



Sample Paper for AIMSET
All India Medical Scholarship Entrance Test
AIMSET – 2021

All India Medical Scholarship Entrance Test
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SAMPLE PAPER

Max. Marks: 180

Duration: 3 Hrs

This paper consists of Chemistry, Physics and Biology

Chemistry

- Multiple Choice Questions with one correct answer Question No. 1 to 45. A correct answer carries 1 Mark. A wrong answer carries a penalty of 0.25 marks.

Physics

- Multiple Choice Questions with one correct answer Question No. 46 to 90. A correct answer carries 1 Mark. A wrong answer carries a penalty of 0.25 marks.

Biology

- Multiple Choice Questions with one correct answer Question No. 91 to 180. A correct answer carries 1 Mark. A wrong answer carries a penalty of 0.25 marks.

Useful Data

At. Wt.:

N = 14; O = 16; H = 1; S = 32; Cl = 35.5; Mn = 55; Na = 23; C = 12; Ag = 108; K = 39; Fe = 56; Pb = 207

Physical constants:

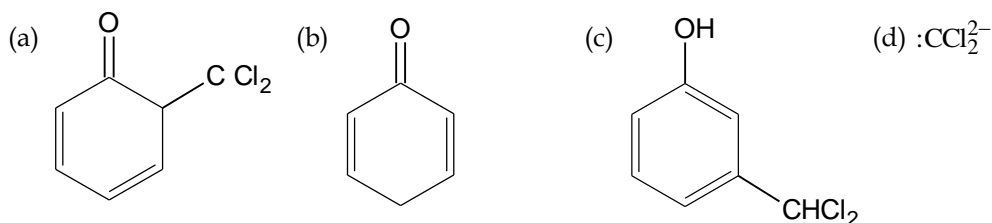
$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{sec}$, $N_a = 6.022 \times 10^{23} \text{ mol}^{-1}$, $C = 2.998 \times 10^8 \text{ ms}^{-1}$, $m_e = 9.1 \times 10^{-31} \text{ kg}$

Chemistry

1. When a metal is burnt, its weight is increased by 24 percent. The Equivalent weight of metal will be
(a) 2 (b) 24 (c) 33.3 (d) 76
2. In which one of the following, the number of protons is greater than number of neutrons but number of protons is less than the number of electrons?
(a) D_3O^{+} (b) SO_2 (c) S^{2-} (d) OH^{-}
3. The correct order of decreasing dipole moment of
(I) toluene (II) m-dichlorobenzene
(III) o-dichlorobenzene (IV) p-dichlorobenzene
(a) IV < II < I < III (b) IV < I < II < III (c) I < IV < II < III (d) IV < I < III < II

4. The latent heats of fusion in Jg^{-1} of five substances A (mol. mass=18) B (mol. mass=20), C (mol.mass=30), D (mol. mass=60) and E(mol. mass =30) are respectively 80, 45, 90, 45, 45. Which of the following pair has same value of " ΔH_{fusion} "?
- (a) A, C (b) B, E (c) D, E (d) C, D
5. What is the decreasing order of strength of bases? OH^- , NH_2^- , $H-C\equiv C^-$, $CH_3CH_2^-$
- (a) $CH_3CH_2^- > NH_2^- > H-C\equiv C^- > OH^-$ (b) $H-C\equiv C^- > CH_3CH_2^- > NH_2^- > OH^-$
(c) $H-C\equiv C^- < CH_3CH_2^- < NH_2^- < OH^-$ (b) $NH_2^- > H-C\equiv C^- > OH^- > CH_3CH_2^-$
6. The addition of a catalyst to the reaction system
- (a) Increases the rate of forward reaction only
(b) Increases the rate of reverse reaction only
(c) Increases the rate of forward but decreases the rate of backward reaction
(d) Increases the rate of forward as well as backward reaction equally
7. The vapour pressure of the solution of two liquids A ($P^\circ = 80\text{mm}$), and B ($P^\circ = 120\text{mm}$) is found to be 100 mm when $X_A = 0.4$. The result shows that
- (a) Solution exhibits ideal behaviour
(b) Solution shows positive deviations
(c) Solution shows negative deviations
(d) Solution will show positive deviations for lower concentrations and negative deviations for higher concentration
8. The number of isomers of the compound C_2BrFCI_2 is
- (a) 3 (b) 4 (c) 5 (d) 6
9. An organic compound A of the formula C_7H_8O is soluble in $NaOH$ but not in $NaHCO_3$. On treatment with bromine water it gives a tribromo product. The compound A is
- (a) *o*-Cresol (b) *m*-Cresol
(d) *p*-Cresol (d) Either of the three
10. Which statement is true regarding following reactions $\text{trans-2-Butene} \xrightarrow{HCO_3H} A$
 $\text{cis-2-Butene} \xrightarrow{HCO_3H} B$
- (a) compound A and B are formed by *syn* addition and they are racemic mixture and meso respectively
(b) compound A and B are formed by *anti* addition and they are racemic mixture and meso respectively
(c) compound A and B are formed by *anti* addition and they are meso and racemic mixture respectively
(d) compound A and B are formed by *syn* addition and they are meso and racemic mixture respectively

11. Which of the following is not formed as an intermediate in the Reimer-Tiemann reaction between phenol and alkaline chloroform?



12. Which of the following statement(s) is/are true?

- (a) at room temperature, formyl chloride is present in the form of CO and HCl
 (b) acetamide behaves as a weak base as well as a weak acid
 (c) $\text{CH}_3\text{CONH}_2 \xrightarrow{\text{LiAlH}_4} \text{CH}_3\text{CH}_2\text{NH}_2$
 (d) all the above are true

13. The type of hybrid orbitals used by chlorine atom in ClO_2^- ions:

- (a) sp^3 (b) sp^2 (c) sp (d) dsp^3

14. Which shows highest magnetic moment?

- (a) V^{3+} (b) Cr^{3+} (c) Fe^{3+} (d) Co^{3+}

15. The number of ions given by $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}_2$ complex in aqueous solution is equal to:

- (a) 2 (b) 3 (c) 4 (d) 5

16. O_2^{2-} is isoelectronic with:

- (a) H_2 (b) N_2 (c) F_2 (d) S

17. Which of the following elements has highest electro positivity?

- (a) copper (b) caesium (c) barium (d) chromium

18. In a periodic table the basic character of oxides:

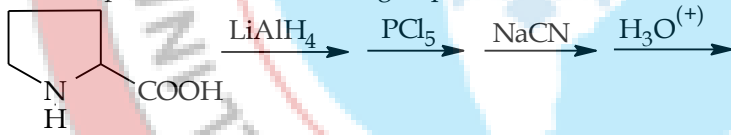
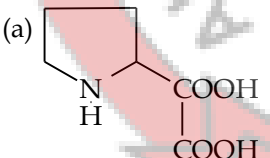
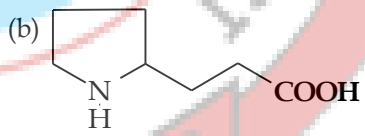
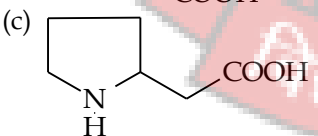
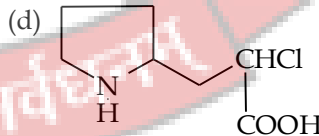
- (a) increases from left to right and decreases from top to bottom
 (b) decreases from right to left and increases from top to bottom
 (c) decreases from left to right and increases from top to bottom
 (d) decreases from left to right and increases from bottom to top

19. An element, X, forms compounds of the formula XCl_3 , X_2O_5 and Ca_3X_2 but does not form XCl_5 . The element X is

- (a) B (b) N (c) Al (d) P

20. At STP if 1 mL of water contains 20 drops then number of molecules in a drop of water is

- (a) 6.023×10^{23} molecules (b) 1.376×10^{26} molecules
 (c) 1.344×10^{18} molecules (d) 4.34×10^{20} molecules

21. Under identical conditions of pressure and temperature, 2 L of gaseous mixture (H_2 and CH_4) effuses through a hole in 5 minutes whereas 2 L of gas X of molecular mass 36 takes 10 minutes to effuse through the same hole. The mole ratio of H_2 : CH_4 in the mixture is
- (a) 1:2 (b) 2:1 (c) 2:3 (d) 1:1
22. Calculate the wavelength of light required to break the bond between two chlorine atoms in a chlorine molecule. The $Cl-Cl$ bond energy is 243 KJ/mol . ($h = 6.6 \times 10^{-34} \text{ Js}$)
- (a) $4.91 \times 10^{-7} \text{ m}$ (b) $4.11 \times 10^{-6} \text{ m}$ (c) $8.81 \times 10^{-31} \text{ m}$ (d) $6.26 \times 10^{-21} \text{ m}$
23. Heat of neutralization of a strong acid HA and a weaker acid HB with KOH are -13.7 and $-12.7 \text{ K cal mol}^{-1}$. When 1 mole of KOH is added to a mixture containing 1 mole each of HA and HB , the heat changes was -13.5 K cal . In what ratio is the base distributed between HA and HB .
- (a) 3:1 (b) 1:3 (c) 4:1 (d) 1:4
24. At STP, a container has 1 mole of Ar , 2 moles of CO_2 , 3 moles of O_2 and 4 moles of N_2 . Without changing the total pressure if one mole of O_2 is removed, the partial pressure of O_2 is
- (a) Changed by about 16% (b) Halved
(c) Changed by 26% (d) Unchanged
25. For the reaction of one mole of zinc dust with one mole of sulphuric acid in a bomb calorimeter, ΔU and W corresponds to
- (a) $\Delta U > 0, W = 0$ (b) $\Delta U < 0, W = 0$ (c) $\Delta U < 0, W > 0$ (d) $\Delta U > 0, W < 0$
26. The end product in the following sequence of reaction
- 
- (a)  (b) 
- (c)  (d) 
27. Vapour density of PCl_5 is 104.16 but when heated to 230°C its vapour density is reduced to 62. The degree of dissociation of PCl_5 at this temperature will be
- (a) 6.8% (b) 68% (c) 46% (d) 64%
28. For the equilibrium, $CH_3CH_2CH_2CH_3(g) \rightleftharpoons CH_3-\underset{\substack{| \\ CH_3}}{CH}-CH_3(g)$
- n-Butane iso-Butane

if the value of K_c is 3.0, the percentage by mass of iso-butane in the equilibrium mixture would be

