

Since 1999



NEET FRESH 2023-24

Mark 720	Group PCB	PCB EXAM - 65	Date : 11/01/2024 Time : 3:20 Hours
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Answer Key Version - R (NEET FRESH All Batches)

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PHYSICS

SECTION - A (35 Questions)

01. (3) Given, $\Delta Q = 4\Delta W$
 But, $\Delta W + \Delta U = \Delta Q$
 $\therefore \Delta U = 3\Delta W = \frac{3}{4}\Delta Q$
 $\Rightarrow nC_V\Delta T = \frac{3}{4}nC\Delta T$
 or, $C = \frac{4}{3}C_V = \frac{4}{3}\left(\frac{3R}{2} = 2R.\right)$
02. (3) $PV = n_1RT = RT$... (i)
 $P'V = n_2R \cdot 2T = 2RT$... (ii)
 (ii)/(i)
 $\frac{P'}{P} = 2 \Rightarrow P' = 2P$
03. (4) (I) Adiabatic process : No exchange of heat takes place with surroundings.
 $\Rightarrow \Delta Q = 0$
 (II) Isothermal process : Temp. remains constant
 $\therefore \Delta T = 0 \Rightarrow \Delta U = \frac{f}{2}nR\Delta T \Rightarrow \Delta U = 0$
 No change in internal energy [$\Delta U = 0$].
 (III) Isochoric process volume remains constant
 $\Delta V = 0 \Rightarrow W = \int P \cdot dV = 0$
 Hence work done is zero.
 (IV) In isobaric process pressure remains constant.
 $W = P \cdot \Delta V \neq 0$
 $\Delta U = \frac{f}{2}nR\Delta T = \frac{f}{2}[P\Delta V] \neq 0$
 $\therefore \Delta Q = nC_p\Delta T \neq 0$
04. (3) $PV = nRT$
05. (4) Total translational K.E. = $\frac{3}{2}RT = \frac{3}{2}pV$
06. (4) $Q_{ACB} = W_{ACB} + U_{ACB}$
 $60 \text{ J} = 30 \text{ J} + U_{ACB}$
 $U_{CB} = 30 \text{ J}$
 $U_{ADB} = U_{ACB} = 30 \text{ J}$
 $U_{ACD} = U_{ACB} = 30 \text{ J}$
 $Q_{ACD} = U_{ACB} + W_{ACB}$
 $= 10 \text{ J} + 30 \text{ J} = 40 \text{ J}.$

07. (3) $P = \frac{1}{3} \frac{mN}{V} \bar{v}^2 = \frac{1}{3} \frac{M}{V} v_{rms}^2 \Rightarrow P \propto v_{rms}^2$

$$v_{rms} = \sqrt{\frac{3RT}{M_0}} \Rightarrow v_{rms} \propto T^{1/2}$$

08. (3) The ratio of the specific heats in relation with degrees of freedom is given by $\gamma = 1 + \frac{2}{n}$
09. (3) Internal energy depends only on initial and final state
 So, $\Delta U_A = \Delta U_B$
 Also, $\Delta Q = \Delta U + W$
 As $W_A > W_B \Rightarrow \Delta Q_A > \Delta Q_B$
10. (3) $W = Q_{AB} + Q_{BC} + Q_{CA}$
 $\frac{1}{2} \times 4 \times 10^4 \times 2 \times 10^{-3} = 400 + 100 + Q_{CA}$
 $Q_{CA} = -460 = Q_{AC}$, $Q_{AC} = 460 \text{ J}$
11. (1) ΔU is same for all the paths $\Delta U_1 = \Delta U_2 = \Delta U_3$
 $W_1 > W_2 > W_3$
 $Q_1 > Q_2 > Q_3$
12. (4) a \rightarrow Isobaric, b \rightarrow Isothermal, c \rightarrow Adiabatic, d \rightarrow Isochoric
13. (3) $P \propto T^{\left(\frac{\gamma}{\gamma-1}\right)}$ $P \propto T^{7/2}$
 $\frac{2}{P_2} = \left(\frac{300}{1200}\right)^{\frac{7}{2}} \Rightarrow P_2 = 2(4)^{\frac{7}{2}} = 256 \text{ atm}.$
14. (4) $P_1V_1^{\frac{5}{3}} = P_2\left(\frac{V_1}{8}\right)^{\frac{5}{3}}$ $P_2 = 32 P_1$
15. (2) In isochoric process volume remains constant.
16. (2) $T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$
 $300(V)^{2/3} = T_2\left(\frac{8V}{27}\right)^{2/3}$
 $T_2 = 300\left(\frac{27}{8}\right)^{2/3} \Rightarrow T_2 = 300 \times \frac{9}{4} = 675 \text{ K}$
17. (3) $V_{rms} = \sqrt{\frac{3pv}{\text{mass of the gas}}}$
18. (4) Given $P = \alpha V$
 Work done, $w = \int_V^{mV} PdV$
 $= \int_V^{mV} \alpha V dV = \frac{\alpha V^2}{2}(m^2 - 1).$

