WEEKLY TEST MEDICAL PLUS - 03 TEST - 14 RAJPUR
SOLUTION Date 10-11-2019

[PHYSICS]

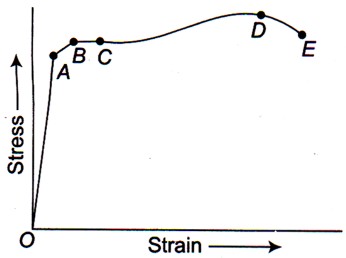
31. As stress is shown on x-axis and strain on y-axis

So we can say that $Y = \cot\theta = \dfrac{1}{\tan\theta} = \dfrac{1}{\text{slope}}$

So elasticity of wire P is minimum and of wire R is maximum.

32. In the region OA, the graph is linear showing that stress is proportional to the strain. Is proportional to the strain. Thus, in this region Hooke's law is obeyed.

The point D on the graph is known as ultimate tensile strength.



The point E on the graph is known as fracture point.

33. $Y = \tan\theta$. According to figure $\theta_A > \theta_B > \theta_C$

i.e., $\tan\theta_A > \tan\theta_B > \tan\theta_C$

or $Y_A > Y_B > Y_C$

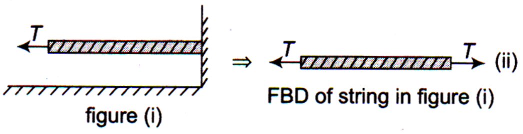
$\therefore$ A, B, and C graph are for steel, brass and rubber respectively.

34. From the given graph for a stress of 150×10^6 N m^{-2} the strain is 0.002.

$\therefore$ Young's modulus $Y = \dfrac{\text{Stress}}{\text{Strain}}$

$$Y = \frac{150\times10^6}{0.002}\,\text{N m}^{-2} = 7.5\times10^{10}\,\text{N m}^{-2}$$

35. Tension in both string shall be same which can be observed by making FBD of string in figure (1)



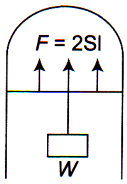
36. Shearing strain $= \dfrac{\Delta x}{L}$

37. Because film tries to cover minimum surface area.

38. Here, $W = 1.5 \times 10^{-2}$ N,

$l = 30$ cm $= 30 \times 10^{-2}$ m

A liquid film has two free surfaces. A slider will support the weight when the force of surface tension action upwards on the slider ($2Sl$) balances the downward force due to weight ($= W$)



39. Energy needed = Increment in surface energy

= (surface energy of n small drops) – (surface energy of one big drop)

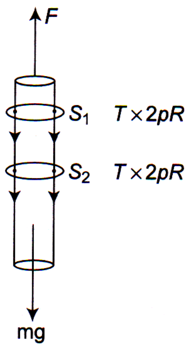
$= n4\pi r^2 T - 4\pi R^2 T = 4\pi T(nr^2 - R^2)$

40. $W = 8\pi T(r_2^2 - r_1^2) = 8\pi T\left[\left(\dfrac{2}{\sqrt{\pi}}\right)^2 - \left(\dfrac{1}{\sqrt{\pi}}\right)^2\right]$

$\therefore \quad W = 8 \times \pi \times 30 \times \dfrac{3}{\pi} = 720$ erg

41. The free body diagram of the capillary tube is as shown in the figure. Net force F required to hold tube is

F = force due to surface tension at cross-section



Free body daigram of capillary tube

$(S_1 + S_2)$ + weight of tube.