- (a) 75% (b) 90% (c) 30% (d) 60%

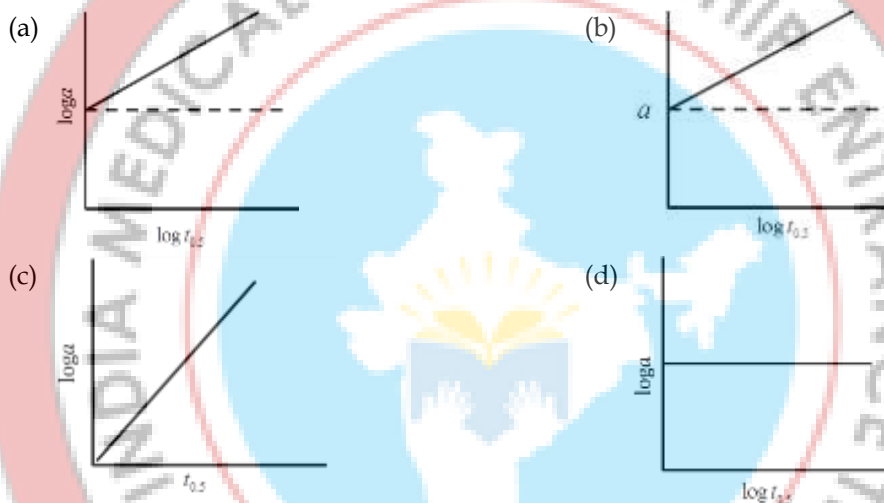
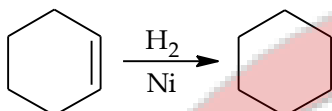
29. The P^H of a solution obtained by mixing 100 ml of 0.2 M CH_3COOH with 100 ml of 0.2 M NaOH would be (P^{Ka} for $CH_3COOH = 4.74$)

- (a) 4.74 (b) 8.87 (c) 9.10 (d) 8.57

30. In the electrolytic refining of zinc:

- (a) graphite is at the anode (b) the impure metal is at the cathode
(c) the metal ion gets reduced at the anode (d) acidified zinc sulphate is the electrolyte

31. Which of the following is a correct graph for the reaction?



32. In which of the following reaction, H_2O_2 is acting as a reducing agent?

- (a) $SO_2 + H_2O_2 \longrightarrow H_2SO_4$ (b) $2KI + H_2O_2 \longrightarrow 2KOH + I_2$
(c) $Ag_2O + H_2O_2 \longrightarrow 2Ag + H_2O + O_2$ (d) $PbS + 4H_2O_2 \longrightarrow PbSO_4 + 4H_2O$

33. Which gives least basic oxide?

- (a) Mg (b) Ba (c) Be (d) Ra

34. Which of the following oxidation states are the most characteristic for lead and silicon respectively?

- (a) +2, +4 (b) +4, +4 (c) +2, +2 (d) +4, +2

35. The potential at which a solution containing 1 M $CuSO_4$, 1 M $NiSO_4$ and 2 M H_2SO_4 be electrolyzed so as to deposit only copper and no nickel so that $1 \times 10^{-9} M Cu^{+2}$ is left, is

- (a) 0.04 V (b) 0.4 V (c) 0.07 V (d) 0.007 V

36. The crystal field stabilization energy (CFSE) is highest for

- (a) $[CoF_4]^{2-}$ (b) $[Co(NCS)_4]^{2-}$ (c) $[Co(NH_3)_6]^{3+}$ (d) $[CoCl_4]^{2-}$

37. Which of the following is not considered as an organometallic compound?

- (a) cis-Platin (b) Ferrocene
(c) Zeise's salt (d) Grignard reagent

38. A metal "M" forms M_2O_3 type oxide and MN type nitride. The atomic number of the metal could be

- (a) 11 (b) 12 (c) 13 (d) 19

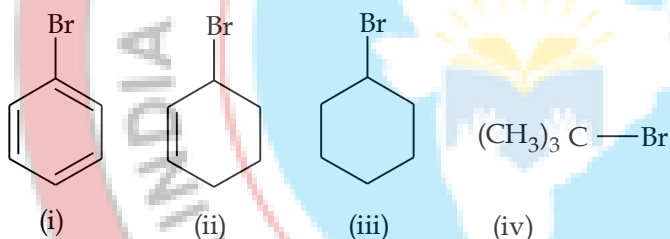
39. The $X-X$ bond dissociation energy is minimum in

- (a) Fluorine (F_2) (b) Chlorine (Cl_2) (c) Bromine (Br_2) (d) Iodine (I_2)

40. For which of the following pairs, magnetic moment is same?

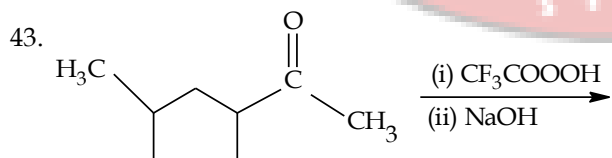
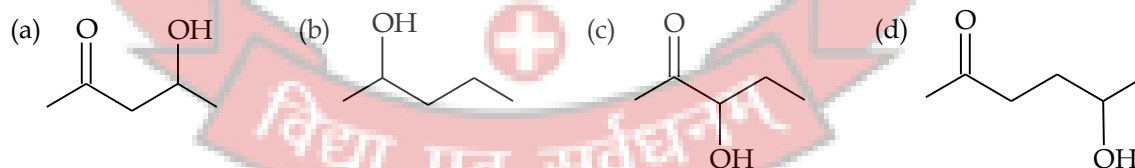
- (a) $MnCl_2, CuSO_4$ (b) $CuCl_2, TiCl_3$ (c) $TiO_2, CuSO_4$ (d) $TiCl_3, NiCl_2$

41. The increasing order of hydrolysis of the following compounds is



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

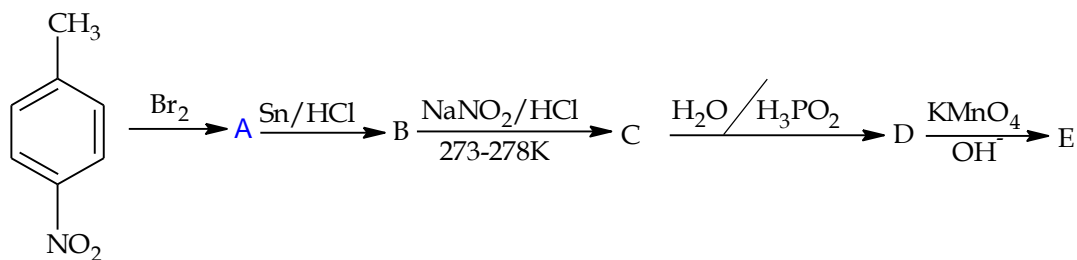
42. Which one of the following will most readily be dehydrated in acidic conditions?



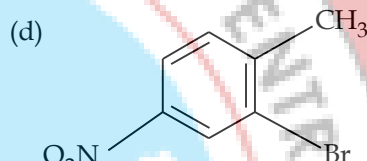
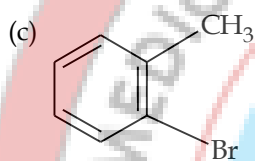
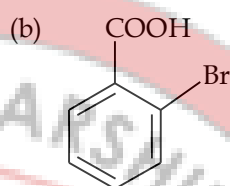
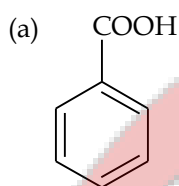
Find the organic acid produced from the above reaction.

- (a) $CH_3COO^-Na^+$ (b) COO^-Na^+
(c) $COO^{(-)}Na^+$ (d) OH

44. In the following reaction,



Identify the product 'E'.



45. The given diagram indicates the energy levels of certain atoms. When the system moves from $2E$ level to E a photon of wave length λ is emitted.

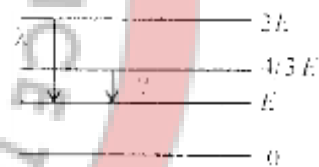
The wave-length of photon produced during its transition from $\frac{4E}{3}$ level to E is

(a) $\frac{\lambda}{3}$

(b) λ

(c) $\frac{4}{3}\lambda$

(d) 3λ



Physics

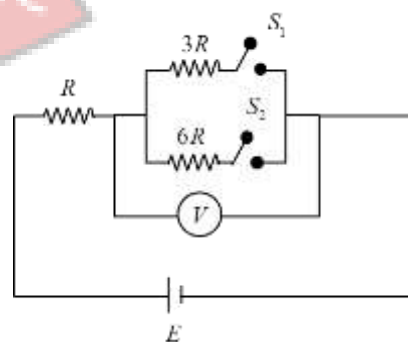
46. In the circuit shown in the figure, reading of voltmeter is V_1 when only S_1 is closed, reading of voltmeter is V_2 when only S_2 is closed and reading of voltmeter is V_3 when both S_1 and S_2 are closed, then

(a) $V_3 > V_2 > V_1$

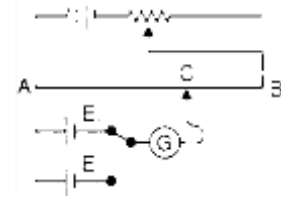
(b) $V_2 > V_1 > V_3$

(c) $V_3 > V_1 > V_2$

(d) $V_1 > V_2 > V_3$



47. The circuit shown here is used to compare the emf 's of the cells E_1 and E_2 ($E_1 > E_2$). When the galvanometer is connected to E_1 , the null point is at C . When the galvanometer is connected to E_2 , the null point will be



- (a) to the left of C (b) to the right of C (c) at C itself (d) nowhere on AB

48. At the mid-point along the length of a long solenoid, the magnetic field is equal to X . If the length of the solenoid is doubled and the current is reduced to half the field at the new mid-point will be nearest to

- (a) $\frac{X}{4}$ (b) $\frac{X}{2}$ (c) $2X$ (d) X

49. de Broglie wavelength of an alpha particle and a neutron are same then velocity of

- (a) α - particle is greater than that of neutron
 (b) neutron is greater than of α particle
 (c) both are equal
 (d) none of the above

50. The retarding potential for photoelectrons emitted when potassium having work function 0.3 eV is illuminated by light of wavelength 3300 \AA is

- (a) 0.68 V (b) 6.8 V (c) 0.34 V (d) 3.4 V

51. Consider the following reaction ${}_1\text{H}^2 + {}_1\text{H}^2 \longrightarrow {}_2\text{He}^4 + Q$. If $m({}_1\text{H}^2) = 2.0141 \text{ u}$; $m({}_2\text{He}^4) = 4.0024 \text{ u}$. The energy Q released (in MeV) in this fusion reaction is

- (a) 12 (b) 6 (c) 24 (d) 48

52. Difference in working of an amplifier and step up transformer is

- (a) amplifier increase power which is not possible with transformer
 (b) amplifier decreases power whereas transformer increases the power
 (c) amplifier keeps power constant whereas transformer decreases power
 (d) amplifier keeps the power constant whereas transformer increases power

53. The dominated waves associated with radiation emitted from a black body which is at a temperature 2.7 K belongs to (stefan's constant $b = 2.88 \times 10^{-3} \text{ mK}$)

- (a) radiowaves (b) microwaves (c) ultraviolet rays (d) infrared waves

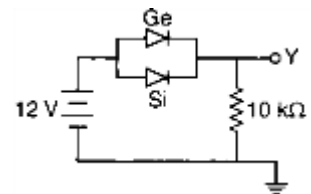
54. Which of the following is represents 'action and reaction' pair

- (a) gravitational force and buoyant force acting on a floating body
 (b) gravitational force and thrust force acting on a rocket
 (c) gravitational force and friction force acting on a sliding body
 (d) none of these

