LEC-MOCK Test - 1

GROUP – A

Solution

1. **c)**

   Initial K.E. = $\frac{1}{2}mu^2$

   K.E. at highest point = $\frac{1}{2}m(u\cos\theta)^2 = \frac{3}{4}E$

2. **c)**

   $C_p = r\,C_v$ or, $C_p - C_v = R$ or, $rC_v - C_v = R$

   or, $C_v = \frac{R}{r-1}$

3. **b)** Obvious
4. **d)** Obvious
5. **a)** Hint, $\frac{1}{f} = (\mu - 1)\frac{1}{R}$ R = 8cm.
6. **d)** Hint, total R = $\frac{R \times R}{R+R} = \frac{R}{2}$

   As question, $\frac{6^2}{\frac{R}{2}} = 48 \Rightarrow R = \frac{72}{48} = 1.5\Omega$

7. **d)** $\lambda_{min} = \frac{332 \times 100cm}{2000}$ = 1.66cm = 16.6mm ≈20mm
8. **d)** Hint, power = F*v

   To see relation between R & T in dimension

   $MLT^{-2} \times LT^{-1} \Rightarrow L^2 \propto T^3 \Rightarrow$ distance $\propto t^{3/2}$

9. **a)** Obvious
10. **b)** Hint, $v \propto t^{1/2}$

    $\Delta v = \frac{1}{2}\frac{\Delta T}{T} = \frac{1}{2} \times 0.8 = 0.4\%$

11. **c)** Obvious
12. **b)** Hint, wave number = $R(\frac{1}{n_1^2} - \frac{1}{n_2^2})$

    For first line of Balmer series $n_1=2$, $n_2=3$

    Wave number = $\frac{5R}{36}$

13. **a)** Obvious
14. **b)** Hint: $1 = 1^2 + 2\times 1^2\cos\theta + 1^2 \Rightarrow \text{Cos}\theta = -\frac{1}{2}$

    $|\vec{a} - \vec{b}| = \sqrt{1^2 + 1^2 - 2.1^2.cos\theta} = \sqrt{3}$

15. **c)** Hint, $V = L^3 \Rightarrow \frac{\Delta V}{V} = 3\frac{\Delta L}{L} = 3.\frac{1}{100} = 0.03$
16. **b)** Hint, % increase = $\frac{\Delta L}{L} \times 100\% = \alpha\Delta\theta \times 100\%$

    $= 10^{-5}\times 100 \times 100\% = 0.1\%$

17. **c)** $\lambda = \frac{h}{p}$ i.e., momentum will be equal
18. **c)** Hint, $\frac{1}{\log_3 12} + \frac{1}{\log_4 12} = \log_{12}3 + \log_{12}4 = \log_{12}12 = 1$
19. **a)** Hint, $\text{sinA sinB} = \frac{ab}{c^2}$

    $\text{sinA sinB} = \frac{4R^2\text{sinA sinB}}{4R^2\text{sin}^2\text{C}} \Rightarrow \text{sin}^2\text{C} = 1 \Rightarrow \text{C} = 90^0$

20. **b)** $\cos\theta = \frac{\vec{a}.\vec{b}}{|\vec{a}||\vec{b}|} = \hat{a}.\hat{b}$
21. **d)** Hint, $\lim_{x\to 0^-} = \frac{-x}{x} = -1$

    $\lim_{x\to 0^+} = \frac{x}{x} = 1 \Rightarrow$since,$\lim_{x\to 0}\frac{|x|}{x}$, does not exist

22. **c)** Hint, Number of its possible ways

3	5	5	5

    = 375

23. **b)** Hint, Roots = α, β

    $\frac{\alpha+\beta}{2} = 9$, $\sqrt{\alpha\beta} = 4 \Rightarrow x^2 + (\alpha + \beta)x + \alpha\beta = 0$

    $x^2 - 18x + 16 = 0$

24. **a)** Obvious
25. **c)** Hint, $\sin 9\theta - \sin\theta = 0$

    $\Rightarrow 2\cos 5\theta.\sin 4\theta = 0 \Rightarrow \sin 4\theta = 0 \Rightarrow 4\theta = n\pi$

26. **a)** Hint, $\overrightarrow{GA} + \overrightarrow{GB} + \overrightarrow{GC} = (\overrightarrow{OA} - \overrightarrow{OG}) + (\overrightarrow{OB} - \overrightarrow{OG}) + (\overrightarrow{OC} - \overrightarrow{OG})$

