

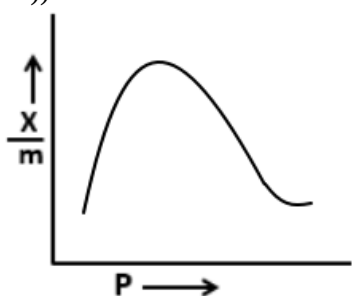
Chemistry - Section A

1. When an excess of AgNO_3 and KI is added in a freshly prepared precipitate of AgI then it forms

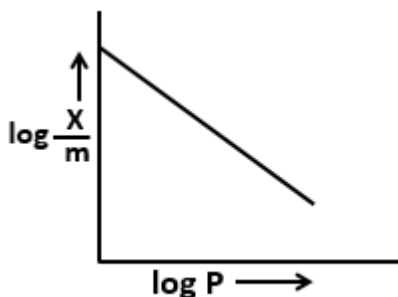
1. Positively charged colloid i.e. AgI / K^+
2. Positively charged colloid i.e. AgI / Ag^+
3. Negatively charged colloid i.e. AgI / I^-
4. Negatively charged colloid i.e. $\text{AgI} / \text{NO}_3^-$

2. The plot that best represents the relationship between the extent of adsorption ($\frac{x}{m}$) and pressure (P) is

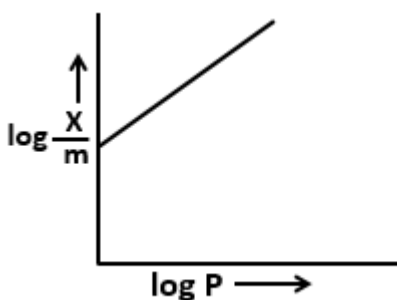
(x = mass of adsorbate(variable), m = mass of adsorbent (fixed))



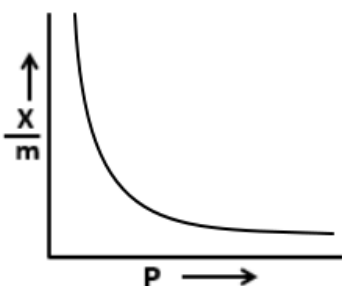
1.



2.



3.



4.

3. The most effective electrolyte to cause the flocculation of a positively charged ferric hydroxide colloid is

1. AlCl_3
2. $\text{K}_4[\text{Fe}(\text{CN})_6]$
3. BaSO_4
4. Na_3PO_4

4. 100 ml of 0.2 M acetic acid is shaken with 0.8 gram wood charcoal. The final concentration of acetic acid in the solution after adsorption is 0.1 M. The mass of acetic acid adsorbed per gram of charcoal is-

1. 0.075 gram
2. 0.75 gram
3. 1.50 gram
4. 0.15 gram

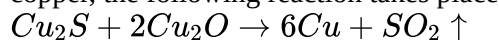
5. The electrolyte which has maximum coagulation value for the flocculation of negatively charged arsenic sulphide colloid is

1. NaCl
2. BaSO_4
3. AlCl_3
4. MgCl_2

6. A catalyst accelerates a reaction primarily by stabilizing the

1. Substrate
2. Product
3. Intermediate
4. Transition state

7. In the bessemerisation process in the metallurgy of copper, the following reaction takes place



For the above reaction, the correct statement is-

1. Cu_2S and Cu_2O both are reduced
2. Cu_2S is oxidised and Cu_2O is reduced
3. Cu_2S and Cu_2O both are oxidised
4. Cu_2S is reduced and Cu_2O is oxidised

8. In the metallurgy of copper, the slag formed is

1. CuSiO_3
2. FeSiO_3
3. $\text{FeS}_2 + \text{Cu}_2\text{S}$
4. CaSiO_3

9. In the Ellingham diagram, the graph between ΔG vs T has a negative slope for which of the following conversion

1. $\text{C} \rightarrow \text{CO}_2$
2. $\text{Mg} \rightarrow \text{MgO}$
3. $\text{C} \rightarrow \text{CO}$
4. $\text{Al} \rightarrow \text{Al}_2\text{O}_3$

10. The sulphide ore is

1. Fool's Gold
2. Calamine
3. Magnetite
4. Gibbsite

11. The non oxide ore of aluminium is

1. Alunite
2. Diaspore
3. Cryolite
4. Kaolinite

12. The number of P-O and P=O in P_4O_{10} are, respectively,

1. 8, 4
2. 16, 0
3. 4, 12
4. 12, 4

13. The correct order of acidic strength of HPO_3 , H_3PO_4 , H_3PO_3 and H_3PO_2 is -

- 1) $HPO_3 > H_3PO_4 > H_3PO_3 > H_3PO_2$
- 2) $H_3PO_4 > H_3PO_3 > H_3PO_2 > HPO_3$
- 3) $HPO_3 > H_3PO_2 > H_3PO_3 > H_3PO_4$
- 4) $H_3PO_2 > H_3PO_3 > H_3PO_4 > HPO_3$

14. When PCl_3 is hydrolyzed then oxyacid of phosphorous is formed. The basicity of oxyacid of phosphorous is

1. 1
2. 2
3. 3
4. 4

15. The molecule which is not hydrolysed by water at $25^\circ C$ is

1. SF_4
2. SF_6
3. BF_3
4. $SiCl_4$

16. The reaction that does not produce nitrogen is

1. Heating of NH_4NO_2
2. Heating of $(NH_4)_2Cr_2O_7$
3. Reaction of excess of NH_3 with Cl_2
4. Heating of NH_4NO_3

17. The molecule which is not produced on partial as well as complete hydrolysis of XeF_6 is

1. $XeOF_2$
2. $XeOF_4$
3. XeO_2F_2
4. XeO_3

18. Gold does not react with concentrated HNO_3 but dissolves in aqua regia. The product formed, which gets dissolved in the aqua regia solution is

1. $AuCl_3$
2. $Au(NO_3)_3$
3. $HAuCl_4$
4. $HAu(NO_3)_4$

19. When $CuSO_4$ is reacted with an excess of KCN then the soluble complex formed is

1. $K_2[Cu(CN)_4]$
2. $K_3[Cu(CN)_4]$
3. $K[Cu(CN)_2]$
4. $K_4[Cu(CN)_6]$

20. The spin only magnetic moment of $[ZCl_4]^{2-}$ is 3.87 BM where Z is

1. Co
2. Ni
3. Mn
4. Cu

21. $KMnO_4$ is colored due to which of the following factor?

1. d-d transition
2. Charge transfer spectra
3. Both (1) and (2)
4. Polarisation of anion

22. How many moles of $KMnO_4$ are required to oxidize one mole of KI in the alkaline medium?

1. $1/2$
2. 1
3. 2
4. 6

23. The colourless ion from among the following is

1. Mn^{2+}
2. Cu^+
3. Cr^{3+}
4. Fe^{2+}

24. Bell metal is an alloy of copper and

1. Aluminium
2. zinc
3. Nickel
4. Tin

25. In which of the following complexes, C-O bond length in carbon monoxide is highest?

1. $[V(CO)_6]^-$
2. $[Mn(CO)_6]^+$
3. $[Fe(CO)_4]^{2-}$
4. $[Ni(CO)_4]$

26. Among the following, the species that is both tetrahedral and diamagnetic is

1. $[Ni(CN)_4]^{2-}$
2. $[Ni(CO)_4]$
3. $[NiCl_4]^{2-}$
4. $[Cu(NH_3)_4]^{2+}$

27. Among the following, the π -acid ligand is

1. F^-
2. NH_3
3. CN^-
4. I^-

28. 2.335 g of compound X (empirical formula $CoH_{12}N_4Cl_3$) upon treatment with excess $AgNO_3$ produces 1.435 g of a white precipitate. The primary and secondary valences of cobalt in compound X, respectively are :

(Given, atomic mass : Co = 59, Cl = 35.5 , Ag = 108)

1. 3, 4
2. 2, 4
3. 4, 3
4. 3, 6

29. The total number of geometrical isomers possible for an octahedral complex of the type $[Ma^2b^2c^2]$ are

- [M = transition metal; a, b, and c are monodentate ligands]
1. 3
 2. 4
 3. 5
 4. 6

30. The complex having zero crystal field stabilization energy is

1. $[Mn(H_2O)_6]^{3+}$
2. $[Fe(H_2O)_6]^{3+}$
3. $[Co(H_2O)_6]^{2+}$
4. $[Co(H_2O)_6]^{3+}$

31. Which complex follows EAN rule?

1. $K_3[Fe(CN)_6]$
2. $[Ni(CO)_4]$
3. $[Ni(CN)_4]^{2-}$
4. $[Cr(NH_3)_6]Cl_3$

32. In $[Cu(NH_3)_4]^{2+}$, one unpaired electron shifts from

1. $3d_{z^2}$ orbital to $4p_x$ orbital
2. $3d_{x^2-y^2}$ orbital to $4p_z$ orbital
3. $3p_x$ orbital to $4p_x$ orbital
4. Does not shift

33. In tetrahedral complexes, CFSE (Crystal Field Stabilisation energy) is $\frac{4}{9}$ times of the CFSE of octahedral complexes. From the following statements, mark the statement that explains this phenomenon:

1. $\frac{2}{3}$ rd is due to a decrease in the number of ligands and $\frac{2}{3}$ rd is due to a lack of direct interaction between metal and ligands
2. All of it is due to a lack of direct interaction between metal and ligands
3. All of it is due to a decrease in the number of ligands
4. None of the above.

