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NEET 2023-24

Mark 720	Group PCB	PRE FINAL ROUND - 06	Date : 28/03/2024 Time : 3 :20 Hours

Answer Key Version - Q (PCB NEET 2023-24)

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PHYSICS

SECTION - A (35 Questions)

01. **(4)** We know that moment of inertia (I) = MK^2, (where M = Mass of the wheel)

or $M = \frac{I}{K^2} = \frac{360}{(0.6)^2} = \frac{360}{0.36} = 1000$ kg

02. **(3)** $S = \frac{Q}{M \times \Delta T}$, at boiling $\Delta T = 0$ $\therefore s = \infty$

03. **(4)** Here, $n = 2$, $T_1 = 30°C$, $T_2 = 35°C$; $T_2 - T_1 = 35 - 30 = 5°C = 5K$

R = 8.31 J/mole K, dQ = ?

As the gas in balloon is expanding at constant pressure, therefore, $dQ = nC_p dT$

Helium is monoatomic gas with $C_p = \frac{5}{2}R$

$\therefore\ dQ = 2 \times \frac{5}{2} R(T_2 - T_1) = 5R(T_2 - T_1)$

$= 5 \times 8.31 \times 5 = 207.75\ J \simeq 208J$

04. **(3)** Wave velocity $v = \frac{\lambda}{T} = \frac{\omega\lambda}{2\pi}$

Maximum particle velocity $(v_{max})_\rho = A\omega$

Given, $v = (v_{max})_\rho$

$\frac{\omega\lambda}{2\pi} = A\omega \Rightarrow \lambda = 2\pi A$

05. **(1)** $s = u + \frac{a}{2}(2n - 1)$

$= 7 + \frac{4}{2}(2 \times 5 - 1)$

$= 7 + 2 \times 9 = 25$

06. **(3)**

07. **(3)** $W = \vec{F} \cdot \vec{r} = (5\hat{i} + 3\hat{j} + 2\hat{k}) \cdot (2\hat{i} - \hat{j})$

$= 10 - 3 = 7$ J

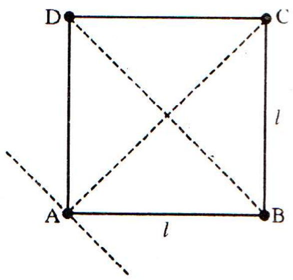
08. **(4)** Work = Area enclosed by F-s graph and s-axis

$= \frac{35 + 15}{2} \times 10 = 250J$

09. **(1)** $\tau = \frac{\Delta J}{\Delta t}$. When $\tau = 0$, $\Delta J = 0$ or J = constant.

10. **(3)** $I = m_B\left(\frac{l}{\sqrt{2}}\right)^2 + m_D\left(\frac{l}{\sqrt{2}}\right)^2 + m_C(l\sqrt{2})^2$

$= m\frac{l^2}{2} + \frac{ml^2}{2} + 2ml^2 = 3ml^2$



11. **(4)** Let θ be the final common temperature. Further, let s_c and s_h be the average heat capacities of the cold and hot (initially) bodies respectively (where $s_c < s_h$ given)

From, principle of calorimetry,

heat lost = heat gained

$s_h(100^0C - \theta) = s_c\theta$

$\therefore\ \theta = \frac{s_h}{(s_h + s_c)} \times 100^oC = \frac{100^0C}{\left(1 + \frac{s_c}{s_h}\right)}$

$\because\ s_c / s_h < 1 \quad \therefore 1 + s_c / s_h < 2$

$\therefore \theta > \frac{100^0C}{2}$ or $\theta > 50^0C$

12. **(2)**

13. **(1)** $E \propto T$, with rise of temperature kinetic energy increases.

14. **(2)** Loss in potential energy = mgh

$= 2 \times 10 \times 2 = 40$ J

15. **(4)** The given statement is zeroth law of thermodynamics.

16. **(2)**

17. **(2)**

18. **(4)** Work done $= \frac{1}{2} \times \text{load} \times \text{extension} = \frac{1}{2} Fl$

19. **(1)** Young's module of a perfectly rigid body is infinite.