    $= (a - \frac{a+b+c}{3}) + (b - \frac{a+b+c}{3}) + (c - \frac{a+b+c}{3}) = 0$

27. **c)** Obvious

28. **b)** Area = $|\vec{a} \times \vec{b}|$

29. **c)** $\int \tan^2 x\, dx = \int (\sec^2 x - 1)dx = \tan x - x + c$

30. **c)** max value of sinx + cosx = $\sqrt{a^2+b^2}$
So max value = $\sqrt{2}$

31. **a)** x = sinA then
$$\frac{d}{dx}\left(\sec^{-1}\frac{1}{\sqrt{1-\sin^2 A}}\right) = \frac{d}{dx}(\sec^{-1}\sec A) = \frac{dA}{dx}$$
$$\frac{d}{dx}(\sin^{-1}x) = \frac{1}{\sqrt{1-x^2}}$$

32. **d)** Hint, $y(y^2-9x^2) = 0$
Or, $y(y + 3x)(y - 3x) = 0$
Or, $y = 0, y = \pm 3x$; all passing through origin

33. **a)** Hint, $f(x) = (-x)^2 + \cos(-x) + 1$
$= x^2 + \cos x + 1$
F(-x) = f(x) [even function]

34. **b)** $n(A \cap B) = n(A) + n(B) - n(A \cup B)$
To be $n(A \cap B)$ minimum , $n(A \cup B)$ should be maximum.
So, min $n(A \cap B) = 240+160-360 = 40$

35. **d)** Hint, Area = $\frac{3}{2}(x_1y_2 - x_2y_1) = \frac{3}{2}(4+6) = 15$

36. **b)** $r^2 = 8\operatorname{cosec} 2\theta$ reduces to $xy = 4$ which is hyperbola.

37. **c)** Hint, $y = \sqrt{x}$
It gives two value of y

38. **d)** Hint, $Ni^{++} \Rightarrow [Ar]\ 3d^8 \Rightarrow$ 2 unpaired electron
$Al^{++} \Rightarrow [Ne]\ 3d^8 \Rightarrow$ 0 unpaired electron
$Co^{++} \Rightarrow [Ar]\ 3d^8 \Rightarrow$ 3 unpaired electron
$Fe^{++} \Rightarrow [Ar]\ 3d^8 \Rightarrow$ 4 unpaired electron

39. **b)**
40. **d)**
41. **b)** Hint, In $CaCl_2$, O.N. of Cl = -1
In $Ca(OCl)_2$, O.N. of Cl = +1
In $CaOCl_2$, O.N. of Cl = -1 & +1
42. **d)**
43. **d)** Hint, The salt formed by complete neutralization of acid or salt not having replaceable H-atom is neutral salt.
44. **a)** Hint, Calgon removes hardness by complex formation.
45. **c)** Hint, Iodide i.e. KI or NaI is added to table salt to prevent goiter.
46. **c)** Hint, zinc has lower boiling point so, it is refined by distillation.
47. **b)** Hint, Molecule having electron deficient center acts as electrophile.
48. **d)** 49. **a)** 50. **a)** 51. **d)** 52. **c)** 53. **d)** 54. **b)** 55. **b)** 56. **d)** 57. **a)** 58. **d)** 59. **b)** 60. **c)**

Group B

61. **a)** $\frac{2}{bc}\Delta = \frac{2}{bc}\left(\frac{1}{2}bc\sin A\right) = \sin A$

62. **a)** Hint, $(1 + x^2)^{40}\left(x + \frac{1}{x}\right)^{-10} = \frac{(1+x^2)^{30}}{x^{10}}$

Coefficient of x^{10} in the expansion of $(1 + x^2)^{30} = {}^{30}C_{25}$

63. **a)** Midpoint of the line joining the points (2, 3, 4) & (6, 7, 8) is $\left(\frac{2+6}{2}, \frac{3+7}{2}, \frac{4+8}{2}\right) = (4, 5, 6)$

This coordinates satisfy only equation of option (a).

