AVIRAL CLASSES
CREATING SCHOLARS
FOR JEE (Main & advance), PMTs & FOUNDATION

DATE : 15.01.2017

FINAL TEST SERIES NEET -2017
TEST-03

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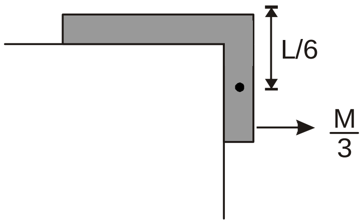
[PHYSICS]

1. Mass $\frac{M}{3}$ has its centre of mass $\frac{L}{6}$ below the table surface



$\therefore \quad W = mgh = \left(\frac{m}{3}\right)(g)\left(\frac{L}{6}\right)$

$= \frac{MgL}{18}$

2. Wrok done by tension on M is negative (force and displacement are in opposite directions). But work done by tension on m is positive. Net work done will be zero.

3. W = change in potential energy = mgh = mgL(1 – cos θ)

4. From work-energy theorem

W = change in kinetic energy

or $W = \frac{1}{2}mv^2$

$\therefore$ W – v graph is a parabola

5. $W = \frac{1}{2} \times m \times (10)^2 = 50$

$W' = \frac{1}{2} \times m \times (400 - 100) = 150m = 3W$

6. $v = \frac{dx}{dt} = 8t^3$

$v_{0s} = 0, v_{1s} = 8\ m/s$

$\therefore \quad \Delta KE = \frac{1}{2} \times 2 \times (64 - 0)\,J$

= 64 J

7. $K = \frac{P^2}{2m}$ or $K \propto P^2$

When P is doubled, kinetic energy will become four times.

8. From work-energy theorem,

Work done = change in kinetic energy

$\therefore$ Fx = K(as F = constant because a constant)

Therefore K - x graph is straight line passing through origin

9. In equilibrium $kd = mg$ or $d = \frac{mg}{k}$

In allowed to fall suddenly, if does not stop in its equilibrium position. In that case,

decrease in gravitational PE = increase in elastic PE

or $mgd' \frac{1}{2}kd'^2$

or $d' = \frac{2mg}{k} = 2d$

10. F = Kx or K = slope of F-x graph (F along y-axis)

Here F is along x-axis.

So, $K = \frac{1.0}{10} = 0.1\frac{kgf}{cm}$

11. Average velocity $= \dfrac{\text{Total displacement}}{\text{Time}}$

$= \dfrac{\text{Area under } v-t \text{ graph}}{\text{Time}}$

Since area $\neq 0$

$\therefore$ Average velocity $\neq 0$

12. $E = \dfrac{1}{2}mv^2$

$\therefore \quad \dfrac{dE}{dv} = mv$

or $\quad P = \dfrac{dE}{dv}$ (as mv = P)

13. $K = \dfrac{F}{x} = $ slop of F – x graph

$K \propto \dfrac{1}{l}$

Length is reduced to half. Therefore K will become two times. Slope will increase.

14. $K = 4t^2$ or $v^2 \propto t^2$

$\therefore \quad v \propto t$

v varies linearly with time when acceleration or force is constant.

15. Speed of doubled. Therefore kinetic energy will become four times. Hence minimum stopping distance will also become four times.

16. Total loss in friction = $K_i - K_f = \dfrac{1}{2}m(100-81)$

$\dfrac{19}{2}m$ (m = mass)

Half of the loss will be in upward journey

Hence, $mgh + \dfrac{1}{2}\left(\dfrac{19}{2}m\right) = K_1 = \dfrac{1}{2}m(100) = 50m$

$\therefore \quad h = 4.61$ m

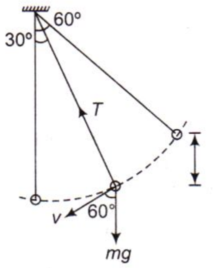
17. F.d = mg(h + d)

$\therefore \quad F = mg\left(1 + \dfrac{h}{d}\right)$

work done against resistance

= decrease in mechanical energy

18. Power of tension = 0

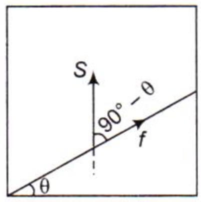


Power of mg = (mg) (v) cos 60º

Here $\quad v = \sqrt{2gh}$

and h = 1(cos30º – cos 60º)

