

New Light Institute

SINCE 1984

PHYSICS TOPIC TEST : 2021-22

Test ID : 000

Paper ID : PTT-09



TEST DATE : 26-11-2021

SOLUTION

PHYSICS

Part-1 [SECTION-A]

1. (2) [NCERT-240]
Double the length of the wire
2. (1) [NCERT-235]
young's modulus for given material is constant it is not depend on length & radius so option (1) is correct.
3. (3) [NCERT-236]
Linear strain = $\frac{\text{change in length}}{\text{original length}}$
= $1/100 = 0.01$.
4. (1) [NCERT-251]
 $B = \frac{\Delta P}{\frac{\Delta V}{V}} = \frac{100 \times 10^5}{0.01 \times 10^{-2}} = 10^{11} \text{ N/m}^2$
= $10^{12} \text{ dyne/cm}^2$.
5. (3) [NCERT-239]
 $P = \rho gh$
= 27×10^6
 $\beta = -\frac{P}{\left(\frac{\Delta V}{V}\right)}$
= 1.2×10^{-2} .
6. (2) [NCERT-252]
 $F = \frac{mg}{A} = \frac{\pi R^2 l \times g \times \rho}{\pi R^2}$
 $10^9 = 1 \times 10 \times 3 \times 10^3$
 $l = \frac{10^8}{3 \times 10^3} = \frac{10^5}{3} = \frac{10}{3} \times 10^4 \text{ cm}$
 $3.4 \times 10^4 \text{ m}$.
7. (1) [NCERT 265]
Volume of big drop = Volume of 1000 small drop
 $\frac{4}{3} \pi R^3 = 1000 \frac{4}{3} \pi r^3$
 $r = \frac{R}{10}$
8. (4) [NCERT 266]
 $\frac{1}{r} = \frac{1}{r_1} - \frac{1}{r_2} \Rightarrow r = \frac{r_2 r_1}{r_2 - r_1}$

Part-1 [SECTION-A]

1. (2) [NCERT-240]
r k dhy EkZ nphgs
2. (1) [NCERT-235]
fn; sx; si nZi sf, ; ai R kR kx d fu; r gSg y EkZ / Sf k; kij fuH Z u g d j r k g S
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j s h fod fr = y EkZ e i f j o r Z @ k f H d y EkZ
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9. (1) [NCERT 266]

Excess pressure in two soap bubbles are

$$P_p = \frac{4T}{r} \quad P_Q = \frac{4T}{2r}$$

$$\text{So } \Delta P = P_p - P_Q = \frac{2T}{r}$$

Suppose R is radius of curvature at common interface then

$$\frac{4T}{R} = \frac{2T}{r}$$

$$R = 2r$$

10. (1) [NCERT 265]

Work done is given as

$$W = T \times \Delta A$$

$$W = T \times 8 \pi R^2$$

$$\text{As } V = \frac{4}{3} \pi R^3$$

$$R = \left(\frac{3V}{4\pi} \right)^{1/3}$$

Put this value in eq.

$$W = T \times 8\pi \times \left(\frac{3V}{4\pi} \right)^{2/3}$$

$$\text{or } W \propto V^{2/3}$$

$$\text{given } V_2 = 2V$$

$$\text{So } \frac{W_1}{W_2} = \left(\frac{V_1}{V_2} \right)^{2/3}$$

$$\frac{W}{W_2} = \left(\frac{V}{2V} \right)^{2/3}$$

$$W_2 = 2^{2/3} W$$

$$\Rightarrow W_2 = 4^{1/3} W$$

11. (3) [NCERT-261]

Soap bubble has two surface, Hence ,

$$W = T \Delta A$$

$$\text{Here, } \Delta A = 2[4\pi\{(2.5 \times 10^{-2})^2 - (1.0 \times 10^{-2})^2\}]$$

$$= 1.32 \times 10^{-2} \text{ m}^2$$

$$\therefore W = (3.0 \times 10^{-2})(1.32 \times 10^{-2}) \text{ J}$$

$$= 3.96 \times 10^{-4} \text{ J}$$

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12. (4) [NCERT-261]

Excess pressure inside the liquid drop = $\frac{2T}{R}$,
where T is surface tension and R is its radius.

$$\text{If } P_1 = \frac{2T}{R}; P_2 = \frac{2T}{R'}$$

$$\text{i.e., } P_1 = \frac{2T}{R} = 4 \times \frac{2T}{R'}$$

$$\text{or } \frac{2T}{R} = \frac{2T}{(R'/4)}$$

$$\therefore R' = 4R \text{ or } R = R'/4$$

$$m_1 = \frac{4}{3} \pi R^3 \rho$$

$$m_2 = \frac{4}{3} \pi (4R)^3 \rho = 64m_1$$

$$\therefore \frac{m_1}{m_2} = \frac{1}{64} \text{ or } 1:64$$

13. (1) [NCERT-260]

$$h = \frac{2T \cos \theta}{r \rho g}$$

$$\therefore hr = \frac{2T \cos \theta}{\rho g} = \text{constant}$$

$$\therefore h_1 r_1 = h_2 r_2$$

substituting the values

$$h_2 = (2.0) \left(\frac{r_2}{r_1} = \frac{1}{3} \right)$$

$$= 6.0 \text{ cm}$$

14. (1) [NCERT-236]

$$Y = \frac{FL}{A \Delta L} = \frac{1000 \times 100}{10^{-6} \times 0.1} = 10^{12} \text{ N/m}^2$$

