   b. $5 \times 10^{15}$  
   c. $7 \times 10^{12}$  
   d. $9 \times 10^{12}$

8. For the given network (figure). The equivalent resistance between points $C$ and $D$ is
   a. 1Ω  
   b. 4Ω  
   c. 5Ω  
   d. None of these

9. In the following figure, the direction of induced current in figure in the coil is
   a. anit-clockwise  
   b. clockwise  
   c. zero  
   d. None of these
10. In the network shown in figure, \( C_1 = 6 \mu F \) and \( C = 9 \mu F \). The equivalent capacitance between points \( P \) and \( Q \) is

\[ \begin{align*}
a. & \ 3 \mu F \\
b. & \ 6 \mu F \\
c. & \ 9 \mu F \\
d. & \ 12 \mu F \\
\end{align*} \]

11. For the given velocity-time graph, velocity the corresponding displacement-time graph will be

12. Figures shows four paths for a kicked football ignoring the effects of air on the flight rank the paths according to the initial horizontal velocity component highest first

\[ \begin{align*}
a. & \ 1, 2, 3, 4 \\
b. & \ 2, 3, 4, 1 \\
c. & \ 3, 4, 1, 2 \\
d. & \ 4, 3, 2, 1 \\
\end{align*} \]
13. Which one of the following statement is not true of de-Broglie waves?
   a. All atomic particles in motion have waves of a definite wavelength associated with them
   b. The higher the momentum, the larger is the wavelength
   c. The faster the particle, the shorter is the wavelength
   d. For the same velocity, a heavier particle has a shorter wavelength

14. If a particle of mass \( m \) and charge \( q \) is thrown at a speed \( u \) against a uniform electric field \( E \). The distance that it will travel before coming to momentary rest is
   a. \( \frac{mu^2}{2qE} \) 
   b. \( \frac{mu}{qE} \) 
   c. \( \frac{qE}{m} \) 
   d. None of these

15. A thermodynamic system is taken through the cycle ABCD as shown in figure. Heat rejected by the gas during the cycle is

16. Sand is being dropped on a conveyer belt at the rate of \( M \) kg/s. The force necessary to keep the belt moving with a constant velocity of \( v \) m/s will be
   a. \( \frac{Mv}{2} \) 
   b. zero 
   c. \( 2Mv \) 
   d. \( Mv \)

17. If one end of wire of length 4.5 m of radius 3 mm is fixed to a tree limb and a body weighing 100 N is tied to it, then the elongation in the wire is \( (Y = 4.8 \times 10^{11} \text{ N/m}^3) \)
   a. \( 2.22 \times 10^{-5} \text{ m} \) 
   b. \( 3.22 \times 10^{-5} \text{ m} \) 
   c. \( 5.5 \times 10^{-7} \text{ m} \) 
   d. \( 9.2 \times 10^{-12} \text{ m} \)

18. Sound waves travels at a speed of 350 m/s through a warm air and at 3500 m/s through gold. What will be the wavelength of a 700 Hz acoustic wave as it enters gold from warm air?
   a. increases by a factor 20 
   b. decreases of a factor 20
   c. increases by a factor 10 
   d. decreases by a factor 10

19. If two electrical devices, whose resistances are in the ratio of 1:2 and connected in series, the power dissipated in them has the ratio of
   a. 1:1 
   b. 1:4  
   c. 2:1 
   d. 1:2

20. If force \( F \) is given by relation \( F = M \sqrt{x + Nt^2} \), where \( x \) is distance and \( t \) is time, then the dimensions of \( M/N \) will be
   a. \([L^2T^2] \) 
   b. \([L^{1/2} T^2] \) 
   c. \([L^{-1/2} T^2] \) 
   d. \([MLT^{-2}] \)

21. An artificial satellite moving in a circular orbit around the earth has a total (kinetic + potential) energy \( E_0 \). Its potential energy is
   a. \( -E_0 \) 
   b. \( 1.5 E_0 \) 
   c. \( 2 E_0 \) 
   d. \( E_0 \)
22. A disc is rolling (without slipping) on a horizontal surface. C is its centre and Q and P are two points equidistant from C. Let \( v_P, v_Q \) and \( v_C \) be the magnitudes of velocities of points \( P, Q \) and \( C \) respectively, then

a. \( v_Q > v_C > v_P \)  

b. \( v_Q < v_C < v_P \)  

c. \( v_Q = v_P, v_C = \frac{1}{2} v_P \)  

d. \( v_Q < v_C > v_P \)

23. A thin spherical shell of radius \( R \) has charge \( Q \) spread uniformly over its surface. Which of the following graphs, most closely represents the electric field \( E(r) \) produced by the shell in the range \( 0 \leq r < \infty \), where \( r \) is the distance from the centre of the shell?

![Graphs](image)

24. A bullet losses 19% of its kinetic energy when passes through an obstacle. The percentage change in its speed is

a. increase by 10%  

b. decrease by 10%  

c. increase by 20%  

d. decrease by 20%

25. The spring constant of a spring \( K \), when it is divided into \( n \) equal parts, then the spring constant of one piece is

a. \( \frac{K}{n} \)  

b. \( nK \)  

c. \( \frac{nK}{(n + 1)} \)  

d. \( \frac{(n + 1)K}{n} \)

26. If mass-energy equivalence is taken into account, when water is cooled to form ice, the mass of water should

a. increase  

b. remain unchanged  

c. decrease  

d. first increase then decrease

Space for Rough Work
27. The nuclei $^{14}\text{N}$ and $^{13}\text{C}$ can be described as
a. isobars  b. isotones  
c. isotopes of carbon  d. isotopes of nitrogen

28. For amplification by a triode, the signal to be amplified is given to
a. the grid  b. the cathode  c. the glass envelope  d. the anode

29. In the phenomenon of electric discharge through gases at low pressure, the coloured glow in the tube appears as a result of
a. excitation of electron in atoms  
b. collision between the atom of gas  
c. collision between the charged particles emitted from the cathode and the atoms of the gas  
d. collision between different electron of the atoms of the gas

30. A thin rod of length $L$ and mass $M$ is bent at the middle point $O$ at an angle $60^\circ$. The moment of inertia of the rod about an axis passing through $O$ and perpendicular to the plane of the rod will be

\[ \frac{ML^2}{6} \quad \frac{ML^2}{12} \quad \frac{ML^2}{24} \quad \frac{ML^2}{3} \]

31. If 3 bulbs $P$, $Q$ and $R$ are connected as shown in figure. What changes occur in brightness of the bulbs, when the switch is closed?

a. Brightness of $P$ increases but that of $R$ decreases.  
b. Brightness of $P$ remains the same but that of $R$ decreases.  
c. Brightness of both $P$ and $R$ decreases.  
d. Brightness of $P$ increase but that of $R$ remains same.

32. In the following arrangement as shown in figure, the magnetic field at point $O$ is given by

\[ B = \frac{\mu_0}{4\pi} \frac{i}{a} (\sin \theta_1 + \sin \theta_2) \]
\[ B = \frac{\mu_0}{4\pi} \frac{i}{a} (\sin \phi_1 + \sin \phi_2) \]

c. Both of (a) and (b)  d. None of these
33. In following figure, four curves $A, B, C$ and $D$ are given. The curves are

- a. isothermal for $A$ and $D$ while adiabatic for $B$ and $C$
- b. adiabatic for $A$ and $C$ while isothermal for $B$ and $D$
- c. isothermal for $A$ and $B$ which adiabatic for $C$ and $D$
- d. isothermal for $A$ and $C$ while adiabatic for $B$ and $D$

34. From the given figure describing the photoelectric effect it may be inferred that

- a. $A$ and $B$ both have the same threshold frequency
- b. Maximum kinetic energy for both metals depend linearly on frequency both $A$
- c. Stopping potential are different for $A$ and $B$ for some change in frequency
- d. $B$ is better photosensitive material than $A$

35. A stone is dropped into a well which is $H$ metre deep, then the time after which the splash of sound is heard (let speed of sound in air is $v$)

- a. $\sqrt{\frac{2H}{g}}$
- b. $\sqrt{\frac{2H}{g} + \frac{2H}{v}}$
- c. $\sqrt{\frac{2H}{g} + \frac{H}{v}}$
- d. None of these

36. For the given system as shown in figure, the pulley are light and frictionless. The tension in the string is

- a. $2Mg \sin\theta$
- b. $\frac{1}{2}Mg \sin\theta$
- c. $\frac{2}{3}Mg \sin\theta$
- d. $\frac{3}{2}Mg \sin\theta$
37. A particle of mass \( m = 5 \) units is moving with a uniform speed \( v = 3 \sqrt{2} \) m in the XOY plane along the \( y = x + 4 \). What will be the magnitude of the angular momentum about the origin?
   a. 0 units  
   b. 30 units  
   c. 60 units  
   d. None of these

38. Two balls of masses \( M_1 \) and \( M_2 \) are placed on a horizontal frictionless table connected by a spring as shown in figure, how mass \( M_2 \) is pulled to the right with a force \( F \)? If the acceleration of mass \( M_1 \) is \( a \), then acceleration of mass \( M_2 \) will be
   a. \( \frac{F}{M_1} \)  
   b. \( \frac{F - M_1a}{M_2} \)  
   c. \( \frac{F}{M_2} \)  
   d. None of these

39. A block is attached to the three identical springs as shown in figure. Each spring has spring constant \( k \) and mass of block is \( M \). If spring 1 is compressed by a small distance \( x \), then time period of oscillation of block is?
   a. \( T = 2\pi \sqrt{\frac{M}{k}} \)  
   b. \( T = 2\pi \sqrt{\frac{M}{2k}} \)  
   c. \( T = 2\pi \sqrt{\frac{2M}{k}} \)  
   d. None of these

40. The figure shows variation of electric potential \( V \) as a function of \( x \). Arrange the four region in descending order according to the magnitude of \( n \)-component of the electric field \( E \) within them?
   a. \( E_2 = E_4 > E_1 = E_3 \)  
   b. \( E_1 = E_2 > E_3 > E_4 \)  
   c. \( E_4 > E_1 = E_3 > E_2 \)  
   d. \( E_1 > E_2 > E_3 > E_4 \)

41. If a parallel plate capacitor with air as dielectric has capacitance \( C \). A slab of dielectric constant \( k \) and having same thickness as the separation between the plates is introduced so as to fill one-fourth of the capacitor as shown in figure, then new capacitance will be
   a. \( \frac{(4 + k)C}{4} \)  
   b. \( \frac{(3 + k)C}{4} \)  
   c. \( \frac{kC}{2} \)  
   d. \( \frac{kC}{4} \)
42. In the given distribution, what is the value of \( i \)?

