AVIRAL CLASSES
IIT-JEE | NEET | FOUNDATIONS

ULTIMATE TEST SERIES NEET -2020
TEST-4 SOLUTION

Test Date :11-03-2020

[PHYSICS]

1. $-\frac{GMm}{2R^3}\left(3R^2-\frac{R^2}{4}\right)+\frac{1}{2}mv_e^2=0$

$v_e=\sqrt{\frac{11}{4}\frac{GM}{R}}$

2. $A_1V_1 = A_2V_2$

$=\pi\left(\frac{3}{2}\right)^2 \times 4 = \pi\left(\frac{6}{2}\right)^2 \times v$

$= v = 1$ m/s

3. Breaking force = Breaking stress × Area

$\frac{F_1}{F_2}=\left(\frac{r_1}{r_2}\right)^2$

$\frac{200}{F_2}=\left(\frac{r}{2r}\right)^2 \Rightarrow F_2 = 800N$

4. $F=\frac{YA\Delta x}{L} = \frac{YA^2\Delta x}{V}$

$\boxed{F \propto A^2}$

5. Apply $W = T\Delta A$

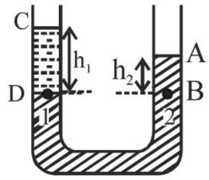
and as for bubble there are two surfaces

$W = T\left[2\times4\pi\left(\frac{2D}{2}\right)^2-2\times4\pi\left(\frac{D}{2}\right)^2\right] = 6\pi D^2T$

6. A

7. A

8.



$P_1 = P_2$

$P_o + \rho_{oil} \times g \times h_1 = P_o + \rho_w \times g \times h_2$

$\frac{\rho_{oil}}{\rho_w}=\frac{h_2}{h_1}$

9. D

10. $3P = P + h\rho_w g \Rightarrow h\rho_w g = 2P$

when water is drawn out, the pressure at bottom.

$P'=P+\left(h-\frac{h}{5}\right)\rho_w g=P+\frac{4}{5}h\rho_w g$

$P'=P+\frac{4}{5}(2P)=\frac{13}{5}P$

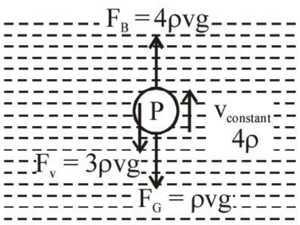
11. C

12. A

13. $F_B = F_v + F_G$

$F_v = 3\rho vg$

$$\frac{F_V}{F_G} = \frac{3\rho vg}{\rho vg}$$



14. $h \propto \frac{1}{r}$

$$\frac{r_1}{r_2} = \frac{h_2}{h_1} = \frac{66}{22} = \frac{3}{1}$$

15. C

16. Let the unstretched length be ℓ, then

$$T_1 = K[\ell_1 - \ell]$$

$$T_2 = K[\ell_2 - \ell]$$

Dividing equation (i) by equation (ii), we get

$$\frac{T_1}{T_2} = \frac{\ell_1 - \ell}{\ell_2 - \ell} \text{ or } \ell = \frac{T_1\ell_2 - T_2\ell_1}{T_1 - T_2}$$

17. Moment of inertia of a rod

$$I = \frac{1}{12}ML^2 \quad ...(i)$$

Where M is the mass of the rod and L is the length of the rod

$$\therefore \quad \Delta I = \frac{1}{12}2ML\Delta L \quad (\because \quad \text{M is a constnat}) \quad ....(ii)$$