64. **a)** $-1 \le \log_3\left(\frac{x}{3}\right) \le 1 \Rightarrow 3^{-1} \le \left(\frac{x}{3}\right) \le 3$

$\Rightarrow 1 \le x \le 9 \Rightarrow [1, 9]$

65. **d)** Hint, a, b, c are in G.P. i.e. $b^2 = ac$

$$= \frac{(b-a)(b+c)+(b-c)(b+a)}{b^2-c^2}$$

$$= \frac{b^2-ac}{ac-c^2} = 2\frac{(ac-ac)}{ac-c^2} = 0$$

66. **b)** $(x-1)^3 = -8$ or, $\left(\frac{x-1}{-2}\right)^3 = 1$

or, $\frac{x-1}{-2} = \sqrt[3]{1} = 1, w, w^2$

or, $x-1 = -2, -2w, -2w^2$

or, $x = -1, -2w + 1, 1 - 2w^2$

67. **b)** Hint, $\frac{2b^2}{a} = b$

$\Rightarrow \frac{b}{a} = \frac{1}{2} \Rightarrow \frac{b^2}{a^2} = \frac{1}{4} \Rightarrow a = \sqrt{1 - \frac{b^2}{a^2}} = \frac{\sqrt{3}}{2}$

68. **c)** Hint, $y = k^{lnx}$

$lny = (lnx)^2$

$\frac{1}{y}\frac{dy}{dx} = \frac{2lnx}{x} \Rightarrow \frac{dy}{dx} = 2\,x^{lnx-1}lnx$

69. **a)** Hint, solving we get, k = -1, 1

Area = $\int_0^1 (2 - x^2 - x^2)dx = \frac{8}{3}$

70. **c)** $y = 2^x$ then $dy = 2^x log2\, dx$

$\int \frac{2^x dx}{\sqrt{1-4^x}} = \int \frac{1}{log2}\frac{dy}{\sqrt{1-y^2}} = \frac{1}{log2}\sin^{-1} y$

$\Rightarrow \frac{1}{log2}\sin^{-1}(2^x)$ so, $k = \frac{1}{log2}$

71. **a)** Hint, equation of the bisector of the angles

between the lines: $ax^2 + 2hxy - ay^2 = 0$ is,

$(a + a)xy = h(x^2 - y^2)$

$hx^2 - 2axy - hy^2 = 0$ it is identical with $bx^2 + 2gxy - by^2 = 0$ so, $\frac{h}{b} = \frac{-2a}{2g} = \frac{-h}{b}$

from first two ratio, ab + gh = 0

72. **b)** Equation of hyperbola is $\frac{x^2}{25} - \frac{y^2}{9} = 1$

Difference between focal distances in a hyperbola is constant & equal to, 2a = 2*5 = 10

73. **b)** Hint, $|adjA| = |A|^{n-1}$ where n is the order of A.

$|adjA| = |A|^2 = 2^2 = 4$

74. **d)** Hint, Area = $2(\frac{1}{2} \times 4 \times \sqrt{2}) = 4\sqrt{2}$ sq. units

75. **c)** Hint, $f(x)$ is not defined at x = 0. So, option (a) is not answer.

Clearly, f(x) is continuous at $x = \frac{\pi}{6}$

Next, $f(\frac{3\pi}{4} -) = 1$

Also, $f(\frac{3\pi}{4} +) = 2\sin(\frac{2}{9} \times \frac{3\pi}{4}) = 2\sin\frac{\pi}{6} = 1$

So, f(x) is continuous at $x = \frac{3\pi}{4}$

76. **a)** Hint, Equivalent volume of chlorine is same in all three cases as valency of chlorine is same. Hence volume becomes same.

77. **b)** wt. of $CaCO_3 = \frac{V \times N \times E}{1000} = \frac{(200 \times 0.75 - 40 \times 0.5) \times 1 \times 50}{1000}$

= 6.5 g

% pure $CaCO_3 = \frac{6.5}{7} \times 100\% = 92.85\%$

78. **d)** Hint, ksp of $Ag_2CrO_4 = [Ag^+]^2.[CrO_4^{--}]$

Or, $1.4 \times 10^{-13} = (2S)^2 \times 0.1$

$S = \sqrt{\frac{1.4 \times 10^{-13}}{0.4}} = 3.7 \times 10^{-7}$

79. **c)**

equivalent weight of metal = $\frac{55.44}{34.46} x 35.5 = 57.11$

Approx atomic weight = $\frac{6.4}{0.113} = 56.63$

Exact atomic weight = 57.11 x 1 = 57.11

80. **a)**

$SO_2 + H_2O \longrightarrow H_2SO_4 + [H]$

[H] + color matter $\longrightarrow$ colorless product

The action is temporary and reduction.