$= (2\pi RT + 2\pi RT) + mg = 4\pi RT + mg$

42. It may be noted that the soap film has two free surfaces. So, the effective length is 8ℓ.

43. $W = [2 \times 4\pi(3r)^2 - 2 \times 4\pi r^2]\, T = 64\, \pi r^2 T$

44. $h = \frac{2\sigma \cos\theta}{r\rho g}$ or $r = \frac{2\sigma \cos\theta}{h\rho g}$

or $r = \frac{2 \times 75 \times 10^{-3} \times \cos 0^\circ}{3 \times 10^{-2} \times 10^3 \times 10} \text{m} = 5 \times 10^{-4}\, \text{m}$

45. $h = h_0 = \frac{2T \cos\theta}{\rho g r}$

$= \frac{2(72)\cos 0^\circ}{(1)(1000)\left(\frac{1}{40}\right)} = 57.6\text{ cm}$

Since ℓ (= 50 cm) < h_0.

$h = 50$ cm

[CHEMISTRY]

46. **(b)** $K = \kappa R = (6.67 \times 10^{-3}\, \Omega^{-1}\, \text{cm}^{-1})\, (243\, \Omega) = 1.62\, \text{cm}^{-1}$.

47. **(c)** $\lambda^{\infty}\text{BaCl}_2 = \frac{1}{2}\lambda^{\infty}\text{Ba}^{2+} + \lambda^{\infty}\text{Cl}^-$

$= \frac{127}{2} + 76 = 139.5\, \text{ohm}^{-1}\text{cm}^{-1}\,\text{eq}^{-1}$

48. **(d)** Molar conductivity $\propto$ no. of ions per mole of electrolyte.

49. **(a)** $CuSO_4 + 2e^- \longrightarrow Cu + SO_4^-$
$Bi_2(SO_4)_3 + 6e^- \longrightarrow 2Bi + 3SO_4^-$
$AlCl_3 + 3e^- \longrightarrow Al + 3Cl^-$
$AgNO_3 + e^- \longrightarrow Ag + NO_3^-$

50. **(c)** $\kappa = \Lambda_c = (200\, \text{S cm}^2\, \text{mol}^{-1})\, (0.05 \times 10^{-3}\, \text{mol cm}^{-1})$
$= 0.01\, \text{S cm}^{-1}$

$R = \frac{1}{\kappa}\left(\frac{\ell}{A}\right) = \frac{1}{(0.01\, S\, \text{cm}^{-1})}\left(\frac{1}{3}\text{cm}^{-1}\right) = 33.33\, \Omega$

51. **(b)** At anode $2H_2O \longrightarrow O_2 + 4H^+ + 4e^-$
At cathode $Ag^+ + e^- \longrightarrow Ag$

52. **(d)** Since $Ag^+ + e^- \rightarrow Ag$, $Cu^{2+} + 2e^- \rightarrow Cu$, $Au^{3+} + 3e^- \rightarrow Au$, 3 F of electricity will deposit 3 moles of Ag, 1.5 moles of copper, and 1 mole of gold. Therefore, the molar ratio is 3 : 1.5 : 1 or 6 : 3 : 2.

53. **(c)** $\frac{\text{Weight of Cu}}{\text{Weight of } H_2} = \frac{\text{Eq. weight of Cu}}{\text{Eq. weight. of H}}$

$\frac{\text{Weight of Cu}}{0.50} = \frac{63.6/2}{1}$

Weight of Cu = 15.9 g

54. **(c)** $2O^{2-} \longrightarrow O_2 + 4e$

$$\text{Mole of } e = \frac{0.75 \times 10 \times 60}{96500}$$

$$\text{Mole of } O_2 = \frac{4.66 \times 10^{-3}}{4} = 0.0261 \text{ L}$$

55. **(a)** In galvanic cell/electrochemical cell electrical energy is produced due to some chemical reaction.

56. **(a)** $Zn + MgCl_2 \rightarrow ZnCl_2 + Mg$

$$\therefore\ E^{\circ}_{cell} = E^{\circ}_{Zn/Zn^{+2}} + E^{\circ}_{Mg^{+2}/Mg} = +0.762 - 2.37$$

$$= -1.608 \text{ V}$$

Here, E°_{cell} is negative so no reaction will take place.

57. **(c)** Salt bridge completes the electrical circuit and minimises the liquid–liquid junction potential.