20. **(2)**

21. **(3)** Given, $r = 5$ cm $= 4 \times 10^{-2}$ m and $T = 0.2\,\pi$ s

We know that acceleration $a = r\omega^2 = \frac{4\pi^2}{T^2} r$

$$= \frac{4 \times \pi^2 \times 5 \times 10^{-2}}{(0.2\pi)^2} = 5\text{ms}^{-2}$$

22. **(2)**

23. **(1)**

24. **(3)**

25. **(1)** F = 4C

$$\frac{F-32}{180} = \frac{C-0}{100}$$

26. **(4)** $x = a + bt + ct^2$

velocity $v = \frac{dx}{dt} = 0 + b + c \cdot 2t = b + 2ct$

acceleration $f = \frac{dv}{dt} = 0 + 2c = 2c$

27. **(3)**

28. **(3)** Given H = R, $\frac{u^2 \sin^2\theta}{2g} = \frac{2u^2 \sin\theta\cos\theta}{g}$

$\Rightarrow \tan\theta = 4 \Rightarrow \theta = \tan^{-1}(4)$

29. **(4)** In each cyclic process

$\Delta U = U_{Final} - U_{initial} = 0$

30. **(2)** $S_n = u + \frac{a}{2}(2n-1) = \frac{a}{2}(2n-1) \quad (\because u = 0)$

$S_{n+1} = \frac{a}{2}(2n+1) \quad \therefore \frac{S_n}{S_{n+1}} = \left(\frac{2n-1}{2n+1}\right)$

31. **(1)**

32. **(1)**

33. **(4)** Given, damping force $\propto$ velocity

$F = kv \Rightarrow k = \frac{F}{v}$

Unit of $k = \frac{\text{unit of F}}{\text{unit of } v} = \frac{kg - ms^{-2}}{ms^{-1}} = kgs^{-1}$

34. **(3)** We know that torque = Force × Perpendicular distance. Therefore dimensions of torque = Dimensions of force × Dimension of distance = $[MLT^{-2}][L] = ML^2T^{-2}$. And work = Force × Distance. Therefore dimensions of work = Dimensions of force × Dimensions of distance = $[MLT^{-2}] \times [L]$ Thus, the dimensions of torque and work are same.

35. **(2)**

SECTION - B (Attempt Any 10 Questions)

36. **(4)** For closed organ pipe, possible frequency,

$f_n = (2n+1)\frac{v}{4l} = (2n+1)\frac{340}{4 \times 0.85}$

For $n = 0, f_0 = 100\text{Hz}$

$n = 1, f_1 = 300\text{Hz}$

$n = 2, f_2 = 500\text{Hz}$

$n = 3, f_3 = 700\text{Hz}$

$n = 4, f_4 = 900\text{Hz}$

$n = 5, f_5 = 1100\text{Hz}$

$n = 6, f_6 = 1300\text{Hz}$

Hence possible natural oscillation whose frequencies are less than 1250 Hz will be 6(n = 0, 1, 2, 3, 4, 5)

37. **(4)** As acceleration due to gravity acts against the motion up to the highest point, hence vertical component of the velocity first decreases. But during downward motion, acceleration due to gravity acts in the direction of motion; hence vertical component of velocity then starts increasing.

38. **(4)** $V_{rms} = \sqrt{\frac{3RT}{M}} \quad V_{rms} \propto \frac{1}{\sqrt{M}}$

39. **(3)** $a = \frac{(m_1 - m_2)g}{(m_1 + m_2)} = \frac{(10-5)g}{10+5}$ or $a = \frac{g}{3}$

40. **(2)** Distance for last two second

$= \frac{1}{2}\times 2\times 10 = 10\ m$

and Total distance $= \frac{1}{2}\times(6+2)\times 10 = 40$ m

41. **(1)** $T = 2\pi\sqrt{\frac{m}{K}}$

42. **(1)** $v = \frac{dx}{dt} = 12 - 3t^2 = 0$ ...(i)

If velocity is zero, $12 - 3t^2 = 0$ which gives t = 2 sec

For acceleration again differential equation (i)

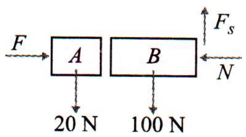
$a = \frac{d^2x}{dt^2} = -6t$ ...(ii)

At time t = 2 sec, $a = -6 \times 2 = -12$ m/s^2

Hence retardation = 12 m/s^2

43. **(3)** As is clear from figure, for the system to be in vertical equilibrium.

$F_s = 100 + 20 = 120$ N



44. **(4)**

45. **(1)** Here, $m = 10^{-2}$ kg, $v_0 = 10$ m/s, t = 10 s

F = – kv^2, k = ?

If v_t is velocity of body after 10s, then

$\frac{1}{2}mv_t^2 = \frac{1}{8}mv_0^2 \therefore v_t = \frac{v_0}{2} = \frac{10}{2} = 5$ m/s

From F = – kv^2

$m\frac{dv}{dt} = -kv^2$

$\frac{dv}{dt} = \frac{-k}{m}v^2 = -100kv^2$ or $\frac{dv}{v^2} = -100k\,dt$

$\int_{10}^{5}\frac{dv}{v^2} = -100K\int_{0}^{10}dt$

$\frac{1}{5} - \frac{1}{10} = 100k(10-0)$

$\frac{1}{10} = 100\times 10k$

$k = 10^{-4}\,kg\ m^{-1}$

46. **(3)** In cyclic process $\Delta U = 0$; from First law of thermodynamics $Q = \Delta U + W$.