34. The IUPAC name of $[Pt(NH_3)_2Cl_2][PtBr_4]$ is

1. Diamminedichloridoplatinum (II) tetrabromidoplatinate (IV)
2. Diamminedichloridoplatinum (III) tetrabromidoplatinate (III)
3. Diamminedichloridoplatinum (IV) tetrabromidoplatinate (II)
4. Diamminedichloridoplatinum (IV) tetrabromidoplatinum (II)

35. Consider the complex, $[NiCl_4]^{2-}$, $[Ni(NH_3)_6]^{2+}$, and $[Ni(CN)_4]^{2-}$. These complexes absorb Red, Yellow, and Blue light respectively. The colours that they emit, respectively, are

1. Green, Violet, and orange
2. Blue, Red, and Yellow
3. Green, Orange, and Violet
4. Cannot be predicted

Chemistry - Section B

36. 0.25-gram starch protects 5ml gold sol in a 1 ml 2% NaCl solution. The gold number of starch will be

1. 25
2. 250
3. 2500
4. 5000

37. The incorrect statement regarding chemical adsorption is

1. It is irreversible in nature
2. On increasing the temperature, chemical adsorption firstly increases and then decreases
3. On increasing the pressure, chemical adsorption increases
4. Heat of adsorption is about 20-40 KJ/mole

38. The extraction of silver is achieved by the initial complexation of the ore (Argentite) with X followed by reduction with Y. X and Y respectively are

1. CN^- and Zn
2. CN^- and Cu
3. Cl^- and Zn
4. Br^- and Zn

39. Van Arkel method of purification of metals involves converting the metal to a

1. Non-volatile stable compound
2. Volatile stable compound
3. Non-volatile unstable compound
4. Volatile unstable compound

40. The following compounds are heated

- (i) KNO_3
- (ii) $\text{Cu}(\text{NO}_3)_2$
- (iii) $\text{Pb}(\text{NO}_3)_2$
- (iv) NH_4NO_3

Which of the following statement(s) is/are correct?

1. (ii) and (iii) liberate NO_2
2. (iv) liberates N_2O
3. (i), (ii) and (iii) liberate O_2
4. All statements are correct

41. When an excess of NH_3 is reacted with Cl_2 then a compound (X) and a gas (Y) are formed. Compound (X) is reacted with lime water then a gas (Z) is evolved. The gases (Y) and (Z), respectively, are

1. HCl and N_2
2. NH_3 and HCl
3. N_2 and HCl
4. N_2 and NH_3

42. When a mixture of HCOOH and oxalic acid is heated in presence of concentrated H_2SO_4 then gases are evolved.

When the evolved gases are passed through alcoholic KOH then volume of gases is reduced by $1/6$ th of the total volume of gases. The molar ratio of formic acid and oxalic acid in the mixture is

1. 1 : 1
2. 1 : 4
3. 4 : 1
4. 2 : 1

43. Which element has the highest melting point?

1. Cr
2. Fe
3. Mo
4. Cu

44. Silver nitrate solution when added to a colorless aqueous solution E forms a white precipitate which dissolves in excess of E. If the white precipitate is heated with water, it turns black and supernatant solution gives a white precipitate with acidified barium nitrate solution. Therefore, E is

1. Na_2S
2. $\text{Na}_2\text{S}_2\text{O}_3$
3. Na_2SO_3
4. Na_2SO_4

45. MnO_2 when fused with KOH and oxidized in the air gives a dark green compound X. In acidic solution, X undergoes disproportionation to give an intense purple compound Y and MnO_2 . The compounds X and Y, respectively are :

1. Mn_2O_7 and KMnO_4
2. K_2MnO_4 and KMnO_4
3. KMnO_4 and K_2MnO_4
4. KMnO_4 and Mn_2O_7

46. The oxidising ability of the given anions follows the order

1. $\text{CrO}_4^{2-} < \text{MnO}_4^- < \text{VO}_4^{3-} < \text{TiO}_4^{4-}$
2. $\text{MnO}_4^- < \text{CrO}_4^{2-} < \text{VO}_4^{3-} < \text{TiO}_4^{4-}$
3. $\text{TiO}_4^{4-} < \text{VO}_4^{3-} < \text{CrO}_4^{2-} < \text{MnO}_4^-$
4. $\text{TiO}_4^{4-} < \text{VO}_4^{3-} < \text{MnO}_4^- < \text{CrO}_4^{2-}$

47. The number of hydrate isomers of $\text{CoCl}_3 \cdot 6\text{H}_2\text{O}$ is/are:

1. 1
2. 2
3. 3
4. 4

48. The Crystal Field Stabilization Energy (CFSE) and the spin-only magnetic moment in Bohr Magnetron (BM) for the complex $K_3[Fe(CN)_6]$ are, respectively

1. $-2.0\Delta_0$ and $\sqrt{35} BM$
2. $-2.0\Delta_0$ and $\sqrt{3} BM$
3. $-0.4\Delta_0$ and $\sqrt{3} BM$
4. $-2.4\Delta_0$ and $\sqrt{35} BM$

49. In which of the following complexes, the central atom has sp^3 hybridisation?

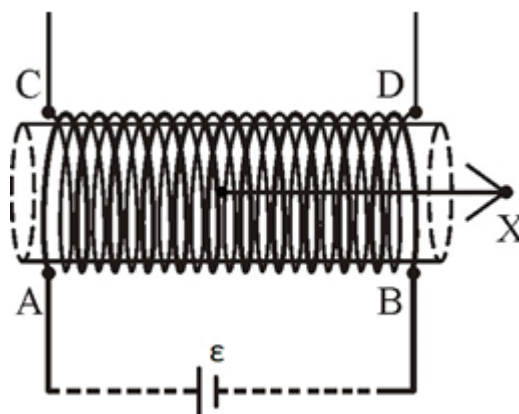
1. $[PtCl_4]^{2-}$
2. $[AuCl_4]^-$
3. $[Cu(NH_3)_4]^{2+}$
4. None of these

50. The co-ordination number and oxidation number of Fe in ferrocene respectively are

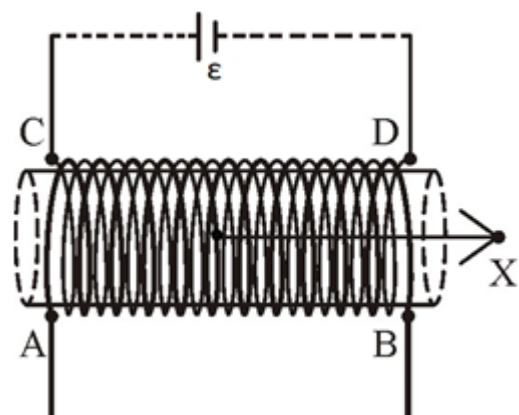
1. 6 and +2
2. 10 and +2
3. 6 and zero
4. 10 and zero

Physics - Section A

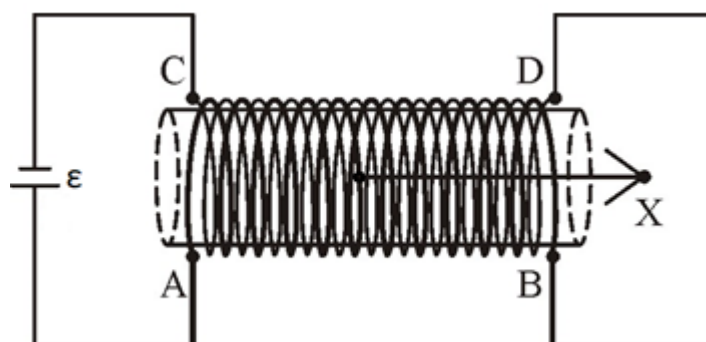
51. A wire is wound on a long cylinder so as to make a solenoid. Its ends are A & B. A second wire is wound on top of the first wire and its ends are C & D.



If a cell of emf ε is connected across A & B, a current of 1 A flows in the first wire, and the magnetic field within is 20 G (along x). If the same cell is connected across C & D, a current of 1 A flows in the second wire, and the magnetic field within is 10 G (along x).