19. (1) Given, $V_1 = V$ $V_2 = 2V$
 $T_1 = 27^\circ + 273 = 300 \text{ K}$ $T_2 = ?$
 From charle's law

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \text{ (: Pressure is constant)}$$
 or,
$$\frac{V}{300} = \frac{2V}{T_2}$$

$$\therefore T_2 = 600 \text{ K} = 600 - 273 = 327^\circ \text{ C}$$
20. (3) As we know,

$$\gamma = \frac{C_p}{C_v} = 1 + \frac{2}{f}$$
, where f = degree of freedom
- (1) Monatomic, $f = 3$

$$\therefore \gamma = 1 + \frac{2}{3} = \frac{5}{3}$$
- (2) Diatomic rigid molecules, $f = 5$

$$\therefore \gamma = 1 + \frac{2}{5} = \frac{7}{5}$$
- (3) Diatomic non-rigid molecules, $f = 7$

$$\therefore \gamma = 1 + \frac{2}{7} = \frac{9}{7}$$
- (4) Triatomic rigid molecules, $f = 6$

$$\therefore \gamma = 1 + \frac{2}{6} = \frac{4}{3}$$
21. (1) $W = 300 \text{ J}$ $f = 3$

$$\Delta U = \frac{f}{2} W$$

$$\Delta U = \frac{3}{2} \times 300 \Rightarrow \Delta U = 450 \text{ J}$$

$$Q = W + \Delta U = 300 + 450 = 750 \text{ J.}$$
22. (3) $dQ = du + dW$

$$nC_dT = nC_vdT + dW$$

$$\Delta U > 0 \text{ and } \Delta W > 0$$

$$\therefore C > C_v.$$
23. (2) $TV^{\gamma-1} = C$

$$\gamma - 1 = n$$

$$\gamma = \frac{4 \times \frac{7}{2} R + 2 \times \frac{5}{2} R}{4 \times \frac{5}{2} R + 2 \times \frac{3}{2} R} = \frac{19}{13} \quad n = \frac{6}{13}.$$
24. (3) From P - V graph $P \propto \frac{1}{V}$, $T = \text{constant}$ and pressure is increasing from 2 to 1.
25. (2) i) Work done in the process $B \rightarrow C$, $W = 0$

Volume is constant and heat given to the system
 $Q = 50 \text{ J}$ (given)

Hence, by the first law of thermodynamics, the change in the internal energy is

$$\Delta U = (U_C - U_B) = Q - W = 50 \text{ J}$$

$$U_C = U_B + \Delta U = 30 + 50 = 80 \text{ J.}$$

26. (3) ΔU is independent of path $\Delta U_1 = \Delta U_2$

$$Q_1 - W_1 = Q_2 - W_2$$
27. (2)
28. (3)
$$\frac{v'_{rms}}{v_{rms}} = \sqrt{\frac{T'}{T}} = \sqrt{\frac{127 + 273}{27 + 273}} = \sqrt{\frac{400}{300}}$$

$$v'_{rms} = \sqrt{\frac{4}{3}} v_{rms} = \sqrt{\frac{4}{3}} \times 200 = \frac{400}{\sqrt{3}} \text{ m/s}$$
29. (2) First law is applicable to a cyclic process. Concept of entropy is introduced by the second law of thermodynamics.
30. (4) $U = U_{O_2} + U_{Ar} = 2 \times \frac{5}{2} RT + 4 \times \frac{3}{2} RT = 11 RT$
31. (1) Mean free path $\lambda = \frac{1}{\sqrt{2} \pi d^2 n}$
 n : number of molecules/volume
 d : Diameter of molecules
32. (1) $\Delta U_A = \Delta U_B, \Delta W_A > \Delta W_B$ (since area below the process $A >$ area below the process B)