15. (2) [NCERT-240]

$$\text{Compressibility} = \frac{\Delta V/V}{P}$$

$$\Rightarrow \sigma = \frac{\Delta V}{PV} \Rightarrow \Delta V = \sigma PV$$

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16. (4) [NCERT-234]

$$\frac{Y_A}{Y_B} = \frac{\tan \theta_A}{\tan \theta_B} = \frac{\tan 60}{\tan 30} = \frac{\sqrt{3}}{1/\sqrt{3}} = 3$$

$$\Rightarrow Y_A = 3Y_B$$

17. (3) [NCERT-262]

$$\Delta P \propto \frac{1}{r} \Rightarrow \frac{\Delta P_1}{\Delta P_2} = \frac{r_2}{r_1} \Rightarrow \frac{r_2}{r_1} = \frac{3}{1}$$

$$\therefore \frac{V_1}{V_2} = \left(\frac{r_1}{r_2}\right)^3 = \left(\frac{1}{3}\right)^3 = \frac{1}{27}$$

18. (1) [NCERT-261]

Surface tension of the liquid.

19. (4) [NCERT-191]

$$g' = g \left(\frac{R}{R+h}\right)^2 = g \left(\frac{R}{R+\frac{R}{2}}\right)^2 = \frac{4}{9}g$$

$$\therefore W = \frac{4}{9} \times W = \frac{4}{9} \times 72 = 32N$$

20. (3) [NCERT-262]

$$F = 2T \times 4L \\ = 8TL.$$

21. (3) [NCERT-190]

Decreases by 2%

$$g = \frac{GM}{R^2}$$

$$\frac{\Delta g}{g} = \frac{\Delta M}{M} - \frac{2\Delta R}{R}$$

$$= -1 - 1 = 2\%$$

22. (2) [NCERT-261]

$T_c = T_o(1 - \alpha t)$ i.e. surface tension decreases with increase in temperature.

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23. (2) [NCERT-240]
 Elastic energy per unit volume is

$$U = \frac{1}{2} \times \text{longitudinal stress} \times \text{longitudinal strain}$$
 As $y = \frac{\text{longitudinal stress}}{\text{longitudinal strain}}$

$$= \frac{S}{Y}$$
 So longitudinal strain = S/Y
 so
$$U = \frac{1}{2} \times S \times \frac{S}{Y}$$

$$U = \frac{S^2}{2Y}$$

24. (4) [NCERT-263]
 In the satellite, the weight of the liquid column is zero. So the liquid will rise up to the top of the tube.

25. (4) [NCERT-251]
 Value of poisson's ratio σ is 0 to 0.5.

26. (1) [NCERT-259]
 Addition of highly soluble substances increase surface tension.

27. (1)
 Conservation of angular momentum.

28. (1) [NCERT 254]

$$P_{\text{open}} + \frac{1}{2} \rho v^2 = P_{\text{closed}}$$

$$\Rightarrow v = \sqrt{\frac{2(P_{\text{closed}} - P_{\text{open}})}{\rho}}$$

$$= \sqrt{\frac{2 \times (3.5 - 3) \times 10^5}{10^3}} = 10 \text{ m/s}$$

29. (4) [NCERT 254]

$$\frac{1}{2} \rho v^2 = \rho gh + \frac{Mg}{A}$$

$$v = \sqrt{2gh + \frac{2Mg}{\rho A}} = \sqrt{2 \times 10 \times 6 + \frac{2 \times 50 \times 10}{10^3 \times 1}}$$

$$= \sqrt{120 + 1} = \sqrt{121} = 11 \text{ m/s}$$

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30. (4) [NCERT 254]

$$P_{\text{inside}} + \frac{\rho v_{\text{inside}}^2}{2} + \rho g_{\text{eff}} y = P_{\text{outside}} + \frac{\rho v_{\text{outside}}^2}{2} + \rho g_{\text{eff}} y$$

$$v_{\text{inside}} = 0 \quad P_{\text{inside}} = P_{\text{outside}} = P_0$$

[atmospheric pressure]

Therefore, $v_{\text{outside}} = 0$. i.e., no water comes out.

31. (1) [NCERT 259]

Viscosity of gases Increases with Increase in temperature.