55. To increase both the resolving power and magnifying power of a telescope

- (a) both the focal length and aperture of the objective has to be increased

- (b) the focal length of the objective has to be increased
 (c) the aperture of the objective has to be increased
 (d) the wavelength of light has to be decreased
56. Two plane mirrors are placed perpendicular to each other. A ray strikes one mirror and after reflection falls on the second mirror. The ray after reflection from the second mirror will be
 (a) perpendicular to the original ray (b) parallel to the original ray
 (c) at 45° to the original ray (d) can be at any angle to the original ray
57. A clear sheet of polaroid is placed on the top of similar sheet so that their axes make an angle $\sin^{-1}\left(\frac{3}{5}\right)$ with each other. The ratio of intensity of the emergent light to that of unpolarised incident light is
 (a) 16:25 (b) 9:25 (c) 4:5 (d) 8:25
58. In a $n-p-n$ transistor circuit, the collector current is 10mA . If 90% of the electrons emitted reach the collector, the emitter current (I_E) and base current (I_B) are given by
 (a) $I_E = 9\text{mA}, I_B = -1\text{mA}$ (b) $I_E = -1\text{mA}; I_B = 9\text{mA}$
 (c) $I_E = 11.1\text{mA}; I_B = 1.1\text{mA}$ (d) $I_E = 1.1\text{mA}; I_B = 11.1\text{mA}$
59. A count rate meter shows a count of 240 per minute from a given radioactive source. One hour later the meter shows a count rate of 30 per minute. The half-life of the source is
 (a) 80 min (b) 120 min (c) 20 min (d) 30min
60. In a nuclear reactor 0.01 mg of a fissile material is totally converted into energy in one second. The power of the reactor in MW is
 (a) 1000 (b) 900 (c) 0.01 (d) 100
61. In an LCR circuit capacitance is changed from C to $2C$. For the resonant frequency to remain unchanged, the inductance should be changed from L to
 (a) $4L$ (b) $2L$ (c) $\frac{L}{2}$ (d) $\frac{L}{4}$
62. Dimensional formula of spring constant (K) is
 (a) $M^0L^0T^0$ (b) MLT
 (c) MLT^{-2} (d) no dimensional formula because it is a constant
63. Two junction diodes one of Germanium (Ge) and other of silicon (Si) are connected as shown in figure to a battery of emf 12V and a load resistance $10\text{k}\Omega$. The germanium diode conducts at 0.3V and silicon diode at 0.7V . When a current flows in the circuit, the potential of terminal Y will be
 (a) 12V (b) 11V (c) 11.3V (d) 11.7V
64. A $\frac{1}{2}\text{kg}$ ball moves in a circle 0.4m of radius at a velocity of 4 m/s . Its centripetal acceleration is



- (a) $10m/s^2$ (b) $20m/s^2$ (c) $40m/s^2$ (d) $80m/s^2$
65. A solid ball of volume V is dropped in a viscous liquid. It experiences a viscous force F . If the solid ball of volume $8V$ is dropped in the same fluid, then the viscous force acting on it is
- (a) F (b) $2F$ (c) $\frac{F}{2}$ (d) $8F$
66. Transverse waves of same frequency are generated in two steel wires A and B . The diameter of A is twice that of B and the tension in A is half that of B . The ratio of velocities of waves in A and B is
- (a) $1:2$ (b) $1:\sqrt{2}$ (c) $1:2\sqrt{2}$ (d) $3:2\sqrt{2}$
67. An ideal gas heat engine operates in a Carnot's cycle between $227^\circ C$ and $127^\circ C$. It absorbs $6 \times 10^4 J$ of heat at high temperature. The amount of heat converted into work is
- (a) $4.8 \times 10^4 J$ (b) $3.5 \times 10^4 J$ (c) $1.6 \times 10^4 J$ (d) $1.2 \times 10^4 J$
68. The height from the earth's surface at which the acceleration due to gravity is $\frac{1}{100}$ th of the value at the surface is [radius of the earth is R]
- (a) $9R$ (b) $10R$ (c) $100R$ (d) R
69. A wire of length 1 m increases in length by 0.02 m. When subjected to a tensile stress of $12 \times 10^8 N/m^2$. The Young's modulus of material of the wire is
- (a) $6 \times 10^{10} N/m^2$ (b) $600 N/m^2$ (c) $12 \times 10^{10} N/m^2$ (d) $24 \times 10^6 N/m^2$
70. Water rises up to a height h in a capillary tube of certain diameter. When this is replaced by a tube of half the diameter, then water will rise to a height of
- (a) $4h$ (b) $2h$ (c) $3h$ (d) h
71. A small drop of oil spreads over water because
- (a) oil has a higher surface tension (b) water has a higher surface tension
(c) oil has a higher viscosity (d) water has a higher viscosity
72. The materials for the construction of electro magnets should have
- (a) high initial permeability (b) low initial permeability
(c) large area of hysteresis loop (d) high coercivity
73. An aeroplane flies along a straight line from A to B with air speed V and back again with the same air speed. If the distance between A and B is l and a steady wind blows perpendicular to AB with speed u , the total time taken for the round trip is
- (a) $\frac{2l}{V}$ (b) $\frac{2l}{\sqrt{V^2+u^2}}$ (c) $\frac{2Vl}{V^2u^2}$ (d) $\frac{2l}{\sqrt{V^2-u^2}}$

74. Two shells are fired from a cannon with same speed at angle α and β respectively with the horizontal. The time interval between the shots is T . They collide in mid-air after time ' t ' from the first shot. Which of the following conditions must be satisfied?

- (a) $\alpha < \beta$ (b) $\cos(\alpha t) = \cos \beta(t-T)$
 (c) $(t-T)\cos \alpha = t \cos \beta$ (d) none of these

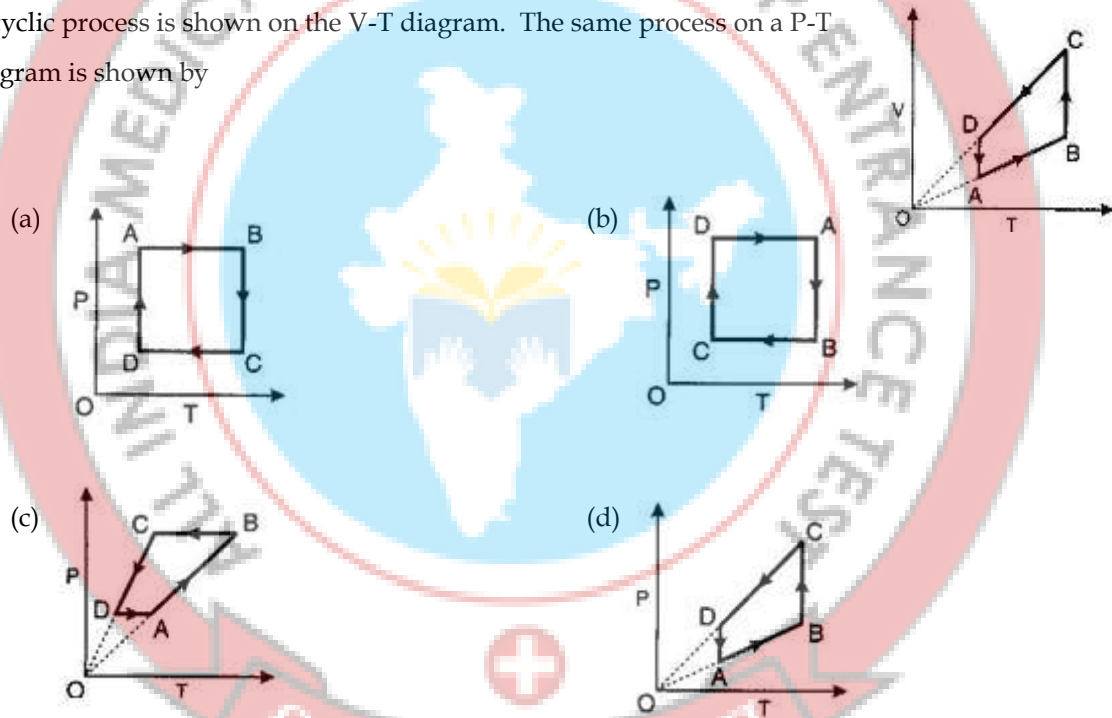
75. Paraffin have relative permittivity $K=2.1$, find the refractive index for paraffin? (Relative permeability of paraffin $\mu_r \approx 1$)

- (a) 1.45 (b) 2.1 (c) 1 (d) 0

76. A particle of mass m is moving in a circular path of radius r under the influence of centripetal force $F = -C/r^2$. The total energy of the particle is

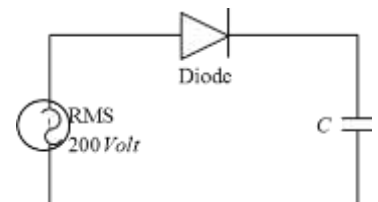
- (a) $-\frac{C}{2r}$ (b) $\frac{C}{2r}$ (c) $C \times 2r$ (d) Zero

77. A cyclic process is shown on the V-T diagram. The same process on a P-T diagram is shown by



78. A sinusoidal voltage of rms value 200 volt is connected to the diode and capacitor C in the circuit shown so that half wave rectification occurs. The final potential difference in volt across C is

- (a) 500 (b) 200
 (c) 283 (d) 141



79. A meter bridge is balanced at 40 cm from left end, when a known resistance 4Ω is fixed in left gap and a metal wire of length 10 cm and diameter 1 cm is fixed in right gap. The resistivity of the wire is?

- (a) $1.5\pi \times 10^{-3} \Omega m$ (b) $\pi \times 10^{-3} \Omega m$ (c) $2.5 \times 10^{-3} \Omega m$ (d) $2.5\pi \times 10^{-3} \Omega m$

80. Long distance short-wave radio broad-casting uses.

- (a) ground wave (b) space wave (c) direct wave (d) sky wave

81. The volume of the bulb of a mercury thermometer at $0^\circ C$ is V_0 and cross-section of the capillary is A_0 . The coefficient of linear expansion of glass is α_g per $^\circ C$ and the cubical expansion of mercury γ_m per $^\circ C$. If the mercury just fills the bulb at $0^\circ C$, what is the length of mercury column in capillary at $T^\circ C$?