If the cell is connected between A & C (left ends of the two wires) and the wire-ends B & D (right ends of the two wires) are connected together,

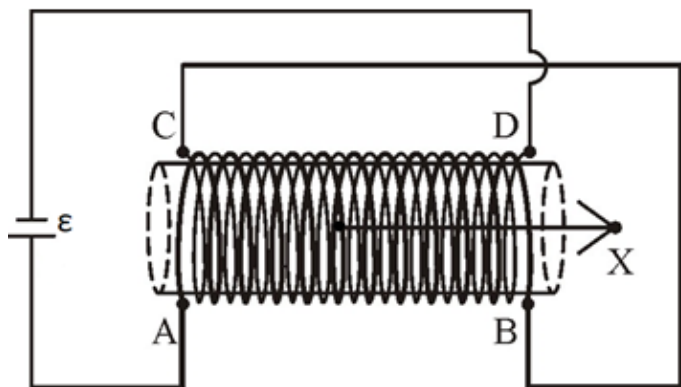


the magnetic field at the centre will be

1. 30 G
2. 10 G
3. 15 G
4. 5 G

52. Based on the data given in the previous question, consider the following:

If the cell is connected between A & D (left end of first wire & right end of second wire) and the wire-ends B & C (right end of first wire & left end of second wire) are connected together,



the magnetic field at the centre will be

1. 30 G
2. 10 G
3. 15 G
4. 5 G

53.

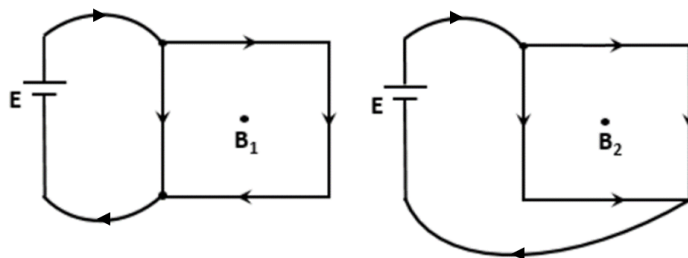
When a particle of charge q and mass m is projected perpendicular to a magnetic field, it moves in a circle of radius r . When the particle is projected upward with the same kinetic energy in a uniform gravitational field (g), it rises to a height h . The magnetic field is:

1. $\frac{m}{qr} \sqrt{\frac{gh}{2}}$
2. $\frac{2m}{qr} \sqrt{\frac{gh}{2}}$
3. $\frac{m}{2qr} \sqrt{\frac{gh}{2}}$
4. none of the above.

54. A long solenoid has a square cross-section of side a . It has a turns density n (number of turns per unit axial length). A current i is passed through this solenoid. The magnetic field at the centre of the solenoid is B_c . Then, B_c is proportional to:

- (I) a
- (II) $\frac{1}{a}$
- (III) n
- (IV) i
1. I, III, IV
2. II, III, IV
3. III, IV
4. IV Only

55. Identical cells are connected to identical square wire loops as shown in the two diagrams, and the magnetic fields are respectively B_1, B_2 at the centres.



Then, we can conclude that

1. $B_1 > 0, B_2 = 0$
2. $B_1 > B_2 > 0$
3. $B_2 > B_1 > 0$
4. $B_1 = 0, B_2 = 0$

56. An α -particle and a proton of the same kinetic energy move along circular paths of radii r_α and r_p respectively, in the same magnetic field. The ratio (r_α/r_p) equals

1. 2
2. $\frac{1}{2}$
3. 1
4. 4

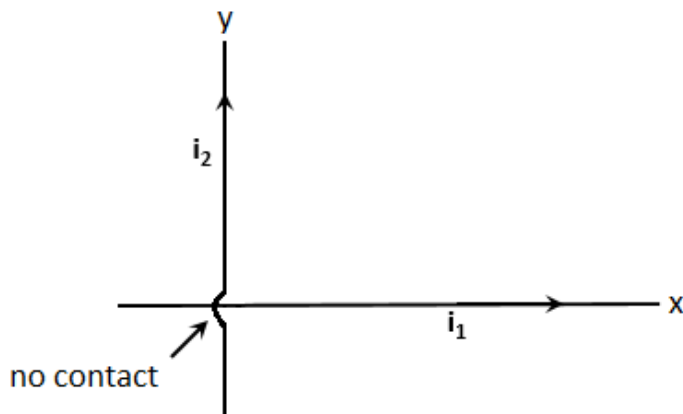
57. A particle of mass m and charge q is observed to move with a uniform velocity v in a region containing a uniform magnetic field B , and a uniform gravitational field g . The magnetic field B must satisfy

1. $B = \frac{mg}{qv}$
2. $B \leq \frac{mg}{qv}$
3. $B \geq \frac{mg}{qv}$
4. $B = \frac{qv}{mg}$

58. A straight long current carrying wire carrying a current i is placed in a uniform magnetic field, and it is observed that the field vanishes at a point which is at a distance r from the wire. The force on the wire, per unit length is

- (1) $\frac{\mu_0 i^2}{2\pi r}$
- (2) $\frac{\mu_0 i^2}{4\pi r}$
- (3) $\frac{\sqrt{2}\mu_0 i^2}{2\pi r}$
- (4) $\frac{\mu_0 r^2}{2\pi r\sqrt{2}}$

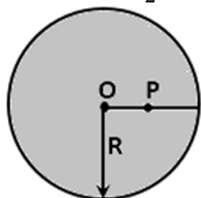
59. Two long straight wires carrying currents i_1 , i_2 are placed as shown in the figure, just avoiding contact. The separation between the wires is negligible, and the wires are aligned along x & y axes respectively.



The wire along the x-axis experiences

1. a force along +y axis only.
2. a force along -y axis.
3. zero force, but a torque.
4. no force and no torque.

60. A current i is distributed uniformly over the cross-section of a cylindrical wire of radius R , as shown in the diagram. The magnetic field at the surface is B_s . The magnetic field at the point P inside the cross-section equals ($OP = \frac{R}{2}$)



Cross-sectional view of the wire

1. $\frac{B_s}{2}$
2. $2B_s$
3. $\frac{B_s}{4}$
4. $4B_s$

61. The magnetic field, at a point 10 cm away, from a short bar magnet is 3×10^{-4} T, when the magnet is placed in an end-on position. If the magnet is in a broadside-on position, the field will be

1. 6×10^{-4} T
2. 1.5×10^{-4} T
3. $3\sqrt{2} \times 10^{-4}$ T
4. $\frac{3}{\sqrt{2}} \times 10^{-4}$ T

62. The angle of the dip, at a certain place where the total magnetic field of the earth is B , is 60° . The vertical component of earth's magnetic field is

1. $\frac{B}{2}$
2. $\frac{B\sqrt{3}}{2}$
3. $\frac{B}{\sqrt{3}}$
4. $B\sqrt{3}$

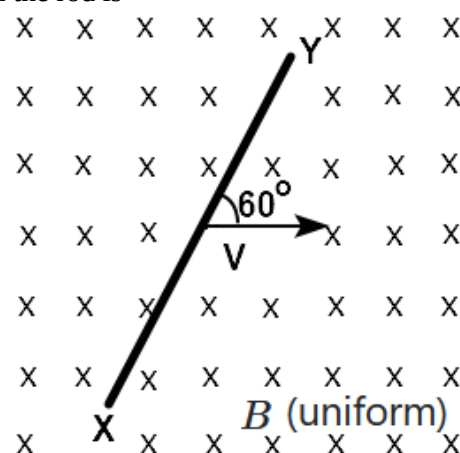
63. A ferromagnetic material consists of domains in which the magnetic moments of the atoms are in the same direction within each domain. However, the domains are randomly oriented. A ferromagnetic material is placed in an external magnetic field. Then,

1. all the domains grow in size.
2. all the domains shrink in size.
3. some domains grow in size, others shrink.
4. domains rotate in the magnetic field.

64. The coercive force for a certain magnet is 3×10^3 A/m. This magnet is placed within a solenoid having 40 turns/cm. What current should be passed through the solenoid so that the magnet is demagnetised?