$$\Delta Q_1 = \Delta U_A + \Delta W_A, \Delta Q_2 = \Delta U_B + \Delta W_B$$

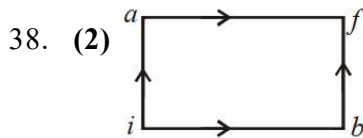
$$\Delta Q_1 > \Delta Q_2$$
33. (2) $\lambda \propto 1/P$
 When mean free path is doubled, pressure becomes half.
34. (1)
35. (4) Zeroth law of thermodynamics defines the concept of temperature.

Section - B (Attempt Any 10 Questions)

36. (2)
$$\Delta U = \frac{P_2 V_2 - P_1 V_1}{\gamma - 1} = \frac{12 \times 10^3 - 20 \times 10^3}{\frac{7}{5} - 1}$$

$$= -20000 \text{ J} = -20 \text{ kJ.}$$
37. (2)
$$W = \int P dV = \int \frac{RT}{V} dV$$
 Since $V = kT^{2/3} \Rightarrow dV = \frac{2}{3} kT^{-1/3} dT$
 Eliminating K , we find
$$\frac{dV}{V} = \frac{2}{3} \frac{dT}{T}$$
 Hence

$$W = \int_{T_1}^{T_2} \frac{2}{3} \frac{RT}{T} dT = \frac{2}{3} R(T_2 - T_1) = \frac{2}{3} R(30) = 20R.$$



For path *iaf*,

$$Q_1 = 50 \text{ cal}, W_1 = 20 \text{ cal}$$

By first law of thermodynamics,

$$\Delta U = Q_1 - W_1 = 50 - 20 = 30 \text{ cal.}$$

For path *ibf*

$$Q_2 = 36 \text{ cal}$$

$$W_2 = ?$$

$$\Delta U_{ibf} = Q_2 - W_2$$

Since, the change in internal energy does not depend on the path, therefore $\Delta U_{iaf} = \Delta U_{ibf}$

$$\Delta U_{iaf} = \Delta U_{ibf}$$

$$\Rightarrow 30 = Q_2 - W_2$$

$$\Rightarrow W_2 = 36 - 30 = 6 \text{ cal.}$$

39. (2) Change in internal energy from A → B is

$$\begin{aligned} \Delta U &= \frac{f}{2} \mu R \Delta T = \frac{f}{2} (P_f V_f - P_i V_i) \\ &= \frac{3}{2} (2P_0 \times 2V_0 - P_0 \times V_0) = \frac{9}{2} P_0 V_0 \end{aligned}$$

Work done in process A → B is equal to the Area covered by the graph with volume axis i.e.,

$$W_{A \rightarrow B} = \frac{3}{2} (P_0 + 2P_0) \times (2V_0 - V_0) = \frac{3}{2} P_0 V_0$$

H e n c e ,

$$\Delta Q = \Delta U + \Delta W = \frac{9}{2} P_0 V_0 + \frac{3}{2} P_0 V_0 = 6 P_0 V_0.$$

40. (3) Here, $Q_1 = 600 \text{ J}$, $Q_2 = -400 \text{ J}$, $Q_3 = -300 \text{ J}$ and $Q_4 = 200 \text{ J}$, $W_1 = 300 \text{ J}$, $W_2 = -200 \text{ J}$, $W_3 = -150 \text{ J}$, $W_4 = ?$

$$Q = Q_1 + Q_2 + Q_3 + Q_4 = (600 - 400 - 300 + 200) = 100 \text{ J}$$

$$= (W_4 = 50) \text{ J}$$

As the process, undergone is cycle, $dU = 0$.