32. (1) [NCERT 255]

$$\frac{v^2}{2g} = \frac{10 \times 10}{2 \times 10} = 5m$$

33. (2) [NCERT 260]

$$v = \frac{2r^2(\rho - \sigma)}{9\eta}g$$

So $v \propto r^2$

$$\frac{V_A}{V_B} = \left(\frac{r_A}{r_B}\right)^2 = \left(\frac{r_A}{2r_A}\right)^2$$

$$= \frac{1}{4} \Rightarrow V_A : V_B = 1 : 4$$

34 (3) [NCERT 254]

$$F = 6\pi\eta rV.$$

35. (4) [NCERT 256]

$$\begin{aligned} M &= m_1 + m_2 \\ Av_1 &= Av_2 + 2Av \\ 5 &= 2 + 2v \\ v &= 1.5 \text{ m/s} \end{aligned}$$

Part-1 [SECTION-B]

36. (2) [NCERT-262]

$$\begin{aligned} \text{Change in area } \Delta A &= n4\pi r^2 - 4\pi R^2 \\ &= 4\pi(nr^2 - R^2) \end{aligned}$$

$$\begin{aligned} \text{so change in energy} &= T \times \Delta A \\ w &= (4\pi r^2 n - 4\pi R^2)T \end{aligned}$$

37. (3) [NCERT-264]

$$\frac{r_1 r_2}{r_1 - r_2}$$

$$p = P_2 - P_1$$

$$\frac{4T}{R} = \frac{4T}{r_2} - \frac{4T}{r_1}$$



$$R = \frac{r_1 r_2}{r_1 - r_2}$$

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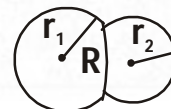
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$$R = \frac{r_1 r_2}{r_1 - r_2}$$

38. (3)

[NCERT-261]

$$F = 6\pi r\eta v$$

$$\frac{4}{3}\pi r^3 \times \rho \times g = 6\pi r\eta v$$

$$\eta = \frac{2}{9} \frac{r^2 \rho g}{v} = \frac{2}{9} \times \frac{1 \times 10^{-14}}{2 \times 10^{-3}} \frac{1.5 \times 10^{-3}}{10^{-6}} \times 10$$

$$\eta = \frac{3}{18} \times 10^3 = \frac{1}{6} \times 10^3 = 0.166 \times 10^3$$

$$= 1.6 \times 10^3 \text{ Poise.}$$

38. (3)

[NCERT-261]

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39. (3)

[NCERT-255]

$$\frac{T_w}{T_m} = \frac{h_w}{\cos \theta_w} \times \frac{\cos \theta_m}{h_m} \times \frac{\rho_w}{\rho_m}$$

$$= \frac{10}{1} \times \frac{1}{\sqrt{2}} \times \frac{1}{13.6} \times \frac{1}{3.42} = \frac{1}{6.5}$$

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40. (4)

[NCERT-270]

$$Q' = \frac{Q}{16} \times \frac{2p}{p} \times \frac{a^4}{a^4} = \frac{Q}{8}$$

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41. (2)

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42. (3)

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$$\rho_1 + \frac{1}{2}\rho v_1^2 = \rho_2 + \frac{1}{2}\rho v_2^2$$

$$\rho_2 - \rho_1 = \frac{1}{2} \rho (v_1^2 - v_2^2)$$

$$\text{left} = A \times (\rho_2 - \rho_1)$$

$$\rho A (v_1^2 - v_2^2) / 2.$$

$$\rho_1 + \frac{1}{2}\rho v_1^2 = \rho_2 + \frac{1}{2}\rho v_2^2$$

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$$ck k = A \times (\rho_2 - \rho_1)$$

$$\rho A (v_1^2 - v_2^2) / 2.$$

43. (2)

[NCERT-252]

$$y = \frac{Fl}{AL} = \frac{25 \times 9.8 \times 2 \times 10^{-2}}{3.14 \times (0.2 \times 10^{-2})^2 \times 1}$$

$$= \frac{25 \times 9.8 \times 2}{3.14 \times 0.04} \times 10^2$$

$$= 3.9 \times 10^5 \text{ N/m}^2$$

44. (3)

[NCERT 260]

Formula for terminal velocity $v = \frac{2}{9} \frac{r^2}{\eta} (r-s) g$

$$v \propto r^2$$

45. (3)

[NCERT-252]

$$F = \frac{mg}{A} = \frac{\pi R^2 l \times g \times \rho}{\pi R^2}$$

$$10^9 = 1 \times 10 \times 3 \times 10^3$$

$$l = \frac{10^8}{3 \times 10^3} = \frac{10^5}{3} = \frac{10}{3} \times 10^4 \text{ cm}$$

$$3.4 \times 10^5 \text{ m.}$$

46. (3)

[NCERT-258]

$$2 \times \frac{4}{3} \pi r^3 = \frac{4}{3} \pi R^3$$

$$R = 2^{1/3} r$$

Since $v \propto r^2$

$$\frac{v_1}{v_2} = \frac{r^2}{2^{2/3} r^2}$$

$$v_2 = (4)^{1/3} v_1$$

47. (1)

[NCERT-240]

$$A_0 V_0 = AV$$

$$V^2 = V_0^2 + 2gh$$

$$V_0 = \sqrt{\frac{2gh.A^2}{A_0^2 - A^2}}$$

or $R = A_0 V_0 = A_0 \sqrt{\frac{2gh.A^2}{A_0^2 - A^2}}$

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45. (3)