![Diagram of electric circuit]

- \( a. \ 8 \ A \)
- \( b. \ 0 \)
- \( c. \ 2 \ A \)
- \( d. \ 5 \ A \)

43. If minimum angle of deviation for a glass prism is equal to its refracting angle. The refractive index of glass is 1.5 then the angle of prism is

- \( a. \ 2 \sin^{-1}\left(\frac{3}{4}\right) \)
- \( b. \ \sin^{-1}\left(\frac{3}{4}\right) \)
- \( c. \ \cos^{-1}\left(\frac{3}{2}\right) \)
- \( d. \ 2 \cos^{-1}\left(\frac{3}{4}\right) \)

44. If a body falls in air, the resistance of air depends to a great extent on the shape of body. Three different shapes are given. Identify the combination of air resistances which truly represents the physical situation? (Cross sectional areas are the same)

![Diagram of shapes]

- \( a. \ 1 < 2 < 3 \)
- \( b. \ 2 < 3 < 1 \)
- \( c. \ 3 < 2 < 1 \)
- \( d. \ 3 < 1 < 2 \)

45. A small sphere carrying a charge \( q \) is having in between two parallel plates by a string of length \( L \). Time period of pendulum is \( T_0 \). When parallel plates are charged, the time period changes to \( T \), the ratio of \( T / T_0 \) is equal to

\[
\frac{g + \frac{qE}{m}}{g}
\]

- \( a. \ \left(\frac{g + \frac{qE}{m}}{g}\right)^{\frac{1}{2}} \)
- \( b. \ \left(\frac{g + \frac{qE}{m}}{g}\right)^{\frac{3}{2}} \)
- \( c. \ \left(\frac{g}{g + \frac{qE}{m}}\right)^{\frac{1}{2}} \)
- \( d. \ None \ of \ these \)

**Space for Rough Work**
PART B  CHEMISTRY

46. Arrange following in correct sequence of basic strength

\[
\begin{aligned}
&\text{I} & \text{II} & \text{III} & \text{IV} \\
&\text{H} & \text{H} & \text{H} & \text{H}
\end{aligned}
\]

\[a. \ IV \ > \ I \ > \ III \ > \ II \]
\[b. \ III \ > \ I \ > \ II \ > \ IV \]
\[c. \ II \ > \ I \ > \ III \ > \ IV \]
\[d. \ I \ > \ III \ > \ II \ > \ IV \]

47. Strength of acid increases with the attachment of group showing –I effect and decreases with the attachment of group showing +I effect. Which of the following is correct sequence of basic strength in aqueous solution?

\[a. \ (\text{CH}_3)_2\text{NH} \ < \ (\text{CH}_3)_2\text{NH}_2 \ < \ (\text{CH}_3)_3\text{N} \]
\[b. \ (\text{CH}_3)_2\text{NH} \ < \ (\text{CH}_3)_2\text{NH}_2 \ < \ (\text{CH}_3)_3\text{N} \]
\[c. \ (\text{CH}_3)_2\text{NH} \ < \ (\text{CH}_3)_2\text{NH}_2 \ < \ (\text{CH}_3)_3\text{N} \]
\[d. \ (\text{CH}_3)_2\text{NH} \ < \ (\text{CH}_3)_2\text{NH}_2 \ < \ (\text{CH}_3)_3\text{N} \]

48. IUPAC name of

\[
\begin{aligned}
&\text{CH}_3 & \text{CH}_3 \\
&\text{CH}_3 & \text{CH}_3
\end{aligned}
\]

\[a. \ 1,2\text{-dimethyl cyclobutane and 2, 3-dimethyl butene} \]
\[b. \ 1,2\text{-dimethyl cyclobut 1-ene and 3, 4-dimethyl cyclo-but-1-ene} \]
\[c. \ 2,3\text{-dimethyl cyclobutene and 2, 3-dimethyl cyclobutane} \]
\[d. \ 2,3\text{-dimethyl butene and 1, 2-dimethylcyclobut-1-ene} \]

49. Phosphorous in any organic compound can be estimated by the formula

\[
\% \ of \ P = \frac{\text{wt. of Mg}_2\text{P}_2\text{O}_7 \ \text{formed} \times 62}{\text{wt. of compound} \ \times 100 \times 222}
\]

This formula is related to

\[a. \ \text{Carius method} \]
\[b. \ \text{Lassaigne’s method} \]
\[c. \ \text{Kjeldahl’s method} \]
\[d. \ \text{Duma’s method} \]

50. \[\text{reacts with B}_2\text{H}_6 \text{ in presence of H}_2\text{O}_2 \text{ produces} \]

\[
\begin{aligned}
&a. \ \text{COCCH}_3 \\
b. \ \text{CHOHCH}_2\text{OH} \\
c. \ \text{CH}_2\text{CH}_2\text{OH} \\
d. \ \text{RCH}_2\text{CHO}
\end{aligned}
\]
51. When benzene is heated with chlorine in the presence of sunlight, it forms
   a. BHC  
   b. cyclopropane  
   c. p-dichlorobenzene  
   d. None of these

52. The product formed when toluene is heated in light with Cl₂ and in absence of halogen carrier is
   a. chlorobenzene  
   b. gammexane  
   c. benzotrichloride  
   d. DDT

53. In IF₇ molecule, central atom has all the bonded electrons i.e., no lone pair is present on the central atom. Structure of IF₇ is
   a. pentagonal bipyramidal  
   b. octahedral  
   c. square pyramidal  
   d. octahedral monopyramidal

54. On dissolving moderate amount of sodium metal in liquid NH₃ at low temperature, which of the following does not occur?
   a. Na⁺ ions are formed in the solution  
   b. Blue coloured solution is obtained  
   c. Liquid NH₃ becomes good conductor of electricity  
   d. Liquid NH₃ remains diamagnetic

55. Most of the compounds of transition metals are coloured in solid state or solutions. The transition metals which have either completely filled d-orbitals or completely empty d-orbitals are colourless. The colour of transition metal is due to
   a. presence of unpaired d-electrons  
   b. small size  
   c. metallic nature  
   d. All of these

56. Electron gain enthalpy increases across the period and decreases down the group. Which of the following order of electron gain enthalpy is correct?
   a. F < Cl < Br < I  
   b. F < Cl > Br > I  
   c. I > Br > F < Cl  
   d. I < Cl < Br > F

57. In which of the following pairs both the complexes show optical isomerism?
   a. cis—[Cr(C₂O₄)₂Cl₂]³⁻, cis—[Co(NH₃)₄Cl]  
   b. [PtCl(dien)]Cl, [NiCl₂Br₂]²⁻  
   c. [Co(NO₃)₉(NH₃)₃], cis—[Pt(en)₂Cl₂]  
   d. [Co(en)₃Cl₃], cis—[Co(en)₂Cl₂]Cl

58. XeF₆ is colourless crystalline solid. It undergoes hydrolysis in water. The final product obtained is an explosive solid. This explosive solid will be
   a. XeO₃  
   b. XeO  
   c. XeO₂  
   d. Xe

Space for Rough Work
59. The number of spectral lines that can be possible when electrons in 7th shell in different hydrogen atoms return to the second shell is
   a. 12  b. 15  c. 14  d. 10

60. Principal quantum number defines the principal shell in which electron is revolving around the nucleus and Azimuthal quantum number described the name of the subshell and the shape of orbitals. The values of principal and Azimuthal quantum number for 23rd electron present in iron atom are.
   a. 3 and 2  b. 3 and 1  c. 4 and 1  d. 4 and 0

61. A compound A is obtained by reaction between first member of 1st group element and lightest element of periodic table, then correct statement about compound A is
   a. A is acidic in nature  b. A is basic in nature
   c. A is amphoteric in nature  d. A turns blue litmus paper red

62. Potassium superoxide is the inorganic compound with the formula KO2. It is a yellow solid that decomposes in moist air. It is a rare example of a stable salt of the superoxide ion. Which of the following statement is incorrect regarding potassium superoxide?
   a. Oxidation state of oxygen in KO₂ is −1/2
   b. Oxidation state of potassium is +1
   c. It is used in preparation of breathing mask
   d. It is a reducing agent

63. Werner’s theory was the first successful theory, which explained the properties of complexes. According to Werner’s theory the primary and secondary valence of [Co Cl₃(NH₃)₃] Cl₃ is
   a. 3 and 3 respectively  b. 6 and 6 respectively
   c. 3 and 6 respectively  d. 6 and 3 respectively

64. Boron on reaction with CO₂ and H₂O produces boron hydride as a major constituent the other byproduct produced in these reactions are
   a. H₂O and C  b. H₂ and CO₂
   c. H₂ and C  d. H₂O and CO₂

65. NaBH₄ on reaction with I₂ produces a compound X, X on reaction with oxygen produces an anhydride. X on reaction with NH₃ forms an adduct. X is
   a. BH₄⁻  b. LiH
   c. BH₃  d. IBH₂

66. Equilibrium constant of a chemical reaction is 1.5 and rate constant of forward reaction is 7.5 × 10⁻⁴. Then, rate constant of backward reaction will be
   a. 1.125 × 10⁻³  b. 2.225 × 10⁻³
   c. 3.335 × 10⁻⁵  d. 1.125 × 10⁻¹

67. The pH of the solution is defined as the negative logarithm of the concentration of hydrogen ions which it contains. pH of 0.365 gL⁻¹ HCl solution will be
   a. 1  b. 2  c. 3  d. 0.1

68. When copper metal is dipped in a solution of HNO₃, it produces copper nitrate and some gaseous molecule, the change in oxidation number of nitrogen is
   a. +2  b. +1  c. +4  d. 0
69. What amount of current will be required to evolve 20 g of chlorine in 6 h from HCl solution?
   a. 10 A
   b. 15 A
   c. 5 A
   d. 2.45 A

70. Which of the following is not the assumption of kinetic theory of gases?
   a. The actual volume of the gaseous molecules is negligible as compared to the total volume of the gas
   b. Molecules are perfectly elastic
   c. The critical temperature is the measure of the kinetic energy of the molecule
   d. The effect of gravity on motion of molecules is negligible

71. A solid is made of two elements P and Q. Atoms P are in ccp arrangement and atoms Q occupy all the octahedral voids and half of the tetrahedral voids, then the simplest formula of the compound is
   a. PQ₂
   b. P₂Q
   c. PQ
   d. P₂Q₂

72. The space occupied in different packings is called packing fraction. Packing fraction = \( \frac{\text{total volume of sphere}}{\text{volume of the unit cell}} \)
   Fraction of total volume occupied by atoms in a simple cubic unit cell is
   a. \( \frac{\pi}{2} \)
   b. \( \frac{\sqrt{3} \pi}{8} \)
   c. \( \frac{\sqrt{2} \pi}{6} \)
   d. \( \frac{\pi}{6} \)

73. Spontaneity of a process is decided by the value of \( \Delta G \). A negative value of \( \Delta G \) shows a spontaneous process. Since, the value of \( \Delta G \) depends upon \( \Delta S \) and \( \Delta H \), these two also play an important role for deciding spontaneity of a process. The condition for spontaneity of any chemical reaction, if
   a. \( T\Delta S = \Delta H \) and both \( \Delta H \) and \( \Delta S \) are positive
   b. \( T\Delta S > \Delta H \) and both \( \Delta H \) and \( \Delta S \) are positive
   c. \( T\Delta S < \Delta H \) and both \( \Delta H \) and \( \Delta S \) are positive
   d. \( T\Delta S > \Delta H \) and \( \Delta H \) is positive and \( \Delta S \) is negative

74. A container has hydrogen and oxygen mixture in ratio of 1 : 1 by weight, then
   a. internal energy of the mixture decreases
   b. internal energy of the mixture increases
   c. entropy of the mixture increases
   d. entropy of the mixture decreases

75. Arrhenius proposed a quantitative relationship between rate constant and temperature as \( k = Ae^{-E_a/RT} \) or \( \ln k = \ln A - E_a/RT \). What will be the slope of graph when \( \ln k \) is plotted versus \( 1/T \)?
   a. \( \frac{E_a}{R} \)
   b. \( -\frac{E_a}{R} \)
   c. \( \frac{1}{T} \)
   d. \( \ln A \)
76. Freundlich gave the relationship between the gas adsorbed by solid adsorbent surface and pressure of the gas at a particular temperature. Which of the following equation represent Freundlich adsorption isotherm?

a. \( \frac{x}{m} = kp^{1/n} \)  
b. \( \frac{x}{m} = \frac{k}{p} \)  
c. \( \frac{x}{m} = kp \)  
d. \( \frac{x}{m} = kp^n \)

77. An exothermic chemical reaction occurs in two steps as follows

I. \( A + B \rightarrow X \) (fast)  
II. \( X \rightarrow AB \) (slow)

The progress of the reaction can be best represented by

a.  

![Diagram A](image1.png)  
b.  

![Diagram B](image2.png)  
c.  