19. Block does not slide. Hence force of friction



$f = mg \sin\theta$

In time t, displacement S = vt

$\therefore \quad W_f = f.s.\cos(90^\circ - \theta)$

$= (mg \sin\theta)(vt)(\sin\theta)$

$= mgvt \sin^2\theta$

20. Work done by conservative forces = $U_i - U_f$

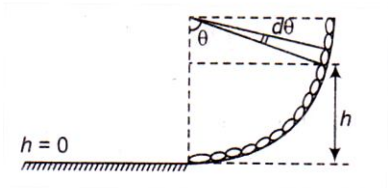
Work done by external forces = $E_f - E_i$

and net work done by all the forces = $K_f - K_i$

21. On M horizontal components of N and f are balanced (as Mg is vertical). Hence on 2 M alos they will be balanced.

$\therefore$ Horizontal Kx force on 2M should be zero.

22. $h = R(1 - \cos\theta)$



$dm = \left(\dfrac{m}{\pi/2}\right).d\theta$

$= \dfrac{2m\,d\theta}{\pi}$

$dv_i = (dm)\,gh$

$\dfrac{2mgR(1-\cos\theta)d\theta}{\pi}$

$\therefore \quad U_i = \int_0^{90^\circ} dU_i$

$= mgR\left(1 - \dfrac{2}{\pi}\right)$

$U_f = 0$

Decrease in PE = increase in KE

23. From conservation of linear momentum, velocity of combined mass just after collision will be 50 cm/s as mass has doubled.

Now $$H = \frac{u^2}{2g} = \frac{(0.5)^2}{20} m$$
$$= 1.25 \text{ cm}$$

24. $$a_{CM} = \frac{\text{External force}}{\text{Total mass}}$$
$$= \frac{\text{Force of friction from ground}}{\text{Total mass}}$$
$$= \frac{0.2 \times (2+1)(10)}{1+2} = 2 m/s^2$$

25. The centre of mass of the object must lies on the line segment joining (0, 0) and (R/2, R/2). Here (0, 0) is the centre of mass of the ring and (R/2, R/2) is the centre of mass of the chord.

26. $$T = \frac{d}{v/\sqrt{2}} + \frac{d}{ev/\sqrt{2}} = \left(1 + \frac{1}{e}\right)\frac{\sqrt{2}d}{v}$$

or $$\frac{2v/\sqrt{2}}{g} = \left(1 + \frac{1}{e}\right)\frac{\sqrt{2}d}{v}$$

or $$e = \frac{gd}{v^2 - gd}$$

27. Angular momentum will not remain conserved due to a torque of weight of particle about axis of rotation.

28. It depends whether pure rolling is taking place on ground or over a platform

29. Direction of linear velocity always keeps on changing. Hence linear momentum is varying.

30. W = chang in rotational kinetic energy
$$= \frac{1}{2} I(\omega_f^2 - \omega_i^2)$$
$$= \frac{1}{2}\left(\frac{1}{2} mR^2\right)[(2\pi f_f)^2 - (2\pi f_i)^2]$$
$$= \frac{1}{4} \times 2(1)^2 \times 4 \times \pi^2 (100 - 25)$$
$$= 1.48 \times 10^3 J \approx 1.5 \times 10^3 J$$

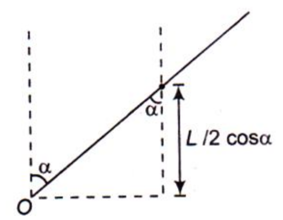
31. τ = r × f i.e., τ is perpendicular to both r and F
$\therefore$ τ.r = 0 and τ.F = 0

32. Otherwise net torque or net angular acceleration will become zero.

33. From the property of a circle, if an arc subtends an angle θ at any point A on circumference then it will subtend an angle 2θ at centre C. So in the same time interval a particle rotating in a circle turn double the angle with respect to centre point C compared to point A.
$\therefore$ $\omega_c = 3\omega_A$