- (a) $\frac{V_0 T (\gamma_m + 3\alpha_g)}{A_0 (1 + 2\alpha_g T)}$ (b) $\frac{V_0 T (\gamma_m - 3\alpha_g)}{A_0 (1 + 2\alpha_g T)}$
 (c) $\frac{V_0 T (\gamma_m + 2\alpha_g)}{A_0 (1 + 3\alpha_g T)}$ (d) $\frac{V_0 T (\gamma_m - 2\alpha_g)}{A_0 (1 + 3\alpha_g T)}$

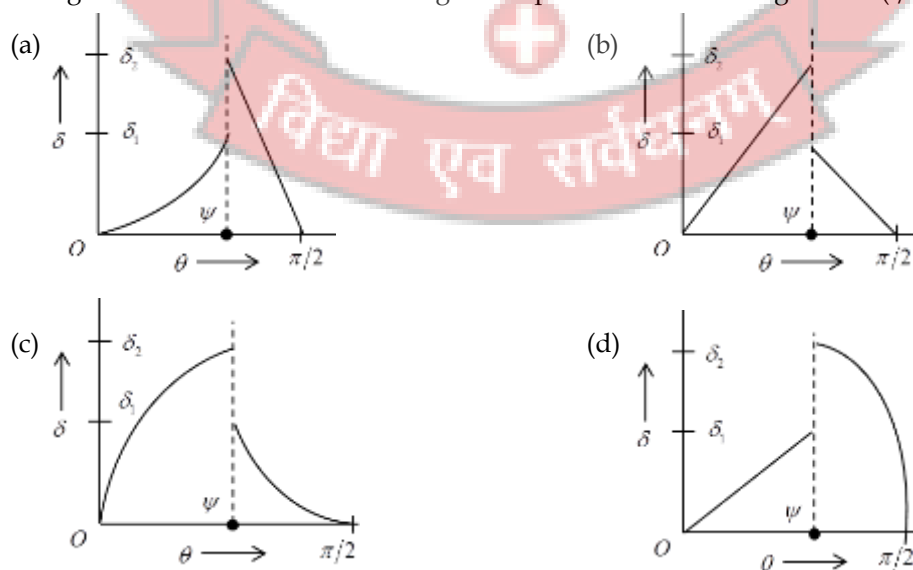
82. In a compound microscope, the image between objective and eye piece may be

- (a) virtual, erect and magnified (b) real, erect and magnified
 (c) real, inverted and magnified (d) virtual, erected and diminished

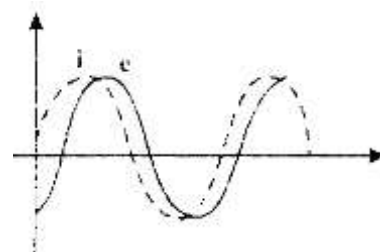
83. For hydrogen atom an electron in n th Bohr orbit, the ratio of radius of orbit to its de-Broglie wavelength is

- (a) $\frac{n}{2\pi}$ (b) $\frac{n^2}{2\pi}$ (c) $\frac{1}{2\pi n}$ (d) $\frac{1}{2\pi n^2}$

84. A ray of light travels from a medium of refractive index μ to air. Its angle of incidence in the medium is θ , measured from the normal to the boundary, and its angle of deviation is δ . δ is plotted against θ . Which of the following best represents the resulting curve? ($\psi \rightarrow$ critical angle)



85. When an AC source of emf $e = E_0 \sin(100t)$ is connected across a circuit, the phase difference between the emf e and the current i in the circuit is observed to be $\pi/4$, as shown in the diagram. If the circuit consists possibly between the two elements

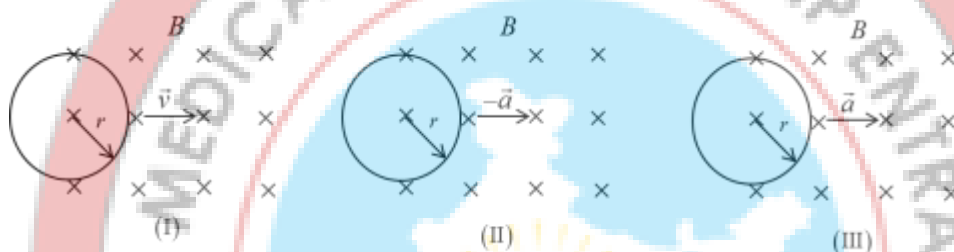


- (a) $R = 1k\Omega, C = 10\mu F$ (b) $R = 1k\Omega, C = 1\mu F$
 (c) $R = 1k\Omega, L = 10H$ (d) $R = 1k\Omega, L = 1H$

86. Twenty seven identical drops of mercury are charged simultaneously to the same potential of 10 units. Assuming the drops are made to combine to form one large drop, then its potential is

- (a) 45units (b) 135units (c) 270units (d) 90units

87. Three identical conducting loops each having radius r are moving towards a region of uniform magnetic field of induction B as shown in the figure (I), (II) and (III). Then the current in the loop is clockwise in



- (a) (I) (b) (II) (c) (III) (d) None of these

88. What is the radius of the circular orbit of a stationary satellite which remains motionless with respect to earth's surface?

- (a) $\left(\frac{gR^2T^2}{4\pi^2}\right)^{\frac{1}{3}}$ (b) $\left(\frac{gR}{4\pi^2T^2}\right)^{\frac{1}{2}}$ (c) $\left(\frac{gRT}{2\pi}\right)^{\frac{1}{3}}$ (d) $\left(\frac{gR}{2\pi T}\right)^{\frac{1}{2}}$

89. Assertion (A): When a guitar string is plucked, the frequency of oscillations of plucked string will not be same as the wave produced in air.

Reason (B): The speed of wave depends on medium in which they are propagating.

- (a) both Assertion A and Reason B are correct
 (b) only Assertion A is correct
 (c) only Reason B is correct
 (d) neither Assertion A nor Reason B are correct

90. A rigid disc rolls without slipping on a fixed rough horizontal surface with uniform angular velocity. If the acceleration of lowest point on the disc a and the velocity of the lowest point on the disc is v , then

- (a) $a = 0, v = 0$ (b) $a = 0, v \neq 0$ (c) $a \neq 0, v = 0$ (d) $a \neq 0, v \neq 0$

Biology

91. Diffusion pressure is directly proportional to:
- (a) concentration of molecules diffusing (b) kinetic energy of diffusing molecules
(c) concentration gradient (d) all of the above
92. What happens when a formalin preserved filament of Spirogyra is placed in a hypertonic sugar solution?
- (a) it loses turgidity (b) it gains turgidity (c) it is plasmolysed (d) nothing happens
93. Nif genes occur in
- (a) rhizobium (b) Aspergillus (c) Pencillium (d) Steptococcus
94. Which of the following statements about absorption spectrum is correct?
- (a) In blue region peak of Chl-b forms at lower wavelength than peak of Chl - a
(b) In red region height of peak of Chl - a is more than that of Chl - b
(c) In blue region height of peak of Chl - a is more than that of Chl - b
(d) In red region peak of Chl - a forms at lower wavelength than that Chl - b
95. With reference to Calvin cycles, which of the given options is correct for the following question?
- I) How many gross PGAL molecules are produced?
II) Total, how many ATP molecules are required for synthesis of PGAL molecules?
III) Total, how many NADPH₂ molecules are required for the synthesis of obtained PGAL molecules?
- (a) I - 3 PGAL, II - 3 ATP, III - 3 NADPH₂
(b) I - 6 PGAL, II - 6 ATP, III - 6 NADPH₂
(c) I - 18 PGAL, II - 18 ATP, III - 18 NADPH₂
(d) I - 9 PGAL, II - 9 ATP, III - 19 NADPH₂
96. The enzyme that catalyses phosphorylation of the substrate without ATP molecule is
- (a) Glyceraldehyde 3- phosphate dehydrogenase
(b) Glucose 6- phosphor-trans-ferase
(c) Phosphofructokinase
(d) Pyruvatedikinase
97. FAD is electron acceptor during oxidation of which of the following?
- (a) α - ketoglutaric acid \rightarrow Succinyl Co - A (b) Succinic acid \rightarrow Fumaric acid
(c) Succinyl Co- A \rightarrow Succinic acid (d) Fumaric acid \rightarrow Malic acid
98. Gibberellin induces flowering in
- (a) some plants only
(b) in long day plants under short day conditions
(c) in short day plants under long day conditions
(d) day neutral plants

99. Match the following:

- | List - 1 | List - 2 |
|-----------------|-----------------------|
| (A) Auxin | p) GA_3 |
| (B) Gibberellin | q) Indole acetic acid |
| (C) Cytokinins | r) Abscisic acid |
| (D) Dormin | s) Acetic acid |
| | t) Zeatin |

The correct match is

- (a) a-q, b-r, c-p, d-t (b) a-q, b-s, c-p, d-t (c) a-q, b-p, c-t, d-r (d) a-q, b-t, c-p, d-r

100. A synthetic seed consists of

- (a) Somatic embryo without protecting capsule
(b) Only sodium alginate capsule
(c) Somatic embryo with capsule made with mercuric chloride
(d) Somatic embryo, nutrient medium and capsule made with sodium alginate

101. Rotenone, a natural insecticide, is obtained from

- (a) *Azadirachta indica* (b) *Derris* sp
(c) *Bacillus thuringiensis* (d) *Phytophthora palmivora*

102. Major sources of Biofertilizers are

- (a) selected symbiotic micro - organisms (b) only nitrogen fixing bacteria
(c) only nitrogen fixing cyanobacteria (d) bacteria, cyanobacteria and fungi

103. Which enzyme is used in the polymerase chain reaction?

- (a) Restriction enzymes (b) Reverse transcriptase
(c) Ligase (d) DNA polymerase.

104. E. Coli cloning vector pBR 322 contains restriction sites (Hind III, Eco RI, Bam HI, Sal I, Pvu II, Pst

I, Cla I), ori , amp^R , tet^R , and rop . Rop codes for the

- (a) antibiotic resistance genes
(b) Foreign DNA
(c) Selection of recombinants from non-recombinants
(d) Proteins involved in the replication of the plasmid

105. α -1 Antitrypsin is

- (a) an antacid (b) an enzyme
(c) used to treat arthritis (d) used to treat emphysema

106. Which of the following nematodes infects the roots of tobacco plants and causes a great reduction in yield?

- (a) Truffles (b) *Meloidogyne incognita*
(c) *Penicillium* (d) *Rhizopus*

107. A genetically engineered microorganism used successfully in bioremediation of oil spills is a species of

- (a) Pseudomonas (b) Trichoderma (c) Xanthomonas (d) Bacillus

108. Bond between the following is an ester bond

- (a) Sugar and Phosphate (b) Sugar and N_2 base
(c) Nucleotides of opposite strands (d) N_2 base and phosphate

109. Nucleic acids can be fragmented by

- (a) Polymerases (b) Nucleases (c) Proteases (d) Ligases

110. m - RNA chain has 66 nitrogen bases. The last three are UAG. What will be the number of functional codons and amino acids in the polynucleotide chain

- (a) 22 - 21 (b) 21 - 22 (c) 22 - 22 (d) 21 - 21

111. Nawaschin discovered triple fusion in

- (a) Allium and scilla (b) Allium and Liliium
(c) Liliium and Fritillaria (d) Fritillaria and colchicum

112. Wrong match among the following

- (a) Arachis - Oil and fodder (b) Crotalaria - fibre and fodder
(c) Trigonella - leaf vegetable and medicinal (d) Pterocarpus - Fodder and green manure

113. The taxonomist who popularised the binomial system

- (a) Linnaeus (b) Theophrastus (c) Thaktajan (d) Bentham & Hooker

114. Study the following

- | | | |
|-----------------------------------|-------------------|----------------|
| (I) Exchange of O_2 and CO_2 | Joseph Priestly | Physiology |
| (II) Organ culture | Hanning | Tissue culture |
| (III) Phylogenetic classification | Hutchinson | Taxonomy |
| (IV) Plant tissues | Benson and Basham | Anatomy |

The correct combination is

- (a) I, II & IV (b) II, IV & III (c) I, II & III (d) I, IV & III

115. Study the following pairs

- (I) Lathyrus Tendril (II) Ziziphus - Spines
(III) Argemone - Spines (IV) Smilax - Tendrils

Which of the above two pairs show same morphology of the modified structures?