[NCERT-252]

$$F = \frac{mg}{A} = \frac{\pi R^2 l \times g \times \rho}{\pi R^2}$$

$$10^9 = 1 \times 10 \times 3 \times 10^3$$

$$l = \frac{10^8}{3 \times 10^3} = \frac{10^5}{3} = \frac{10}{3} \times 10^4 \text{ cm}$$

$$3.4 \times 10^5 \text{ m.}$$

46. (3)

[NCERT-258]

$$2 \times \frac{4}{3} \pi r^3 = \frac{4}{3} \pi R^3$$

$$R = 2^{1/3} r$$

$v \propto r^2$

$$\frac{v_1}{v_2} = \frac{r^2}{2^{2/3} r^2}$$

$$v_2 = (4)^{1/3} v_1$$

47. (1)

[NCERT-240]

$$A_0 V_0 = AV$$

$$V^2 = V_0^2 + 2gh$$

$$V_0 = \sqrt{\frac{2gh.A^2}{A_0^2 - A^2}}$$

$R = A_0 V_0 = A_0 \sqrt{\frac{2gh.A^2}{A_0^2 - A^2}}$

48. (1) [NCERT-260]

$$h = \frac{2T \cos \theta}{r \rho g}$$

$$\therefore hr = \frac{2T \cos \theta}{\rho g} = \text{constant}$$

$$\therefore h_1 r_1 = h_2 r_2$$

$$h_2 = (2.0) (2) \left(\frac{r_2}{r_1} = \frac{1}{2} \right) = 4.0 \text{ cm}$$

49. (3) [NCERT-254]

$$Av_1 = Av_2 + 1.5 Av$$

$$A \times 3 = A \times 1.5 + 1.5 Av \quad \therefore v = 1 \text{ m/s.}$$

50. (2) [NCERT-262]

$$R_{\max} = \frac{H}{2} = \frac{92}{2} = 46 \text{ cm}$$

Part-2 [SECTION-A]

51. (1)

$$F_{\text{res}} = \sqrt{6^2 + 6^2 + (\sqrt{72})^2} = \sqrt{144}$$

$$= 12 \text{ N along OE}$$

52. (1)

$$\text{FSR} = \text{MSR} + n \times \text{L.C}$$

$$= 0.5 + 25 \times 0.01$$

$$= 0.525$$

-0.004 is -ve error so add in FSR

$$\text{FSR} = 0.525 + 0.004 = 0.529$$

53. (1)

$$\text{Power} = \frac{\text{work}}{\text{time}}$$

$$\therefore [P] = \frac{[ML^2T^{-2}]}{[T]} = [ML^2T^{-3}]$$

$$\text{Surface tension} = \frac{\text{Force}}{\text{Length}}$$

$$\therefore [S] = \frac{[MLT^{-2}]}{[L]} = [ML^0T^{-2}]$$

Planck's constant

$$\frac{\text{Energy}}{\text{Frequency}}$$

$$\therefore [h] = \frac{[ML^2T^{-2}]}{[T^{-1}]} = [ML^2T^{-1}]$$

The ascending order of dimensions of time in their dimensional formulae is P, S, h.

48. (1) [NCERT-260]

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$$\therefore hr = \frac{2T \cos \theta}{\rho g} = \text{constant}$$

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$$\text{Planck's constant} = \frac{h \nu}{\nu}$$

$$\therefore [h] = \frac{[ML^2T^{-2}]}{[T^{-1}]} = [ML^2T^{-1}]$$

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54. (4)

$$3.72 + 9.4 = 13.12 = 13.1$$

55. (2)

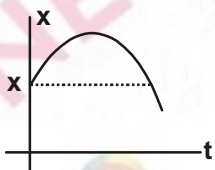
$\Delta v =$ Area under $A - t$ graph

$$\Delta v = \frac{1}{2} \times 4 \times 4 \Rightarrow \Delta v = 8$$

$$v - u = 8$$

$$v = 8 \text{ as } u = 0$$

56. (3)



$$\Delta x = 0$$

$$\bar{v}_{\text{avg}} = \frac{\Delta x}{\Delta t}$$

$$\therefore \bar{v}_{\text{avg}} = 0$$

57. (2)

Adding areas to get displacement

$$= \text{OAB} - \text{BCD} + \text{DEFG}$$

$$= \frac{1}{2} \times 2 \times 3 - \frac{1}{2} \times 2 \times 1 + 1 \times 1$$

$$= 3 - 1 + 1 = 3 \text{ m}$$

58. (4)

After 3 sec velocity & height of parachutist

$$v = -u + gt = -10 + 10 \times 3 = 20 \text{ m/s}$$

$$h' = -ut + \frac{1}{2}gt^2 = 15$$

so height from ground = 30 m

$$h = ut - \frac{1}{2}at^2$$

$$30 = 20t - \frac{1}{2} \times 5t^2$$

$$5t^2 - 40t - 60 = 0$$

$$t^2 - 8t + 12 = 0$$

$$(t - 2)(t - 6) = 0$$

$$t = 2 \text{ sec}$$

$$\therefore \text{Total time} = 3 + 2 = 5 \text{ sec}$$

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$$3.72 + 9.4 = 13.12 = 13.1$$