![Diagram C](image3.png)  
d. All of these

78. Which of the following plots represents the behaviour of an ideal binary liquid solution?

a. Plot of \( p_{total} \) vs \( Y_A \) (mole-fraction of \( A \) in vapour phase) is linear  
b. Plot of \( p_{total} \) vs \( Y_B \) is linear  
c. Plot of \( 1/p_{total} \) vs \( Y_A \) is linear  
d. Plot of \( 1/p_{total} \) vs \( Y_B \) is non-linear

79. A compound obtained by burning of an element belongs to 2\textsuperscript{nd} group and 3\textsuperscript{rd} period when passes through red litmus paper it turns blue the equivalent weight of compound is

a. 58  
b. 29  
c. 116  
d. 14.5

80. What will be the formation of \( CO_2 \) is?

\[
\begin{align*}
C + O_2 & \rightarrow CO_2 & \Delta H = X \\
CO + \frac{1}{2} O_2 & \rightarrow CO_2 & \Delta H = Y
\end{align*}
\]

a. \( X - Y \)  
b. \( Y - 2X \)  
c. \( X + Y \)  
d. \( 2X - Y \)

81. Which of the following is not correctly matched?

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. XeO\textsubscript{3}</td>
<td>tetrahedral</td>
</tr>
<tr>
<td>b. XeF\textsubscript{4}</td>
<td>square planar</td>
</tr>
<tr>
<td>c. XeF\textsubscript{2}</td>
<td>linear</td>
</tr>
<tr>
<td>d. XeO\textsubscript{2}F\textsubscript{2}</td>
<td>square planar</td>
</tr>
</tbody>
</table>

82. How many carbon in 2 methyl pentan-3-one is \( sp^2 \) hybridised?

a. 2  
b. 1  
c. 0  
d. 3
83. Most of the organic compounds are generally used in the formation of drugs. 1.1% solution of phenol is used as
   a. antiseptic  
   b. antipyretic  
   c. disinfectant  
   d. tranquilizer
84. CFCs, HCFCs and halons destroy the earth’s protective ozone layer, which shields the earth from harmful ultraviolet rays generated from the SUN. Why CFC are widely used in air conditioners?
   a. Because CFC are highly reactive  
   b. It is highly inflammable  
   c. It is non-reactive  
   d. All of these are true
85. Nylon 4 can be prepared by polymerisation of
   a.  
   b.  
   c.  
   d.  
86. Aldohexoses are six carbon sugars with four chirality centres and an aldehyde carbonyl group. There are 16 possible stereoisomeric aldohexoses. D-glucose and D-mannose are X of each other X is
   a. epimer  
   b. anomer  
   c. enantiomer  
   d. diasteromer
87. In the below reaction, B is
   a. caproic acid  
   b. caproic anhydride  
   c. caprolactum  
   d. cyclohexanone oxime
88. Which of the following chemical reactions will produce phenol?
   a. Aniline  
   b. Aniline  
   c. Benzene  
   d. All of these
89. Primary amine on reaction with a mixture of chloroform and alc. KOH produced isocyanides while phenol on reaction with a mixture of chloroform and aq KOH produces
   a. salicylic acid  
   b. benzoic acid  
   c. benzaldehyde  
   d. salicylaldehyde
90. LiAlH₄ is a strong reducing agent and reduces most of the functional groups to alcohol. The product obtained after reduction of dimethylcarbinol with LiAlH₄, it produces
   a. propan-2-ol  
   b. propan-1-ol  
   c. pentan-2-ol  
   d. propanoic acid
91. **Assertion** (A) Blood is a connective tissue with fluid matrix.

**Reason** (R) Haemopoiesis is the process of formation of blood.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true, but R is not the correct explanation of A
c. A is true, but R is false
d. A is false, but R is true

92. Label the parts in the given diagram with the following set of codes.

![Diagram](image)

a. A–D-loop; B–Anticodon arm; C–TψC arm; D–CCA acceptor arm
b. A–CψC loop; B–Amino acid arm; C–Acceptor arm; D–Anticodon arm
c. A–D-loop; B–TψC arm; C–Acceptor arm; D–Anticodon arm
d. A–Anticodon arm; B–Amino acid arm; C–CψC arm; D–Acceptor arm

93. Touch receptors present in the skin are known as

a. Pacinian corpuscles
b. Meissner’s corpuscles
c. Krause’s end bulbs
d. Organs of Ruffini

94. Select the incorrect statement from the following options.

a. Nucleic acid — Genetic material
b. Proteins — Heteropolymers of amino acids
c. Ribozymes — Protein with catalytic activity
d. Collagen — Most abundant protein in animal world

95. Bone and cartilage can be distinguished by the presence of one of the following structure

a. lacuna  b. myofibril  c. Haversian canal  d. chromatophores

96. Which of the following disease(s) may lead to Iron Deficiency Anaemia (IDA).

I. Peptic ulcer
II. Inflammatory Bowel Disease (IBD)
III. Hypochlorhydria
IV. Pregnancy

a. I and III  b. All may lead to IDA  c. Only IV  d. I, II and IV

97. When osmotic potential is either zero or negative and pressure potential is positive, then the water potential will be

a. always negative  b. always positive
c. some times negative and some times positive  d. do not show any specificity
98. Mesangial cells are specialised smooth muscle cells that function to regulate blood flow in the blood vessels. They are found in which organ of the body?
   a. Testis  
   b. Brain  
   c. Kidney  
   d. Ovary

99. Match the following columns.

<table>
<thead>
<tr>
<th>Column I (Structure of Earthworm)</th>
<th>Column II (Its location)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Pairs of testis</td>
<td>1 10th and 11th segment</td>
</tr>
<tr>
<td>B. Pairs of seminal vesicles</td>
<td>2 17th and 19th segment</td>
</tr>
<tr>
<td>C. Pair of ovary</td>
<td>3 13th segment</td>
</tr>
<tr>
<td>D. Accessory gland</td>
<td>4 11th and 12th segment</td>
</tr>
</tbody>
</table>

   a. 1 4 3 2
   b. 2 4 3 1
   c. 4 1 3 2
   d. 2 3 1 4

100. The biochemical or morphological change of meristematic daughter cell to become a permanent cell is called
   a. differentiation  
   b. dedifferentiation  
   c. redifferentiation  
   d. indifferentiation

101. Which one of the following is an exclusive character of living beings?
   a. Isolated metabolic reactions occurring in vitro.
   b. Increase in the body mass from inside only
   c. Perception of happening of events in the environment and their memory
   d. Increase in mass by accumulation of material both on surface as well as internally

102. Match the following columns.

<table>
<thead>
<tr>
<th>Column I (Organism)</th>
<th>Column II (Characteristics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. <em>Euglena</em></td>
<td>1. Causing haemoglobinuric fever in cattle</td>
</tr>
<tr>
<td>B. <em>Noctiluca</em></td>
<td>2. Connecting link between plants and animals</td>
</tr>
<tr>
<td>C. <em>Babesia</em></td>
<td>3. Free living marine</td>
</tr>
<tr>
<td>D. <em>Trichonympha</em></td>
<td>4. Symbiosis in termite’s get</td>
</tr>
</tbody>
</table>

   a. 4 3 1 2
   b. 2 4 3 1
   c. 2 3 1 4
   d. 3 4 2 1

103. CFC is an organic compound that contains only carbon, chlorine and fluorine, produced as a volatile derivative of methane and ethane. They are the main culprit for ozone depletions. Which of the following pledged to phase out CFC’s?
   a. Riodeclaration  
   b. Helsinki declaration  
   c. Kyoto Protocol  
   d. Earth Summit

104. Which of the following statement is not correct?
   a. Double fertilisation is characteristic feature of angiosperms. It was discovered by SG Nawaschin
   b. In adventive embryos, embryos develop directly from the nucellus
   c. Milky water of coconut is called liquid endosperm
   d. In anatropous ovule, the micropyle, funicle and chalaza lie in a straight line
105. You have hired a driver, which is 55 year old. During the interaction before joining. He had informed you very honestly that he is a diabetic patient. Which of the following suggestion you will give him before going on a drive.

I. Take a double dose of insulin, so that he does not develop any problem during driving
II. Always carry a identification card with full detail
III. Take regular snacks or meal during long journey.
IV. Drink only 500 mL of water in 24 hours to avoid any hypoglycemic attack

a. I and III  
b. III and IV  
c. I and II  
d. II and III

106. Cichlid fish became extinct due to a alien species in the lake Victoria. Find out the name of that alien species from the following options.

a. Nile perch  
b. African catfish  
c. Murrels  
d. Water hyacinth

107. As per the fluid mosaic theory/model of cell membrane, lipid is also present in the membrane select the correct organelles in which it synthesised

a. smooth endoplasmic reticulum  
b. Golgi apparatus  
c. mitochondria  
d. lysosome

108. Label the given diagram with options given below.

A B C
a. Epicotyl Hypocotyl Cotyledons  
b. Hypocotyl Epicotyl Cotyledons  
c. Hypocotyl Cotyledons Epicotyl  
d. Epicotyl Cotyledons Hypocotyl

109. Biosystematics is

a. the identification and arrangement of different organisms on the basis of their morphological characters  
b. the systematic arrangement of different organisms on the basis of their ecological niche  
c. the analysis of the geographical distribution of population or organisms and than systematic organisation of the population/organisms  
d. the systematic arrangement of organisms on the basis of their evolutionary, genetic and biochemical framework to assess the taxonomic relationships of organisms or populations

110. Statement A Fertilised eggs of honeybee develop into drone and unfertilised eggs develop into female.

Statement B Female develops parthenogenetically.

a. Both statements are true and B is the correct explanation of A.  
b. Both statements are true, but B is not the correct explanation of A.  
c. Both are false
11. All below are the symptoms of one of the following condition Urtirearia
   Hypotension
   Wheeze
   Flushing
   Angioedema of lips
   a. Mitral stenosis  b. Aortic stenosis
   c. Acute asthma  d. Anaphylaxis

12. These processes are compulsory for the complete development of the male gametophyte from pollen mother cell
   a. two meiotic cell division
   b. one mitotic cell division and two meiotic cell division
   c. one meiotic cell division and two mitotic cell division
   d. two meiotic cell division and one mitotic cell division

13. Which one of following term is used for local population, adapted genetically to its particular environment
   a. biotic community  b. demes
   c. biome  d. ecotype

14. Human eyes have lot of glands, which are prone to infection. Infection of which modified gland of eyelids causes style or external hordeolum?
   a. Gland of Moll  b. Meibomian gland
   c. Gland of Zeis  d. Lacrimal gland

15. The Respiratory Quotient (RQ) of C₄H₆O₆ is
   a. 1.33 (more than unity)  b. 0.7 (less than unity)
   c. zero  d. ∞ (infinite)

16. Identify the correct relationship with reference to water potential of a plant cell.
   a. \( \psi_w = \psi_m + \psi_s + \psi_p \)
   b. \( \psi_w = \psi_m - \psi_s - \psi_p \)
   c. \( \psi_w = \psi_m - \psi_s + \psi_p \)
   d. \( \psi_w = \psi_m + \psi_s - \psi_p \)

17. Symptoms alcoholic withdrawal are
   a. tranquillisers  b. sedatives
   c. opiate  d. stimulants

18. Which among the following represent central dogma?
   a. RNA → DNA → Protein  b. Protein → RNA → DNA
   c. DNA → RNA → Protein  d. DNA → Protein → RNA