Divide equation (ii) by (i), we get

$$\frac{\Delta I}{I} = 2\frac{\Delta L}{L} \quad ....(iii)$$

As $\Delta L = L\alpha\Delta T$

or $\frac{\Delta L}{L} = \alpha \Delta T$

Substituting the value $\frac{\Delta L}{L}$ is equation (iii), we get,

$$\frac{\Delta I}{I} = 2\alpha \Delta t$$

18. $R_B^2 = \frac{FL}{Y_B\pi\Delta L}, \quad R_S^2 = \frac{FL}{Y_S\pi\Delta L}$

$$\therefore \quad \frac{R_B^2}{R_S^2} = \frac{Y_S}{Y_B} = \frac{2\times10^{10}}{10^{10}} = 2$$

$$R_B = \sqrt{2}\,Rs \text{ or } Rs = \frac{R_B}{\sqrt{2}}$$

19. As we know that energy expended

$$= T(4\pi R^2)(n^{1/3} - 1)$$

$\therefore \quad \Delta E = T(4\pi R^2)n^{1/3} - T.4\pi R^2$

Now, $T.\,4\pi R^2 = E_i$ = initial surface energy of drop

$\therefore \quad \Delta E = T(4\pi R^2)n^{1/3} - E_i$

or $\quad T(4\pi R^2)n^{1/3} = \Delta E + E_i$

Now, $E_i + \Delta E$ = final surface energy = E_f

$\therefore \quad E_f = T(4\pi R^2)n^{1/3}$

and $\quad E_i = T(4\pi R^2)$

So, $\frac{E_f}{E_i} = n^{1/3} = (1000)^{1/3} = 10$

$\therefore \quad E_f = 10E_i = 10E.$

20. C

21. D

22. Let the volume of sphere is V.

$$mg = F_{b_1} + F_{b_2}$$

$$v\rho g = \frac{4}{5}v\times10^3\times g+\frac{1}{5}v\times13.5\times10^3 g$$

$$\rho = 3.5 \times 10^3 \text{ kg/m}^3$$

23. Water has least volume at 4ºC. So volume will increase when water is heated or cooled at 4ºC.

24. In equilibrium, the pressure of liquid at the same level must be equal. Considering pressure at level D in both arms of U-tube.

Pressure of 20 h cm of oil + pressure of (20 – h) cm of mercury = pressure of 20 cm of carbon tetrachloride,

$$h \times 0.9 \times g + (20 - h) \times 13.6 \times g = 20 \times 1.6 \times g$$

or $0.9\,h + 272 - 13.6\,h = 32$

or $12.7\,h = 240$

or $h = \frac{240}{12.7}$

$= 18.9$ cm

25. $$L = L_0\left[1+\frac{1}{100}\right]$$

Hence, $2L^2 = 2L_0^2\left(1+\frac{1}{100}\right)^2$

or $2L^2 - 2L_0^2 \cong 2L_0^2 \times \frac{2}{100}$

or $\frac{\Delta S}{2L_0^2} = \frac{2}{100} = 2\%$

26. The air through the horizontal tube will decrease the pressure and more liquid will be pushed into the capillary tube.

27. There will be excess pressure $\Delta p = \frac{4T}{R}$ inside the soap bubble. As $R_B > R_A > R_C$ so $P_C > P_A > P_B$. Therefore the air will flow from A and C towards B

28. $Y = 2\eta(1 + \sigma)$

29. $$P = \frac{2T}{r}$$

$$= \frac{2\times4.65\times10^{-1}}{6\times10^{-3}} = 155 \text{ Pa}$$

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

$$\frac{v_1}{v_2} = \left[\frac{\rho_1-\sigma}{\rho_2-\sigma}\right]$$

$$\frac{0.2}{v_2} = \left[\frac{19.5-1.5}{10.5-1.5}\right]$$

$$v_2 = 0.1 \text{ m/s}$$

31. C

32. $k = yr_0$

$$r_0 = \frac{k}{y} = \frac{3.6\times10^{-9}}{1.2\times10^{11}} = 3 \times 10^{-20}\text{m}$$

33. $$\mu = \frac{\text{Real depth}}{\text{Apparent depth}} = \frac{d}{x}$$

$\therefore$ Due to first liquid, $\sqrt{2} = \frac{d}{x_1}$ or $x_1 = \frac{d}{\sqrt{2}}$

Due to the second liquid, $n = \frac{d}{x_2}$

$\therefore$ $x_2 = \frac{d}{n}$

34. Additional kinetic energy = $TE_2 - TE_1$

$$= -\frac{GMm}{2R_2} - \left(-\frac{GMm}{2R_1}\right) = \frac{1}{2}GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