- (a) I & IV (b) II & IV (c) I & III (d) II & III

116. It is justified that potato tuber is an underground stem because

- (a) It stores reserve food (b) It possesses axillary buds
(c) It does not bear roots (d) It possesses chlorophyll

117. The phylloclades are

- (I) Variation of cladodes

(II) Modified assimilatory stem bearing the flowers

(III) Found in all xerophytes

(IV) Found only in xerophytes

(a) I, III, V are correct

(b) II and IV are correct

(c) III and IV are correct

(d) IV and I are correct

118. Study the following table

List - I

(a) Medullary rays

(b) Pericycle with dedifferentiating ability

(c) Lignified hypodermis

(d) Mesophyll with heterogenous chlorenchyma

List - II

(I) Dicot leaf

(II) Monocot stem

(III) Dicot stem

(IV) Monocot leaf

(V) Dicot root

A B C D

(a) II III I IV

(c) III V II I

A B C D

(b) III I II IV

(d) II V I II

119. Identify the incorrect statement regarding vascular bundles of monocot stem

(a) All vascular bundles in ground tissue are scattered irregularly

(b) In a vascular bundle xylem, phloem separated by cambium

(c) 'Y' shaped arrangement of xylem strands

(d) Vascular bundle covered by bundle sheath

120. Heart wood and sap wood are formed due to

(a) Climatic changes which occur periodically

(b) Variation in water requirement of the tree with seasonal changes

(c) Variation in water requirement of the tree in spring and Autumn

(d) Gradual non-functioning of the wood progressively due to production of functional wood from the cambium outwards

121. Vein ending, epithem cavity and water stoma are the part of

(a) Stomata

(b) Hydathode

(c) Osmophores

(d) Pneumathode

122. Identify the incorrect statement regarding Tyloses

(a) obstruct conduction of water in old and injured vessels

(b) balloon shaped structure formed from xylem parenchyma

(c) check the spreading of pathogenic fungi

(d) initially thick walled, later disappear

123. The two chromatids of a metaphase chromosome represent

(a) Replicated chromosomes to be separated at anaphase

(b) Homologous chromosomes of a diploid set

(c) Non - homologous chromosomes joined at the centromere

(d) Maternal and paternal chromosomes joined at the centromere

124. Daughter cells of meiosis - I

- (I) receive half the number of chromosomes of their parent cell
- (II) Have same chromosome number
- (III) Contain double the number of chromosomes compared to daughter cells of meiosis II
- (IV) Receive half the number of chromosomes due to disjunction

- (a) I and II correct
- (b) II and III correct
- (c) III and IV correct
- (d) I and IV correct

125. The part of chromatid / arm beyond secondary constriction is called

- (a) Satellite
- (b) Centromere or Kinetochore
- (c) Nucleolar organizer
- (d) Balbiani ring

126. Dichogamy favours cross pollination because

- (a) Anthers and stigmas are placed at different levels
- (b) Stamens and stigma mature at different times
- (c) Pollen is unable to germinate
- (d) Structure of stigma acts as a barrier

127. Some diseases caused by bacteria are:

- (a) AIDS, hydrophobia, pneumonia, smallpox
- (b) typhoid, tuberculosis, pneumonia, tetanus
- (c) polio, hepatitis, scurvy, beri-beri, leprosy
- (d) measles, mumps, malaria, sleeping sickness, syphilis

128. Jacob and Monod studied lactose metabolism in *E. Coli* and proposed operon concept. Operon concept is applicable for

- (a) all prokaryotes
- (b) all prokaryotes and some eukaryotes
- (c) all prokaryotes and all eukaryotes
- (d) all prokaryotes and some protozoans

129. Which is a correct match?

- (a) Mycorrhiza - Saprophytism
- (b) Algae and Fungi in lichens - Mutualism
- (c) Orchids - Parasitism
- (d) *Cuscuta* - Epiphytism

130. Select the correct match from the option given below:

- A. Phaeophyceae : Mannitol
- B. Rhodophyceae : Dictyota
- C. Chlorophyceae : Non-motile gametes
- D. Rhodophyceae : *r* - phycoerythrin

- (a) A, B and C
- (b) B, C and D
- (c) A and C
- (d) A and D

131. Keystone species deserve protection because these

- (a) are capable of surviving in harsh environmental conditions
- (b) indicate presence of certain minerals in the soil
- (c) have become rare due to overexploitation
- (d) play an important role in supporting other species

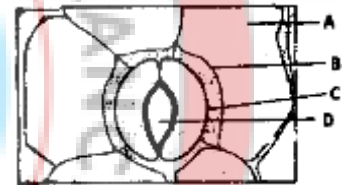
132. Tropical dense forest are due to

- (a) high rainfall and high temperature
- (b) high rainfall and low temperature
- (c) low rainfall and high temperature
- (d) low rainfall and low temperature

133. In the vast marine ecosystem, certain sea develops red colouration. This red colour is due to the presence of large population of which one of the following organisms?

- (a) certain members of rhodophyta
- (b) physarium
- (c) dinoflagellates
- (d) diatoms and members of red algae

134. Given below is the diagram of stomatal apparatus. In which of the following all the four parts labelled as A, B, C and D are correctly identified?



- | A | B | C | D |
|---------------------|-------------------|-------------------|-------------------|
| (a) subsidiary cell | epidermal cell | guard cell | stomatal aperture |
| (b) guard cell | stomatal aperture | subsidiary | epidermal cell |
| (c) epidermal cell | guard cell | stomatal aperture | subsidiary cell |
| (d) epidermal cell | subsidiary cell | stomatal aperture | guard cell |

135. Ground tissue includes

- (a) all tissues internal to endodermis
- (b) all tissues external to endodermis
- (c) all tissues except epidermis and vascular bundle
- (d) epidermis and cortex

136. Foot is displaced to the neighbourhood of mouth and divided into arms in

- (a) Ostrea
- (b) Sepia
- (c) Pila
- (d) Chiton

137. Germ cell of sponges are

- (a) Endodermal in origin
- (b) ectodermal in origin
- (c) Mesodermal in origin
- (d) both (a) and (b)

138. The postanal tail is present in

- (a) Chordates (b) vertebrates (c) invertebrates (d) all of these

139. This is not the cell of areolar tissue:

- (a) Plasma cell (b) Adipose cell (c) Macrophage (d) Schwann cell

140. Which cells have the shape of singnet rings?

- (a) Mast cells (b) Osteocytes (c) Adipocytes (d) Melanocytes

141. Which of the following amino acids has hydroxyl methyl group as its R group?

- (a) Serine (b) proline (c) alanine (d) arginine

142. Pick out the wrong statement:

- (a) Amino acids are substituent methanes (b) Glycerol is trihydroxy propane
(c) Lysine is a neutral amino acid (d) Lecithin is phospholipid

143. During and injury nasal septum gets damaged, for recovery which cartilage is responsible?

- (a) Elastic cartilage (b) Fibrous cartilage
(c) Hyaline cartilage (d) Calcified cartilage

144. Which of the following are absorbed in the alimentary canal as such?

- (a) Albumen of egg (b) Polysaccharides
(c) Fat soluble vitamins (d) Proteins

145. Match the following and choose correct one

- | | |
|-------------------|-------------|
| A) Duodenum | 1) Zymogen |
| B) parietal cells | 2) Secretin |
| C) Paneth cells | 3) Lysozyme |
| D) Chief cells | 4) HCl |
- (a) A-1, B-3, C-2, D-4 (b) A-3, B-4, C-1, D-2
(c) A-2, B-4, C-3, D-1 (d) A-4, B-1, C-2, D-3

146. The respiratory centre in the brain is stimulated by

- (a) CO_2 Concentration in venous blood
(b) O_2 Concentration in artery blood
(c) CO_2 Concentration in artery blood
(d) O_2 Concentration in venous blood

147. Respiration is controlled by

- (a) Cerebellum (b) Medulla oblongata (c) Olfactory lobes (d) Hypothalamus

148. (A) : Both each stroke volume 70mL of blood is pumped by each ventricle

(R): The duration of a cardiac cycle is directly proportional to the number of heart beats

In the following question a statement of assertion (A) is followed by a statement of reason (R).

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A)
(b) Both (A) and (R) are true and (R) is not the correct explanation of (A)

- (c) (A) is true but (R) is false
(d) Both (A) are (R) wrong
149. The cardiac pacemaker in a patient fails to function normally. The doctors find that an artificial pacemaker is to be grafted in him. It is likely that it will be grafted at the site of
(a) Atrioventricular bundle (b) Purkinje system
(c) Sino atrial node (d) atrioventricular node
150. You are required to draw blood from a patient and to keep it in a test tube for analysis of blood corpuscles and plasma. You are also provided with the following four types of test tubes. Which of these will you not use for the purpose?
(a) Test tube containing calcium bicarbonate (b) Chilled test tube
(c) Test tube containing heparin (d) Test tube containing sodium oxalate
151. Colour of urine is yellow due to the pigment
(a) Urochromogen (b) urochrome (c) carotene (d) none of these
152. Sweating is meant for
(a) Removal of excess salt
(b) regulation of body temperature
(c) Killing of skin bacteria
(d) removal of excess water
153. A cricket player is fat chasing a ball in the field. Which one of the following groups of bones are directly contributing in this movement?
(a) Femur, malleus, tibia, metatarsals (b) Pelvis, ulna, patella, tarsals
(c) Sternum, femur, tibia, fibula (d) Tarsals, femur, metatarsals, tibia
154. Which of the following pairs is correctly matched?
(a) Cartilaginous joint - Skull bones
(b) Hinge joint - Between vertebrae
(c) Fibrous joint - Between phalanges
(d) Gliding joint - Between zygapophyses of the successive vertebrae
155. Excessive stimulation of vagus nerve in humans may lead to
(a) Hoarse voice (b) peptic ulcers
(c) Efficient digestion of proteins (d) irregular contractions of diaphragm
156. The homeostatic regulation of an animal requires three basic components, _____ to detect changes, _____ to evaluate the changes and _____ to adjust the changes respectively.
(a) receptors, effectors, effectors (b) brain, spinal cord, effectors
(c) receptors, integrators, effectors (d) receptors, integrators, effectors
157. If dorsal nerve of spinal cord is broken down then its effect is:
(a) no impulse is transmitted (b) impulse is transmitted but slowly
(c) impulse is transmitted fast (d) no effect on impulse

158. When both ovaries are removed from rat then which hormone is decreased in blood?
- (a) Oxytocin (b) Prolactin
(c) Estrogen (d) Gonadotropin releasing factor
159. MSH is secreted by
- (a) anterior lobe of pituitary (b) middle lobe of pituitary
(c) posterior lobe of pituitary (d) end style
160. What is the effect of GnRH produced by hypothalamus?
- (a) Stimulates the synthesis and secretion of androgens
(b) Stimulates secretion of milk in mammary glands
(c) Stimulates foetal ejection reflex
(d) Stimulates the synthesis of carbohydrates from non-carbohydrates in liver
161. The female hormone inhibin is secreted by
- (a) zona pellucida (b) ovary
(c) Corpus luteum (d) uterine epithelium
162. Head of epididymis present at head of testis is
- (a) Caput epididymis (b) Cauda epididymis
(c) Vas deferens (d) Gubernaculum
163. Given below are assertion and reason. Point out if both are true and the reason is correct explanation
- (A):** In a woman after hysterectomy (removal of uterus), the ovarian cycle is stopped.
(R): Stoppage of FSH secretion
- (a) Both are true but reason is not correct explanation
(b) Assertion is true but reason is wrong
(c) Both are wrong
(d) None of these
164. Mammary glands are modification of
- (a) Sebaceous glands (b) Sweat glands
(c) Meibomian glands (d) None of these
165. Weight loss, infections and cancers are the most common symptoms of the disease
- (a) AIDS (b) Gonorrhoea (c) Vaginal candidiasis (d) Genital warts
166. In IVF-ET technology, developing embryo is implanted in the uterus at
- (a) Zygote stage (b) 8-celled stage (c) Gastrula stage (d) 32-celled stage
167. In a cross between genotype AB and ++, 650 out of 1000 individuals were parental type. The distance between A and B is:
- (a) 15 map units (b) 30 map units (c) 35 map units (d) 45 map units
168. Mutations which normally happen randomly are considered one of the raw materials for evolution because they

- (a) contribute to new variation in organism (b) cause death of organism
(c) are stable (d) none of these

169. Barr body of a mammal represents:

- (a) All heterochromatin in female cells
(b) All heterochromatin in male and female cells
(c) The Y-chromosome in the somatic cells of male
(d) One of the two X-chromosomes in the somatic cells of females

170. In the garden pea, round seeds are dominant over wrinkled seeds. An investigator crosses a plant having round seeds with a plant having round seeds. He counts 400 offspring. How many of the offspring have wrinkled seeds if the plant having round seeds is a heterozygote?

