

ULTIMATE TEST SERIES NEET -2020
XII TEST-3 SOLUTION

Test Date :21-03-2020

[PHYSICS]

$$1. I_B = \frac{Mr^2}{2} + \left[\frac{Mr^2}{2} + M(2r)^2 \right] = 5Mr^2$$

2. Net force on motor will be
 $F_m = [920 + 68(10)]g + 6000$
 $= 22000 \text{ N}$
 So, required power for motor
 $P_m = \vec{F}_m \cdot \vec{v}$
 $= 22000 \times 3$
 $= 66000 \text{ watt}$

$$3. I = Mr^2 = (2\pi r \lambda) R^2, I \propto R^3 \frac{1}{8} = \left[\frac{R}{nR} \right]^3, n = 2$$

$$4. x = \frac{0 \times \pi(28)^2 - 7 \times \pi(21)^2}{\pi(28)^2 - \pi(21)^2}$$

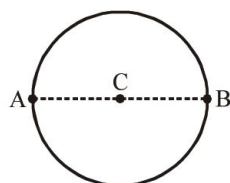
$$x = -\frac{7\pi(21)^2}{\pi \times 7 \times 49} = -9 \text{ cm}$$

distance from origin = 9 cm

$$5. \frac{I_2}{I_1} = \frac{m_2 r_2^2}{m_1 r_1^2} = \frac{(A \times 2\pi r_2) \rho r_2^2}{(A \times 2\pi r_1) \rho r_1^2} = \frac{r_2^3}{r_1^3}$$

$$\frac{r_2}{r_1} = (4)^{1/3}$$

$$6. \frac{\omega_A}{\omega_C} = \frac{r_A}{r_C} = \frac{r_C}{r_A}$$



$$= \frac{a}{2a} = \frac{1}{2}$$

$$7. I = \frac{2}{5} MR^2$$

$$I' = \frac{2}{5} MR^2 + \frac{2}{5} MR^2 + \frac{7}{5} MR^2 + \frac{7}{5} MR^2$$

$$I' = \frac{18}{5} mR^2 = 9I$$

$$8. mgh = \frac{1}{2} mv^2 + \frac{1}{2} I\omega^2$$

$$mgh = \frac{1}{2} mv^2 + \frac{1}{2} \frac{MR^2}{2} \times \frac{v^2}{R^2}$$

$$v = \sqrt{\frac{4mgh}{2m + M}}$$

$$9. (2 \times 3) \hat{i} + (1 \times 4)(-\hat{i}) = (2 + 1) \vec{v}$$

$$2\hat{i} = 3\vec{v}$$

$$\vec{v} = \frac{2}{3} \hat{i} \text{ m/s}$$

$$10. \vec{\tau} = \frac{d\vec{J}}{dt} = \frac{d}{dt} (\vec{r} \times \vec{p}) = m \frac{d}{dt} (\vec{r} \times \vec{v})$$

$$\vec{\tau} = [16 t] \hat{k}$$

$$\text{at } t = 2 \quad \vec{\tau}_{t=2} = (16 \times 2) \hat{k} = 32 \hat{k} \text{ N-m}$$

$$11. \vec{r}_{cm} = \frac{m_1 \vec{r}_1 + m_2 \vec{r}_2 + m_3 \vec{r}_3}{m_1 + m_2 + m_3}$$

12. $P = \tau \cdot \omega$

$$P = I \alpha \cdot \omega = I \left(\omega \frac{d\omega}{d\theta} \right) \cdot \omega$$

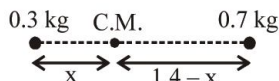
$$\omega^2 d\omega = \frac{P}{I} d\theta$$

$$\omega \propto \theta^{1/3}$$

$$\omega \propto (n)^{1/3}$$

13. B

14. $0.3X = 0.7(1.4 - X)$
 $x = 0.9 \text{ m}$



15. C

16. Moment of inertia of solid sphere of mass M and radius R about an axis passing through the centre of mass is: $I = \frac{2}{5} MR^2$. Let the radius of the disc is r.

Moment of inertia of circular disc of radius r and mass M about an axis passing through the centre of mass and perpendicular to its plane $= \frac{1}{2} Mr^2$.

Using theorem of parallel axes, moment of inertia of disc about its edge is:

$$I' = \frac{1}{2} Mr^2 + Mr^2 = \frac{3}{2} Mr^2$$

Given : $I = I'$

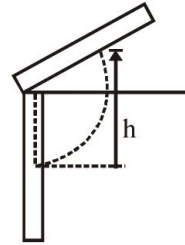
or $\frac{2}{5} MR^2 = \frac{3}{2} Mr^2$

or $r^2 = \frac{4}{15} R^2$

or $r = \frac{2R}{\sqrt{15}}$

17. $TE_i = TE_f$

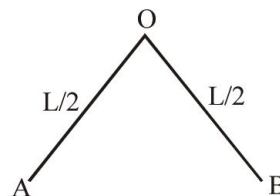
$$\frac{1}{2} I \omega^2 = mgh$$



$$\frac{1}{2} \times \frac{1}{3} m l^2 \omega^2 = mgh$$

or $h = \frac{1}{6} \frac{l^2 \omega^2}{g}$

18.