19. Match the followings columns.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Food storing tissue</td>
<td>1. Grapes</td>
</tr>
<tr>
<td>B. Parthenocarpic fruit</td>
<td>2. Mango</td>
</tr>
<tr>
<td>C. Membranous seed coat</td>
<td>3. Maize</td>
</tr>
<tr>
<td>D. Single seeded fruit developing from monocarpellary superior ovary</td>
<td>4. Litchi</td>
</tr>
<tr>
<td></td>
<td>5. Endosperm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
120. A 12 year old boy, whose body mass index BMI is 18.5, starts complaining of stomach-ache on every Monday morning. His doctor has not found any organic cause despite all investigations. What may be the cause of this abdominal pain
   a. Psychogenic
   b. Pseudo-obstruction
   c. Haemorrhoids
   d. Hirschprung’s disease

121. Match the following columns.

<table>
<thead>
<tr>
<th>Column I (Classes of Enzymes)</th>
<th>Column II (Examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Transferases</td>
<td>1. Histidine decarboxylases</td>
</tr>
<tr>
<td>B. Lyases</td>
<td>2. Amylase</td>
</tr>
<tr>
<td>C. Hydrolases</td>
<td>3. Glutamate pyruvate transaminase</td>
</tr>
<tr>
<td>D. Ligases</td>
<td>4. Pyruvate carboxylase</td>
</tr>
</tbody>
</table>

   a. 4 2 3 1
   b. 3 1 2 4
   c. 1 2 3 4
   d. 4 1 3 2

122. Which of the following enzyme is called regulatory enzyme of glycolysis?
   a. Phosphoglucoisomerase
   b. Phosphofructokinase
   c. Phosphotriose isomerase
   d. Mutase

123. A individual has low blood potassium and hypertension. Blood investigations show that has blood aldosterone is very high. He might be suffering from
   a. Addison’s disease
   b. cretinism
   c. gigantism
   d. Conn’s disease

124. Which of the following statement(s) is/are true
   I. Salivary gland chromosomes or polytene chromosome have been seen in dipteran insects
   II. Lampbrush chromosomes have been observed in primary oocyte nuclei of vertebrate only
   III. Lampbrush chromosomes have been observed in primary oocyte nuclei of vertebrates as well as invertebrates.
   IV. Kinetochore is an another name for satellites chromosomes.
   a. I and IV
   b. I, II, III and IV
   c. II and III
   d. I and III

125. Identify the correct sequence of gene in an operon.
   a. Promoter, operator, regulator, structural
   b. Structural, regulator, operator, promoter
   c. Regulator, promoter, operator, structural
   d. Operator, structural, regulator, promoter

126. Select the correct statement from the given options regarding homologous organs?
   a. Similar in origin but dissimilar in functions
   b. Similar in origin with similar/dissimilar function
   c. Dissimilar in origin and dissimilar in structures
   d. Similar in origin but dissimilar in functions

127. Which is not used for detection of cancer of internal organs?
   a. Radiography
   b. Computed tomography
   c. Magnetic resonance imaging
   d. Enzyme linked immunosorbent assay
128. What happens during stomatal opening
   a. Malate enter into the guard cell
   b. H* extruding from guard cells
   c. K* enters into the guard cell
   d. All of these

129. Match the following columns.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Azoic</td>
<td>1. Era of ancient life</td>
</tr>
<tr>
<td>B. Proterozoic</td>
<td>2. Era of no life</td>
</tr>
<tr>
<td>C. Palaeozoic</td>
<td>3. Era of medieval life</td>
</tr>
<tr>
<td>D. Mesozoic</td>
<td>4. Era of early life</td>
</tr>
</tbody>
</table>

Codes
   a. 1 3 4 2
   b. 2 4 1 3
   c. 1 2 3 4
   d. 4 3 2 1

130. Hassal’s bodies which area potent source of the cytokine TS2P, are found in one of the following organ
   a. liver
   b. thymus
   c. adrenal
   d. thyroid

131. Being a student of biology, your one of the relative called you and informed that he has a chest pain which is peripheral, extracted by deep breathing or coughing.
   Which of the following system is most likely seems to be involved?
   a. Respiratory system
   b. Cardiac system (cardio-vascular system)
   c. Neural system
   d. Sensory system

132. RFLP, RAPD, VNTR and STR are examples of
   a. enzymes
   b. molecular marker
   c. plasmids
   d. antigens

133. Assertion (A) Neo-Lamarckism is the modified form of Lamarckism.
   Reason (R) Evidences in favour of inheritance of acquired characters support Neo-Lamarckism.
   a. Both A and R are true and R is the correct explanation of A
   b. Both A and R are true, but R is not the correct explanation of A
   c. A is true, but R is false
   d. A is false, but R is true

134. When one molecule of glucose enters into glycolysis two molecules of pyruvic acid is formed then pyruvic acid enter into the Krebs’ cycle. How many carbon dioxide molecules are formed when one glucose molecule passes through glycolysis and Krebs’ cycle?
   a. 3
   b. 4
   c. 5
   d. 6

135. Auxin cause apical dominance this hormone is mainly produces in the apical part of shoot the reason for apical dominance by auxin.
   a. Auxin in apical part of shoot have the ability to bans part the cytokinin from root in the apical part of shoot
   b. Cytokinin is not transported to apical part that is why auxin cause apical dominance
   c. Both (a) and (b).
   d. None of the above
136. Choose the correct statement.

I. LSD – Ergot
II. Mescaline – Peyote cactus
III. Marijuana – Angel dust
IV. Ganja – Cannabis sativa
V. Opium – Synthetic drug

a. I, II and V  
b. II, III and IV  
c. I, II and IV  
d. None of these

137. Match the following columns.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Biosynthesis of IAA</td>
<td>1. Zinc</td>
</tr>
<tr>
<td>B. Protein synthesis</td>
<td>2. Manganese</td>
</tr>
<tr>
<td>C. Hydrolysis of pyrophosphate</td>
<td>3. Nitrogen</td>
</tr>
<tr>
<td>D. Photolysis of water</td>
<td>4. Phosphorus</td>
</tr>
</tbody>
</table>

A B C D  
a. 1 4 2 3  
b. 4 2 1 3  
c. 1 3 4 2  
d. 3 4 2 1

138. A hormone is a class of regulatory biochemical produced in particular parts of organism by specific cells, glands and/or tissues. Identify the systemic hormone from the following options.

a. Oxytocin  
b. Somatostatin  
c. Melatonin  
d. Somatotrophin

139. Which of the following statement is incorrect?

a. Ethidium bromide stained DNA can be seen in light 
b. DNA cannot be seen in visible light 
c. Ethidium bromide stained DNA can be seen when exposed to UV-light 
d. DNA cannot be seen in visible light even if stained

140. Identify the types of birth control device based on the features given below.

I. Requires the erection of penis  
II. Can cause excess menstrual bleeding and pain.  
III. Relatively unreliable and sometimes messy.

a. I–Diaphragm  
b. I–Levonorgestral  
c. I–Condom  
d. I–Cervical cap  
II–Cervical cap  
III–Implant  
III–Norplant  
II–IUD  
III–Vaginal suppositories  
III–Condom

141. Match the following columns.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Lymph</td>
<td>1. Wharton’s jelly</td>
</tr>
<tr>
<td>B. Blood</td>
<td>2. Adipose cells</td>
</tr>
<tr>
<td>C. Mucoid tissue</td>
<td>3. Less glucose concentration</td>
</tr>
<tr>
<td>D. Reticular tissue</td>
<td>4. Middle man</td>
</tr>
</tbody>
</table>

A B C D  
a. 1 4 2 3  
b. 4 2 1 3  
c. 4 3 1 2  
d. 3 1 2 4
142. Match the following columns.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Duration (in hours)</th>
<th>Vicia faba</th>
<th>Mouse L-cells</th>
<th>Human Hela cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. G&lt;sub&gt;1&lt;/sub&gt;</td>
<td>1.</td>
<td>12</td>
<td>3-4</td>
<td>3</td>
</tr>
<tr>
<td>B. S</td>
<td>2.</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>C. G&lt;sub&gt;2&lt;/sub&gt;</td>
<td>3.</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>D. M</td>
<td>4.</td>
<td>6</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

A B C D A B C D

a. 2 4 1 3
b. 3 2 1 4
c. 4 1 3 2
d. 1 2 3 4

143. Match the following columns.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Allogamy</td>
<td>1. Fusion of gametes</td>
</tr>
<tr>
<td>B. Homogamy</td>
<td>2. Cross-pollination</td>
</tr>
<tr>
<td>C. Syngamy</td>
<td>3. Male and female parts of a flower mature simultaneously</td>
</tr>
</tbody>
</table>

A B C A B C

a. 3 1 2
b. 3 2 1
c. 3 2 1
d. 1 2 3 4

144. Assertion (A) *Plasmodium* is an endoparasite.

**Reason** (R) Female mosquito is an example of temporary parasite.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true, but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

145. Identify the incorrect statement regarding oogenesis.

a. It has long resting periods
b. It forms one functional and three non-functional cells
c. Its growth phase is very short
d. The division of primary oocyte is not equal

146. Which one of the statement given below is not correct?

a. The new name of dark reaction is carbon assimilation, in which CO<sub>2</sub> gas reduces into carbohydrates glucose
b. Photolysis means splitting of water molecules to release oxygen in photosystem-I
c. A chlorophyll molecule has a tadpole like structure with phytol head and porphyrin tail
d. ATP is energy rich compound where maximum energy is present in terminal pyrophosphate bonds

147. Which of the following is not a vestigial organ in man?

a. Nail
b. Muscles of ear pinna
c. Wisdom teeth
d. Tail vertebra
148. Match the followings columns.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Calcium</td>
<td>1. Required for synthesis of mitotic spindle</td>
</tr>
<tr>
<td>B. Chlorine</td>
<td>2. Required to active respiratory enzyme</td>
</tr>
<tr>
<td>C. Manganese</td>
<td>3. Essential for constitution of nucleic acid</td>
</tr>
<tr>
<td>D. Phosphorus</td>
<td>4. Required for ionic balance</td>
</tr>
</tbody>
</table>

Codes

a. 1 3 2 4  
b. 1 4 2 3  
c. 4 2 3 1  
d. 2 3 4 1

149. Consider the following statements.

I. In non-endospermic seeds, food is stored in seed coat.
II. Caryopsis is one seeded dry indehiscent fruit developed from a monocarpellary, unilocular and superior ovary.
III. Hesperidium is a modification berry.