34. L = Iω = I(2πf)
Frequency f is doubled. Hence angular momentum will become 2L.

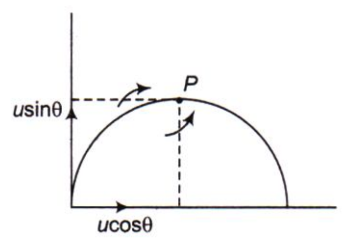
35. Decrease in gravitational PE = increase in rotational KE



$$\therefore \quad mgh = \frac{1}{2} I\omega^2$$
$$mg\left[\frac{L}{2} - \frac{L}{2}\cos\alpha\right] = \frac{1}{2}\left(\frac{mL^2}{3}\right)\omega^2$$
$$\therefore \quad \omega = \sqrt{\frac{3g}{L}(1 - \cos\alpha)}$$
$$= \sqrt{\frac{3g}{L}\left(2\sin^2\frac{\alpha}{2}\right)}$$
$$= \sqrt{\frac{6g}{L}}\sin\frac{\alpha}{2}$$

36. $\frac{K_R}{K_T} = \frac{I}{mR^{2'}}$ if v = Rω in case of pure rolling $\frac{K^2}{R^2}$
$$\therefore \quad K_R = \left(\frac{K^2}{K^2 + R^2}\right) K_{Total} \text{ or } \frac{K_R}{K_{Total}} = \frac{K^2}{K^2 + R^2}$$

37. $$L_p = (mu\sin\theta)\left(\frac{R}{2}\right)(mu\cos\theta)(H)$$



$$= (mu\sin\theta)\left(\frac{u\sin\theta}{g}\right)(u\cos\theta)\left(\frac{u^2\sin^2\theta}{2g}\right)$$

$$= \frac{mu^2 \sin^2\theta\cos\theta}{2g}$$

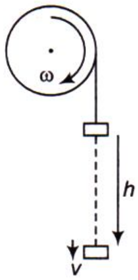
38. From $L_i = L_f$ about centre of rod

$$m.vr_{\perp} = I_{CM}.\omega$$

$$\Rightarrow (1)(2)\left(\frac{1}{4}\right) = \frac{1}{12}\times(2)(1)^2.\omega$$

39. $v = r\,\omega$

Decrease in gravitational potential energy = increase kinetic energy



$$\therefore \quad mgh = \frac{1}{2}I\omega^2 + \frac{1}{2}mv^2$$

$$= \frac{1}{2}I\omega^2 + \frac{1}{2}m(r\omega)^2$$

$$\therefore \quad \omega = \sqrt{\frac{2mgh}{I+mr^2}}$$

40. At bottommost point total kinetic will be mgh. Ratio of rotational to translational kinetic energy will be $\frac{2}{5}$

$$\therefore \quad K_T = \frac{5}{7}mgh = \frac{1}{2}mv^2$$

$$\therefore \quad v = \sqrt{\frac{10}{7}gh}$$

41. In case of pure rolling ratio of rotational to translational kinetic energy is $\frac{2}{5}$. Therefore, total kinetic energy is $\frac{7}{5}$ times the translational kinetic energy. At maximum compression whole of energy is elastic potential. Hence,

$$\frac{7}{5}\left(\frac{1}{2}Mv^2\right) = \frac{1}{2}kx_{max}^2$$

$$\therefore \quad x_{max} = v\sqrt{\frac{7M}{5k}}$$

42. Whole mass has equal distance from the centre O. Hence, $I_0 = mR^2$. Further centre of mass of the remaining portion will be to the left of point O. More the distance of axis from centre of mass, more is the moment of inertia. Hence $I_A > I_O$.

43. $a = \dfrac{g\sin\theta}{1+\dfrac{I}{mr^2}}$

For a sphere, $a = \dfrac{g\sin\theta}{1+\dfrac{I}{mr^2}}$

Hence, $a = \frac{5}{7}g\sin\theta$ = constant

Hence, speed of all spheres is same at the bottom. Sphere (ii) has the largest mass, it will have the maximum kinetic energy.

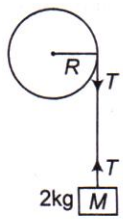
44. Conserve angular momentum about common centre of mass

$$mv\frac{R}{2} = I_{Total}\omega$$

$$= \left[m\left(\frac{R}{2}\right)^2 + \frac{1}{2}mR^2 + m\left(\frac{R}{2}\right)^2\right]\omega$$

$$\therefore \quad \omega = \frac{v}{2R}$$

45. $TR = I\alpha, TR = I\frac{a}{R}$ or $T = \frac{Ia}{R^2}$



$$Mg - T = Ma$$

or $Mg = Ma + T = \left(M + \frac{1}{R^2}\right)a$

or $a = \dfrac{Mg}{\left(M+\dfrac{I}{R^2}\right)}$

$$= \frac{2\times10}{\left(2+\dfrac{0.32}{0.04}\right)} = 2m/s^2$$

[CHEMISTRY]