- (a) 200 (b) 250 (c) 300 (d) All 400

171. Which is the most important factor for continuity of a species from evolutionary point of view?

- (a) Replication of genetic material (b) Formation of gametes
(c) Synthesis of proteins (d) None of these

172. Random genetic drift in a population probably results from

- (a) Highly genetically variable individuals (b) Interbreeding within the population
(c) Constant low mutation rate (d) Large population size

173. Which of the following evidences does not favour the Lamarckian concept of inheritance of acquired characters?

- (a) Lack of pigment in cave-dwelling animals (b) Melanisation in peppered moth
(c) Absence of limbs in snakes (d) Presence of webbed toes in aquatic birds

174. Biological concept of species is mainly based on:

- (a) Reproductive isolation
(b) Morphological features only
(c) Methods of reproduction only
(d) Morphology and methods of reproduction

175. Short-lived immunity acquired from the mother to foetus across placenta or through mother's milk to the infant is categorised as

- (a) Innate non-specific immunity (b) Active immunity
(c) Passive immunity (d) Cellular immunity

176. Human immune deficiency virus (HIV) has a protein coat and a genetic material which is

- (a) Single stranded DNA (b) Double stranded DNA
(c) Single Stranded RNA (d) Double stranded RNA

177. It is the practice of mating of animals within same breed, but having no common ancestors on either side of their pedigree up to 4 to 6 generations

- (a) Out crossing (b) Cross breeding
(c) In breeding (d) Interspecific hybridisation

178. The world biodiversity day is celebrated annually on:

- (a) 5th June (b) 22nd April (c) 29th December (d) 16th September

179. Animals take phosphorous from

- (a) Water (b) Plants (c) rock (d) soil

180. Biomagnification of DDT causes decline in bird population by

- (a) Disturbing Ca metabolism (b) Thinning of egg shells
(c) Premature breaking of egg shell (d) All the these

Chemistry:

Answer Key:

1. c	2. d	3. b	4. d	5. a	6. d	7. c	8. d	9. b	10. c
11. d	12. d	13. a	14. c	15. b	16. c	17. b	18. c	19. b	20. c
21. d	22. a	23. c	24. c	25. b	26. c	27. b	28. a	29. b	30. d
31. a	32. c	33. c	34. a	35. c	36. c	37. a	38. c	39. d	40. b
41. d	42. a	43. a	44. b	45. d					

Physics:

Answer Key:

46. b	47. a	48. b	49. b	50. d	51. c	52. a	53. b	54. d	55. a
56. b	57. d	58. c	59. c	60. b	61. c	62. c	63. d	64. c	65. b
66. c	67. d	68. a	69. a	70. b	71. b	72. a	73. d	74. d	75. a
76. a	77. a	78. c	79. a	80. d	81. b	82. c	83. a	84. a	85. a
86. d	87. d	88. a	89. c	90. c					

Biology:

Answer Key:

91. d	92. d	93. a	94. b	95. b	96. a	97. b	98. b	99. c	100. d
101. b	102. d	103. d	104. d	105. d	106. b	107. a	108. a	109. b	110. d
111. c	112. d	113. a	114. c	115. b	116. b	117. b	118. c	119. b	120. d
121. b	122. d	123. a	124. d	125. a	126. b	127. b	128. c	129. b	130. d
131. d	132. b	133. c	134. d	135. c	136. b	137. d	138. a	139. d	140. c
141. a	142. c	143. c	144. c	145. c	146. c	147. b	148. c	149. c	150. a
151. b	152. b	153. d	154. d	155. b	156. c	157. a	158. c	159. b	160. a

161. c	162. a	163. b	164. b	165. a	166. d	167. c	168. a	169. d	170. a
171. a	172. b	173. b	174. a	175. c	176. c	177. a	178. c	179. b	180. d

Chemistry

Solutions:

1. Let weight of the metal = 100 g

Thus weight of oxygen consumed = 24 g

Equivalent weight of oxygen = 8

∴ 1 equivalent of metal reacts with 1 equivalent of oxygen

$$\text{i.e., } \frac{\text{weight of metal}}{\text{eq. wt of metal}} = \frac{\text{weight of oxygen}}{\text{eq. wt of oxygen}}$$

$$\Rightarrow \frac{100}{\text{eq wt}} = \frac{24}{8}$$

$$\Rightarrow \text{eq wt} = \frac{100}{3} = 33.3$$

2. No. of protons in $\text{OH}^- = 8+1=9$

No. of neutrons in $\text{OH}^- = 8+0=8$

No. of electrons in $\text{OH}^- = 8+1+1=10$

3. Dipole moment of P-dichlorobenzene is zero while that of o-dichlorobenzene is 2.54 D and for m-dichlorobenzene is 1.48 D.

∴ The sequence of dipole moment is

P-dichlorobenzene < toluene < m-dichlorobenzene < o-dichlorobenzene. IV < I < II < III

4. $\Delta_{\text{fus}} H$ of C and D will be respectively

$$\Delta_{\text{fus}} H = -90 \times 30 = -2700 \text{ J mol}^{-1} \text{ and}$$

$$\Delta_{\text{fus}} H = -45 \times 60 = -2700 \text{ J mol}^{-1}.$$

5. Acidic strength of H_2O , NH_3 , C_2H_2 and C_2H_6 is in the order $\text{H}_2\text{O} > \text{C}_2\text{H}_2 > \text{NH}_3 > \text{C}_2\text{H}_6$

Basic strength of their conjugate bases would be in the order $\text{OH}^- < \text{HC} \equiv \text{C}^- < \text{NH}_2^- < \text{C}_2\text{H}_5^-$

6. Catalyst enhances the rate of forward and backward reaction to same extent.

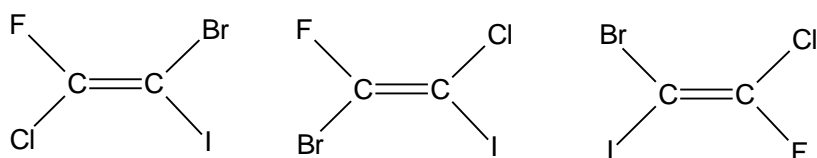
7. Pressure expected from Raoult's law

$$= 80 \times 0.4 + 120 \times 0.6 = 104 \text{ mm}$$

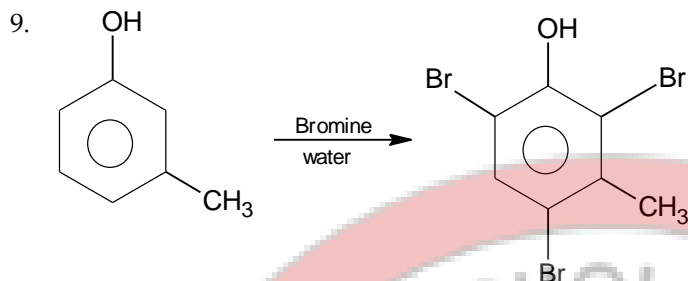
But $P_{\text{obs}} = 100 \text{ mm}$

Since $P_{\text{obs}} < P_{\text{expected}}$, this means that solution exhibits negative deviation.

8. Taking any two halogens, the possible structural isomers for the alkene can be three.

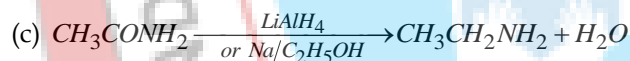
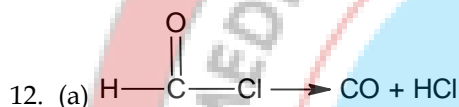


Each of the three alkene can exist as *E* and *Z* isomer, making total number of isomers as six.



10. Performic acid causes hydroxylation of the double bond; the two $-OH$ groups add in *anti*-manner. Hence *cis*-isomer gives racemic mixture while the *trans*-isomer gives meso.

11. Dichlorocarbene is a neutral species, not ionic.



13. In ClO_2^- the central atom (*Cl*) has two bond pairs and two lone pairs. Hence sp^3 hybridisation.

14. Fe^{3+} because it has five unpaired electrons. Other ions have less than five unpaired electrons.



One mole complex gives three moles ions

16. Both O_2^{2-} and F_2 have 18 electrons.

17. Alkali metals have highest electro-positivity.

18. Basic nature of oxides is directly proportional to metallic nature of elements.

19. Nitrogen can form the compound NCl_3 , N_2O_5 and Ca_3N_2 but cannot form from NCl_5 (non-availability of *d* orbitals).

20. Since, 22400 mL water contains water molecules = 6.023×10^{23}

$$\therefore \text{In 1 mL, the number of water molecules} = \frac{6.023 \times 10^{23}}{22400}$$

Since, 1 mL contains 20 drops

Therefore, number of water molecules in 1 drop

$$= \frac{6.023 \times 10^{23}}{22400 \times 20}$$

$$= 1.344 \times 10^{18} \text{ molecules.}$$

$$21. \frac{r_{mix}}{r_x} = \frac{2/5}{2/10} = 2 = \sqrt{\frac{M_x}{M_{mix}}} \Rightarrow M_{mix} = 9$$

$$M_{mix} = M_{H_2} X_{H_2} + M_{CH_4} X_{CH_4}$$

$$= 2X_{H_2} + 16(1 - X_{H_2}) = 9 \text{ (calculated)}$$

$$\Rightarrow X_{H_2} = 0.5$$

22. Energy required to break one $Cl-Cl$ bond

$$= \frac{\text{bond energy per mole}}{\text{Avogadro's number}} = \frac{243 \times 10^3 \text{ J}}{6.023 \times 10^{23}}$$

Let the wavelength of the photon to cause rupture of one $Cl-Cl$ bond be λ .

$$\lambda = \frac{hc}{E} = \frac{6.6 \times 10^{-34} \times 3 \times 10^8 \times 6.023 \times 10^{23}}{243 \times 10^3}$$

$$= \frac{119.255}{243} \times 10^{-34} \times 10^{31} \times 10^{-3}$$

$$= 4.91 \times 10^{-7} \text{ m}$$

23. Let x mole of KOH be neutralized by the strong acid HA . Then, moles neutralized by $HB = 1 - x$

$$\text{Hence, } -13.7 \times x + (-12.7) \times (1 - x) = -13.5$$

$$\Rightarrow x = 0.8; \frac{x}{1-x} = \frac{0.8}{0.2} = 4$$

24. Partial pressure of O_2 initially = $\frac{3}{10}$

$$\text{Partial pressure of } O_2 \text{ afterwards} = \frac{2}{9}$$

$$\text{Change of partial pressure of } O_2 = \frac{3}{10} - \frac{2}{9} = \frac{7}{90}$$