$\therefore Q = W = -$Area ABCA

$= -\frac{1}{2}\times(3-1)\times(5-1) = -4J$

47. **(1)**

48. **(2)** F = [MLT^{-2}]

49. **(2)** Heat required to melt whole ice = ML

= 80 × 1000 = 80, 000 cal

$\therefore$ Heat supplied by water to cool upto 0°C

= 1,000 × 1 × 80 = 80, 000 cal

$\therefore$ Heat supplied = Heat required; whole of the ice will just melt. Temperature of the mixture is 0°C

50. **(4)** Force acting on the block down the incline is

$mg\sin\theta = 1\times 10\sin 37^0 = 6.018$ N

Force of friction acting up the incline is

$F = \mu R = \mu mg\cos\theta = 0.8\times 1\times 10\cos 37^0 = 6.389$ N

As F > $mg\sin\theta$, the block will not slide down the incline, even when tension in the string is zero.

CHEMISTRY

SECTION - A (35 Questions)

51. **(3)** As $n_{Fe} = \frac{560}{56} = 10$, $n_{N_2} = \frac{70}{14} = 5$

So, number of atoms of Fe are twice that of

N-atoms.

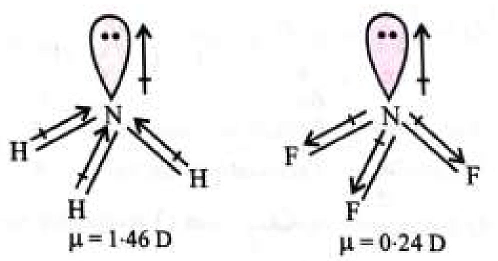
52. **(2)** V.D. = $\frac{M}{2}$

53. **(1)** sp^2 sp^2 sp sp

$H_2C = CH - C \equiv CH$

54. **(3)** ABC = CAB

55. **(2)** BF_3 is triangular planar and B_2H_6 is a dimer of triangular planar molecule (BH_3), therefore, both of these have zero dipole moment. NH_3 and NF_3, on the other hand have pyramidal structures and thus have dipole moments



In NH_3, the dipole moments of the three N–H bonds reinforce the dipole moment due to pair of elctrons but in NF_3, the dipole moments of the three N–F bonds oppose the dipole moment due to lone pair of electrons. As a result, dipole moment of NH_3 (μ=1.46 D) is higher than that of NF_3 (μ=0.24 D).

56. **(4)** $MnO_4^- \rightarrow Mn^{2+}$. In this reaction $5e^-$ are needed for the reduction of Mn^{2+} as :

$MnO_4^- + 5e^- \rightarrow Mn^{2+}$.

57. **(2)** $\overset{*}{S}O_2 = +4$

$H_2\overset{*}{S}O_4 = +6$

$Na_2\overset{*}{S}_2O_3 = +2$

$Na_2\overset{*}{S}_4O_6 = +\frac{5}{2}$

58. **(3)** It will be more close to 575 kJ mol^{-1}. The value for Al should be lower than that of Mg because in case of Al, a less tightly held p-electron is to be removed while in Mg, a more tightly held s-electron is to be removed.

59. **(1)** 0.1 mol/L

60. **(4)** 4

61. **(3)** 2, 3-dimethyl butane

62. **(3)** 2-phenyl-2-propanol

63. **(2)** The correct statement is the electron affinity of fluorine is less negative than that of chlorine.

64. **(1)** As combustion is always exothermic $\Delta H = -ve$

65. **(1)** (ii) and (iv) are correct

66. **(3)** $C_2H_5Cl + Mg \xrightarrow{\text{Dryether}} \underset{(X)}{C_2H_5MgCl} \xrightarrow{H_2O} \underset{(Y)}{C_2H_6} + \underset{(Z)}{Mg.(Cl).OH}$

67. **(2)** (A) At. No. 60 corresponds to Nd which is a 4 f-block element.

(B) At. No. 57 corresponds to La which is a d-block element.

(C) At. No. 56 corresponds to Ba which is a s-block element.

(D) At. No. 52 corresponds to Te which is a p-block element,

68. **(2)** 2, 3 and 4

69. **(2)**

70. **(1)** In the Henderson's equation, pH = pKa + log [Salt]/[Acid] when [Salt] = [Acid] pH = pKa = 9.30

71. **(1)** If both assertion and reason are true and reason is the correct explanation of assertion.

72. **(3)** 3

73. **(2)** 2 : 1

74. **(2)**

75. **(1)** G = H – T.S

It is a single valued function of thermodynamic state of the system.

76. **(3)** Statement-I is correct and Statement-II is incorrect

77. **(3)** HCl being stronger acid undergoes dissociation as compared to acetic acid. In equimolar solution number of titrable proton in HCl is greater than present in acetic acid.