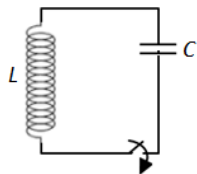
1. 0.75 A
2. 75 A
3. 1.33 A
4. 133 A

65. A rod XY of length l is placed in a uniform magnetic field B , as shown in the diagram. The rod moves with a velocity v , making an angle of 60° with its length. The emf induced in the rod is



1. vBl
2. $\frac{vBl}{2}$
3. $\frac{\sqrt{3}}{2}vBl$
4. $\frac{1}{\sqrt{3}}vBl$

66. An inductor (L) and a capacitor (C) are connected in a circuit, with the capacitor initially charged to a maximum voltage V_0 . The switch is now closed. The maximum current in the circuit is



1. $\frac{V_0}{\sqrt{LC}}$
2. $V_0\sqrt{LC}$
3. $V_0\sqrt{\frac{L}{C}}$
4. $V_0\sqrt{\frac{C}{L}}$

67. An inductor (L) and a resistor (R) are connected in series across a battery of emf ε , and the circuit is switched on. The current rises steadily. The rate of increase of the current (i.e. $\frac{di}{dt}$), when the voltage drop across the resistor is $\frac{\varepsilon}{2}$, is given by: $\frac{di}{dt} =$

1. $\frac{\varepsilon}{L}$
2. $\frac{\varepsilon}{2L}$
3. $\frac{2\varepsilon}{L}$
4. $\frac{\varepsilon}{L}e^{-1}$

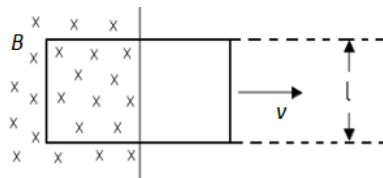
68. A metallic rod of length 3 m rotates with an angular speed of 4 rad/s in a uniform magnetic field. The field makes an angle of 30° with the plane of rotation. The emf induced across the rod is 72 mV. The magnitude of the field is

1. 4×10^{-3} T
2. 8×10^{-3} T
3. 16×10^{-3} T
4. 48×10^{-3} T

69. A square wire loop of resistance $0.5 \Omega/m$, having a side 10 cm and made of 100 turns is suddenly flipped in a magnetic field B , which is perpendicular to the plane of the loop. A charge of 2×10^{-4} C passes through the loop. The magnetic field B has the magnitude of

1. 2×10^{-6} T
2. 4×10^{-6} T
3. 2×10^{-3} T
4. 4×10^{-3} T

70. A rectangular loop of resistance R is placed in a region where there is a magnetic field B , passing perpendicularly through the plane of the loop, as shown in the figure. The loop is pulled with a constant velocity v so that it is partially within the field.



Assertion (A) :

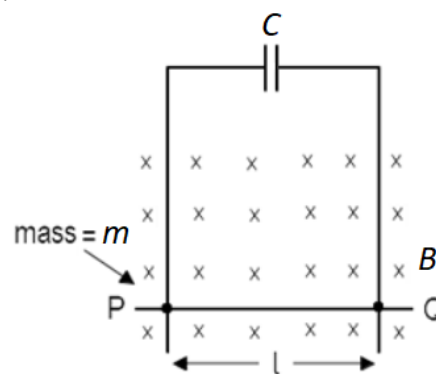
An external force F is needed to be applied in the direction of the velocity v , so that the loop can move with constant velocity v .

Reason (R) :

As the loop moves towards right, the magnetic flux decreases inducing an emf and a corresponding current. This current causes a retarding force to be exerted on the wire.

1. The (A) is true but the (R) is false.
2. The (A) is false but the (R) is true.
3. Both the (A) and the (R) are true and the (R) is a correct explanation of the (A).
4. Both the (A) and (R) are true but the (R) is not a correct explanation of the (A).

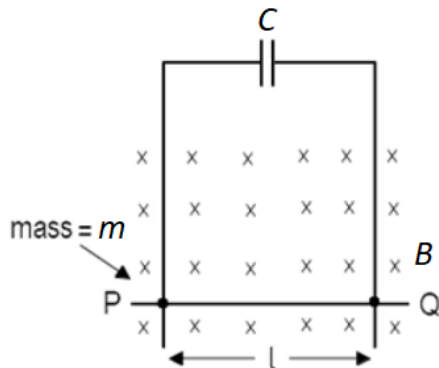
71. In the system shown in the figure the horizontal rod falls vertically down under its own weight while retaining electrical contact with parallel rails. There is no resistance in the circuit, and there is a uniform horizontal magnetic field into the plane. The acceleration of the rod PQ, as it falls down is 'a'.



Then,

1. $a = g$
2. $a > g$
3. $a < g$
4. a is initially less than g , but later it is greater than g .

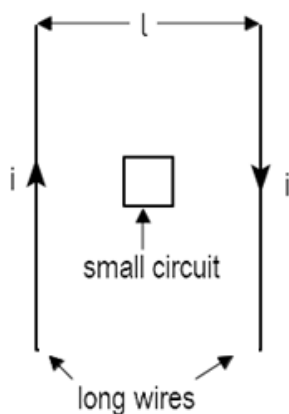
72. In the system shown in the figure the horizontal rod falls vertically down under its own weight while retaining electrical contact with parallel rails. There is no resistance in the circuit, and there is a uniform horizontal magnetic field into the plane.



The current through the circuit is i . Then,

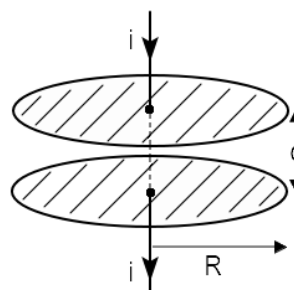
1. $i = CBlg$
2. $i > CBlg$
3. $i < CBlg$
4. $i = 0$

73. The two long, parallel wires shown in the diagram carry equal and opposite currents i . The currents change linearly with time: $\frac{di}{dt} = \text{a constant} = K$. The small circuit is situated midway between the wires and has an area A . The emf induced in the small circuit is



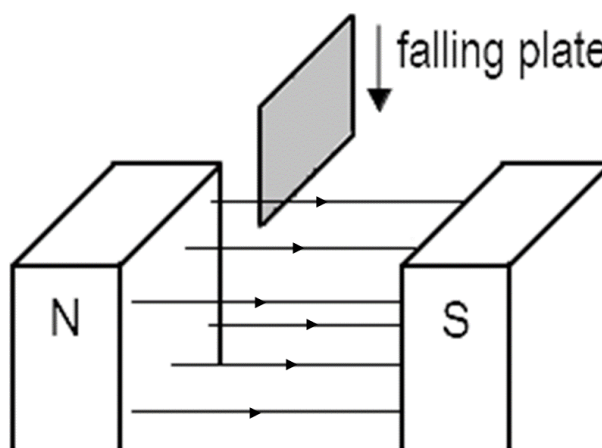
1. zero
2. $\frac{\mu_0 AK}{2\pi l}$
3. $\frac{\mu_0 AK}{\pi l}$
4. $\frac{2\mu_0 AK}{\pi l}$

74. A parallel plate capacitor is being charged by means of a constant current i . The plates are circular (of radius R) and are separated by a distance d . The magnetic field between the plates, at a distance $\frac{R}{2}$ from the central axis is



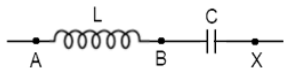
1. zero
2. $\frac{\mu_0 i}{2\pi \frac{R}{2}}$
3. $\frac{1}{4} \frac{\mu_0 i}{2\pi R}$
4. $\frac{1}{2} \left(\frac{\mu_0 i}{2\pi R} \right)$

75. A thin metallic plate is allowed to fall through the space between two magnetic poles creating a horizontal magnetic field. The plate is vertical, and its face is perpendicular to the field lines as it falls. While it is entering the region of magnetic field,



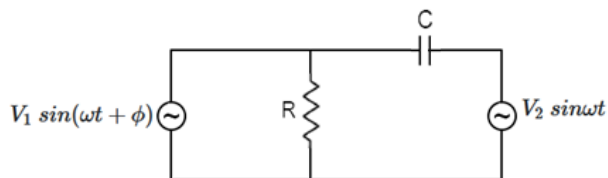
1. the acceleration of the plate is equal to g .
2. the acceleration of the plate is greater than g .
3. the acceleration of the plate is less than g .
4. the plate comes to a stop and rebounds upward.

76. The rms voltage across the inductor is twice that across the capacitor, while the applied rms voltage across the entire combination (i.e. V_{AX}) is V_r . The rms voltage across the capacitor is



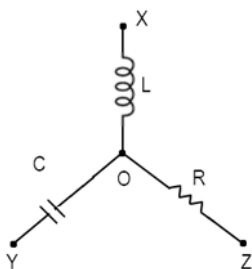
1. $\frac{V_r}{3}$
2. $\frac{2V_r}{3}$
3. $\frac{V_r}{2}$
4. V_r

77. The voltage $V_2 > V_1$ and no current flows through the source on the left. Then, the phase difference between the two sources is ϕ and



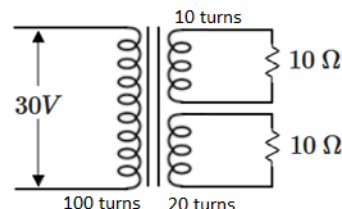
1. $R \sin \phi = \frac{1}{\omega C}$
2. $R \cos \phi = \frac{1}{\omega C}$
3. $R \tan \phi = \frac{1}{\omega C}$
4. $R \cot \phi = \frac{1}{\omega C}$

78. Exactly identical voltages are imposed on the system at X, Y, Z : $V_m \sin \omega t$. The peak voltage at O is V_o . Then,



1. $V_o = V_m$
2. $V_o < V_m$
3. $V_o > V_m$
4. any of the above can be possible.