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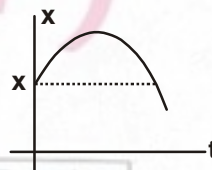
$$\Delta v = (A - t) \times \dots$$

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59. (4)

$$v = 2x + 2$$

$$a = v \frac{dv}{dx} = (2x + 2)2$$

so, $30 = (2x + 2)2$

$$2x + 2 = 15$$

$$x = \frac{13}{2} = 6.5 \text{ m}$$

60. (2)

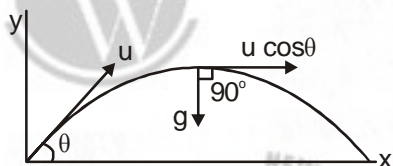
$$a = -\alpha x^2 \Rightarrow v \frac{dv}{dx} = -\alpha x^2$$

$$\int_{v_0}^0 v dv = -\int_0^x \alpha x^2 dx$$

$$\int_0^{v_0} v dv = \alpha \int_0^x x^2 dx$$

$$\frac{v_0^2}{2} = \frac{\alpha x^3}{3} \Rightarrow x = \left(\frac{3v_0^2}{2\alpha} \right)^{\frac{1}{3}}$$

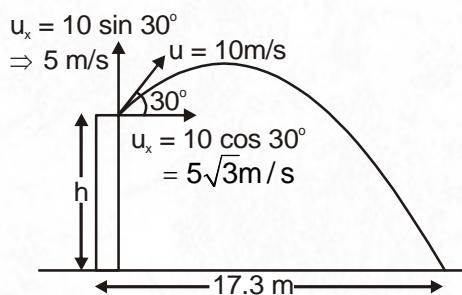
61. (3)



62. (2)

$$h = \frac{1}{2}gt^2 = \frac{1}{2}g \left(\frac{200}{2000} \right)^2 = \frac{1}{2} \times 10 \times \frac{1}{100} = 5 \text{ cm}$$

63. (3)



$$x = (u \cos \theta) \times t$$

$$17.3 = 5\sqrt{3}t$$

$$t = 2 \text{ second}$$

59. (4)

$$v = 2x + 2$$

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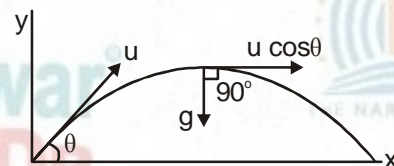
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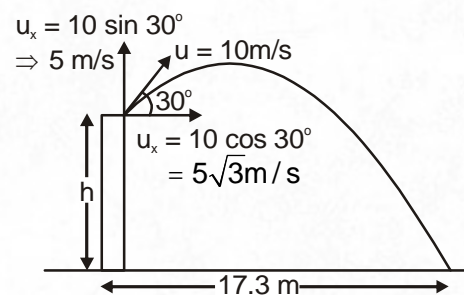
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63. (3)



$$x = (u \cos \theta) \times t$$

$$17.3 = 5\sqrt{3}t$$

$$t = 2 \text{ second}$$

$$-h = u \sin \theta t - \frac{1}{2} g t^2$$

$$-h = 5 \times 2 - \frac{1}{2} \times 10(2)^2$$

$$h = 10 \text{ m.}$$

64. (3)

[NCERT-79]

$$V_y = u_y - g t$$

$$V_y = 30 \sin 30 - 10 \times 1.5 = 0$$

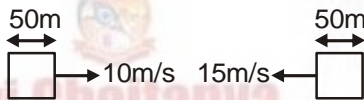
\therefore ball is at highest point $\therefore \theta = 0$

65. (3)

At highest point speed is only horizontal component.

66. (2)

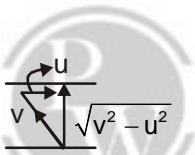
[NCERT-76]



$$\text{time of crossing} = \frac{50 + 50}{10 - (-15)} = \frac{100}{25} = 4 \text{ sec}$$

67. (1)

[NCERT-76]



Distance travelled perpendicular river flow

$$d = (\sqrt{v^2 - u^2}) t$$

Distance travelled in downstream

$$d = (v + u) T$$

$$(\sqrt{v^2 - u^2}) t = (v + u) T$$

$$(v + u)(v - u) t^2 = (v + u)^2 T^2$$

$$\left(\frac{v}{u} + 1\right) T^2 = \left(\frac{v}{u} - 1\right) t^2$$

$$\frac{v}{u} = \frac{T^2 + t^2}{t^2 - T^2}$$

68. (3)

[NCERT-76]

Velocity of Approach

$$= V_B - V_A$$

$$-h = u \sin \theta t - \frac{1}{2} g t^2$$

$$-h = 5 \times 2 - \frac{1}{2} \times 10(2)^2$$

$$h = 10 \text{ m.}$$

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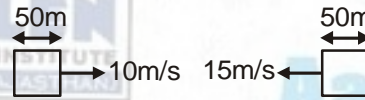
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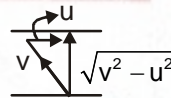
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68. (3)