46. b.
47. $P_{mix}V_{mix} = P_AV_A + P_BV_B$
48. Acc. to Le-chatlier principle exothermic reaction favared by low temperature.
49. $\frac{r_A}{r_B} = \frac{V_A / t_A}{V_B / t_B} = \sqrt{\frac{M_{WB}}{M_{WA}}}$

$$\frac{1/150}{1/200} = \sqrt{\frac{36}{M_{wA}}}$$

50. For ppt. of AgCl ; $[Ag^+] = \frac{K_{sp}(AgCl)}{[Cl^-]}$

$$= \frac{10^{-10}}{0.05} = 2\times10^{-9}$$

51. $\text{Acid} \xrightarrow{-H^+} \text{conjugate base}$
52. d
53. a
54. d
55. pOH = pKb + log $\frac{[Salt]}{[Base]}$

$$= 4 + \log\frac{[0.2]}{[0.1]}$$

pOH = 4 + log 2
pH = 10 – log 2
56. b.
57. a
58. b
59. a
60. a
61. c
62. b
63. b
64. $\because\ \Delta E - \Delta H = -\Delta n_g RT = 1200$ cal

$$\Rightarrow \Delta n_g = \frac{-1200}{2\times300} = -2$$

$$\therefore \frac{K_p}{K_c} = (RT)^{\Delta n} = (0.082\times300)^{-2}$$

$= 1.648 \times 10^{-3}$
65. c
66. Buffer is a solution or weak acid and a conjugate of weak acid or a weak base and a conjugate of weak base e.g., $NH_4Cl + NH_4OH$, $CH_3COOH + CH_3COONa$, NaCN + HCN
67. $[H^+] = \sqrt{CK_a} = \sqrt{0.5+0.2\times10^{-4}} = \sqrt{1.0}\times10^{-2}$
$[H^+] = 10^{-2}$
pH = – log $[H^+]$ = – log(10^{-2}) = + 2
68. $M = \frac{m_1v_1 + m_2v_2}{v_1+v_2} = \frac{0.6\times800+1\times200}{1000}$

$$= \frac{480+200}{1000} = \frac{680}{1000} = 0.68M$$

69. An exothermic reaction is a chemical reaction that releases energy in the form of light of heat. The given reaction is an exothermic reaction, hence low temperature and increasing pressure will favour forward reaction
70. $MX_2 \rightleftharpoons M^{2+} + 2X^-$
(s) (2s)
$K_{sp} = [M^{2+}][X^-]^2 = (s) \times (2s)^2$
4×10^{-12} M = $4s^3$
s = 10^{-4} M
71. $\Delta n = (3 + 1) - 2 = 2$
$K_p = K_c(RT)^{\Delta n}$
$= 3 \times 10^{-4}(0.0821 \times 1000)^2$
$= 3 \times 6740.41 \times 10^{-4}$
$= 3 \times .6740 = 2.02$
72. Given $V_2 = 100$ L, $V_1 = 10$ L

$$\Delta S = -2.303nR\log\left(\frac{V_2}{V_1}\right)$$

$$= -2.303\ nR\ \log\left(\frac{100}{10}\right)$$

= – 2.303 × 10 × 8.314 $JK^{-1}\ mol^{-1}$
= – 191.47 $JK^{-1}\ mol^{-1}$
73. An isothermal process is a change of a system, in which the temperature remains constants. For isothermal process
$\Delta T = 0$
Hence $\Delta U = 0 = Q - W$

$$Q = W = -RT\ln\frac{V_2}{V_1}$$

74. When water and ice are at equilibrium at temperature 0ºC, the $\Delta G = 0$
where, $\Delta G = G_{ice} - G_{water}$
$G_{ice} - G_{water} = 0$
$\Rightarrow\ G_{ice} = G_{water} \neq 0$
75. $H_2 + I_2 \rightleftharpoons 2HI$
Since $\Delta n = 2 - 2 = 0$
Hence this given reaction will not be affected by change in pressure.