Which of the statements given above are correct?

a. I and II  
b. I and III  
c. II and III  
d. I, II and III

150. Which of the following is a missing link?

a. Peripatus  
b. Neopilina  
c. Ichthyostega  
d. Protopterus

151. Which hormone of pancreas inhibits the release of pancreatic juice?

a. Insulin  
b. Glucagon  
c. Somatostatin  
d. Pancreatic polypeptide

152. Select the correct statement regarding active ion uptake, which differentiate it from secondary transport

a. ions are active  
b. ions move freely  
c. energy is expended  
d. ions move passively

153. Which of the following combination of drugs has a dramatic rapid increase in sedative effect?

a. Alcohol + Antihistamines  
b. Alcohol + Benzodiazepines  
c. Alcohol + Aspirin  
d. Amphetamine + Insulin

154. Which one of the statement given below is not correct?

a. Kreb’s cycle is a common pathway of oxidative breakdown of carbohydrates, fatty acids and amino acids  
b. The energy present in one gram carbohydrate in 4.4 kcal or 18.4 kJ  
c. When protein are used as respiratory substrate respiration is called protoplasmic respiration  
d. The energy present in one gram of fat is 4.8 kcal or 20 kJ

155. Genetically modified foods contain

a. same number of genes as conventional crop  
b. same number of genes as hybrid crop  
c. one of two additional genes  
d. hundreds of additional genes

156. During photorepiration, the conversion of phosphoglycolate to glycolate takes place in which cell organelle.

a. Mitochondria  
b. Peroxisome  
c. Chloroplast  
d. Glyoxysome
157. Which of the following statements is correct for Cro-magnon man?
   a. Advanced stage of man’s evolution than Homo erectus
   b. Predecessor of Homo neanderthalensis
   c. Direct ancestor of man
   d. Lived during last ice age

158. Steps of relaxation are
   I. Discharge of neuron
   II. Release of Ca\(^{2+}\) from troponin
   III. Generation of end plate potential
   IV. Cessation of interaction between actin and myosin.
   a. I, II, III and IV
   b. II and IV
   c. I, II and III
   d. I, III and IV

159. Clotting is a process via which flow of blood from the wound stops naturally. A step of clotting is given belows identify the correct catalyst
   Fibrinogen $\rightarrow$ Fibrin
   a. prothrombium
   b. thrombin
   c. thrombium
   d. thromboplastin

160. Which of the following is incorrect about eutrophication?
   a. Found in all ecosystems
   b. Leads to organic loading
   c. Bloom formation is eutrophic water
   d. Enrichment with plant nutrients

161. Two chromatin fibre per chromosome is present in
   a. G\(_1\)
   b. G\(_2\)
   c. S
   d. Telophase

162. Wobble pairing takes place
   a. under unusual condition between homologous chromosomes of a somatic cell causing somatic crossing over
   b. in some cases between the third base of a codon and that of an anticodon
   c. in those rare instances where unequal crossing over takes place for the lack of segment to segment pairing
   d. in radiation included base deletion from one strand of a DNA molecule so that the complementary counter-part of the other strand exhibits mispairing

163. Which of the following statement is true for heterochromatinisation. It takes place
   a. during fertilisation
   b. early in the gestational development
   c. immediately before birth
   d. prior to the onset of puberty

164. Genetically modified plants are superior to parent plants in many ways. Identify the correct effect of GMFs on human gene.
   a. it causes damage to human gene
   b. It has no effect on human gene
   c. it causes change in number of human gene
   d. it modifies human gene
165. Match the following columns.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Apple</td>
<td>1. Perianth</td>
</tr>
<tr>
<td>B. Walnuts</td>
<td>2. Juicy testa</td>
</tr>
<tr>
<td>C. Pomegranate</td>
<td>3. Cotyledons</td>
</tr>
<tr>
<td>D. Mulberry</td>
<td>4. Fleshy thalamus</td>
</tr>
</tbody>
</table>

A  B  C  D  A  B  C  D  

a. 4 3 2 1  b. 3 2 1 4  c. 4 2 1 3  d. 2 1 3 4

166. Due to imbibition, the seed coat breaks because, kernels swell to higher degree because
   a. kernel is made up of cellulose
   b. kernel is made up of proteins, lipid and starch
   c. depends on nature of medium
   d. None of the above

167. Ozone depletion of stratosphere shall results in lot of side effects to atmosphere one of them is that it
   a. causes forest fires
   b. increased incidence of skin cancer.
   c. causes blood cancer
   d. None of these

168. Extinction of passenger pigeon (Ictopistus migratorius) is a result of one of the following cause.
   a. absence of food
   b. presence of predators
   c. over exploitation by humans
   d. bird flu

169. Stellosis sea cow (Hydrodamalis gigas) was a large herbivorous marine mammals. It was the largest number of the order-Sirenia. It was discovered in
   a. Africa
   b. Russia
   c. Mauritius
   d. Australia

170. Which one of the following human genes has the longest stretch of DNA (~ 24 Mb)?
   a. Globin gene
   b. Histone gene
   c. Dystrophin gene
   d. tRNA gene

171. Which of the following is true about Lamarckism?
   I. It was proposed by Jean Baptiste de Lamarck.
   II. It is based on use and disuse of organs.
   III. Principle of natural selection.
   IV. Inheritance of acquired characters.
   a. I, II and III  b. IV, III and II  c. I, IV and II  d. I, II, III and IV

172. Mental retardation in man associated with sex chromosomal abnormality is usually due to
   a. moderate increase in Y complement
   b. large increase in Y complement
   c. reduction in X complement
   d. increase in X complement

173. Identify the correct statement regarding pBR322. It is a
   a. bacteriophage
   b. yeast
   c. plasmid
   d. parasite
174. The first step in dark reaction of photosynthesis is
   a. formation of ATP
   b. excitation of chlorophyll molecule
   c. photolysis of water
   d. attachment of carbon dioxide to a pentose sugar

175. Which of the following is helpful in studying sex-linked characters?
   a. Back cross
   b. Test cross
   c. Reciprocal cross
   d. Trihybrid cross

176. Which scientist pair determined the given structure of DNA?

   a. Brenner and Nirenberg
   b. Jacob and Monod
   c. Watson and Crick
   d. Singner and Nicolson

177. Which one of the following statements correctly describes allosteric enzymes?
   a. Not usually controlled by feedback inhibition
   b. Regulatory site may be catalytic site
   c. Michaelis-Menten kinetics describe their activity
   d. Effectors may enhance or inhibit substrate binding

178. An ideal vector must have which among the following.
   I. An origin of replication.
   II. Single cloning site.
   III. Have a gene encoding transcription.
   IV. Have a gene encoding resistance to antibiotic.

   Choose the correct combination.
   a. I and IV
   b. III and IV
   c. II and IV
   d. I and II

179. Haemophilic man marries a normal woman. Their offsprings will be all
   a. haemophilic
   b. boys haemophilic
   c. girls
   d. normal

180. Assertion (A) In human eye, cornea absorbs UV-B radiation and a high dose of UV-B causes inflammation of cornea.

   Reason (R) Such exposure may permanently damage the cornea.
   a. Both A and R are true and R is the correct explanation of A.
   b. Both A and R are true, but R is not the correct explanation of A
   c. A is true, but R is false
   d. Both A and R are false
1. (b) The frequency of source

\[ S = 270 \pm 12 = 282 \text{ or } 258 \]

If \( S \) have frequency of 258 Hz then it will give 8 beats/s with source of 250 Hz.

So, \( S \) have frequency 258 Hz.

2. (d) As,

\[ i = t^2 e^{-t} \]

and \[ |\varepsilon| = L \frac{di}{dt} \]

So, emf will be zero when \( \frac{di}{dt} = 0 \)

Now, \[ \frac{di}{dt} = 2te^{-t} - t^2e^{-t} \]

\[ \Rightarrow 2te^{-t} - t^2e^{-t} = 0 \]

\[ \Rightarrow te^{-t} (t - 2) = 0 \]

As, \( t \neq \infty \) and \( t \neq 0 \)

\[ \therefore \quad t = 2 \text{ s} \]

3. (a) In parallel plate capacitor

\[ C = \frac{\varepsilon_0 A}{d} \text{ and } V = E \times d \]

\[ \therefore \quad \frac{1}{2} CV^2 = \frac{1}{2} \varepsilon_0 A \cdot E^2 \cdot d^2 \]

Energy \( = \frac{1}{2} \varepsilon_0 E^2 Ad \)

4. (b) Boolean expression of the following circuit is given by

\[ O = (X + Y) \cdot Z \]

\[ Y = (X + Y) \]

\[ X = \bar{Y} \]

when \( X = 1, Y = 0, Z = 1 \)

We have, \( O = 1 \)

5. (d) The arrangement and ray diagram is shown in figure

\[ d = 2t_1 + t_2 \]

6. (d) Frequencies of electromagnetic waves which employed in space communication vary over a range of \( 10^4 \) Hz to \( 10^{11} \) Hz.

7. (b) As energy,

\[ E = h\nu = 6.63 \times 10^{-34} \times 6.0 \times 10^{14} = 3.98 \times 10^{-19} \text{ J} \]

Now, number of photons emitted per second \( n = \frac{E}{E} \)

\[ = \frac{2.0 \times 10^{-3}}{3.98 \times 10^{-19}} = 5 \times 10^{15} \text{ photons per second.} \]

8. (a) The circuit can be redrawn as

Which is a balanced Wheatstone bridge.

9. (c) As the same current is flowing through wires and the net change in flux is zero through the coil, so there will be no induced current.

10. (a) The last three capacitors on the right, each of capacitance \( = 9 \mu F \) are in series and are equivalent to a capacitance \( C' \) given by

\[ \frac{1}{C'} = \frac{1}{9} + \frac{1}{9} + \frac{1}{9} = \frac{1}{3} \]

or \[ C' = 3 \mu F \]

Since \( C' \) is in parallel with \( C_1 \), the equivalent capacitance of the last part of the network is

\[ C'' = C' + C_1 = 3 + 6 = 9 \mu F \]

Continuing the process of calculation towards the left, we notice that we are finally left with the combination whose equivalent capacitance is 3 \( \mu F \).

11. (d) Here in velocity-time graph, the velocity is constant for first part, so displacement will increase at constant rate.

In next part velocity is zero, so displacement will not increase or decreases.

In last part, velocity is in negative direction so displacement will decreases and finally will become zero.
12. \( R = \frac{u^2 \sin 2\theta}{g} = \frac{2(u \sin \theta)(u \cos \theta)}{g} = \frac{2u_x u_y}{g} \)

\[ \therefore \text{Range } \propto \text{horizontal initial velocity component } u_x \]

In path range 4 is maximum, so football has maximum horizontal velocity component in this path.

13. (b) As, \( \lambda = \frac{h}{p} \)

where, \( h = \text{Planck’s constant}, \lambda = \text{wavelength}, \)

\( p = mv = \text{momentum} \)

It is shown that wavelength \( \lambda \) is inversely proportional to the momentum. Hence, lighter the momentum, lesser will be the wavelength.

So, statement (b) is not true.

14. (a) Particle is thrown against electric field

\[ \therefore \text{Retardation is } a = -\frac{F}{m} = -qE/m \]

Now, \( v^2 - u^2 = 2as \)

\[ \Rightarrow 0 - u^2 = 2 \left( -\frac{qE}{m} \right) s \Rightarrow s = \frac{mu^2}{2qE} \]

15. (b) Work done in cyclic process is equal to the area under the cycle, also work done is positive, if cycle is clockwise and negative if cycle is anticlockwise.

In cyclic process \( \Delta U = 0 \)

By 1st law of thermodynamics

\[ \Delta Q = \Delta U + \Delta W \]

Putting \( \Delta U = 0 \) and \( \Delta W = -p \cdot 2V = -2pV \) in Eq. (i)

We have \( \Delta Q = \Delta W = -2pV \) (\( \Delta Q \text{ heat absorbed} \))

\[ \therefore \text{Heat rejected by gas} = 2pV \]

16. (d) \( F = \frac{\text{d}M}{\text{d}t} = v \frac{\text{d}M}{\text{d}t} + M \frac{\text{d}v}{\text{d}t} \)

As \( v \) is a constant,

\[ F = v \frac{\text{d}M}{\text{d}t} \]

But \( \frac{\text{d}M}{\text{d}t} = M = \text{kg/s} \)

\[ \therefore \text{To keep the conveyor belt moving force needed} = vM \text{ newton.} \]

17. (b) \( Y = \frac{\text{Stress}}{\text{Strain}} = \frac{T/A}{L/l} \)

where, \( T = \text{tension}, \ A = \text{Area}, \)

\( l = \text{elongation or change in length}, \)

\( L = \text{original length} \)

\[ \Rightarrow l = \frac{TL}{AY} = \frac{100 \times 4.5}{(3.14 \times 9 \times 10^{-6}) \times (4.8 \times 10^{-6})} = 3.22 \times 10^{-5} \text{ m} \]

18. (c) Here \( v_{\text{air}} = 350 \text{ m/s} \), \( v_{\text{gold}} = 3500 \text{ m/s} \) as sound travels from one medium to another, frequency remain constant.

\[ \therefore \text{Frequency } v = \frac{v_{\text{air}}}{\lambda_{\text{air}}} = \frac{v_{\text{gold}}}{\lambda_{\text{gold}}} \]

\[ \lambda_{\text{gold}} \times \frac{v_{\text{gold}}}{v_{\text{air}}} = \lambda_{\text{air}} \times \frac{3500}{350} = 10 \lambda_{\text{air}} \]