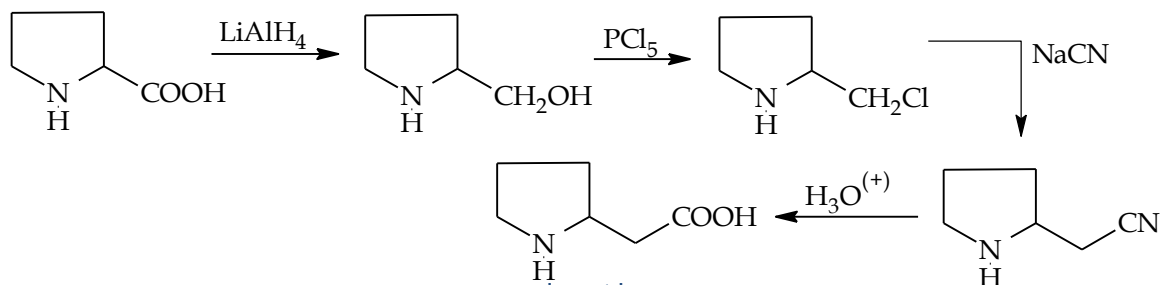
$$\therefore \% \text{ of change of partial pressure of } O_2 = \frac{\frac{7}{90}}{\frac{3}{10}} \times 100 = \frac{7}{90} \times \frac{10}{3} \times 100 = 25.9 \approx 26\%$$

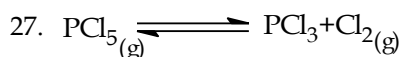
25. In bomb calorimeter, heat of combustion (Exothermic reaction) is determined at constant volume

($\Delta V = 0$), hence heat of reaction corresponds to ΔU .

$$\therefore \Delta U < 0, W = 0.$$

26.





$$\alpha = \frac{D-d}{d(n-1)}$$

where,

D = Density in the beginning

d = Density at equilibrium

n = No. of particles formed by dissociation of one molecule

$$= \frac{104.16 - 62}{62(2-1)}$$

$$= 0.68$$

$$28. K_c = \frac{[\text{Isobutane}]}{[\text{n-butane}]} = 3$$

\therefore mole ratio of isobutane: n-butane is 3:1

Since isobutane and n-butane have same molecular mass, their mass ratio is also 3:1

$$\therefore \% \text{ of isobutane in mixture} = \frac{3}{3+1} \times 100 = \frac{3}{4} \times 100 = 75\%$$

29. On mixing the two solutions complete neutralization would take place resulting in formation of sodium acetate solution having conc. 0.1 M. For hydrolysis of sodium acetate solution,

$$p^H = \frac{1}{2} [p^{K_a} + p^{K_w} + \log c]$$

$$= \frac{1}{2} [14 + 4.74 + \log(0.1)] = \frac{1}{2} [14 + 4.74 - 1] = 8.87$$

30. In electro refining pure metal is taken as cathode, impure metal taken as anode, acidified zinc sulphate is the electrolyte.
31. As the reaction occurs in the presence of a catalyst and hydrogen gas adsorbs on the surface of Nickel, therefore it is a zero order reaction. Hence the correct answer is (a).
32. Hydrogen peroxide reduces silver oxide to silver. Hydrogen peroxide is reducing agent because it changes Ag^+ to Ag , oxidation number of Ag decreases and $\text{O}_2^{2-} \rightarrow \text{O}_2^0$
33. BeO has amphoteric nature. Basic nature of oxides increases down the group.
34. Lead shows +2 oxidation state due to inert pair effect. Silicon shows +4 oxidation state. Stability of lower oxidation state increases down the group due to inert pair effect.
35. $\text{Cu}^{+2} + 2e^- \longrightarrow \text{Cu}, E^\circ = 0.34V$

$$E = 0.34 + \frac{0.059}{2} \log [Cu^{2+}]$$

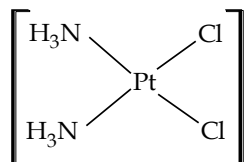
$$E = 0.34 - (0.0296)(9) = 0.34 - 0.266$$

$$= 0.07V$$

36. CFSE depends on nature of ligand.

In the given NH_3 is strongest ligand. Hence (c) has highest CFSE

37. cis-platin is not an organometallic compounds, organometallic compounds should contain metal-carbon bond. cis-platin has no such bond.



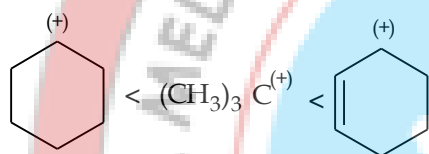
38. Al forms Al_2O_3 and AlN

39. Bond energy of $Cl_2 > Br_2 > F_2 > I_2$

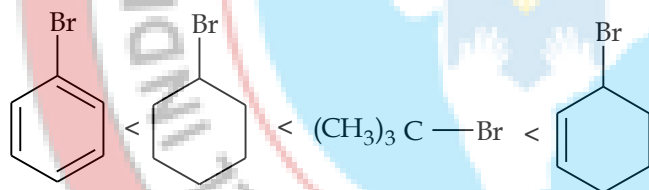
40. Species having the same number of unpaired electrons have same magnetic moment.

Cu^{2+} and Ti^{3+} have comes unpaired electron.

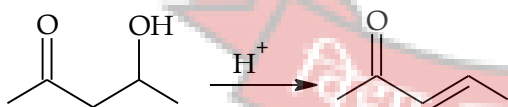
41. Cyclic and tertiary halides undergo hydrolysis by SN^1 mechanism and involve formation of carbocation intermediate. Greater the stability higher is the ease of halides to undergo hydrolysis.



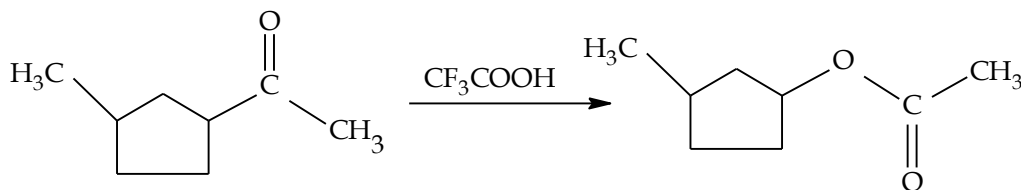
\therefore The increasing order is



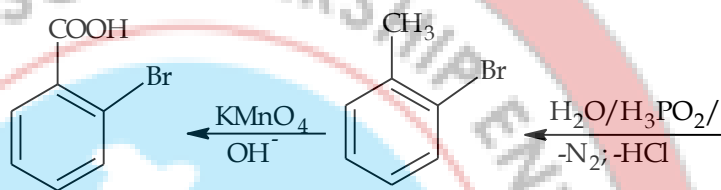
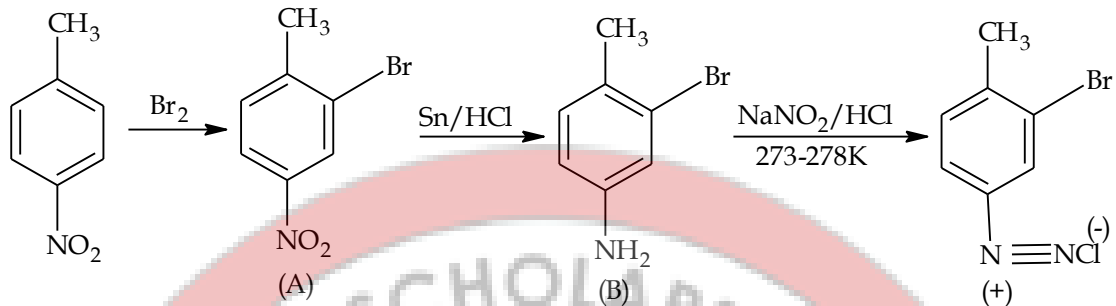
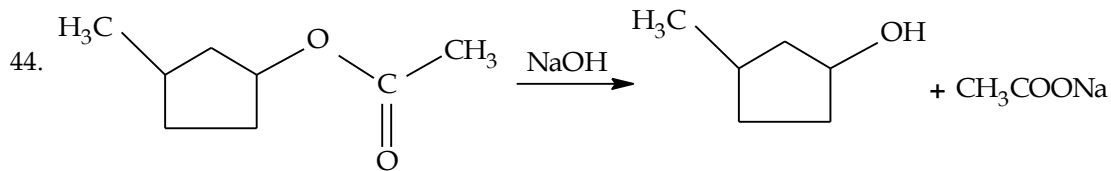
42. Dehydration of  gives more stable conjugated alkene.



43. The reaction-1 is a Baeyer-villiger oxidation. Here 2° -alkyl has higher migrating attitude than $-CH_3$.



The reaction -2 is a Saponification of ester.



45. From the given data, when the system moves from $2E$ level to E level, we have

$$2E - E = \frac{hc}{\lambda}$$

$$\text{or } E = \frac{hc}{\lambda}$$

When the system moves from $\frac{4E}{3}$ level to E level, we have

$$\frac{4}{3}E - E = \frac{hc}{\lambda_1} \quad [\lambda_1 \text{ is the wave length of photon emitted}]$$

$$\text{or } \frac{E}{3} = \frac{hc}{\lambda_1}$$

$$\text{or } \frac{hc}{\lambda \cdot 3} = \frac{hc}{\lambda_1}$$

$$\text{or } \frac{1}{3\lambda} = \frac{1}{\lambda_1}$$

$$\text{or } \frac{\lambda_1}{\lambda} = 3$$

$$\text{or } \boxed{\lambda_1 = 3\lambda}$$

Physics

Solutions:

$$46. V = E - iR = E - \frac{ER}{R+R'}$$

$$V_1 = E \left(1 - \frac{R}{R+3} \right); V_2 = E \left(1 - \frac{R}{R+6} \right)$$

$$V_3 = E \left(1 - \frac{R}{R+2} \right) \quad \therefore V_2 > V_1 > V_3$$

47. Since $E \propto \ell$. So, for $E_1 > E_2$ we have $\ell_1 > \ell_2$ and hence null point will be obtained at shorter length i.e. to left of C.

$$48. B = \mu_0 ni$$

$$B' = \mu_0 ni/2 = \frac{B}{2}$$

$$49. \lambda = \frac{h}{p} = \frac{h}{mv} = m_\alpha v_\alpha = m_n v_n$$

$$m_\alpha > m_n \Rightarrow v_\alpha < v_n$$

$$50. h\nu = eV_s + \phi = \frac{hc}{\lambda} = eV_s + \phi$$

$$\frac{6.6 \times 10^{-34} \times 3 \times 10^8}{3300 \times 10^{-10}} = eV_s + 0.3eV$$

$$V_s + 0.3 = \frac{0.6 \times 10^{-34} \times 10^8}{10^2 \times 10^{10} \times 1.6 \times 10^{-19}}$$

$$V_s + 0.3 = \frac{6}{1.6} = 3.75$$

$$V_s = 3.45V$$

$$51. {}_1H^2 + {}_1H^2 \longrightarrow {}_2He^4 + Q$$

$$\Rightarrow \Delta m = m({}_2He^4) - 2m({}_1H^2)$$

$$\Rightarrow \Delta m = 4.0024 - 2(2.0141)$$

$$\Rightarrow \Delta m = -0.0258u$$

$$\text{Since, } Q = c^2 \Delta m$$

$$\Rightarrow Q = (0.0258)(931.5) MeV$$

$$\Rightarrow Q = 24 MeV$$

52. Amplifier magnifies the signal and hence power gain but a transformer not.

$$53. \lambda_m T = \text{constant}$$

$$\Rightarrow \lambda_m \times (2.7K) = 2.888 \times 10^{-3} Km$$

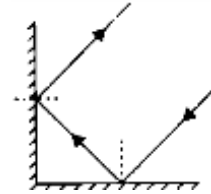
$$\Rightarrow \lambda_m = \frac{0.2888}{2.7} \text{ cm}$$

$$\Rightarrow \lambda_m = 0.10 \text{ cm} = 1 \text{ mm (for microwave)}$$

54. Action and reaction acts on two different bodies.

55. $M = \frac{f_0}{f_e}$; Resolving power $\propto a$ (aperture)

56. Rays after reflections from two perpendicular mirrors are always parallel to incident ray irrespective of angle of incidence.