58. **(b)** $Ag|Ag^{+}||AgI|Ag$

$$E_{cell} = E^{o}_{Ag/Ag^{+}} + E^{o}_{I^{-}/AgI(s)/Ag}$$

$$= -0.799 - 0.151 = -0.950 \text{ V}$$

59. **(a)** E° is intensive property and it does not depend on mass of F_2 taking part.

60. **(d)** More is E°_{RP}, more is the tendency to get reduced or lesser is tendency to get oxidised. $E^{o}_{RPCr^{3+}/Cr^{2+}}$ is maximum among all.

61. **(a)** More is E°_{RP}, more is oxidizing power or lesser is reducing power.

62. **(d)** For the cell: $Zn \mid ZnSO_4\,(aq) \parallel H_2SO_4\,(aq) \mid H_2\,(g) \mid Pt$

LHE reaction: $Zn \longrightarrow Zn^{2+} + 2e$

RHE reaction: $2H^{+} + 2e \longrightarrow H_2$

Net reaction: $Zn + 2H^{+} \longrightarrow Zn^{2+} + H_2$

or $Zn\,(s) + H_2SO_4\,(aq) \longrightarrow ZnSO_4\,(aq) + H_2\,(g)$

63. **(a)**

$Cu^{2+} + 1e^{-} \longrightarrow Cu^{+}$	$E_1 = 0.15$	...(i)
$Cu^{+} + 1e^{-} \longrightarrow Cu$	$E_2 = 0.50$	...(ii)
$Cu^{2+} + 2e^{-} \longrightarrow Cu$	$E_3 = ?$	...(iii)

Clearly (iii) = (i) + (ii)

$$-\Delta G^{0}_{3} = -\Delta G^{0}_{1} + (-\Delta G^{0}_{2})$$

$$2 \times F \times E_3 = 1 \times F \times E_1 + 1 \times F \times E_2$$

$$E_3 = \frac{0.65}{2} = 0.325 \text{ V}$$

64. **(c)** Lower SRP containing ion can displace higher SRP containing ion.

65. **(b)** Negative electrode potential (reduction potential) indicates lesser tendency for the reduction. Hence A is readily oxidized.

66. **(a)** The more negative the electrode potential, the lesser the tendency of the metal to undergo reduction and therefore metal would act as stronger reducing agent.

67. **(a)** More negative the standard potential, least the reduction tendency of the ion. The corresponding atom has largest oxidation tendency and thus is a strong reducing agent. Zn is the strongest reducing agent.

68. **(b)** $\Delta G^\circ = -nFE^\circ$ cell if E°_{cell} is positive, then ΔG° will be –ve showing that cell reaction is spontaneous.

69. **(b)** More the negative E° value, larger the reducing power of the metal.

70. **(c)** $Fe^{+2} + Zn \rightarrow Zn^{2+} + Fe$ (Oxidation: Zn → Zn^{2+}; Reduction: Fe^{+2} → Fe)

EMF = $E_{cathode} - E_{anode} = 0.44 - (0.76) = +0.32$ V

71. **(d)** The tendency to gain electron is in the order

$Z > Y > X$

Thus $Y + e \rightarrow Y^-$; $X \rightarrow X^+ + e$

72. **(a)** $E = E^\circ - \frac{0.0591}{n}\log\frac{[\text{Product}]}{[\text{Reactant}]}$

if $\frac{[\text{Product}]}{[\text{Reactant}]} = 1$, then $E = E^\circ$.

73. **(c)** $\frac{2}{3}Al_2O_3 \longrightarrow \frac{4}{3}Al + O_2$

Thus, $\frac{2}{3} \times 3\,(O^{2-})$

i.e., $2O^{2-} \longrightarrow O_2 + 4e^-$ $[\because n = 4]$

$\Delta G = +966\text{ kJ mol}^{-1} = 966 \times 10^3\text{ J mol}^{-1}$

$G = -nFE_{cell}$

$966 \times 10^3 = -4 \times 96500 \times E_{cell}$

$E_{cell} = 2.5$ V