19. (d) In series combination, power dissipated, \( P \propto i^2R \)

\[ \Rightarrow P \propto R \text{ or } \frac{R_1}{R_2} = \frac{R_1}{R_2} \]

Here \( R_1 : R_2 = 1 : 2 \)

\[ \Rightarrow \frac{R_1}{R_2} = \frac{1}{2} \]

20. (c) Here, \( M\sqrt{x} \) has dimension of force \( F \)

\[ M = \frac{F}{\sqrt{x}} = [\text{ML}^{-1}\text{T}^{-2}] \]

Similarly,

\[ N = \frac{F}{t} = [\text{ML}^{-2}\text{T}^{-1}] = [\text{ML}^{-4}] \]

\[ \therefore M = \frac{[\text{ML}^{\frac{1}{2}}\text{T}^{-2}]}{[\text{ML}^{\frac{1}{2}}\text{T}]} = [\text{L}^{-\frac{1}{2}}] \]

21. (c) For a satellite, we have

\[ \text{Kinetic energy} = \frac{GmM}{2r} \]

\[ \text{Potential energy} = -\frac{GmM}{r} \]

Total energy \( E_0 = KE + PE \)

\[ = \frac{GmM}{2r} - \frac{GmM}{r} = -\frac{GmM}{2r} = PE \]

or

\[ PE = 2E_0 \]

22. (a) The rolling (without slipping) about \( O \) is shown in figure. From figure \( OQ > OC > OP \)

\[ \therefore v_Q > v_C > v_P \]

23. (a) Inside the shell \( (r = 0 \text{ to } r = R) \), \( E = 0 \) on the surface of the shell \( (r = R) \), \( E = \text{max} \) outside the shell, \( (r > R) \), \( E \propto \frac{1}{r} \).
24. (b) $Kmv^2 \Rightarrow v = \frac{2K}{m}$
\[ \therefore \quad v = \sqrt{\frac{2 \times 0.81K}{m}} \approx 0.9v \]
\[ \therefore \quad \% \text{ decrease in speed} = \frac{v - 0.9v}{v} \times 100 = 10\%\]

25. (b) When a spring is cut into $n$ equal parts, the spring constant $k$ of each part is given by
\[ k = nK \]
- $k$ is spring constant of one small piece
- $K$ is spring constant of original.

26. (a) According to the mass-energy equivalence, mass and energy remain conserved. So, when water is cooled to form ice, water loses its energy so, change in energy increases the mass of water.

27. (b) $\text{As, } ^{13}_6\text{C and } ^{14}_7\text{N have same number of neutrons}$
$\text{As, } 13 - 6 = 7 \text{ for C and } 14 - 7 = 7 \text{ for N}$

28. (a) The amplifying action of a triode is based on the fact that a small change in grid voltage causes a large change in plate current. The AC input signal which is to be amplified is superimposed on the grid potential.

29. (c) It is due to collision of charged particles emitted from the cathode and the atoms of the gas.

30. (b) Moment of inertia of a uniform rod about one end $= \frac{ML^2}{3}$
\[ \therefore \quad \text{Moment of inertia of the system in which rod is bent} \]
\[ = 2 \times \frac{M}{2} \left( \frac{L}{2} \right)^2 \frac{ML^2}{3} = \frac{ML^2}{12} \]

Note: Here axis is perpendicular to the plane of the rod.

31. (a) If switch is closed, bulbs get connected in parallel to bulb $P$, due to which the effective resistance of the circuit decreases and hence effective current of the circuit increases. Since brightness of bulb $\propto (\text{current})^2$
\[ \therefore \quad \text{brightness of bulb } P \text{ bulb increase. Now current of bulb } R \text{ is shared by bulb } Q, \]
\[ \therefore \quad \text{Brightness of bulb } R \text{ decreases.} \]

32. (b) From the given figure, magnetic field at point $O$ is given by
\[ B = \frac{H_0}{4\pi a} (\sin \phi_1 + \sin \phi_2) \]

33. (d) The amount of work done in the isothermal cycle is higher than in the adiabatic cycle, because the area under the isothermal curve is larger than the area under the adiabatic curve.
Hence the curves are isothermal for $A$ and $C$ while adiabatic for $B$ and $D$.

34. (b) The graph between stopping potential and frequency is a straight line so maximum kinetic energy of photoelectrons depends linearly on frequency also threshold frequency and work function of material $B$ is greater than material $A$. So, $A$ is better photosensitive material than $B$.

35. (c) If $t_1$ is time taken by stone to reach at level of water then,
\[ H = 0 + \frac{1}{2} \frac{gH^2}{2} \left[ as, s = ut + \frac{1}{2} at^2 \right] \]
\[ t_1 = \frac{\sqrt{2H}}{g} \]

Now, time taken by sound to reach at top
\[ t_2 = \frac{H}{\sqrt{V}} \]
\[ \therefore \quad \text{Total time} = t_1 + t_2 = \sqrt{\frac{2H}{g}} + \frac{H}{\sqrt{V}} \]

36. (b) The FBD of both the blocks is shown

For 1st block,
\[ T = Ma \quad \text{(i)} \]
For 2nd block,
\[ Mg \sin \theta - T = Ma \quad \text{(ii)} \]
From Eqs. (i) and (ii)
\[ 2T = Mg \sin \theta \Rightarrow T = \frac{Mg \sin \theta}{2} \]

37. (c) Angular momentum about origin is
\[ r = \frac{|0 - 0 - 4|}{\sqrt{(-1)^2 + (-1)^2}} = 2 \sqrt{2} \]
\[ |L| = |r \times mv| = rmv = (2 \sqrt{2}) \times 5 \times (3 \sqrt{2}) = 60 \text{ units} \]
38. (b) Force acting on mass \( M_1 \) is \( f = M_1 a \). Mass \( M_2 \) will pull mass \( M_2 \) towards left with a force \( F = M_1 a \).

Net force acting on mass \( M_2 = F - f = F - M_1 a \)

\[ \therefore \text{Acceleration of mass } M_2 = \frac{F - M_1 a}{M_2} \]

39. (b) As spring 1 is compressed by a small distance \( x \), then springs 2 and 3 are expended by

\[ x_2 = x_3 = x \cos 45^\circ = \frac{x}{\sqrt{2}} \]

\[ F = -(F_1 + F_2 + F_3) \]

The net force acting on black will be

\[ F = -(F_1 + F_2 \cos 45^\circ + F_3 \cos 45^\circ) = -2kx \]

So acceleration, \( a = \frac{F}{M} = -\frac{2k}{m} x = -\omega^2 x \)

\[ \Rightarrow \quad \omega = \frac{2k}{M} \]

\[ \therefore \quad T = \frac{2\pi}{\omega} = 2\pi \sqrt{\frac{M}{2k}} \]

40. (c) As electric field,

\[ E = -\frac{dV}{dx} \]

\[ V_1 = \text{constant} \]

\[ \therefore \quad \frac{d(V_1)}{dx} = 0 \]

\[ \Rightarrow \quad E_1 = 0 \]

For region 2

\[ V_2 = +ve = +f(x) \]

\[ \therefore \quad E_2 = -\frac{d(V_2)}{dx} = -ve \]

41. (b) Capacitor with air as the dielectric has capacitance

\[ C_1 = \frac{\varepsilon_0 (3A)}{d} \left( \frac{A}{4} \right) = \frac{3\varepsilon_0 A}{4d} \]

Similarly the capacitor with \( k \) as dielectric constant has capacitance

\[ C_2 = \frac{\varepsilon_0 k A}{d} \]

\[ \therefore \quad C_1 \text{ and } C_2 \text{ are in parallel} \]

\[ C_{\text{eq}} = C_1 + C_2 = \frac{3\varepsilon_0 A}{4d} + \frac{\varepsilon_0 A}{4d} = \frac{3\varepsilon_0 A}{4d} \left[ 3 + k \right] \]

\[ = \frac{C}{4} (3 + k) \]

42. (c) Applying Kirchhoff's first law

\[ i + 4 + 2 - 5 - 3 = 0 \]

\[ i + 6 - 8 = 0 \]

\[ i = 2A \]

\[ \sin \left( \frac{A + \delta A}{2} \right) = \frac{\sin \frac{A}{2}}{\sin \frac{A}{2}} \]

\[ \Rightarrow \quad \mu = \frac{\sin \left( \frac{A + \delta A}{2} \right)}{\sin \frac{A}{2}} \]

\[ \Rightarrow \quad \mu = \frac{\sin A}{\sin \frac{A}{2}} \]

\[ \Rightarrow \quad \mu = \frac{2 \sin A}{\sin \frac{A}{2}} \cos \frac{A}{2} = 2 \cos \frac{A}{2} \]

\[ \Rightarrow \quad A = 2 \cos^{-1} \left( \frac{\mu}{2} \right) \]

\[ \Rightarrow \quad A = 2 \cos^{-1} \left( \frac{1.5}{2} \right) = 2 \cos^{-1} \left( \frac{3}{4} \right) \]

43. (d) As,

\[ \mu = \frac{\sin \left( \frac{A}{2} \right)}{\sin \frac{A}{2}} \]

\[ \Rightarrow \quad \mu = \frac{\sin A}{\sin \frac{A}{2}} \]

\[ \Rightarrow \quad \mu = \frac{4A}{\sin A} \]

\[ \Rightarrow \quad A = 2 \cos^{-1} \left( \frac{\mu}{2} \right) \]

\[ \Rightarrow \quad A = 2 \cos^{-1} \left( \frac{1.5}{2} \right) = 2 \cos^{-1} \left( \frac{3}{4} \right) \]

44. (c) Figure 3 is stream lined, so air resistance of it will be least.

For figure 1 surface area is maximum so air resistance for it is minimum.

\[ \therefore \quad \text{Correct order is } 3 < 2 < 1. \]
45. (d) Time period of simple pendulum when plates are not changed.

\[ T_0 = 2\pi \sqrt{\frac{L}{g}} \]

where, \( L \) = length of string and \( g \) = acceleration due to gravity

When plates are charged electric field \( E \) will appear.

\[ F = qE = mg \]

where \( q \) is charge on sphere.

\[ \therefore \] Resultant acceleration is

\[ g' = g + \frac{qE}{m} \]

\[ \therefore T = 2\pi \sqrt{\frac{g}{g + \frac{qE}{m}}} \]

46. (b)

More free the electron present on N atom as a lone pair, more will be its basic strength.
In IV lone pair of nitrogen is involved in acromatic 6\( \pi \) electrons, hence IV is least basic among all.

47. (d) Such order of basic strength is weighted result of these three factors.
(a) Inductive effect (b) Solvation effect (c) Steric hindrance

48. (b)

Substituent —2\( \text{CH}_3 \)-1, 2 dimethyl
Parent chain-cyclobutene
IUPAC name = 1, 2 dimethyl cyclo but 1-ene

49. (a) When organic compound is treated with conc. HNO\(_3\) in a carrier tube \( P \) present on organic compound can be converted into \( \text{H}_2\text{PO}_4\). Contents of tube is heated with \( \text{MgCl}_2 \) in presence of \( \text{NH}_3\text{Cl} \) and \( \text{NH}_2\text{OH} \). Then \( \text{MgNH}_2\text{PO}_4 \) is formed which is dried and weighted.

\[ P \rightarrow \text{PO}_4^{2-} \]

50. (c)

In present of \( \text{H}_2\text{O}_2 \), \( \text{B}_2\text{H}_6 \) undergo addition of water to double bond. The addition occurs by antimarkonikov's addition.

51. (a) If the benzene is heated with chlorine in the presence of sunlight then hot benzene will also undergo an addition reaction with chlorine or bromine. The product we get is 1,2,3,4,5,6-hexachlorocyclohexane.