79. A transformer has 100 turns in its primary. It has two secondary circuits: one with 10 turns and the other with 20 turns. The rms voltage across the primary is 30 V. The secondaries are connected to 10Ω loads, as shown. Assuming no power loss, the rms current in the primary is



1. 0.2 A
2. 0.15 A
3. 0.45 A
4. 0.9 A

Hint : Find the net power in the secondaries.

80. An AC source of emf 100 V and frequency $f = \frac{50}{\pi}$ Hz has an internal resistance 100Ω . A load resistance R_L is connected across the source. Maximum power is dissipated in the load, when

1. $R_L = 100\sqrt{2} \Omega$
2. $R_L = \frac{100}{\sqrt{2}} \Omega$
3. $R_L = 100 \Omega$
4. $R_L = 200 \Omega$

81. The electric field of an electromagnetic wave is given by

$$\vec{E} = E_0 \hat{j} \cos(\omega t - kx) + E_0 \hat{i} \sin(\omega t - kx).$$

The maximum value of the electric field in the wave is

1. $\frac{E_0}{\sqrt{2}}$
2. E_0
3. $\sqrt{2}E_0$
4. $\sqrt{3}E_0$

82. **Assertion (A) :**

The fastest speed of propagation of any wave in any medium is the speed of electromagnetic waves in that medium .

Reason (R) :

All signals can at most travel at the speed of light in vacuum.

1. The (A) is true but the (R) is false.
2. The (A) is false but the (R) is true.
3. Both the (A) and the (R) are true and the (R) is a correct explanation of the (A).
4. Both the (A) and (R) are true but the (R) is not a correct explanation of the (A).

83. A positively charged particle is placed on the x-axis in the path of an electromagnetic wave propagating along the x-axis, with its electric field oscillating along the y-axis. The charged particle will begin to move along

1. the electric field.
2. the magnetic field.
3. the direction of propagation.
4. the direction between the electric field and the magnetic field.

84. An electromagnetic wave is incident onto a surface and delivers an energy E , and a momentum p .

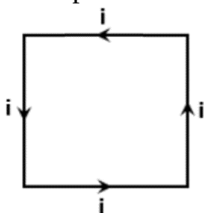
1. E, p are both zero.
2. E, p are both non-zero.
3. E is zero and p is non-zero.
4. E is non-zero, p is zero.

85. The maximum electric field of a plane electromagnetic wave travelling through vacuum is 300 V/m . The maximum magnetic field of this wave is

1. 300 T
2. 10^{-6} T
3. $9 \times 10^{10} \text{ T}$
4. $300\sqrt{2} \text{ T}$

Physics - Section B

86. A current-carrying loop of wire in the shape of a square of side 'a' lies in the x-y plane. A uniform magnetic field B acts in the plane. Then:



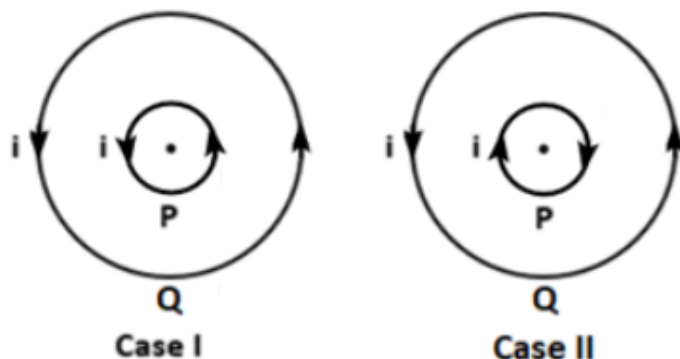
1. The force on the loop is $4iaB$.
2. The torque on the loop is ia^2B .
3. The force on the loop is $\sqrt{2}iaB$.
4. The torque on the loop is $\sqrt{2}ia^2B$.

87. Two long parallel wires carry currents, equal to i each, in opposite directions. The distance between the wires is d . The net magnetic field, at a point which is at an equal distance d from each of the wires, is:

1. $\frac{\mu_0 i}{2\pi d}$
2. $\frac{2\mu_0 i}{2\pi d}$
3. $\frac{\sqrt{3}\mu_0 i}{2\pi d}$
4. zero

Hint: Consider a point equidistant from the two wires, at a distance d correctly.

88. Two current carrying loops of wire are placed as shown in the figure, the inner loop (P) having a radius (r) which is much smaller than the radius (R) of the outer loop (Q). Both the loops are concentric, but the currents in one are in the same sense while in the other, in the opposite sense.



In both cases, the torque on P due to Q is zero. If P is slightly rotated about a diameter, then, it will return to its initial position in

1. case (I) but not in case (II).
2. case (II) but not in case (I).
3. both cases (I) and (II).
4. neither of cases (I) and (II).

89. Two very long wires of length L are placed parallel to each other separated by a distance r ($r \ll L$). The wires carry equal currents i . The force between the two wires is nearly

1. $\frac{\mu_0 i^2 L}{2\pi r}$
2. $\frac{\mu_0 i^2 L}{4\pi r}$
3. $\frac{\mu_0 i^2 L}{2r}$
4. $\frac{\mu_0 i^2 L}{4r}$

90. A piece of iron is heated until it is red hot. It is placed in a solenoid. As the temperature of the iron decreases, the magnetic field inside it

1. first increases, then decreases.
2. first decreases, then increases.
3. increases.
4. decreases.

91. The susceptibility of a paramagnetic material at 400 K is 2×10^{-5} . The susceptibility would increase to 2.5×10^{-5} at a temperature of

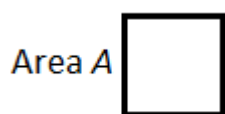
1. 500 K
2. 256 K
3. 320 K
4. 350 K

Hint: Curie's Law

92. A 100-turn coil of wire of size $2 \text{ cm} \times 1.5 \text{ cm}$ is suspended between the poles of a magnet producing a field of 1 T , inside a galvanometer. Calculate the torque on the coil due to a current of 0.1 A passing through the coil.

1. $3 \times 10^{-5} \text{ N-m}$
2. 30 N-m
3. $3 \times 10^{-3} \text{ N-m}$
4. $3 \times 10^{-2} \text{ N-m}$

93. A horizontal square loop of area A has n turns of wire. It is immersed in a uniform, rotating magnetic field B which is initially perpendicular to the plane of the loop. The field rotates with an angular speed ω about a diagonal of the loop. The emf induced across the loop is



1. constant, of magnitude $n\omega BA$.
2. increasing with time t , of magnitude $n\omega^2 BA t$.
3. decreasing with time t , of magnitude $\frac{nBA}{t}$.
4. sinusoidal with time t , of amplitude $n\omega BA$.

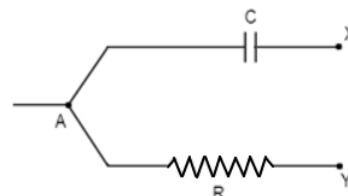
94. The mutual inductance between the two circuits can be determined by simply letting a current i flow through one circuit and finding the flux of the magnetic field through the second circuit: $\phi_2 = M_{12}i_1$, where M_{12} is the mutual inductance. Using this method, or otherwise determine the mutual inductance (M) between a long straight wire, and a small coplanar loop of area A , located at a distance l from the wire. The value of M is

1. $\frac{\mu_0 l}{2\pi}$
2. $\frac{\mu_0 A}{2\pi l}$
3. $\frac{\mu_0 l^3}{4\pi A}$
4. $\frac{\mu_0 A^2}{2\pi l^3}$

95. The current through the primary of a step-down transformer with a turns-ratio of 4 is 1.6 A . The current in the secondary circuit is

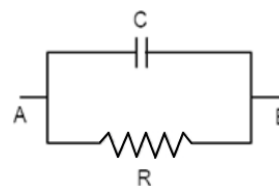
1. 0.4 A
2. 0.8 A
3. 6.4 A
4. 12.8 A

96. Sinusoidal voltages are applied at X and Y so that the currents flowing into the capacitor at X and into the resistor at Y are equal and out of phase with each other. The rms values of the voltages across the capacitor and the resistor are each equal to V_r . The rms value of $V_X - V_Y$ is:



1. zero
2. $\sqrt{2}V_r$
3. $2V_r$
4. $\frac{V_r}{\sqrt{2}}$

97. An alternating $emf = V_o \sin \omega t$ is applied between the two ends A & B of the circuit shown below. The current through C has the same rms value as that through R . The rms value of the current flowing out at B is



1. $\frac{V_o}{\sqrt{2}R}$
2. $\frac{V_o}{R}$
3. $\frac{\sqrt{2}V_o}{R}$
4. zero

98. An RC circuit is connected to a 10 V AC source and it is observed to supply a 200 mA current at a frequency of 100 kHz . The same resistance is now paired with an inductor (L) in series and the same source supplies 200 mA current at a frequency of 1 kHz at the same operating voltage. If the circuit were made with the given L-C-R in series, the current will be a maximum when the frequency is f_o . Then,

1. $f_o = \frac{10^3 + 10^5}{2} \text{ Hz}$
2. $f_o > \frac{10^3 + 10^5}{2} \text{ Hz}$
3. $f_o < \frac{10^3 + 10^5}{2} \text{ Hz}$
4. $f_o = 10^3 + 10^5 \text{ Hz}$

Hint : Consider the impedance at both frequencies and at resonance.