Total mass = M, total length = L

Moment of inertia of OA = OB about Q

$$= MI_{\text{total}} = 2 \times \left(\frac{M}{2} \right) \times \left(\frac{L}{2} \right)^2 \cdot \frac{1}{3} = \frac{ML^2}{12}$$

19. For pure translatory motion of object, the force should act at the centre of mass.

$$Y_{\text{CM}} = \frac{m \times 2\ell + 2m \times \ell}{3m} = \frac{4\ell}{3}$$

20. $\frac{1}{2} MV^2 = \frac{1}{2} KL^2$

$$V^2 = \frac{K}{M} L^2 \Rightarrow V = \sqrt{\frac{K}{M}} L \Rightarrow P = M \sqrt{\frac{K}{M}} L = \sqrt{MK} L$$

21. $\vec{r}_{\text{cm}} = \frac{m_1 \vec{r}_1 + m_2 \vec{r}_2}{m_1 + m_2}$

22. Required fraction

$$\begin{aligned}
 &= \frac{K_R}{K_R + K_T} = \frac{\frac{1}{2}I\omega^2}{\frac{1}{2}I\omega^2 + \frac{1}{2}Mv^2} \\
 &= \frac{\frac{1}{2}MR^2\omega^2}{\frac{1}{2}MR^2\omega^2 + \frac{1}{2}Mv^2} \\
 &= \frac{MR^2(v^2/R^2)}{MR^2(v^2/R^2) + Mv^2} \\
 &= \frac{Mv^2}{Mv^2 + Mv^2} = \frac{1}{2}
 \end{aligned}$$

23. $\vec{v}_{cm} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2}{m_1 + m_2}$

24. From given graphs :-

$$F_x = \frac{3}{4}x + 10, F_y = -\frac{4}{3}y + 20, F_z = \frac{4}{3}z - 16$$

$$W = \int \vec{F} \cdot d\vec{r} = \int_0^8 F_x dx + \int_5^{20} F_y dy + \int_{12}^0 F_z dz$$

$$W = 104 + 50 + 96 = 250 \text{ J}$$

25. D

26. $W = \frac{1}{2} \times 5 \times 10^3 [(10 \times 10^{-2})^2 - (5 \times 10^{-2})^2]$

$$W = 18.75 \text{ N-m}$$

27. B

28. $\Delta u = nC_v \Delta T = n \frac{R}{\gamma-1} \Delta T = \frac{p\Delta V}{\gamma-1} = \frac{pV}{\gamma-1}$

29. $\therefore F \propto V$

$$\therefore P = V^2 \frac{dm}{dt} \quad \boxed{\sqrt{P} \propto V}$$

30. C

31. A

32. A

33. MI of disc about diametric axis will be minimum.

34. Sphere compresses the spring until its all K.E. is converted to P.E. of spring

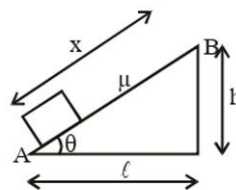
$$\frac{1}{2} MV^2 \left(1 + \frac{K^2}{r^2}\right) = \frac{1}{2} Kx^2$$

35. A

36. B

37. C

38.



$$mg \sin\theta + \mu mg \cos\theta)x$$

$$Mg \left(\frac{h}{x} + \mu \frac{l}{x}\right) \cdot x$$

$$Mg (h + \mu l)$$

39. $\Delta KE = \frac{1}{2} \frac{m_1 m_2}{m_1 + m_2} (1 - e^2) (u_1 - u_2)^2$

$$\Delta KE = \frac{1}{2} \times \frac{m}{2} (1 - e^2) u^2 = \frac{1}{4} \times \left(\frac{1}{2} mu^2\right)$$

$$\Rightarrow \frac{1 - e^2}{2} = \frac{1}{4}$$

$$\Rightarrow e^2 = 1/2 \Rightarrow e = \frac{1}{\sqrt{2}}$$

$$40. \frac{4m_1m_2}{(m_1 + m_2)^2}$$

$$41. W = \frac{m(g \sin 30^\circ)\ell}{2n^2}$$

$$42. \text{Power} = F_{\text{ext}} \cdot v \\ = (m_2 - m_1)g \cdot v$$

$$43. I_{\text{net}} = I_{\text{disc}} - I_{\text{removed}} \\ = \frac{1}{2} (9M)R^2 - \frac{1}{2} M \left(\frac{R}{3}\right)^2 = \frac{40}{9} MR^2$$

44. D

$$45. \text{Here } \frac{dv}{dt} = \text{constant} = a \text{ (say)}$$

$$\text{Use } v^2 = u^2 + 2as \text{ where}$$

$$s = 2 \times 2\pi r = 80 \text{ m, } u = 0, v = 80 \text{ m/s}$$

[CHEMISTRY]

46. (B)