[NCERT-76]

Velocity of Approach

$$= V_B - V_A$$

69. (2) [NCERT-95]

$$\text{Acceleration, } a = \frac{M-m}{M+m}g = \frac{4-2}{4+2}g = \frac{g}{3}$$

Applying Newton's 2nd law on mass C

$$m_c g - T' = m_c a \quad (a = \frac{g}{3})$$

$$2g - T' = 2a = \frac{2g}{3}$$

$$T' = 2g - \frac{2g}{3} = \frac{4g}{3} = \frac{4 \times 9.8}{3} = 13 \text{ N}$$

70. (2) [NCERT-98]

Impulse = change in momentum = $\Delta \vec{p}$

after each 2 sec momentum changed.

71. (4) [NCERT-100]

$$a = \frac{\text{Applied force}}{\text{Total mass}}$$

$$a_1 = \frac{mg}{m}, \quad a_2 = \frac{mg}{3m}, \quad a_3 = \frac{mg}{2m}$$

$$= a_1 > a_3 > a_2$$

72. (3) [NCERT-106]

In this case the component of horizontal acceleration and downward acceleration $g \sin \theta$ are opposite to each other.

Resultant acceleration = $a \cos \theta - g \sin \theta$

or $10 \cos 45^\circ - 10 \sin 45^\circ = \text{zero}$

Thus the block will be at rest.

73. (3) [NCERT-74]

$$\frac{mv^2}{r} = \mu mg$$

$$\mu = \frac{v^2}{rg}$$

$$\mu = \frac{(4.9)^2}{4 \times 9.8} = 0.61$$

74. (3) [NCERT-75]

In non-uniform circular motion net acceleration

$$a = \sqrt{a_r^2 + a_t^2}$$

75. (3) [NCERT-120]

$$\frac{mv^2}{r} = \mu mg, \quad v = \sqrt{\mu gr}$$

$$v = \sqrt{0.4 \times 10 \times 30} = 10.84 \text{ m/s}$$

69. (2) [NCERT-95]

$$m_c g - T' = m_c a = \frac{g}{3}$$

$$m_c g - T' = m_c a \quad (a = \frac{g}{3})$$

$$2g - T' = 2a = \frac{2g}{3}$$

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$$a_1 = \frac{mg}{m}, \quad a_2 = \frac{mg}{3m}, \quad a_3 = \frac{mg}{2m}$$

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In non-uniform circular motion net acceleration

$$a = \sqrt{a_r^2 + a_t^2}$$

75. (3) [NCERT-120]

$$\frac{mv^2}{r} = \mu mg, \quad v = \sqrt{\mu gr}$$

$$v = \sqrt{0.4 \times 10 \times 30} = 10.84 \text{ m/s}$$

76. (4)

[NCERT-125]

$$T = \frac{mv^2}{R}$$

i.e., $\frac{0.5 \times 16}{1} = 8 \text{ N}$

77. (4)

[NCERT-125]

From figure it is clear that

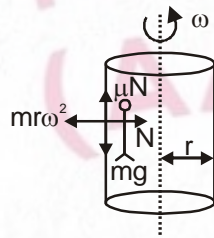
$$N = mr\omega^2$$

$$\text{and } \mu N = mg$$

$$\mu \cdot mr\omega^2 = mg$$

$$\text{or } \mu = \frac{g}{r\omega^2}$$

but $\omega = 2\pi f \therefore \mu = \frac{g}{4\pi^2 f^2 r}$



76. (4)

[NCERT-125]

$$T = \frac{mv^2}{R}$$

i.e., $\frac{0.5 \times 16}{1} = 8 \text{ N}$

77. (4)

[NCERT-125]

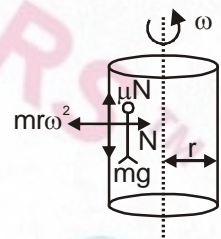
$$N = mr\omega^2$$

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$$\mu \cdot mr\omega^2 = mg$$

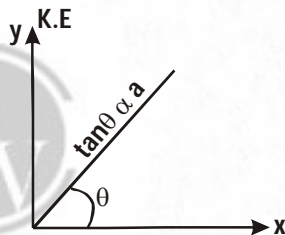
$$\text{or } \mu = \frac{g}{r\omega^2}$$

but $\omega = 2\pi f \therefore \mu = \frac{g}{4\pi^2 f^2 r}$



78. (4)

[NCERT-116]



From work energy theorem

$$\Delta K = W,$$

$$\Delta K = F \cdot \Delta x$$

$$\frac{\Delta K}{\Delta x} = F,$$

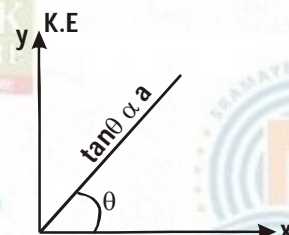
$$\frac{\Delta K}{\Delta x} = ma$$

$$\frac{\Delta K}{\Delta x} \propto a$$

$\tan \theta \propto a$ {where slope $m \propto \tan \theta$ }.