99. A plane electromagnetic wave, propagating along the x-axis, has a magnetic field given by

$$\vec{B} = B_0(\hat{j} + \hat{k})\sin(\omega t - kx).$$

The wave is polarised along

1. \hat{j}
2. \hat{k}
3. $\hat{j} + \hat{k}$
4. $\hat{j} - \hat{k}$

100. The average electric field associated with the plane electromagnetic wave $\vec{E} = E_0\hat{i}\sin(\omega t - kz)$ is

1. $E_0\hat{i}$
2. $\frac{E_0}{\sqrt{2}}\hat{i}$
3. $\sqrt{2}E_0\hat{i}$
4. zero (null)

Zoology - Section A

101. The basic tenets of evolution by natural selection as defined by Darwin do not include:

1. More individuals are produced each generation than can survive.
2. Phenotypic variation exists among individuals and the variation is heritable.
3. Those individuals with heritable traits better suited to the environment will survive.
4. The evolutionarily significant variations in the population arise due to mutations.

102. The only known carriers of the bacterium, *Salmonella typhi*, are the:

1. Humans
2. Bats
3. Rodents
4. House flies

103. Both *Wuchereria* and *Ascaris*:

1. are transmitted by the bite of a female mosquito vector
2. are transmitted by contaminated food and water
3. are nematodes
4. can cause intestinal obstruction in affected children

104. What is common to diabetes mellitus type 1, Graves' disease, inflammatory bowel disease, multiple sclerosis, psoriasis, rheumatoid arthritis, and systemic lupus erythematosus?

1. All are genetic and heritable disorders
2. All are autoimmune disorders
3. All are pre-cancerous conditions
4. All are communicable diseases

105. In humans, maternal antibodies passing through the placenta to the fetus provide the latter:

1. an artificially acquired passive immunity
2. a naturally acquired passive immunity
3. an artificially acquired active immunity
4. a naturally acquired active immunity

106. Consider the following statements:

I. Immunity provided by antibodies is called humoral immunity.

II. Antibodies are secreted by B cells.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is incorrect but II is correct
4. I is correct but II is incorrect

107. The 'first line of defence' against the entry of pathogens in the body are:

1. Anatomical barriers
2. Physiological barriers
3. Cellular barriers
4. Cytokines

108. T cells:

1. are born and get matured in bone marrow
2. are born and get matured in thymus
3. are born in thymus and get matured in bone marrow
4. are born in bone marrow and get matured in thymus

109. The cells least associated with allergies in humans will be:

1. Macrophages
2. Mast cells
3. Basophils
4. Eosinophils

110. A form of aneuploidy with the presence of only one chromosome from a pair is known as:

1. Haploidy
2. Nullisomy
3. Monosomy
4. Trisomy

111. The child of a mother of blood group O has blood group O. The blood group of the father can be:

1. A or B or O
2. A or B or O or AB
3. A or B
4. Only O

112. The theory about the origin of life that holds that living creatures could arise from nonliving matter and that such processes were commonplace and regular is known as:

1. Panspermia
2. Divine or special creation
3. Spontaneous generation
4. Primary abiogenesis

113. World AIDS Day is observed on December 1. The theme for the day in 2021 was:

1. Know your Status
2. Communities Make the Difference
3. Global Solidarity Shared Responsibility
4. End inequalities. End AIDS. End pandemics.

114. Normal genes involved in cell growth and proliferation are known as:

1. Oncogenes
2. Proto-oncogenes
3. V-onc
4. Transgenes

115. When the genetic material of a retrovirus is introduced into an animal cell, it first:

1. is used as a template to produce viral DNA
2. is used as a template to produce more viral RNA
3. gets folded into a circular molecule
4. gets incorporated into the host genome

116. Identify the pair of white blood cells that are most effective phagocytes:

1. Neutrophils and Eosinophils
2. Basophils and Monocytes
3. Neutrophils and Monocytes
4. Lymphocytes and Eosinophils

117. What would not be true regarding Down's Syndrome?

1. It is also known as trisomy 21
2. The parents of the affected individual are usually affected from the disorder.
3. There is no cure for Down syndrome.
4. The extra chromosome 21 material may also occur due to a Robertsonian translocation in 2–4% of cases.

118. Which of the following is not a basic point about Oparin-Haldane hypothesis?

1. Early earth had a chemically oxidising atmosphere.
2. This atmosphere, exposed to energy in various forms, produced simple organic compounds ("monomers").
3. These compounds accumulated in a "soup", which may have been concentrated at various locations (shorelines, oceanic vents etc.).
4. By further transformation, more complex organic polymers – and ultimately life – developed in the soup.

119. Consider the two statements:

- I. Birds and bats have homologous limbs.
 - II. They are both ultimately derived from terrestrial tetrapods.
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II does not explain I
 3. I is incorrect but II is correct
 4. I is correct but II is incorrect

120. HIV:

1. cannot be transmitted to the fetus through placenta
2. usually enters the T helper cells first
3. selectively infects and destroys T cytotoxic cells
4. uses macrophages as a factory to produce new virus particles

121. Which species of the malarial parasite causes malignant tertian malaria?

1. *Plasmodium vivax*
2. *Plasmodium malariae*
3. *Plasmodium ovale*
4. *Plasmodium falciparum*

122. The statement "All the acquisitions or losses wrought by nature on individuals, through the influence of the environment in which their race has long been placed, and hence through the influence of the predominant use or permanent disuse of any organ; all these are preserved by reproduction to the new individuals which arise, provided that the acquired modifications are common to both sexes, or at least to the individuals which produce the young" can be ascribed to:

1. Georges Cuvier
2. Lamarck
3. A R Wallace
4. Charles Darwin

123. All the following are cannabinoids except:

1. Hashish
2. Charas
3. Ganja
4. Afeem

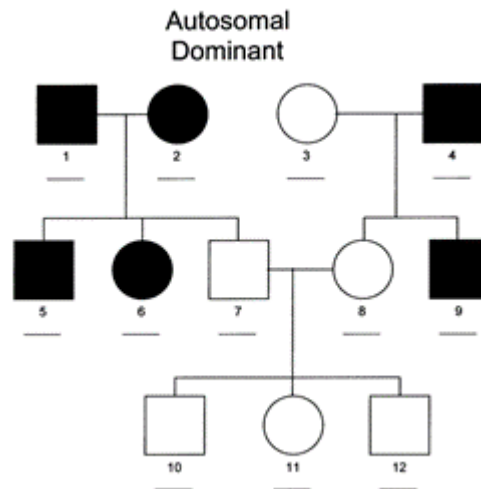
124. Amino acids produced and identified in the "classic" 1952 experiment by Miller include all of the following except:

1. Glycine
2. Alanine
3. Aspartic acid
4. Tryptophan

125. Dysentery in humans can generally be caused by:

- I. bacterial infections
- II. parasitic infections
- III. viral infections
1. Only I and II
2. Only II
3. Only III
4. I, II and III

126. The mode of inheritance shown by filled symbols in the given pedigree is most likely:



1. Autosomal recessive
2. Autosomal dominant
3. Sex linked recessive
4. Sex linked dominant

127. Rhino viruses:

1. are same as the coronaviruses
2. are transmitted by arthropod vectors
3. do not generally infect the lungs
4. are DNA viruses

128. Which age group is considered as the most vulnerable for the development of drug addiction?

1. Pre-pubertal
2. Adolescence
3. Late adulthood
4. Geriatric

129. Allergies:

- I. are caused by hypersensitivity of the immune system to typically harmless substances in the environment.
- II. involve immunoglobulin E antibodies
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

130. Consider the following statements:

- I. Benign tumours are not cancers.
- II. Benign tumour lacks the ability to invade adjacent tissues or spread to distant sites by metastasizing.
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is incorrect but II is correct
4. I is correct but II is incorrect

131. Consider the following statements:

I. Adaptive immunity can provide long-lasting protection, sometimes for the person's entire lifetime.

II. Adaptive immunity creates immunological memory after an initial response to a specific pathogen, and leads to an enhanced response to future encounters with that pathogen..