57. If I is the intensity of the incident unpolarised light, the intensity transmitted by the first is $\frac{I}{2}$.

This is the intensity of incident light on the second polaroid. Intensity transmitted by the second

polaroid is $\left(\frac{I}{2}\right) \cos^2 \theta$, where θ is the angle between the axes.

$$\frac{I}{2} \cos^2 \theta = \frac{I}{2} \times \left(\frac{4}{5}\right)^2 = \frac{8}{25} I$$

$\frac{8}{25}$ is the required ratio.

58. $I_C = 10 \text{ mA}$, $I_C = 90\% I_E$

$$I_E = I_B + I_C$$

59. $A = A_0 e^{-\lambda t}$; $\frac{A}{A_0} = 2^{-t/T_{1/2}}$

$$\frac{30}{240} = (2)^{-t/T_{1/2}}$$

$$2^{-3} = 2^{-t/T_{1/2}}$$

$$T_{1/2} = t/3 = \frac{60}{3} = 20 \text{ min}$$

60. $E = mc^2 = 0.01 \times 10^{-6} \times (3 \times 10^8)^2$

$$P = \frac{E}{t} = 10^{-8} \times 9 \times 10^8 \times 10^8 = 9 \times 10^8 \text{ J/s}$$

$$P = 900 \text{ MW}$$

61. $\omega^2 = \frac{1}{LC}$

$$L' = \frac{L}{2} \text{ if } C' = 2C$$

62. $F = Kx$

63. *Ge* conducts at 0.3 V and silicon at 0.7 V. Both *Ge* and *Si* diodes are connected in parallel. When current begins to flow, the potential difference remains at 0.3 V, so no current flows through *Si*-diode.

$$\therefore \text{Potential difference across } R_L = 12 - 0.3 = 11.7V$$

$$\therefore \text{Potential of } Y = 11.7V$$

$$64. a_c = \frac{v^2}{r} = \frac{4 \times 4}{0.4} = 40m/s^2$$

$$65. F \propto r; \quad \frac{F_1}{F_2} = \frac{r_1}{r_2} = \frac{V_1^{1/3}}{V_2^{1/3}}$$

$$\frac{F_1}{F} = \left(\frac{8V}{V}\right)^{1/3} = 2F$$

$$66. d_A = 2d_B \quad T_A = \frac{T_B}{2}$$

$$V = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{T}{d\pi r^2}}$$

$$\frac{V_A}{V_B} = \sqrt{\frac{T_A}{T_B} \times \left(\frac{d_B}{d_A}\right)^2}$$

$$= \sqrt{\frac{1}{2} \times \frac{1}{4}} = \frac{1}{2\sqrt{2}}$$

$$67. \frac{W}{Q_1} = \frac{T_1 - T_2}{T_1}$$

$$W = Q_1 \left(\frac{T_1 - T_2}{T_1}\right) = 6 \times 10^4 \left(\frac{500 - 400}{500}\right) = \frac{6}{5} \times 10^4 J$$

$$W = 1.2 \times 10^4 J$$

$$68. g = \frac{GM}{R^2}; g' = \frac{GM}{(R+h)^2}; g' = \frac{g}{100}$$

$$\frac{g}{g'} = \frac{(R+h)^2}{R^2} = 100$$

$$h^2 + 2Rh - 99R^2 = 0$$

$$h = 9R$$

$$69. Y = \frac{\text{longitudinal stress}}{\text{longitudinal strain}}$$

$$Y = \frac{12 \times 10^8}{0.02/1} = 6 \times 10^{10} N/m^2$$

$$70. \rho gh = \frac{2T \cos \theta}{a}$$

$$h \propto \frac{1}{a} \quad [a = \text{radius of tube, } T = \text{surface tension}]$$

$$\frac{h'}{h} = \frac{a}{a/2} \Rightarrow h' = 2h$$

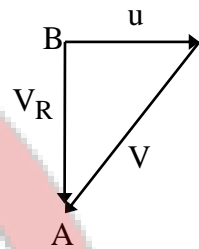
71. Because of more surface tension of water, oil spreads on the water surface.
 72. High initial permeability (easily magnetised)
 73. The resultant velocity of the plane must be along AB during forward journey.

$$t_1 = \frac{\ell}{V_R} = \frac{\ell}{\sqrt{V^2 - u^2}}$$

During return journey, the resultant velocity of the plane must be along BA

$$t_2 \frac{\ell}{V_R} = \frac{\ell}{\sqrt{V^2 - u^2}}$$

$$\text{Total time } t = t_1 + t_2 = \frac{2\ell}{\sqrt{V^2 - u^2}}$$



74. When they collide, their 'x' and 'y' components must be same

$$u \cos \alpha r = u \cos \beta (t - T) \Rightarrow \cos \alpha t = \cos \beta (t - T)$$

$$(u \sin \alpha) t - \frac{1}{2} g t^2 = (u \sin \beta) (t - T) - \frac{1}{2} g (t - T)^2$$

$$\text{Since } \cos \alpha = \cos \beta \left(1 - \frac{T}{t} \right) \text{ and } T < t$$

$$\cos \alpha < \cos \beta \text{ and } \alpha > \beta$$

$$75. C = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

$$V = \frac{1}{\sqrt{\mu_r \mu_0 K \epsilon_0}}$$

$$V = \frac{1}{\sqrt{\mu_r K}} \cdot \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

$$V = \frac{1}{n} \cdot C$$

$$\Rightarrow n = \sqrt{\mu_r K}$$

$$76. F \text{ centripetal } F = \frac{mv^2}{r} = \frac{C}{r^2}; U = -\int_{\alpha} F dr = C \int r^{-2} dr = \frac{-C}{r}; \therefore \left[K = \frac{|U|}{2} \right]$$

$$\therefore E_1 = E_K + U = C/2r - C/r = -C/2r$$

$$77. PV = nRT, \frac{V}{T} \propto \frac{1}{P}$$

$\Rightarrow DC$ and AB are constant pressure process.

78. A junction diode conducts during alternate half cycles of AC input supply. During a half cycle of conduction, the capacitor will charge itself to peak value of supply voltage.

$$\therefore \text{Voltage across capacitor} = E_{rms} \sqrt{2} = 200 \times \sqrt{2} V = 282.8 V = 283 V.$$

79. $\frac{4}{40} = \frac{X}{60}$

$$X = 6 \Omega$$

$$X = \frac{\rho l}{A}$$

$$\rho = 1.5 \times \pi \times 10^{-3} \Omega m$$

80. Ionosphere is used to transmit short wave broad casting ($< 30 MHz$) for long distance is called sky wave propagation.

81. At temperature T

$$V_g = V_0 [1 + 3\alpha_g T]$$

$$V_m = V_0 [1 + \gamma_m T]$$

$$V_m - V_g = V_0 T [\gamma_m - 3\alpha_g] \quad \dots (1)$$

$$V_m - V_g = A \times h$$

$$h = \frac{[V_m - V_g]}{A} = \frac{[V_m - V_g]}{A_0 [1 + 2\alpha_g T]} \quad \dots (2)$$

Substitute (1) in (2)

82. From the ray diagram

Intermediate image is real, inverted and magnified.

83. For n th Bohr orbit, $r = \frac{\epsilon_0 n^2 h^2}{\pi m Z e^2}$

De-Broglie wavelength $\lambda = \frac{h}{mv}$

Ratio of both r and λ , we have

$$\frac{r}{\lambda} = \frac{\epsilon_0 n^2 h^2}{\pi m Z e^2} \times \frac{mv}{h}$$

$$= \frac{\epsilon_0 n^2 h v}{\pi Z e^2}$$

But $v = \frac{Z e^2}{2 h \epsilon_0 n}$ for n th orbit

Hence, $\frac{r}{\lambda} = \frac{n}{2\pi}$

84. Upto critical angle it follows laws of refraction and after critical angle it follows laws of reflection.

85. Since current leads emf (as seen from the graph) therefore, this is an $R-C$ circuit.

$$\tan \phi = \frac{X_C - X_L}{R}$$

Here $\phi = 45^\circ$

$$\therefore X_C = R \quad [X_L = 0 \text{ as there is no inductor}]$$

$$\frac{1}{\omega C} = R \Rightarrow RC\omega = 1$$

$$\therefore RC = \frac{1}{100} s^{-1}$$

86. Let r be the radius of small drop and R , the radius of big drop. Then $\frac{4}{3}\pi R^3 = (27)\frac{4}{3}\pi r^3$ or $R = 3r$

Charge on bigger drop = $27q$

$$V = \frac{1}{4\pi\epsilon_0} \times \frac{27q}{3r} = 9 \left[\frac{1}{4\pi\epsilon_0} \times \frac{q}{r} \right] = 9 \times 10 = 90 \text{ units.}$$

87. $\epsilon = (\vec{v} \times \vec{B}) \cdot \vec{dl}, i \propto \epsilon$

88. A satellite will appear motionless when its period of revolution is the same as that of earth that is $T = 24$ hours. Let r be the radius of orbit from the centre of earth. Then dynamics of circular motion.

$$m\omega^2 r = \frac{GMm}{r^2}, \left(\frac{2\pi}{T} \right)^2 r^3 = GM$$

$$r = \left(\frac{GMT^2}{4\pi^2} \right) = \left(\frac{gR^2 T^2}{4\pi^2} \right)^{\frac{1}{3}} \quad (\because GM = gR^2)$$

89. The frequency of plucked string will be same as the wave it produces in air but speed of wave depends on medium.

90. For a disc rolling without slipping on a horizontal rough surface with uniform angular velocity, the acceleration of lowest point of disc is directed vertically upwards and is not zero (due to translation part of rolling, the tangential acceleration of lowest point is zero. Due to rotational part of rolling, the tangential acceleration of lowest point is zero and centripetal acceleration is non-zero and upwards). Hence Assertion is false Reason is true.