78. (4)

[NCERT-116]



$$\Delta K = W,$$

$$\Delta K = F \cdot \Delta x$$

$$\frac{\Delta K}{\Delta x} = F,$$

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$\tan \theta \propto a$ {where slope $m \propto \tan \theta$ }.

79. (4)

[NCERT-117]

If tangential force also acts on the body in addition to centripetal force work done by centripetal force is zero but work done by tangential force is not zero.

79. (4)

[NCERT-117]

If tangential force also acts on the body in addition to centripetal force work done by centripetal force is zero but work done by tangential force is not zero.

80. (2)

[NCERT-93]

$$MV = (M - m) V' ; \quad \frac{MV}{M - m}$$

(by momentum conservation)

80. (2)

[NCERT-93]

$$MV = (M - m) V' ; \quad \frac{MV}{M - m}$$

81. (3) [NCERT-102]

$$\Delta K = \int_{20}^{30} F dx = -0.1$$

$$\left[\frac{x^2}{2} \right]_{20}^{30} = -\frac{0.1}{2} [(30)^2 - (20)^2]$$

$$K_2 - K_1 = -\frac{0.1}{2} \Rightarrow 50 \times 10 = -25$$

$$\text{So, } K_2 = K_1 = 25 = \frac{1}{2} \times 10 \times 100 + 25 = 475 \text{ J}$$

82. (2) [NCERT-95]

$$ab = (a + c) V ; \quad V = \left(\frac{b}{a+c} \right) a$$

83. (4) [NCERT-97]

$$mv - mv = 2 mV ; \\ V' = 0$$

84. (4) [NCERT-119]

$$P = \frac{1}{2} \frac{mv^2}{t} = \left(\frac{1}{2} \times 70 \times 9^2 \right) \times \frac{1}{2} \\ = \frac{70 \times 81}{4} \text{ watt} = 1417.5 \text{ watt}$$

85. (4) [NCERT-127]

as velocity inter changed so ratio mass will one.

Part-2 [SECTION-B]

86. (3) [NCERT-144]

Co-ordinates of the corners of the square are (0,0), (2,0), (2,2), (0,2).

$$\therefore x_{CM} = \frac{m_1 x_1 + m_2 x_2 + m_3 x_3 + m_4 x_4}{m_1 + m_2 + m_3 + m_4} \\ = \frac{2 \times 0 + 3 \times 2 + 5 \times 2 + 8 \times 0}{2 + 3 + 5 + 8} = \frac{8}{9} \text{ m}$$

$$y_{CM} = \frac{m_1 y_1 + m_2 y_2 + m_3 y_3 + m_4 y_4}{m_1 + m_2 + m_3 + m_4} \\ = \frac{2 \times 0 + 3 \times 0 + 5 \times 2 + 8 \times 2}{2 + 3 + 5 + 8} = \frac{13}{9} \text{ m}$$

87. (4) [NCERT-175]

$$\text{Linear acceleration, } a = \frac{g \sin \theta}{1 + I/MR^2}$$

For circular ring, $I = MR^2$

$$\therefore \alpha = \frac{g \sin \theta}{2} = \frac{g \sin 30^\circ}{2} = \frac{g}{4}$$

81. (3) [NCERT-102]

$$\Delta K = \int_{20}^{30} F dx = -0.1$$

$$\left[\frac{x^2}{2} \right]_{20}^{30} = -\frac{0.1}{2} [(30)^2 - (20)^2]$$

$$K_2 - K_1 = -\frac{0.1}{2} \Rightarrow 50 \times 10 = -25$$

$$\text{So, } K_2 = K_1 = 25 = \frac{1}{2} \times 10 \times 100 + 25 = 475 \text{ J}$$

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$$y_{CM} = \frac{m_1 y_1 + m_2 y_2 + m_3 y_3 + m_4 y_4}{m_1 + m_2 + m_3 + m_4} \\ = \frac{2 \times 0 + 3 \times 0 + 5 \times 2 + 8 \times 2}{2 + 3 + 5 + 8} = \frac{13}{9} \text{ m}$$

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$$a = \frac{g \sin \theta}{1 + I/MR^2}$$

$I = MR^2$

$$\therefore \alpha = \frac{g \sin \theta}{2} = \frac{g \sin 30^\circ}{2} = \frac{g}{4}$$

88. (1) [NCERT-165]

Diameter of the disc lies parallel to X-axis
By theorem of perpendicular axis ,

$$\text{M.I. of disc about diameter} = \frac{1}{2} \left(\frac{MR^2}{2} \right) = \frac{MR^2}{4}$$