76. We know that

$\Delta H^o = \Delta E^o + \Delta n_g RT$

For the reaction

$$(CH_3)_2C{=}CH_2 + 6O_2 \rightarrow 4CO_2 + 4H_2O$$

$\Delta n = 4 - 7 = -3$

$\therefore \quad \Delta H^o = \Delta E^o - \Delta n_g RT [\because \Delta n = \text{negative}]$

i.e., $\Delta H^o < \Delta E^o$

77. We know that

$$K_c = \frac{K_f}{K_b} \Rightarrow K_f = K_b \times K_c$$

$= 1.5 \times 7.5 \times 10^{-4} = 1.125 \times 10^{-3}$

78. Molar mass of HCl = 36.5

Concentration of

$$HCl = \frac{0.365}{36.5} = 1 \times 10^{-2} \text{mol L}^{-1}$$

HCl is a strong acid

$\therefore \quad pH = -\log[H^+]$

$= -\log 10^{-2}$

$= -1 \times -2 = 2$

79. If ΔS = positive, ΔH = positive

Then, ΔG will be negative if and only if

$T\Delta S > \Delta H$

80. $C + O_2 \rightarrow CO_2$, $\Delta H = X$

$$CO + \frac{1}{2}O_2 \rightarrow CO_2, \quad \Delta H = Y$$

81. As we know, number of millimoles = molarity × volume in ml

$\therefore$ For 50 ml CH_3COOH millimoles = 1 M × 50 ml = 50 m moles

For 50 ml NaOH millimoles = 0.5 M × 50 ml = 25 m moles

Thus from the following equation,

$$\underset{\substack{50 \text{ m mol} \\ 5\text{m mol}}}{CH_3COOH} + \underset{\substack{25 \text{ m mol} \\ 0}}{NaOH} \rightarrow \underset{\substack{0 \\ 25 \text{ m mol}}}{CH_3COONa} + H_2O$$

$$pH = pK_a + \log\frac{[\text{salt}]}{[\text{acid}]}$$

$$= \log(1.8 \times 10^{-5}) + \log\frac{25}{25}$$

pH = 4.74

82. We know that

$\Delta G^o = nFE^o$

$= -1 \times 96500F \times 0.220$ V

$= -21.20$ kJ

83. d

84. In triclinic system,the crystal is described by vectors of unequal length, as in the orthorhombic system. Triclinic crystal is a highly dissymmetric crystal having $a \neq b \neq c$, $\alpha \neq \beta \neq \gamma$

85. We know that

$$\Delta S_{fus} = \frac{\Delta H_{fus}}{T_m} = \frac{6000J}{273K} \text{mol}^{-1}$$

$= 21.98$ JK^{-1} mol^{-1}

86. Number of milliequivalents of

NaOH = 800 × 0.05 = 40

Number of milliequivalents of HCl

= 200 × 0.1 = 20

Total volume = 200 + 800 = 1000 mL

Number of milliequivalents of NaOH present in

40 – 20 = 20

$pOH = -\log[OH]^-$

$= -\log[2 \times 10^{-2}]$

= 1.7

also pH + pOH = 14

pH = 14 – pOH

= 14 – 1.7 = 12.3

57. $\Delta G = \Delta H - T\Delta S$

$= -11.7 \times 10^3 - 298 \times (-105) = 19.590$ J

Since, Gibbs free energy change is positive hence it is non-spontaneous reaction.

58. $AgCl \rightleftharpoons Ag^+ + Cl^-$

In $CaCl_2$, $\underset{0.01}{CaCl_2} \rightleftharpoons \underset{0.01}{Ca^{2+}} + \underset{2 \times 0.01}{2Cl^-}$

In NaCl, $\underset{0}{NaCl} \rightleftharpoons \underset{0.01}{Na^+} + \underset{0.01}{Cl^-}$

In $AgNO_3$, $\underset{0.05}{AgNO_3} \rightleftharpoons \underset{0.05}{Ag^+} + \underset{0.05}{Cl^-}$

Common ion effect is maximum is $AgNO_3$

So, $S_1 > S_2 > S_3 > S_4$

59. a

90. $$C_2H_5 + \frac{5}{2}O_2(g) \rightarrow 2CO_2 + H_2O$$

$\Delta G^o = -1234$ kJ .....(i)

$C + O_2 \rightarrow CO_2$ $\Delta G^o = -394$ kJ ....(ii)

$$H_2 + \frac{1}{2}O_2 \rightarrow H_2O \ \Delta G = -237\text{kJ} \quad .....(iii)$$

Ex. (ii) × 2 + Eq (iii) – Eq. (i)

$\Delta G^o = 2(-394) + (-237) - (-1234)$

$\Delta G^o = 209$ kJ