81. **c)**

$H_2SO_4 + ZnS \longrightarrow H_2S + ZnSO_4$

H_2S does not give precipitation with group IIIB metal ions such as Zn^{++} in acidic medium.

82. **b)**

$NaCOOCH{=}CHCOONa \rightarrow COOCH{=}CHCOO^- + 2Na^+$

At anode, $COOCH{=}CHCOO^- \rightarrow CH{\equiv}CH + 2CO_2$

83. **c)** 84. **a)** 85. **c)** 86. **d)**

87. **a)**

Initial surface energy of soap bubble = S x $4\pi R^2$x 2

= 8 SπR^2

Final surface energy of a soap bubble = S x 4π x $(3R)^2$ x 2 = 72 SπR^2

Work done = 72 SπR^2 − 8 SπR^2 = 64 SπR^2

88. **c)**

$$f = \frac{1}{2l}\sqrt{\frac{T}{\mu}} \Rightarrow l \propto \sqrt{T}$$

$$\frac{l_2}{l_1} = \sqrt{\frac{T_2}{T_1}} = \sqrt{\frac{\rho_b - \rho_w}{\rho_b}}$$

$$\frac{40^2}{50^2} = \sqrt{\frac{\rho_b - \rho_w}{\rho_b}} \text{ thus, } \rho_b = \frac{25}{9}$$

89. **c)**

Let, K be the dielectric constant and Co be the capacitance of capacitor with dielectric KC_0.

$$V = \frac{C_1V_1 + C_2V_2}{C_1 + C_2} = \frac{C_0V_0 + KC_0 \times 0}{C_8 + KC_0}$$

$$K = \frac{V_0 - V}{V}$$

90. **d)** $E = -\frac{d\phi}{dt} \Rightarrow |E| = -\frac{d\phi}{dt}$

$$i = \frac{E}{R} = \frac{1}{R}\frac{d\phi}{dt} = 0.2A$$

91. **c)** Force on q = $k\left[\frac{4q.q}{\alpha^2} + \frac{Q.q}{(\frac{k}{2})^2} = 0\right]$ Q + q = 0

Q = -q

92. **b)** Energy of γ photon = [0.5 + 0.5 + 0.78] = 1.78MeV

93. **c)** $\frac{1}{2}mv^2 = \mu mgs$

$$s = \frac{v^2}{2\mu g} = \frac{4^2}{2 \times 0.2 \times 10} = 4m$$

94. **c)** Hint, tanc = $\frac{r}{h}$

Or, $h = \frac{r\cos c}{\sin c} = r\sqrt{\mu^2 - 1} = \sqrt{\frac{5^2}{3^2} - 1} = \frac{4}{3}$cm

95. **a)** Hint, $\frac{T'}{T} = \sqrt{\frac{m+2}{m}} \Rightarrow \left(\frac{3}{2}\right)^2 = \frac{m+2}{m}$

solving m = 1.6kg

96. **c)** Hint, $110 = \left(\frac{130}{\frac{200}{n} + 2.6 + 0.4}\right)\frac{200}{n}$

⇒2200 + 33n = 2600 ⇒ n = 12.12 = 12

97. **b)**

$$B = \frac{\mu_o I_1}{\frac{2\pi a}{2}} - \frac{\mu_o I_2}{\frac{2\pi a}{2}} = \frac{\mu_o(I_1 - I_2)}{\pi a}$$

$$= \frac{4\pi \times 10^{-7}(12-8)}{\pi \times 0.2} = 8 \times 10^{-6}\ T$$

98. **d)**

$$\frac{V_1}{\lambda_1} - \frac{V_2}{\lambda_2} = \frac{10}{3}$$

$$\therefore v = \frac{10}{3} x \frac{2.04 \times 2.08}{2.08 - 2.04} = 353.6 \text{ m/s}$$

99. **c)**

$$I = \frac{Vrms}{2} = \frac{200/\sqrt{2}}{\sqrt{R^2 + (\omega L)^2}}$$

$$= \frac{200}{\sqrt{2}\sqrt{50^2 + (100\pi \times 0.159)^2}} = 2A$$

100. **c)**

$$\frac{1}{\lambda_L} = R\left(\frac{1}{1} - \frac{1}{4}\right) \qquad \frac{1}{\lambda_B} = R\left(\frac{1}{4} - \frac{1}{9}\right)$$

dividing, $\lambda_B = 6561$ Å