$$\text{As } dU + dW = dQ$$

$$\therefore 0 + W_4 - 50 = 100$$

$$W_4 = 100 + 50 = 150 \text{ J.}$$

41. (3) $PV = nRt = \frac{M}{M_0} RT$

$$P = \frac{M}{V} \frac{RT}{M_0} = d \frac{RT}{M_0}$$

$$2P = d' \frac{R(T/3)}{M_0}$$

$$2d \frac{RT}{M_0} = \frac{d'R(T/3)}{M_0} \quad d' = 6d$$

42. (1) Here, $V_1 = 5.6 \text{ litre}$, $V_2 = 0.7 \text{ litre}$

$$\text{Number of moles of He, } n = \frac{5.6}{22.4} = \frac{1}{4}$$

If T_1, T_2 are the initial and final temperature, then

$$\text{from } T_2 V_2^{\gamma-1} = T_1 V_1^{\gamma-1}$$

$$T_2 = T_1 \left(\frac{V_1}{V_2} \right)^{\gamma-1} = T_1 \left(\frac{5.6}{0.7} \right)^{5/3-1} = T_1 \times 8^{2/3} = 4T_1$$

$$\text{Work done} = \frac{nR(T_2 - T_1)}{\gamma - 1}$$

$$W = \frac{\frac{1}{4} \times R(4T_1 - T_1)}{\frac{5}{3} - 1} = \frac{1}{4} \times \frac{3}{2} \times R \times 3T_1 = \frac{9}{8} RT_1$$

43. (1) Work done in the process $B \rightarrow C$, $W = 0$

Volume is constant and heat given to the system $Q = 50 \text{ J}$ (given)

Hence, by the first law of thermodynamics, the change in the internal energy is

$$\Delta U = (U_C - U_B) = Q - W = 50 \text{ J}$$

$$U_C = U_B + \Delta U = 30 + 50 = 80 \text{ J}$$

For the process $A \rightarrow B$, $\Delta U = U_B - U_A$

$$= 30 \text{ J and } W = \text{area } ABED = \Delta E - \Delta A$$

$$= 2 \times 30 = 60 \text{ J}$$

$$\therefore Q = \Delta U + W = 30 + 60 = 90 \text{ J}$$

For the process $C \rightarrow A$, $\Delta U = U_A - U_C = 0 - 80$

$$\Rightarrow \Delta U = -80 \text{ J}$$

and $W = \text{area } ACED = \text{area } ACB + \text{area } ABED$

$$W = \left(\frac{1}{2} \times AB \times BC \right) + (DE - DA)$$

$$W = \left(\frac{1}{2} \times 2 \times 60 \right) + (2 \times 30) = 120 \text{ J}$$

Since in this process the volume decreases, the work will be negative ($W = 120 \text{ J}$) that is, the work will be done on the system. Now, by the first law of thermodynamics, will have

$$Q = \Delta U + W = -80 - 120 = -200 \text{ J}$$

Since it is negative, this heat is given out by the system.

44. (2) Kinetic theory of N molecule of gas

$$E = \frac{3}{2} NkT$$

Initially $E_1 = \frac{3}{2} N_1 k T_1$ and finally $E_2 = \frac{3}{2} N_2 k T_2$

But according to problem

$$E_1 = E_2 \text{ and } N_2 = 2N_1$$

$$\therefore \frac{3}{2} N_1 k T_1 = \frac{3}{2} (2N_1) k T_2 \Rightarrow T_2 = \frac{T_1}{2}$$

Since the kinetic energy constant

$$\frac{3}{2} N_1 k T_1 = \frac{3}{2} N_2 k T_2 \Rightarrow N_1 T_1 = N_2 T_2$$

$$\therefore NT = \text{constant}$$

From the ideal gas equation of N molecule

$$PV = NkT$$

$$\Rightarrow P_1 V_1 = P_2 V_2 \quad \therefore P_1 = P_2$$

[As $V_1 = V_2$ and $NT = \text{constant}$]

[As $f_1 = 5$ (for oxygen) and $f_2 = 3$ (for argon)]

45. (1) For isothermal process

$$P_1 V_1 = P_2 V_2$$

$$4P_0 V_0 = P_2 \times V_0$$

$$P_2 = 4P_0$$

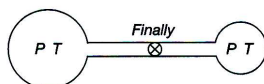
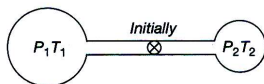
For adiabatic process

$$P_1 V_1^\gamma = P_2 V_2^\gamma$$

$$P_2 = P_1 \left(\frac{V_1}{V_2} \right)^\gamma = P_0 \left(\frac{4V_0}{V_0} \right)^{3/2} \quad P_2 = 8P_0.$$