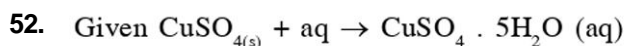
47. (A)

48. (D)

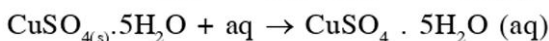
49. A

50. D

51. D

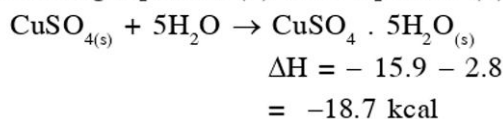


$$\Delta H = -15.9 \text{ kcal} \quad \dots(1)$$



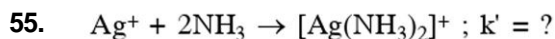
$$\Delta H = +2.8 \text{ kcal} \quad \dots(2)$$

Subtracting equation (2) from equation (1)



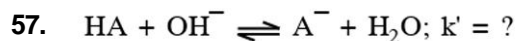
53. D

54. B



$$k' = k_1 \times k_2$$

56. B



$$k' = \frac{1}{k_h} = \frac{1}{k_w/k_a} = \frac{k_a}{k_w} = \frac{10^{-4}}{10^{-14}} = 10^{10}$$

58. A

59. C

60.

$$S^1 = \frac{K_{sp}}{2C}$$

$$C = \frac{10g}{111g/\text{mol} \times 1L}$$

61. Option 4th is of weak base remaining all are salts of SAWB which have pH less than seven

62. B

63. D

$$64. K^1 = \frac{1}{\sqrt{K}}$$

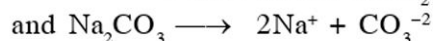
$$65. \Delta G = \Delta G^\circ + 2.303 RT \log_{10} Q$$

66. C

$$67. \text{Molarity (M)} = \frac{\text{wt}}{\text{mol.wt.}} \times \frac{1000}{\text{vol (ml)}}$$

$$= \frac{25.3}{106} \times \frac{1000}{250}$$

$$= .955 \text{ mol/L of Na}_2\text{CO}_3$$



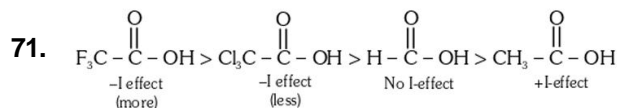
$$\text{therefor } [\text{Na}^+] = 2 \times 0.955 = 1.910 \text{ M}$$

$$[\text{CO}_3^{-2}] = 0.955 \text{ M}$$

68. B

69. A

70. C



72. Down the group in Gr -16 hydrides

M-H bond length increases (due to increases in size)

Hence acidic nature increases

Hence $K_a \uparrow$ while $pK_a \downarrow$

73. Krichoff's equation

$$\Delta C_p = \frac{\Delta H_2 - \Delta H_1}{T_2 - T_1}$$

74. $\text{PbCl}_2(\text{s}) \rightleftharpoons \text{Pb}^{2+}_{\text{S}}(\text{aq}) + 2\text{Cl}^{-}_{\text{2S}}(\text{aq})$

$$K_{\text{sp}} = 4s^3$$

$$1 \times 10^{-6} = 4s^3$$

$$s^3 = \frac{1}{4} \times 10^{-6}$$

$$= \left(\frac{1}{4}\right)^{\frac{1}{3}} \times 10^{-2}$$

$$= 0.63 \times 10^{-2} = 6.3 \times 10^{-3}$$

75. $\int \Delta S = \frac{q}{T} = \int \frac{nC_p dT}{T}$

$$\Delta S = nC_p \ln \frac{T_2}{T_1}$$

76. $\text{pH} = \text{pK}_a + \log \frac{[\text{X}^-]}{[\text{HX}]}$

77. $\Delta n = \oplus \text{ve}$
 $P \uparrow$ backward shifting

78. $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\ell)$

$$\Delta S = \frac{\Delta H}{T}$$

$$\Delta S = S_{\text{product}} - S_{\text{reactant}}$$

79. $\text{PH}_3(\text{g}) \rightarrow \text{P}(\text{s}) + \frac{3}{2} \text{H}_2(\text{g})$

$$\begin{array}{rcl} 100 \text{ mL} & & 0 \text{ mL} \\ 0 \text{ mL} & & 150 \text{ mL} \\ \Delta V = 150 - 100 = 50 \text{ mL} \end{array}$$

80. $w = -2.303 nRT \log_{10} \frac{V_2}{V_1}$

81. $\Delta U = q + w$
 $w = -P_{\text{ext}} \Delta V$

82. $\Delta H - T\Delta S = 0$

83. $T \uparrow$ viscosity \downarrow

84. $NV = (N_1 V_1)_{\text{base}} - (N_2 V_2)_{\text{acid}}$

85. $\text{pH} = 7 + \frac{1}{2} \text{pK}_a - \frac{1}{2} \text{pK}_b$

86. A

87. C

88. B

89. C

90. $K_c = [\text{H}_2\text{O}]^2$. Solid phases are not to be reported.