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is incorrect but II is correct
4. I is correct but II is incorrect

132. Identify the incorrect statement regarding the lymphoid organs in human body:

I. MALT constitutes about 50% of the lymphoid tissue in the human body.

II. Spleen and lymph nodes are primary lymphoid organs

III. Bone marrow and thymus are secondary lymphoid organs

1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

133. The most common cancer in women in India is:

1. Breast cancer
2. Cervix cancer
3. Oral cancer
4. Lung cancer

134. The 'Omicron' variant of SARS-Cov2 is designated as:

1. B.1.1.529
2. B.1.1.7
3. B.1.351
4. B.1.617.2

135. Examples of convergent evolution will include:

I. Opposable thumbs in primates and giant pandas.

II. Eye of cephalopods and vertebrates.

1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

Zoology - Section B

136. In Sanger's method of genome sequencing, when a dideoxyribonucleotide is added to the tube:

1. replication of the strand continues
2. replication of the strand stops
3. replication of the strand is not affected
4. replication of the strand is speeded up

137. During initiation of transcription, the prokaryotic RNA polymerase holoenzyme recognizes promoters specific to certain types of genes with the help of:

1. Alpha subunit
2. Omega subunit
3. Beta subunit
4. Sigma subunit

138. The statement "Embryos pass through successive stages that represent the adult forms of less complex organisms in the course of development" can be equated with:

1. Recapitulation theory
2. Baer's law
3. Descent with modification
4. Punctuated equilibrium

139. Sequence comparisons indicate that the DNA of which of the following living apes is most similar to human DNA?

1. Hoolock Gibbon
2. Orangutan
3. Gorilla
4. Chimpanzee

140. The shortest human autosome is:

1. Chromosome 1
2. Chromosome 22
3. Chromosome 21
4. Y chromosome

141. In traditional DNA fingerprinting [such as RFLP], the DNA that has been collected is first cut into smaller fragments by:

1. probe molecules.
2. restriction enzymes.
3. gel electrophoresis.
4. denaturation.

142. A point mutation in a sequence of DNA that results in a premature stop codon in the transcribed mRNA is known as:

1. Nonsense
2. Silent
3. Missense
4. Frame shift

143. In the anticodon of a tRNA molecule, the base hypoxanthine [inosine] can pair with all of the following except:

1. Adenine
2. Guanine
3. Cytosine
4. Thymine

144. With the passing of stringent laws and pollution control measures in Britain, there has been a decline in the frequency of melanic form of the Peppered moth. The most likely cause for this observation will be:

1. industrial pollutants turned the moths black
2. the selection pressure on the melanic and the non-melanic forms has reversed
3. genetic drift
4. assortative mating

145. All living organisms - past, present and future are linked to each other. All organisms have arisen from a single distant ancestor. The strongest evidence for this will be:

1. All organisms have a triplet genetic code
2. DNA is the genetic material of almost all living organisms
3. The genetic code is degenerate but non-ambiguous
4. The amino acids specified by particular triplets are almost always identical between any two organisms.

146. The second-most frequent mode of HIV transmission is:

1. through sexual contact with an infected person
2. from mother to child during pregnancy, delivery, or breastfeeding
3. via blood and blood products
4. vector borne

147. A method used in molecular biology for detection of a specific DNA sequence in DNA samples is:

1. Northern blotting
2. Western blotting
3. Southern blotting
4. Eastern Blotting

148. Interferons:

1. cause the lysis of bacterial cells
2. fragment bacterial DNA
3. help phagocytes recognize microbes
4. prevent viral replication

149. The BCG vaccine is given to prevent:

1. Covid 19
2. Tuberculosis
3. Anthrax
4. Polio

150. The first multicellular eukaryote, and animal, to have its whole genome sequenced was:

1. *Saccharomyces cerevisiae*
2. *Arabidopsis thaliana*
3. *Zea mays*
4. *Coenorhabditis elegans*

Botany - Section A

151. Identify the incorrect statement:

1. All cellular life-forms use a primase to synthesize a short RNA primer with a free 3' OH group which is subsequently elongated by a DNA polymerase.
2. DNA is read by DNA polymerase in the 5' to 3' direction, meaning the new strand is synthesized in the 3' to 5' direction.
3. The leading strand is the strand of new DNA that is synthesized in the same direction as the growing replication fork.
4. The lagging strand is the strand of new DNA whose direction of synthesis is opposite to the direction of the growing replication fork.

152. During the elongation step of bacterial translation peptide bond formation, is catalyzed by a ribozyme which is:

1. the 23S ribosomal RNA in the 50S ribosomal subunit
2. the 23S ribosomal RNA in the 30S ribosomal subunit
3. the 16S ribosomal RNA in the 50S ribosomal subunit
4. the 16S ribosomal RNA in the 30S ribosomal subunit

153. In transcription:

1. RNA complement formed includes the nucleotide uracil (U) in all instances where thymine (T) would have occurred in a DNA complement.
2. The template strand of DNA is called the coding strand.
3. RNA polymerase can only add nucleotides to the 5' end of the growing mRNA chain.
4. The error rate is much lower than that in DNA replication.

154. Consider the two statements:

- I. Biochemical oxygen demand (BOD) is often used as an indicator of the degree of organic pollution of water.
 II. An increase in BOD is used as a gauge of the effectiveness of wastewater treatment plants.
1. Only I is correct
 2. Only II is correct
 3. Both I and II are correct
 4. Both I and II are incorrect

155. Streptokinase is a:

1. thrombolytic medication and enzyme
2. thrombolytic medication and an ion channel blocker
3. anticoagulant and an anti-platelet agent
4. anticoagulant and vasodilator

156. A double-stranded DNA molecule globally has percentage base pair equality: $A\% = T\%$ and $G\% = C\%$. One such DNA molecule is found to have 23 % Adenine. What is the expected % of Uracil in this DNA?

1. 0
2. 23
3. 27
4. 46

157. In a plant genes A, B and C are located on different autosomes. Two plants with genotypes AaBbCc are intercrossed. The number of phenotypes and genotypes that can occur in their progeny will respectively be:

1. 6 and 8
2. 8 and 9
3. 4 and 16
4. 8 and 27

158. Which of the following two statements can be correctly considered as the conclusions of the Hershey and Chase experiment?

- I. The lack of 35S-labeled DNA remaining in the solution after the bacteriophages had been allowed to adsorb to the bacteria showed that the phage DNA was transferred into the bacterial cell.
 II. The presence of almost all the radioactive ^{32}P in the solution showed that the protein coat that protects the DNA before adsorption stayed outside the cell.
1. Only I
 2. Only II
 3. Both I and II
 4. Neither I nor I

159. Allolactose is an isomer of lactose and is the inducer of the lac operon. Allolactose is:

1. galactose- $\beta(1 \rightarrow 4)$ -glucose
2. galactose- $\beta(1 \rightarrow 6)$ -glucose
3. galactose- $\beta(1 \rightarrow 5)$ -glucose
4. galactose- $\beta(1 \rightarrow 2)$ -glucose

160. Identify the correctly matched pair:

I.	Binding of nitrogenous bases to a pentose sugar to form a nucleoside	N-glycosidic bond at C1 of the pentose sugar
II.	Binding of phosphate to a nucleoside to form a nucleotide	Ester bond at C5 of the pentose sugar
III.	Joining of two nucleotides to form a dinucleotide	5'-3' phosphodiester bond

1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

161. Consider the two statements:

- I. In bacteria, translation initiation occurs as soon as the 5' end of an mRNA is synthesized, and translation and transcription are coupled.
 II. This is not possible in eukaryotes because transcription and translation are carried out in separate compartments of the cell
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II is not a correct explanation of I
 3. I is correct and II is incorrect
 4. I is incorrect and II is correct

162. Consider the two statements:

- I. Ori's sites in DNA are A-T rich.
 II. A-T base pairs have two hydrogen bonds.
1. Both I and II are correct and II explains I
 2. Both I and II are correct but II is not a correct explanation of I
 3. I is correct and II is incorrect
 4. I is incorrect and II is correct

163. Match the terms given in Column I with their definition in Column II and select the correct match from the codes given:

	COLUMN I		COLUMN II
A	Homozygous	P	having two different alleles of a particular gene or genes
B	Heterozygous	Q	having two identical alleles of a particular gene or genes
C	Homologous	R	not having the same alleles or genes in the same order of arrangement
D	Heterologous	S	having the same alleles or genes in the same order of arrangement

Codes:

	A	B	C	D
1.	P	Q	R	S
2.	S	R	Q	P
3.	Q	P	S	R
4.	S	R	Q	P

164. Each tRNA is charged with a specific amino acid by:

1. aminoacyl tRNA synthetase
2. polynucleotide phosphorylase
3. peptidyl transferase
4. topoisomerase

165. During DNA replication, the enzyme that separates the two strands of DNA at the Replication Fork is:

1. DNA helicase
2. DNA gyrase
3. DNA ligase
4. DNA topoisomerase

166. A fungus that is itself used as a fungicide is:

1. *Trichoderma harzianum*
2. *Fusarium graminearum*
3. *Penicillium chrysogenum*
4. *Phytophthora infestans*

167. Unusual bases as dihydrouridine and pseudouridine are most likely to be found in:

1. Complementary DNA
2. mRNA
3. rRNA
4. tRNA

168. What is incorrect regarding DNA replication?

1. For a cell to divide, it must first replicate its DNA.
2. DNA replication is an all-or-none process; once replication begins, it proceeds to completion.
3. DNA replication (DNA amplification) cannot be performed in vitro (artificially, outside a cell).
4. Once replication is complete, it does not occur again in the same cell cycle.