46. (4) Number of moles in first vessel $\mu_1 = \frac{P_1 V}{RT_1}$ and

number of moles in the second vessel $\mu_2 = \frac{P_2 V}{RT_2}$



If both vessels are joined together then the quantity of gas remains same i.e., $\mu = \mu_1 + \mu_2$

$$\frac{P(2V)}{RT} = \frac{P_1 V}{RT_1} + \frac{P_2 V}{RT_2}$$

$$\Rightarrow \frac{P}{RT} = \frac{P_1}{2T_1} + \frac{P_2}{2T_2}$$

47. (1)

48. (1) According to questions $VT = K$ we also know that $PV = nRT$

$$\Rightarrow T = \left(\frac{PV}{nR} \right)$$

$$\Rightarrow V \left(\frac{PV}{nR} \right) = k \Rightarrow PV^2 = K$$

$$\therefore C = \frac{R}{1-x} + C_v \text{ (For polytropic process)}$$

$$C = \frac{R}{1-2} + \frac{3R}{2} = \frac{R}{2}$$

$$\therefore \Delta Q = nC \Delta T$$

$$= \frac{R}{2} \times \Delta T \text{ [here, } n = 1 \text{ mole]}$$

49. (3) In adiabatic process

$$PV^\gamma = \text{constant}$$

$$\therefore P \left(\frac{m}{\rho} \right)^\gamma = \text{constant} \quad \left(\because V = \frac{m}{\rho} \right)$$

As mass is constant

$$\therefore P \propto \rho^\gamma$$

If P_i and P_f be the initial and final pressure of the gas and ρ_i and ρ_f be the initial and final density of the gas. Then

$$\frac{P_f}{P_i} = \left(\frac{\rho_f}{\rho_i} \right)^\gamma = (32)^{7/5}$$

$$\Rightarrow \frac{n P_i}{P_i} = (2^5)^{7/5} = 2^7$$

$$\Rightarrow n = 2^7 = 128.$$

50. (4) Using, $\gamma_{\text{mixture}} = \frac{n_1 C_{p1} + n_2 C_{p2}}{n_1 C_{v1} + n_2 C_{v2}}$

$$\Rightarrow \frac{n_1}{\gamma_1 - 1} + \frac{n_2}{\gamma_2 - 1} = \frac{n_1 + n_2}{\gamma_m - 1}$$

$$\Rightarrow \frac{3}{\frac{4}{3} - 1} + \frac{2}{\frac{5}{3} - 1} = \frac{5}{\gamma_m - 1}$$

$$\Rightarrow \frac{9}{1} + \frac{2 \times 3}{2} = \frac{5}{\gamma_m - 1} \Rightarrow \gamma_m - 1 = \frac{5}{12}$$

$$\Rightarrow \gamma_m = \frac{17}{12} = 1.42$$

CHEMISTRY

SECTION - A (35 Questions)

51. (2)

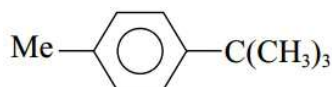
A – (r), B – (p, s), C – (p), D – (p, q)

52. (3)

Insulin is an example of globular protein.

53. (1)

Friedel craft alkylation reactions via rearrangement of isobutyl cation into tertiary butyl cation.



54. (4)

Decreasing order of reactivity of alkyl halide toward dehydro halogenation (E₁ & E₂ elimination) as 3° > 2° > 1°.

55. (1)

In DNA the complimentary base are Adenine and thymine. Guanine and cytosine. The genetic information for cell is contained in the sequence of bases A, T, G and C in DNA molecule.

56. (3)

All those carbohydrates which reduce Fehling's solution and Tollens' reagent are referred to as reducing sugars

57. (1)

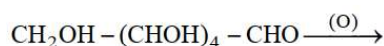
I and II pairs are correctly matched while III and IV are not.