78. **(1)** Liquified Ga expand on solidificatin Ga is less electropositive in nature, It has the weak metallic bond so it expand on solidification.

79. **(3)** Bridge bonds are longer than terminal bonds

80. **(1)** Ionic compounds possess high melting points and non-directional bonds.

81. **(2)** Propane-1, 2,3-tricarbonitrile

82. **(3)** Gram molecule mass

83. **(2)** Molar heat capacity

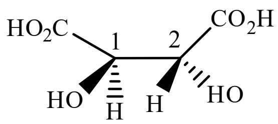
84. **(4)** Bond angle decreases with decrease of electronegativity or with increase of size of the central atom. Thus, the order is $H_2O > H_2S > H_2Se > H_2Te$.

85. **(4)** 3-methylheptane,

$$CH_3CH_2-\overset{*}{C}H(CH_3)-CH_2CH_2CH_3$$ has a chiral carbon and it is optically active.

SECTION - B (Attempt Any 10 Questions)

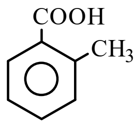
86. **(4)** Correct A : Ionization enthalpy is always positive.
Correct R : Energy is always absorbed when electrons are removed.

87. **(2)** 

Both C_1 and C_2 have R-configuration here.

88. **(2)** (i) Liquid $\rightleftharpoons$ vapour equilibrium exists at the boiling point.
(ii) Solid $\rightleftharpoons$ liquid equilibrium exists at the melting point.
(iii) Solid $\rightleftharpoons$ vapour equilibrium exists at the sublimation point.
(iv) Solute (s) $\rightleftharpoons$ Solute (solution) equilibrium exists in a saturated solution.

89. **(3)** Availability of low lying d-orbitals is silicon

90. **(1)** 

91. **(4)** Size of the orbit

92. **(3)** The correct statemen is : The equatorial bonds are at an angle of 120° with each other whereas axial bonds make an angle of 90° with the equatorial bonds.

93. **(4)** $1 > 3 > 2 > 4$

94. **(1)** $N \equiv N + \frac{1}{2}O = O \longrightarrow N = N = O$

$\Delta H_f^\circ = \Sigma BE$ of reactants $- \Sigma BE$ of products

$= [BE(N \equiv N) + \frac{1}{2}BE(O = O)] - [BE(N{=}N) + BE(N = O)]$

$= (946 + \frac{1}{2} \times 498) - (418 + 607)$

$= 170$ kJ resonance energy

$= \Delta H_f^\circ$ (observed) $- \Delta H_f^\circ$ (calculated) $= 82 - 170$

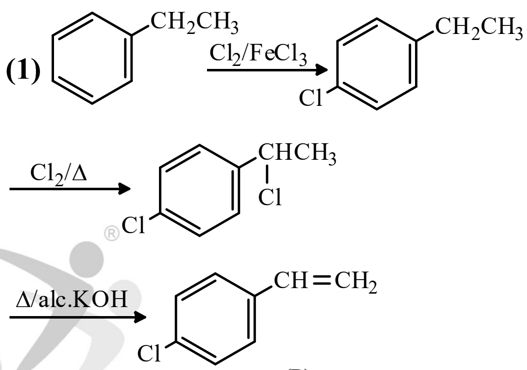
$= -88$ kJ mol^{-1}

95. **(3)** No. of hybrid orbital formed $(X) = \frac{1}{2}$ [Valence electrons of central atom (VE) + No. of monovalent atoms/groups (MA)–charge on polyatomic cation (c) + charge on polyatomic anion

For SF_2, $X = \frac{1}{2}(6 + 2 - 0 + 0) = 4$,
Hybridization $= sp^3$

For SF_4, $X = \frac{1}{2}(6 + 4 - 0 + 0) = 5$,
Hybridization $= sp^3d$

For SF_6, $X = \frac{1}{2}(6 + 6 - 0 + 0) = 6$,
Hybridization $= sp^3d^2$

96. **(1)** 

(P)

97. **(4)** $(NH_4)_2SO_4 \rightleftharpoons 2NH_4^+ + SO_4^-$

$\overset{*}{N}H_4^+$

$x + 4 = +1;\ x = 1 - 4 = -3.$

98. **(4)** O_2 : Bond order = 2, paramagnetic
N_2 : Bond order = 3, diamagnetic
H_2 : Bond order = 1, diamagnetic
C_2 : Bond order = 2, diamagnetic

99. **(1)** The product obtained on dehydration of (1) is conjugated and is more stable. Therefore, it is most readily dehydrated.

100. **(1)** $N_R = \frac{N_AV_A - N_BV_B}{V_T} = \frac{200 \times \frac{1}{10} - 200 \times \frac{1}{20}}{}$

$N_R = \frac{1}{100} = (0.01)$

$pH = -\log_{10}[H^+]$

$= -\log[0.01]$

$= 2$