AVIRAL CLASSES

IIT-JEE | NEET | FOUNDATIONS

ULTIMATE TEST SERIES NEET -2020
TEST-3 SOLUTION

Test Date :07-03-2020

[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

$F_m = [920 + 68(10)]g + 6000$

$= 22000$ N

So, required power for motor

$P_m = \vec{F}_m \cdot \vec{v}$

$= 22000 \times 3$

$= 66000$ 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. $x = \frac{0 \times \pi(28)^2 - 7 \times \pi(21)^2}{\pi(28)^2 - \pi(21)^2}$

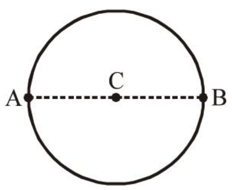
$x = -\frac{7\pi(21)^2}{\pi \times 7 \times 49} = -9$ cm

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. $\frac{\omega_A}{\omega_C} = \frac{\frac{V_A}{r_A}}{\frac{V_C}{r_C}} = \frac{r_C}{r_A}$



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

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. $mgh = \frac{1}{2}mv^2 + \frac{1}{2}Iw^2$

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

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

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

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

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

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

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

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

11. $\overrightarrow{r_{cm}} = \frac{m_1\vec{r_1} + m_2\vec{r_2} + m_3\vec{r_3}}{m_1 + m_2 + m_3}$

12. $P = \tau . \omega$

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

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

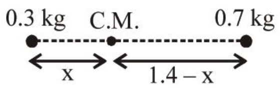
$\omega \propto \theta^{1/3}$

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

13. B

14. $0.3X = 0.7\ (1.4 - X)$

$x = 0.9$ 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 ineratia 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 : $I = I'$

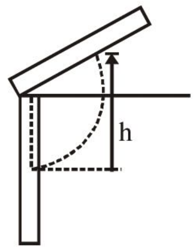
or $\frac{2}{5}MR^2 = \frac{3}{2}Mr^2$

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

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

17. $TE_i = TE_f$

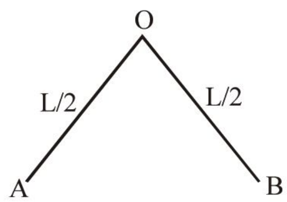
$$\frac{1}{2}I\omega^2 = mgh$$



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

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

18.



Total mass = M, total length = L

Moment of inertia of OA = OB about Q

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

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

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

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

22. Requried fraction

$$= \frac{K_R}{K_R + K_T} = \frac{\frac{1}{2} I\omega^2}{\frac{1}{2} I\omega^2 + \frac{1}{2} Mv^2}$$

$$= \frac{\frac{1}{2} MR^2\omega^2}{\frac{1}{2} MR^2\omega^2 + \frac{1}{2} Mv^2}$$

$$= \frac{MR^2\left(v^2 / R^2\right)}{MR^2\left(v^2 / R^2\right) + Mv^2}$$

$$= \frac{Mv^2}{Mv^2 + Mv^2} = \frac{1}{2}$$

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

24. From given graphs :-

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

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

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

25. D

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

$W = 18.75$ 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. $\because F \propto V$

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

30. C

31. A

32. A

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

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

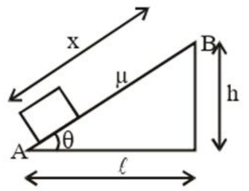
$$\frac{1}{2} MV^2 \left(1 + \frac{K^2}{r^2}\right) = \frac{1}{2}Kx^2$$

35. A

36. B

37. C

38.



mg sinθ + μ mg cos θ)x

$$Mg\left(\frac{h}{x} + u\frac{1}{x}\right).x$$

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

39. $\Delta KE = \frac{1}{2}\frac{m_1m_2}{m_1 + m_2}(1 - e^2)(u_1 - u_2)^2$

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

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

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

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

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

42. $\text{Power} = F_{ext}.\ v$

$= (m_2 - m_1)g.v$

43. $I_{net} = I_{disc} - I_{removed}$

$= \frac{1}{2}\ (9M)R^2 - \frac{1}{2}M\left(\frac{R}{3}\right)^2 = \frac{40}{9}MR^2$

44. **D**

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

Use $v^2 = u^2 + 2as$ where

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

[CHEMISTRY]

46. (B)
47. (A)
48. (D)
49. **A**
50. **D**
51. **D**

52. Given $CuSO_{4(s)} + aq \rightarrow CuSO_4 . 5H_2O$ (aq)

$\Delta H = -15.9$ kcal ....(1)

$CuSO_{4(s)}.5H_2O + aq \rightarrow CuSO_4 . 5H_2O$ (aq)

$\Delta H = +2.8$ kcal ....(2)

Subtracting equation (2) from equation (1)

$CuSO_{4(s)} + 5H_2O \rightarrow CuSO_4 . 5H_2O_{(s)}$

$\Delta H = -15.9 - 2.8$

$= -18.7$ kcal

53. **D**
54. **B**

55. $Ag^+ + 2NH_3 \rightarrow [Ag(NH_3)_2]^+$; k' = ?

$k' = k_1 \times k_2$

56. **B**

57. $HA + OH^- \rightleftharpoons A^- + H_2O$; k' = ?

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

58. **A**
59. **C**

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

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

61. Option 4[th] 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. $\Delta G = \Delta G° + 2.303\ RT\ \log_{10}Q$

66. **C**

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

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

$= .955$ mol/L of Na_2CO_3

and $Na_2CO_3 \longrightarrow 2Na^+ + CO_3^{-2}$

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

$[CO_3^{-2}] = 0.955$ M

68. **B**
69. **A**
70. **C**

71. $F_3C-\overset{O}{\overset{||}{C}}-OH > Cl_3C-\overset{O}{\overset{||}{C}}-OH > H-\overset{O}{\overset{||}{C}}-OH > CH_3-\overset{O}{\overset{||}{C}}-OH$

–I effect (more) –I effect (less) No I-effect +I-effect

72. Down the group in Gr –16 hydrides

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

Hence acidic nature increases

Hence Ka↑ while pKa↓

73. Krichoff's equation

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

74. $PbCl_2(s) \rightleftharpoons \underset{S}{Pb^{2+}}_{(aq)} + \underset{2S}{2Cl^-}_{(aq)}$

$K_{sp} = 4s^3$

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

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

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

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

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

$$\Delta S = nC_p \ell n \frac{T_2}{T_1}$$

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

77. $\Delta n = \oplus ve$

P↑ backward shifting

78. $H_2O(s) \rightarrow H_2O(\ell)$

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

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

79. $PH_3(g) \rightarrow P(s) + \frac{3}{2} H_2(g)$

100 mL 0 mL

0 mL 150 mL

$\Delta V = 150 - 100 = 50$ mL

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

81. $\Delta U = q + w$

$w = -P_{ext}.\Delta V$

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

83. T↑ viscoity↓

84. $NV = (N_1V_1)_{base} - (N_2V_2)_{acid}$

85. $pH = 7 + \frac{1}{2}pK_a - \frac{1}{2}pK_b$

86. **A**

87. **C**

88. **B**

89. **C**

90. $K_c = [H_2O]^2$. Solid phases are not to be reported.