58. (4)

Cyclohexylamine

59. (1)

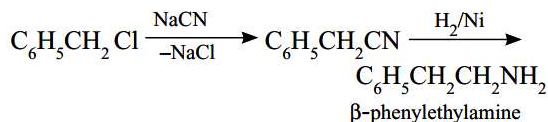
Glucose contains an aldehyde group. It is oxidised into acidic group by bromine water and gluconic acid is formed



60. (4)

Six carbon atoms are arranged in straight chain

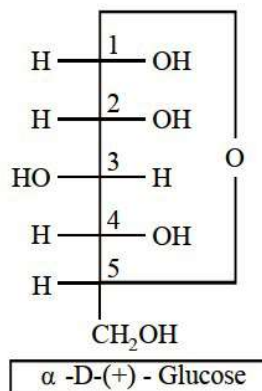
61. (2)



62. (2)

a, c, e

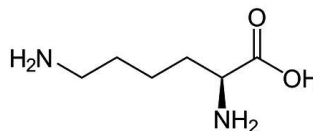
63. (4)



(Fischer formula)

64. (4)

In lysine 1-amino group is more than carboxylic group



65. (3)

Assertion is correct statement but reason is wrong statement.

66. (1)

Assertion and reason both are correct statements and reason is correct explanation for assertion.

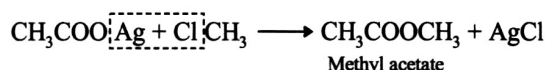
67. (1)

Except alanine, all amino acids are essential amino acids which cannot be synthesised in the body and must be obtained through diet.

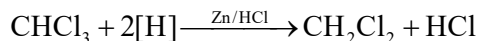
68. (3)

During denaturation 2° and 3° structures are destroyed but 1° structure remains intact.

69. (2)



70. (4)

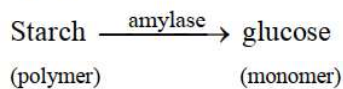
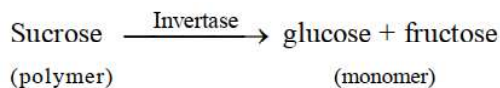


71. (2)

Beri-Beri

72. (4)

The function of enzymes in the living system is to catalyse biochemical reactions which occur in living systems. e.g. invertase, pepsin, amylase.



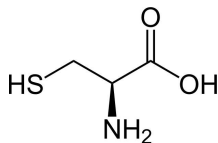
73. (1)

Lactose is a disaccharide

74. (1)

Polysaccharides

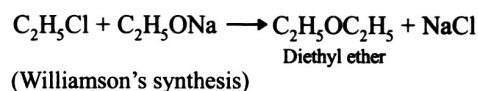
75. (3)



76. (2)

If the compound rotates the plane polarised light to the right, i.e., clockwise direction, it is called dextrorotatory (Greek for right rotating) or the d-form and is indicated by placing a positive (+) sign before the degree of rotation. If the light is rotated towards left (anticlockwise direction), the compound is said to be laevorotatory or the l-form and a negative (-) sign is placed before the degree of rotation.

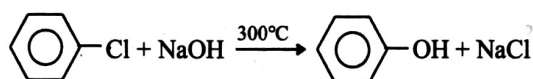
77. (4)



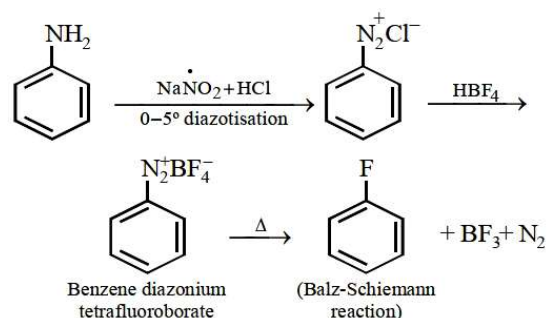
78. (1)

In chlorobenzene -Cl group is weakly deactivating but act as ortho and para director.

79. (1)



80. (4)



81. (1)

Aryl chlorides and bromides can be easily prepared by electrophilic substitution of arenes with chlorine and bromine respectively in the presence of Lewis acid catalysis like iron or iron (III) chloride. The ortho and para isomers can be easily separated due to large difference in their melting points. Reactions with iodine are reversible in nature and require the presence of an oxidising agent (HNO_3 , HIO_4) to oxidise the HI formed during iodination. Fluoro compounds are not prepared by this method due to high reactivity of fluorine.