52. (c)

53. (a) Structure of \( \text{IF}_7 \) is determined by using hybridisation as follows

\[ H = \frac{V + M - C + A}{2} = \frac{7 + 7}{2} = 7 \]

Hybridisation = \( sp^2d^3 \)
Structure = Pentagonal bipyramidal

54. (c) On dissolving moderate amount of sodium metal in liquid \( \text{NH}_3 \) at low temperature, that liquid \( \text{NH}_3 \) becomes paramagnetic due to presence of free electrons.

55. (a) Unpaired electrons undergo excitation from lower energy level to higher energy level, hence causes colour to transition metal ions. Then, phenomenon is called \( d-d \) transition.
56. (b) As we know electron gain enthalpy decreases down the group. Hence, the order should be \( F > Cl > Br > I \) but correct order of electron gain enthalpy is \( F < Cl > Br > I \) due to small size of F-atom. It requires high energy to become \( F^- \) by accepting electron.

57. (d) \([\text{Co(en)}_3\text{Cl}_3] \) i.e., \([\text{Co(en)}_3\text{Cl}_3]^{3+}\)

58. (a) \( \text{XeF}_6 + 3\text{H}_2\text{O} \rightarrow \text{XeO}_3 + 6\text{HF} \)
Xenon hexafluoride on hydrolysis produces \( \text{XeO}_3 \).

59. (b) Number of spectral lines = \( \frac{(n_2 - n_1)(n_2 - n_1 + 1)}{2} \)
\[ = \frac{(7 - 2)(7 - 2 + 1)}{2} \]
\[ = \frac{5 \times 6}{2} = 15 \]

60. (a) Electronic configuration of Fe is \( [Ar] 4s^2 3d^6 \)
The 23rd electron will enter in 3d subshell
Hence, value of \( n \) for 3d = 3
value of \( l \) for 3d = 2

61. (b) Lightest element of periodic table = H
First member of 1st group of periodic table = Li
Compound = LiH
Metal hydrides donates \( H^- \) ion, hence act as a base.

62. (d) In real KO\(_2\) is a very good oxidising agent KO\(_2\) is even more good oxidising agent than K\(_2\)O\(_2\).

63. (c) According to Werner’s theory primary valence means oxidation state and secondary valance means coordination number.
Let oxidation state of Co in \([\text{Co Cl}_3 (\text{NH}_3)_3] \) Cl\(_3\) is \( x \)
x \(- 3 + 0 = + 3 \)
x = 0
\therefore Primary valence = 3
Secondary valence = coordination numbers = 6

64. (c) Boron is a very powerful reducing agent produces \( \text{H}_2 \) gas and carbon by means of replacement reaction.

65. (a) \( \text{LiAlH}_4 + I_2 \rightarrow \text{B}_2\text{H}_6 \)
\( \text{B}_2\text{H}_6 + 3\text{O}_2 \rightarrow \text{B}_2\text{O}_3 \)
Boric anhydride
\( \text{B}_2\text{H}_6 + \text{NH}_3 \rightarrow \text{B}_2\text{H}_3\text{NH}_3 \)

66. (a) We know that
\[ K_c = \frac{K_f}{K_b} \Rightarrow K_f = K_b \times K_c \]
\[ = 1.5 \times 7.5 \times 10^{-1} = 1.125 \times 10^{-3} \]

67. (b) Molar mass of HCl = 36.5
Concentration of HCl = \( \frac{0.365}{36.5} = 1 \times 10^{-2} \) mol L\(^{-1}\)
HCl is a strong acid
\[ \therefore \quad \text{pH} = -\log [\text{H}^+] \]
\[ = -\log 10^{-2} \]
\[ = -1 \times -2 = 2 \]

68. (b) Chemical reaction occur in above reaction is
\( \text{Cu} + \text{HNO}_3 \rightarrow \text{Cu(NO}_3)_2 + \text{NO}_2 + \text{H}_2\text{O} \)
Oxidation number of N in HNO\(_3\) = +5
Oxidation number of N in NO\(_2\) = +4
Charge in oxidation number = 5 - 4 = 1

69. (d) According to Faraday’s first law, we know that
\[ w = \frac{w}{zt} \]
\[ i = \frac{w}{zt} \]
\[ w \times F = \frac{20 \times 96500}{36.5 \times 360 \times 60} = 2.45 \text{ A} \]

70. (c) Assumptions of kinetic theory of gases are
- The gas consists of very small particles known as molecules.
- These particles have the same mass.
- The number of molecules is so large that statistical treatment can be applied.
- These molecules are in constant, random and rapid motion.
- Except during collisions, the interactions among molecules are negligible.
- The average kinetic energy of the gas particles depends only on the absolute temperature of the system.
- It is not the critical temperature but temperature.

71. (a) Four atoms \( P \) contributes to one unit cell from ccp arrangement and 4 atoms \( Q \) from the all octahedral voids and 4 atoms \( Q \) from the half of the tetrahedral void contributes one unit cell.
So, formula of solid is \( P_4Q_6 \) so, the simplest formula of the solid is \( PO_2 \).
72. (d) In simple cubic arrangement, number of atoms = 1
\[ a = 2r \]

Packing fraction
\[ \text{Volume occupied by one atom} = \frac{4 \pi r^3}{3} \]
\[ \text{Volume of unit cell} = \frac{4 \pi r^3}{a^3} = \frac{4 \pi}{6} \]

73. (b) If \( \Delta S \) is positive, \( \Delta H \) is positive
Then, \( \Delta G \) will be negative if and only if
\[ T \Delta S > \Delta H \]

74. (c) Mixing of gases increases the entropy.

75. (b) According to Arrhenius equation, we know that
\[ k = A e^{-\frac{E_a}{RT}} \]
Taking log on both sides
\[ \ln k = \ln A + \frac{E_a}{RT} \]
\[ Y = C + MX \]
\[ m = -\frac{E_a}{R} \quad \text{(Slope)} \]

76. (a) According to Freundlich adsorption isotherm.
Extent of adsorption \( \propto p^m \)
\[ \frac{x}{m} \propto p^m \]
\[ \frac{x}{m} = kp^m \]

77. (c) The reaction occurring in two steps has two activation energy peaks. The first step being fast needs less activation energy. The second step being slow, needs more activation energy. Therefore, second peak will be higher than the first.

78. (c) \[ Y_A = \frac{D_A X_A}{P_{\text{total}}} \]
Graph of \( Y_A \) vs \( \frac{1}{P_{\text{total}}} \) is linear.

79. (b) Element belongs to 2\(^{nd}\) group and 3\(^{rd}\) period is Mg.
Mg on burning in air gives MgO whose aqueous solution is basic in nature due to formation of Mg(OH)\(_2\).
Molecular mass of Mg(OH)\(_2\) = 24 + 17 x 2 = 24 + 34 = 58
Equivalent weight of Mg(OH)\(_2\) = \( \frac{58}{2} \) = 29

80. (a) C + O\(_2\) \( \rightarrow \) CO\(_2\), \( \Delta H = X \) \( \quad \ldots(\text{i}) \)
CO + \( \frac{1}{2} \) O\(_2\) \( \rightarrow \) CO\(_2\), \( \Delta H = Y \) \( \quad \ldots(\text{ii}) \)
By Eqs. (i) and (ii), we get
\[ C + \frac{1}{2} O_2 \rightarrow CO \quad \Delta H = X - Y \]

81. (d) XeO\(_2\)F\(_2\) has sea-saw structure as shown below.

This reaction is known as Riemer-Tiemann reaction.

82. (b) Is showing sp\(^2\) hybridised carbon.

83. (c) 0.2% of phenol solution is used as antiseptic while 1% phenol solution is used as disinfectant.

84. (c) CFC (chlorofluorocarbon) is non-reactive and non-toxic hence used in air conditioner.

85. (c) The reaction occurring in two steps has two activation energy peaks. The first step being fast needs less activation energy. The second step being slow, needs more activation energy. Therefore, second peak will be higher than the first.

86. (a) D-mannose and D-glucose differ at configuration at C-2 only hence they are epimer.

87. (c) Caprolactum

88. (b) This reaction is known as Riemer-Tiemann reaction.

89. (d) In human adults, most of the blood corpuscles are formed in red bone marrow of long bones.
92. (a) Transfer RNA molecule play an important role in protein synthesis. Each tRNA becomes covalently bonded to specific amino acid and form amino acyl tRNA, which in turn recognises corresponding codon in mRNA and ensures correct amino acid is added to growing polypeptide chain.

93. (b) Meissner’s corpuscles are a type of mechanoreceptors. They are stimulated by mechanical deformation like touch and pressure and are located in the skin.

94. (c) Ribozymes are nucleic acids with catalytic power.

95. (c) The Haversian canals, a characteristic feature of the mammalian bones are present in a matrix. These are interconnected by transverse channels, called Volkmann’s canals.

96. (b) Peptic ulcer and IBD causes excess blood loss. Hypochlorhydria causes malabsorption of iron. In pregnancy physiological demand of iron increases. So, all causes IDA.

97. (a) Osmotic potential or solute potential \( \psi_s \) are always in negative values and pressure potential \( \psi_p \) is usually positive. Water potential of a solution is always less than zero of has negative value.

98. (c) Mesangial cells are contractile and play a role in regulation of glomerular filtration. They are of two types i.e., Extraglomerular and intraglomerular.

99. (a) Earthworm is hermaphrodite, so it has both testis and ovary. In earthworm, the fertilisation is external and cross (fertilisation). Testis mature earlier.

100. (b) The phenomenon of regeneration of permanent tissue to meristematic tissue is called dedifferentiation. Redifferentiation is maturation of dedifferentiated tissues.

101. (c) The exclusive character of living beings is their ability of perception. Living beings possess the power of making perceptions about the happening of events occurring in their environment and keeps them in their memory.

102. (c) Euglena, Noctiluca and Trichonympha are members of class-mastigophora of phylum-Protozoa. Babesia is of class-Sporozoa.

103. (b) In May, 1989, Montreal Protocoll was rotified by 82 nations at Helsinki. They pledged to phase out CFCs by 2000.

104. (d) In orthotropous (atropous) ovule, the micropyle, funicle and chalaza lie in a straight line.

105. (c) Insulin treated diabetic driver should be advised to keep an accessible supply of fast-acting carbohydrate in the vehicle and to take frequent meals.

106. (a) Before the introduction of Nile Perch, Lake Victoria supported 300 species of cichlid fish, half of which are extinct now.

107. (a) Membrane lipids are synthesised in smooth endoplasmic reticulum.

108. (a) Identification cards helps him during his comates/hypoglycemic attack stage. People can call his relatives.

109. (d) Biosystematics is the arrangement of organisms on the basis of their evolutionary, genetic and biochemical framework to assess the taxonomic relationships of organisms or populations.

110. (c) Fertilised eggs develop into females. Unfertilised eggs develop into drones.

111. (d) Anaphylaxis is a life-threatening. Systemic allergic reaction caused by the release of histamine and other inflammatory mediators from mast cells.

112. (c) During microprogenesis, the sporogenous cells may directly act as microspore mother cells or pollen mother cells or PMCs. Each PMC, by a meiotic division, gives rise to a group of four haploid microspores, which are combinedly referred to as microspore tetrad. The first mitotic division in a pollen grain or microspore results into two unequal cells. The larger one is the vegetative cell, which eventually forms the pollen tube. The smaller one is the generative cells, which produce the male gametophyte by another mitosis.

113. (d) There may be several ecotypes of same organism, which shows variations amongst them.

114. (c) Glands of Zeis are modified glands of eyelids. They are sebaceous glands, which open into follicles of eye lashes. External hordeolum is characterised by a lump on the top or bottom eyelid, localised pain, swelling and redness.