35. Power = Fv = $v\left(\frac{m}{t}\right)v = v^2(\rho Av)$

$$= \rho Av^3 = (100)(2)^3 = 800\ W$$

36. B

37. B

38. A

39. C

40. Using equation of continuity
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$A_1V_1 = A_2V_2 \Rightarrow$

$$\frac{V_1}{V_2} = \frac{A_2}{A_1} = \left(\frac{4.8}{6.4}\right)^2 = \frac{9}{16}$$

41. Escape velocity

$$= \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G\left(\frac{4}{3}\pi R^3\right)\rho}{R}} \propto R$$

Therefore $v_1 : v_2 : v_3 = R_1 : R_2 : R_3$

$$= R_1 : \frac{R_1}{2} : \frac{R_1}{3} = 6 : 3 : 2.$$

42. B

43. B

44. A

45. $mg' = mg - m\omega^2 R\cos^2\lambda \Rightarrow \frac{3}{5}mg = mg - m\omega^2 R$

$$\omega = \sqrt{\frac{2g}{5R}}$$

[CHEMISTRY]

46. A

47. C

48. C

49. A

50. D

51. C

52. D

53. A

54. $BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$ (Solubility)

55. [Metallic charater $\propto$ size]

56. A

57. B

58. D

59. C

60. C

61. B

62. D

63. A

64. We know that
oxidising nature $\propto$ S.R.P.
Reducing nature $\propto \frac{1}{\text{S.R.P.}}$
→ In the given values, F_2 has highest S.R.P. therefore it is strongest oxidising agent.
→ In the given values Iodine has least S.R.P. therefore I^- is strongest reductant

65. On strong heating only Li gives normal oxide while other alkali metlas gives peroxide or super oxide

66. A

67. C

68. A

69. A

70. A

71. C

72. D

73. A

74. D

75. A

76. (b) When H_2O_2 reduces with $K_4[Fe(CN)_6]$. It is present in acidic solution.

$$2K_4[Fe(CN)_6 + H_2SO_4 + H_2O_2 \rightarrow$$
$$2K_3[Fe(CN)_6] + K_2SO_4 + 2H_2O$$

77. A

78. (d) $2\overset{0}{N_2} + \overset{0}{O_2} \rightarrow 2\overset{+2-2}{NO}$

Here O.N. of N increases from O in N_2 to +2 in NO, 2– and that of decreased from O in O_2 to –2 in O, therefore, it is a redox reaction.

79. (c) Prevent action of water and salt.

80. **B**

81. (a) In this reaction H_2O acts as oxidising agent.

82. (d) I^- act as a more reducing agent than other ions.

83. (d) $NaCl + H_2O \rightarrow NaOH + HCl$

Sodium ion hydrated in water.

84. (a) Potassium has higher negative value of reduction potential hence it shows more reducing properties.

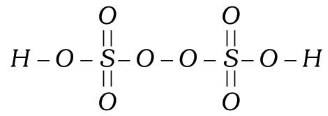
85. (b) The oxidation number of Ni changes from 0 to $+1$

86. (c) $\overset{0}{Br_2} \rightarrow \overset{+5}{BrO_3^-}$, in this reaction oxidation state change from 0 to + 5.

87. (c) In hypochlorous acid chlorine atom has + 1 oxidation number.

88. (a) Phosphorus shows – 3 to + 5 oxidation state.

89. (c) The chemical structure of $H_2S_2O_8$ is as follows:-



So the oxidation number of S should be :

$$\underset{(\text{for } H)}{2 \times (+1)} + \underset{(\text{for } S)}{2 \times X} + \underset{(\text{for } O)}{6 \times (-2)} + \underset{(\text{for } O-O)}{2 \times (-1)} = 0 \text{ or } X = +6 .$$

90. (d) In hydrazoic acid (N_3H) nitrogen shows $-\frac{1}{3}$ oxidation state.

$\overset{*}{N_3}H$

$3x + 1 = 0$, $3x = -1$, $x = -\frac{1}{3}$.