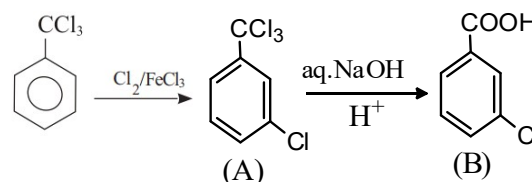
82. (4)

Ketone and aldehyde

83. (2)

The sugar moiety in DNA molecule is β -D-2-deoxyribose whereas in RNA molecule, it is β -D-ribose. Nucleotide is a nucleoside linked to phosphoric acid at 5¹-position of sugar moiety

84. (3)



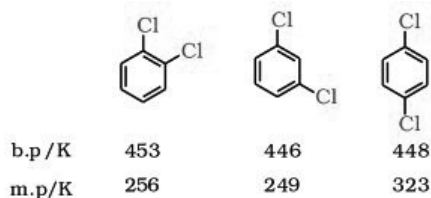
85. (3)

Rate of $\text{ArS}_{\text{N}}2$ reaction \propto electron withdrawing group present on benzene ring.

SECTION - B (Attempt Any 10 Questions)

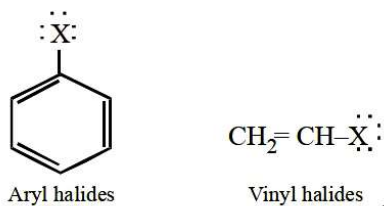
86. (4)

The boiling points of isomeric haloalkanes decrease with increase in branching. For example, 2-bromo-2-methylpropane has the lowest boiling point among the three isomers



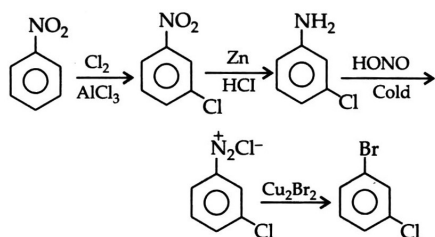
87. (3)

The carbon-halogen bonds of aryl halides are both shorter and stronger (due to possibility of resonance) than the carbon-halogen bonds of R-X and in this respect as well as in their chemical behaviour, they resemble vinyl halides (CH₂=CHX) more than alkyl halides.



Halogen attached to C is sp² hybridised C, C-X bond is shorter and stronger because of partial double bond character due to delocalisation of electrons on halogens

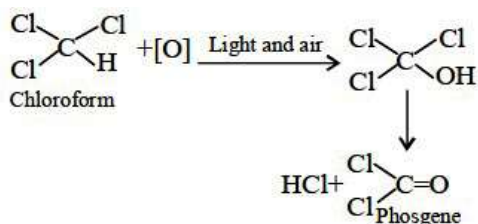
88. (2)



89. (1)

Tertiary > secondary > primary

90. (1)



91. (2)

DNA is responsible for transmission of heredity character.

92. (2)

It is a branched chain polymer of α-D-glucose units in which chain is formed by C1-C4 glycosidic linkage whereas branching occurs by C1-C6 glycosidic linkage.

93. (2)

Polychloro derivative having higher density than water. But monochloro derivative having lower density than water.

94. (1)

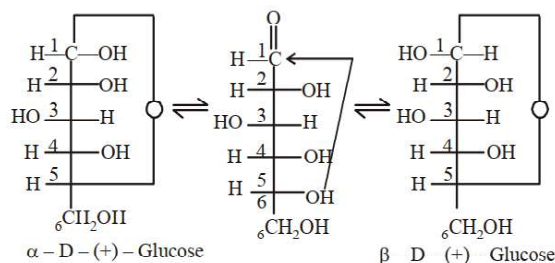
Free radical substitution reaction takes place.

95. (1)

(i) and (iii)

96. (2)

To explain the properties which can not be explained by open chain structure of glucose it was proposed that one of the -OH groups may add to the -CHO group and form a cyclic hemiacetal structure as shown below.



97. (3)



98. (1)

Decreasing order of reactivity of alkyl halide toward S_N2 as 1° > 2° > 3°.

99. (4)

Elimination reaction in presence of small size base follow Saytzeff rule (More substituted alkene is the major product).

100. (4)