169. In contrast to *Rhizobium* species, *Azotobacter* species are:

1. lacking nitrogenase
2. free-living, nitrogen-fixing bacteria
3. obligate symbionts
4. Gram-positive bacteria

170. Consider the two statements:

- I. Baculoviruses are considered a safe option for use in research applications.
- II. They have a broad range of organisms that can act as their hosts.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

171. In a dihybrid cross, $AaBb \times AaBb$, assuming independent assortment, what proportion of progeny are expected to express either of the dominant phenotype?

1. $3/16$
2. $6/16$
3. $9/16$
4. $1/16$

172. *Saccharomyces cerevisiae* is:

- I. Baker's yeast
 - II. Brewer's yeast
1. Only I
 2. Only II
 3. Both I and II
 4. Neither I nor II

173. In a cross $WwYy \times WwYy$ [assuming independent assortment], what proportion of the progeny will be $WWyy$?

1. $1/4$
2. $1/2$
3. $3/4$
4. 0

174. Lady beetles, and in particular their larvae, are voracious predators of:

1. Aphids
2. Mosquito
3. Spider mites
4. Nematodes

175. During transcription, a DNA sequence is read by an RNA polymerase, which produces:

1. a complementary, antiparallel RNA strand called a primary transcript.
2. an identical, antiparallel RNA strand called a primary transcript.
3. a complementary, parallel RNA strand called a primary transcript.
4. an identical, antiparallel RNA strand called a final transcript.

176. Consider the given two statements:

I. In a test cross, the allele the individual in question [one that expresses the dominant phenotype] passes on, determines the phenotype of the offspring.

II. The homozygous recessive individual can only pass on recessive alleles.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

177. Match the Mendel's Laws given in Column I with their correct definition in COLUMN II and select the correct match from the codes given:

	COLUMN I		COLUMN II
A.	Law of dominance	P.	During gamete formation, the alleles for each gene segregate from each other so that each gamete carries only one allele for each gene.
B.	Law of segregation	Q.	In a heterozygote, one trait will conceal the presence of another trait for the same characteristic.
C.	Law of independent assortment	R.	Genes of different traits can segregate independently during the formation of gametes.

Codes:

	A	B	C
1.	Q	R	P
2.	Q	P	R
3.	P	Q	R
4.	R	Q	P

178. Which gene in the lac operon codes for an intracellular enzyme that cleaves the disaccharide lactose into glucose and galactose?

1. Lac A
2. Lac Y
3. Lac Z
4. Lac I

179. In the Avery, Macleod, and McCarty experiment, the use of which of the following will affect bacterial transformation?

1. trypsin
2. chymotrypsin
3. ribonuclease
4. deoxyribonuclease

180. Identify the incorrectly matched row regarding the double helix of DNA:

- | | |
|------------------------|--------|
| 1. Rotation/bp | 600 |
| 2. bp/turn | 10 |
| 3. Pitch/turn of helix | 3.4 nm |
| 4. Diameter | 2.0 nm |

181. Identify the incorrect statement:

- LAB check disease causing microbes in our stomach.
- Dough for making foods like dosa and idli are fermented by yeast.
- Swiss cheese is fermented by *Propionibacterium shermanii*
- Roquefort cheeses is an unripened cheese

182. The mRNA codons GAG and GUG respectively code for:

- Valine and Glutamic acid
- Glutamic acid and Valine
- Tryptophan and Methionine
- Methionine and Tryptophan

183. A drug identical to monacolin K, is the principal statin produced by *Monascus purpureus*. This drug is used as:

- an antihypertensive
- an anticoagulant
- a blood cholesterol lowering agent
- a source of cyanocobalamin

184. Consider the given two statements:

- Cyclosporin is used as an immunosuppressant medication.
 - It activates the T lymphocytes.
- Both I and II are correct and II explains I
 - Both I and II are correct but II does not explain I
 - I is incorrect but II is correct
 - I is correct but II is incorrect

185. What would be not true regarding Griffith's experiment?

- It was the first experiment suggesting that bacteria are capable of transferring genetic information through a process known as transformation.
- Griffith was studying the possibility of creating a vaccine against *Pneumococcus*.
- His experiment proved that DNA is the transforming principle and hence the genetic material.
- In this experiment, bacteria from the III-S strain were killed by heat, and their remains were added to II-R strain bacteria and this combination was able to kill its host.

Botany - Section B

186. Mendel noticed that plants with coloured seed coats always had coloured flowers and coloured leaf axils. (Axils are the parts of the plant that attach leaves to stems.) Mendel also observed that pea plants with colourless seed coats always had white flowers and no pigmentation on their axils. In other words, in Mendel's pea plants, seed coat color was always associated with specific flower and axil colours. Today, we know that Mendel's observations were the result of:

- Variable expressivity
- Incomplete penetrance
- Pleiotropy
- Epistasis

187. A shine Dalgarno sequence:

- serves as a recognition site for stopping RNA synthesis
- a ribosomal binding site in bacterial and archaeal messenger RNA
- serves as a recognition site for stopping translation
- is the part of the 3'-UTR [trailer] of the mRNA molecule in bacteria

188. In the cross-pollination experiments between red and white snapdragon plants, the resulting F1 offspring are all pink. What would be true?

- When the first filial (F1) generation consisting of all pink plants is allowed to cross-pollinate, the resulting F2 generation phenotypic ratio is 1:2:1.
 - When the F1 generation is allowed to cross-pollinate with true breeding red plants, the resulting F2 phenotypic ratio is 1:1.
 - When the F1 generation is allowed to cross-pollinate with true breeding white plants, the resulting F2 plants phenotypic ratio is 1:1.
- Only I and II
 - Only I and III
 - Only II and III
 - I, II and III

189. The ichneumonid wasps, used in biological pest control are:

- Predators
- Pathogens
- Parasitoids
- Commensals

190. Consider the given two statements:

I. Glomus species cannot be cultured in the laboratory in the absence of a plant host.

II. Glomus species form symbiotic relationships (mycorrhizae) with plant roots.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is incorrect but II is correct
4. I is correct but II is incorrect

191. Nucleotides:

I. serve as monomeric units of the nucleic acid polymers

II. play a central role in metabolism at a fundamental, cellular level

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

192. World Health Organization definition "live microorganisms which when administered in adequate amounts confer a health benefit on the host" describes:

1. Antibiotics
2. Antioxidants
3. Protobionts
4. Probiotics

193. Dominance:

1. is an autonomous feature of an allele
2. is inherent in the phenotype expressed by an allele
3. is a relationship between two alleles of a gene and their associated phenotypes
4. determines whether an allele is deleterious, neutral or advantageous

194. All the following are a method of gene transfer in bacteria except:

1. Translocation
2. Conjugation
3. Transduction
4. Transformation

195. In cases of incomplete dominance

I. The principle of dominance discovered by Mendel does not apply.

II. The principle of uniformity works

III. Mendel's principle of segregation of genes holds true

1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II and III are correct

196. Which of the following is not correct regarding polygenic inheritance?

1. Main mode of non-allelic genes interaction in corresponding gene series is addition of mainly small particular allele contributions.

2. The effects of allelic substitution at each of the segregating genes are usually relatively small and interchangeable which results that identical phenotype may be displayed by a great variety of genotypes.

3. The phenotypic expression of the polygenic characters is undergoing considerable modification by environmental influence.

4. Polygenic characters show a discontinuous rather than continuous distribution.

197. Leaves are variously modified from photosynthetic structures to form the insect-trapping pitchers of pitcher plants, the insect-trapping jaws of Venus flytrap, and the spines of cactuses. Such leaves would be an example of:

1. Homology
2. Analogy
3. Phenotypic plasticity
4. Vestigiality

198. The Great Oxidation Event was a time interval when the Earth's atmosphere and the shallow ocean first experienced a rise in the amount of oxygen. This must have coincided with the evolution of:

1. Cyanobacteria
2. Green algae
3. First terrestrial plants
4. Floating aquatic plants

199. Identify the incorrectly matched pair:

1.	Streptomycin	<i>Streptomyces griseus</i>
2.	Chloramphenicol	<i>Streptomyces fradiae</i>
3.	Tetracycline	<i>Streptomyces rimosus</i>
4.	Clavulanic acid	<i>Streptomyces clavuligerus</i>

200. Two genes located on the same autosome in an organism are 70 map unit apart. The recombination frequency between the two genes when a dihybrid cross is performed would be:

1. 100 %
2. Less than 50 %
3. 25 %
4. 0

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