89. (3) [NCERT-179]

$$T = I \alpha = FR$$

$$MR^2 \propto 30 \times 0.4 \Rightarrow \propto 25 \text{ s}^{-2}$$

$$a = R \alpha = 0.4 \times 25 = 10 \text{ m/s}^2.$$

90. (2) [NCERT-179]

$$P = T\omega = 180 \times 200 = 36 \text{ kW.}$$

91. (1) [NCERT-179]

$$E = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

$$= \frac{1}{2}mv^2 + \frac{1}{2}mR^2 \frac{v^2}{R^2} = mv^2$$

$$= 100 \times (0.2)^2$$

$$= 4 \text{ J.}$$

92. (2) [NCERT-179]

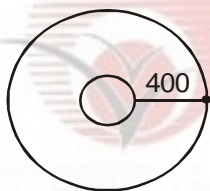
$$a = \frac{g \sin 30}{1 + \frac{1}{2}} = \frac{2}{3}g \frac{1}{2} = \frac{9.8}{3}$$

$$v^2 = u^2 - 2aS$$

$$v^2 = 2aS$$

$$S = \frac{5 \times 5}{2 \times 9.8} \times 3 = 3.8 \text{ m}$$

93. (1) [NCERT-202]



$$E = -\frac{GMm}{2r}$$

$$r = R_e + h = 6400 + 400$$

$$= 6800 \times 10^3 \text{ m}$$

$$\text{So } E' = + \frac{GMm}{2(R_e+h)}$$

$$= \frac{-6.6 \times 10^{-11} \times 6 \times 10^{24} \times 200}{2 \times 6.8 \times 10^6}$$

$$= 5.89 \times 10^9 \text{ J}$$

88. (1) [NCERT-165]

$$y \text{ for } v \{ \text{kd h i e s } | \text{ s}$$

$$= \frac{1}{2} \left(\frac{MR^2}{2} \right) = \frac{MR^2}{4}$$

89. (3) [NCERT-179]

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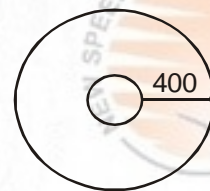
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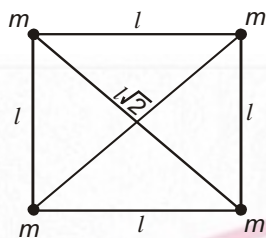
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94. (4)

[NCERT-192]



G.P.E.

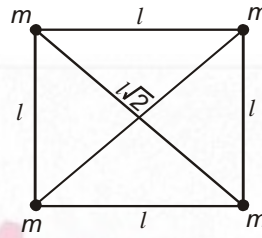
$$U = \frac{-Gm_1m_2}{r}$$

$$= -4 \left[\frac{Gm^2}{l^2} \right] + \left[\frac{-2Gm^2}{l\sqrt{2}} \right]$$

$$= -5.41 \frac{m^2}{l}$$

94. (4)

[NCERT-192]



G.P.E.

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$$= -5.41 \frac{m^2}{l}$$

95. (2)

[NCERT-190]

Since density $\rho = \frac{m}{V}$

$$\therefore d\rho = \frac{-m}{V^2} dV$$

$$\therefore \frac{d\rho}{\rho} = \frac{-dV}{V}$$

Substituting this value in bulk modulus,

$$K = \frac{-P}{\frac{d\rho}{\rho}} = \frac{P\rho}{d\rho}$$

with increase in pressure, the density increases

$$\therefore d\rho = \rho' - \rho$$

$$\therefore K = \frac{P\rho}{\rho' - \rho}$$

$$\therefore \frac{\rho' - \rho}{\rho} = \frac{\rho}{K}$$

$$\frac{\rho'}{\rho} = 1 + \frac{\rho}{K}$$

96. (1)

[NCERT-195]

$$v = \sqrt{\frac{GM}{r}} \therefore K.E. \propto v^2 \propto \frac{1}{r} \text{ and } T^2 \propto r^3$$

$$\therefore K.E. \propto T^{-2/3}$$

95. (2)

[NCERT-190]

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[NCERT-195]

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97. (2)

[NCERT-185]

$$\omega = \sqrt{\frac{g}{R_e}} = \sqrt{\frac{10}{6400 \times 10^{-3}}}$$

$$= 1.25 \times 10^{-3} \text{ Rad /sec}$$

98. (1)

[NCERT-196]

$$PE = -\frac{GMm}{(R_e + h)}$$

$$KE = \frac{1}{2}mv^2 = \frac{GMm}{2(R_e + h)}$$

$$T.E. = P.E. + KE. = -\frac{GMm}{2(R_e + h)}$$

99. (1)

[NCERT-201]

Angle of projectile

100. (4)

[NCERT-199]

The force of gravitation is conservative.

97. (2)

[NCERT-185]

$$\omega = \sqrt{\frac{g}{R_e}} = \sqrt{\frac{10}{6400 \times 10^{-3}}}$$

$$= 1.25 \times 10^{-3} \text{ Rad /sec}$$

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[NCERT-196]

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$$KE = \frac{1}{2}mv^2 = \frac{GMm}{2(R_e + h)}$$

$$T.E. = P.E. + KE. = -\frac{GMm}{2(R_e + h)}$$

99. (1)

[NCERT-201]

i f s d k i j

100. (4)

[NCERT-199]

x p d " k c y l j k h c y g s k g s