115. (a) Malic acid

\[ \text{C}_4\text{H}_6\text{O}_5 + 3\text{O}_2 \rightarrow 4\text{CO}_2 + 3\text{H}_2\text{O} \]

\[ \text{RQ} = \frac{\text{Volume of CO}_2}{\text{Volume of O}_2} = \frac{4}{3} = 1.33 \text{ (More than unity)} \]
116. (a) The difference between the free energy of water molecule in pure water and the energy of water in any other system is termed as water potential. Movement of water occurs from region of higher water potential to lower water potential.
\[ \psi_w = \psi_s + \psi_m + \psi_p \]
Where, \( \psi_w \) = Water potential
\( \psi_m \) = Metric potential
\( \psi_s \) = Solute potential
\( \psi_p \) = Pressure potential

117. (a) Tranquillisers lessen tension and anxiety and promote calmness and soothing without sedating or depressant effect and do not induce sleep.

118. (c) **Classes of information suggested by central dogma are**

<table>
<thead>
<tr>
<th>General</th>
<th>Special</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNA → DNA</td>
<td>RNA → DNA</td>
<td>Protein → DNA</td>
</tr>
<tr>
<td>DNA → RNA</td>
<td>RNA → RNA</td>
<td>Protein → RNA</td>
</tr>
<tr>
<td>RNA → Protein</td>
<td>DNA → Protein</td>
<td>Protein → Protein</td>
</tr>
</tbody>
</table>

119. (b) Food storing tissue — Endosperm
Parthenocarpic fruit — Grapes
Membranous seed coat — Maize
Single seeded fruit developing from monocarpellary superior ovary — Mango.

120. (b) The timing of pain, age of patient and investigations with all normal findings, strongly suggest the psychosocial factors as a cause.

121. (d) **Transferases** — These transfer specific groups from one substrate to another.

**Lyases** — Do the cleavage without hydrolysis

**Hydrolases** — Breakdown the large molecule by hydrolysis.

**Ligases** — Catalyses covalent bonding of two substrates to form a large molecule.

122. (b) Phosphofructokinase called regulatory enzyme of glycolysis. It is inhibited by high concentration of ATP and is stimulated by ADP and Pi.

123. (d) Conn’s disease is a disease of the adrenal glands involving excess production of aldosterone. It causes high blood pressure in humans.

124. (c) Lampbrush chromosomes are seen in both vertebrates as well as invertebrate. Kinetochore is a disc shaped protein structure attached to the centromeric portion.

125. (c) Jacob and Monod proposed model for regulation of transcription.

_The correct sequence is_

Regulator site → Promoter site → Operator site → Structural gene → Downstream → Upstream.

126. (b) **Example** Forelimb of man, cheetah, whale and bat.

127. (d) AIDS can be diagnosed by ELISA test and Western Blotting test.

128. (d) When blue light received by pigment present in stomata guard cell H-ATPase become activated due to hyperpolarisation of membrane which extruded H⁺ from guard cell to outside so negative charge develop inside the cell to overcome this negative charge K⁺ ion enters into the cell malate ion also enters into the cell to balance the positive charge which develop due to K⁺.

129. (b) **Azoic** — Origin of solar system.

**Proterozoic** — Primitive metazoans and prokaryotes.

**Paleozoic** — Origin of reptiles, winged insects, mainly amphibians.

**Mesozoic** — Extinction of dinosaurs.

130. (b) Hassal’s bodies are eosinophilic thymic corpuscles and are present in medulla. They are phagocytic in nature.

131. (b) Peripheral pain which is exacerbated by deep breathing or coughing is characteristics of respiratory disease.

RFLP = Restriction Fragment Length Polymorphism
RAPD = Random Amplified Polymorphic DNA
VNTR = Variable Number Tandem Repeats
STR = Short Tandem Repeat

132. (b) In genetics, a molecular marker is a fragment of DNA that is associated with a certain location within the genome. Molecular markers are used in molecular biology and biotechnology to identify a particular sequence of DNA is a pool of unknown DNA. All these are molecular markers.

133. (a) Neo-Lamarckism stresses on the direct effect of changed environment on the organisms.

134. (d) One glucose molecule formed two pyruvic acid molecules, so two pyruvic acid produces 6 molecules of CO₂.

135. (a) In the apical part of shoot when the cells divide actively auxin transport the cytokinin towards the apical part so that it is not transported towards the axillary buds if cytokinin transported towards axillary bud or sprayd on plant axillary bud starts dividing form the shoot this shows that auxin to cause apical dominance cytokinin should be transported into apical.

136. (c) Marijuana is obtained from dried flowers and top leaves of the female plants of _Cannabis sativa_. Amphetamines are synthetic drugs.
137. (c) Biosynthesis of IAA – Zinc  
Protein synthesis – Nitrogen  
Hydrolysis of pyrophosphate – Phosphorus  
Photolysis of water – Manganese

138. (d) Somatotrophin is secreted by the anterior lobe of the pituitary gland. It is a systemic hormone as it acts on all the tissues of the body. It stimulates growth of the body. It is not produced by any other tissue.

139. (a) Ethidium bromide stained DNA can be seen only if exposed to UV radiation. It is used to detect the presence of nucleic acids in agarose gel during agarose gel electrophoresis.

140. (c) Condom is a thin sheath of rubber for penis. IUD is a small plastic or metal device placed in the uterus. Vaginal suppositories are chemical contraceptives inserted in vagina before intercourse.

141. (c) Lymph acts as middle man, which transports O$_2$, food material, hormones, etc. Glucose concentration is higher in lymph than blood. Change the live. The most conspicuous component of the mucoid tissue is jelly like substance called Wharton’s jelly. Reticular connective tissue composed of a protein called reticulin.

142. (a) The different phases of cell cycle require different time to complete in different organism.

143. (b) Apogamy is also known as cross-pollination, i.e., involvement of male and female gametes of two different flowers.

Homogamy is the condition, in which male and female parts of a flower mature simultaneously.

Syngamy is the fusion of gametes, i.e., the union of nuclei of male gamete and female gamete in the process of reproduction.

144. (b) Plasmodium is a malarial parasite that multiplies inside the host.

Female mosquito transfers the parasite to human beings.

145. (c) Growth phase of oogenesis is very long so that oocytes are much larger than oogonia. In contrast, spermatogenesis has short growth phase so that spermatocytes are only twice the size of spermatogonia.

146. (b) Photolysis occurs in photosystem-II in photosynthesis which is simply the process by which organisms convert solar energy to chemical energy. The photosystem’s stolen electronics replenished by photolysis.

147. (a) Human body has about 90 vestigial organs. Some of these are auricular muscles, tail bone, third molars etc.

148. (b) Calcium Required for synthesis of mitotic spindle.  
Chlorine Required for ionic balance.  
Manganese Required to active respiratory enzyme.  
Phosphorus Essential for constitution of nucleic acid.

149. (c) In non-endospermic or exalbuminous seed, the endosperm is completely consumed by the developing embryo and the mature seeds are without endosperm. The food is stored in cotyledons, e.g., gram, pea etc.

150. (c) Missing links are fossil organisms, showing characters of two different groups.

151. (d) Pancreatic polypeptide is secreted by F-cells of islets Langerhans. It inhibits the release of pancreatic juices.

152. (c) It is mode of mineral absorption, which involves expenditure of metabolic energy. Energy is generally obtained from ATP.

153. (b) Some drug addicts use mixtures of drugs to have immediate effect.

154. (d) The energy present in one gram of fat is 9.8 k cal or 14 kJ, which is maximum as compared to another substrate. The energy present in one gram of protein is 4.8 kcal or 20 kJ.

155. (c) GMFs contain one or two additional genes than conventional crops.

156. (c) Conversion of phosphoglycolate to glycolate takes place in chloroplast. Photorespiration is the uptake of O$_2$ and release of CO$_2$ in light that results from the biosynthesis of glycolate in chloroplast and subsequent metabolism of glycolic acid in the same leaf cell through other two cell organelles (i.e., peroxisome and mitochondria).

157. (c) Cro-magnon man appeared during Holocene period, largest cranial cavity with reduced jaws and omnivorous.

158. (b) Ca$^{2+}$ is pumped back into sarcoplasmic reticulum. Release of Ca$^{2+}$ from troponin.

Cessation of interaction between actin and myosin.

159. (c) Fibrinogen $\rightarrow$ Thrombin $\rightarrow$ Fibrin

160. (a) It is found only in aquatic ecosystem.

161. (a) During G$_1$-phase chromatin is fully extended and not distinguishable.

162. (b) Crick’s Wobble hypothesis states that ‘the base at 5’ end of the anticodon is not spatially confined as the other two bases allowing it to form hydrogen bonds with any of several bases located at the 3’ end of a codon.
163. (b) In homogametic XX female individuals, one X-chromosome gets characteristically condensed and inactivated. Such chromatin material is called facultative heterochromatin. Since, it becomes inactive in certain part of the life cycle and resumes activity before entering the germ line. This heterochromatinised in active chromatin body is called sex chromatin or Barr body.

164. (b) Genes easily digest when enter in human body and there is no effect of the genes of genetically modified crop foods on human genes.

165. (a) Edible parts of some fruits
Apple - Fleshy thalamus
Walnuts - Cotyledons
Pomegranate - Juicy testa
Mulberry - Perianth

166. (b) The seed coat breaks, while kernels swell to higher degree because they are made up of proteins, lipids and starch and they have more imbibational capacity.

167. (b) Ozone of stratosphere filters, most of the ultra violet rays passing towards earth.

168. (c) Extinction of Ectopistes migratorius occurred due to commercial exploitation of pigeon meat.

169. (a) Hydrodamalis Gigas was discovered in 1741 and became extinct in 1768 due to direct overharvesting of food in Russia.

170. (c) The human gene, dystrophin gene has the longest stretch of DNA (~ 24 Mb).

171. (c) Lamarckism is the first theory of evolution, which was proposed by Lamarck in his book 'Philosophie Zoologique'.

172. (d) Mental retardation in man, associated with sex-chromosomal abnormality is usually due to increase in X complement.

173. (c) pBR322 is a plasmid, which has genes coding for enzyme for modifying or destroying ampicillin and tetracycline both.

174. (d) The first step in dark reaction of photosynthesis is carboxylation, in which six molecules of carbon dioxide combine with six molecules of carbon dioxide combine with six molecules of ribulose 1, 5-biphosphate (RuBP) to form six molecules of unstable six carbon compound. Carboxylation of RuBP is catalysed and the enzyme RuBP caboxylase or RUBISCO.

175. (c) It is cross involving two types of individuals, where the male of one type is crossed with female of the second type and vice versa. Reciprocal crosses are helpful in studying sex-linked characters.

176. (c) Watson and Crick defined the DNA structure in 1953. The features are as follows:
(i) It consists of two antiparallel strands of sugar phosphate backbone in opposite direction.
(ii) Purines bind to pyrimidines specifically by hydrogen bonds.
\[ A = T \]
\[ G = C \]
(iii) One strand of DNA as template for the new strand.

177. (d) Binding of an effector causes conformational change that either increases or decreases the activity of the enzyme.

178. (a) Vector must have at least a site for origin of replication even when they have foreign DNA. Another important feature is having genes coding for antibiotic resistance

179. (d) When a haemophilic man (X^hY) marries a normal woman (XX), produces carrier girls (XX^h) and normal boys (XY), i.e. all their off springs will be normal.

180. (a) UV radiation of wavelengths shorter than UV-B, are almost completely absorbed by Earth’s atmosphere, given that the ozone layer is intact. But, UV-B damages DNA and mutation may occur. It causes ageing of skin, damage to skin cells and various types of skin cancers.

In human eye, cornea absorbs UV-B radiation and a high dose of UV-B causes inflammation of cornea, called snow-blindness, cataract, etc. Such exposure may permanently damage the cornea.