

SOLUTIONS

PHASE TEST-2

GR, GRK & GRS

JEE MAIN PATTERN

Test Date: 23-09-2017



Corporate Office: Paruslok, Boring Road Crossing, Patna-01
Kankarbagh Office: A-10, 1st Floor, Patrakar Nagar, Patna-20
Bazar Samiti Office : Rainbow Tower, Sai Complex, Rampur Rd.,
Bazar Samiti Patna-06
Call : 9569668800 | 7544015993/4/6/7

PHYSICS

1. (B)

$$\frac{\Delta T}{T} \times 100 = \frac{1}{25} \times 100 = 0.8\%$$

2. (D)

$\frac{d|\vec{v}|}{dt}$ is the tangential acceleration.

3. (A)

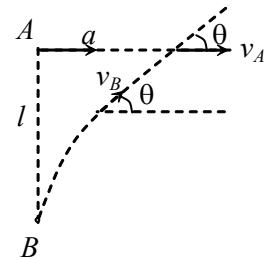
Let after time t , the velocity of particle B is directed at an angle θ with the horizontal, then

$$-\frac{ds}{dt} = bt - at \cos \theta$$

$$\Rightarrow -\int_1^0 ds = b \int_0^t t dt - a \int_0^t t \cos \theta dt$$

$$\text{and } \frac{1}{2} at^2 = b \int_0^t t \cos \theta dt \quad \therefore l = \frac{bt^2}{2} - \frac{a^2 t^2}{2b}$$

$$t = \sqrt{\frac{2bl}{b^2 - a^2}}, \quad S = \frac{1}{2} bt^2 = \frac{1}{2} b \frac{2bl}{b^2 - a^2} = \frac{b^2 l}{b^2 - a^2}$$



4. (B)

Let 1: Block, 2: Platform

$$\vec{u}_{12} = \vec{u}_1 - \vec{u}_2 = 3\hat{i} - 4\hat{j}$$

$$\vec{u}_{12} = \vec{a}_1 - \vec{a}_2 = -\frac{3}{5}(3\hat{i} - 4\hat{j})$$

$$\therefore t_0 = \frac{5}{3} \text{ sec}, \quad \vec{s}_{12} = \frac{25}{6} \left(\frac{3\hat{i} - 4\hat{j}}{5} \right) \text{ m}$$

$$\therefore \vec{s}_k = \frac{5}{6}(3\hat{i} - 4\hat{j}) + \frac{20}{3}\hat{j}$$

$$= \frac{5}{6}(3\hat{i} + 4\hat{j}) + \frac{20}{3}\hat{j}$$

$$\therefore \vec{s}_k = \frac{25}{6} \text{ m.}$$

5. (B)

Acceleration of block m with respect to inclined plane = 6

$$\therefore \text{Acceleration of incline plane } a_2 = \frac{m}{m+2m} \times 6 \sin 60^\circ = \sqrt{3} \text{ m/s}^2.$$

6. (B)

Let the particle leaves the vertical circular motion at an angle ϕ with the upward vertical.Then critical velocity at angle ϕ is given by

$$v_c = \sqrt{gl \cos \phi}$$

$$\therefore l + l \cos \phi + \frac{gl \cos \phi \sin^2 \phi}{2g} = \frac{27l}{16}$$

$$1 + \cos \phi + \frac{\cos \phi (1 - \cos^2 \phi)}{2} = \frac{27}{16}$$

$$2 + 2 \cos \phi + \cos \phi - \cos^3 \phi = \frac{27}{8}$$

$$\cos^3 \phi - 3 \cos \phi + \frac{11}{8} = 0 \Rightarrow \cos \phi = \frac{1}{2} \quad \text{or} \quad \phi = 60^\circ.$$

$$v_c = \sqrt{\frac{gl}{2}}.$$

7. (A)

$$\frac{1}{2} k \left(\frac{h}{4} \right)^2 = mg \left(h + \frac{h}{4} \right), \quad k = \frac{32mg}{h} \left(\frac{5}{4} \right) = \frac{40mg}{h}.$$

8. (D)

Momentum of the shell at highest point = $2m(u \cos \theta)$. As one fragment has initial speed zero (stationary) and hence the other fragment of mass m has velocity component $(2u \cos \theta)$ in horizontal direction. This will move under gravity, So, it will fall at a distance which is equal to

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

$$\text{Hence, distance covered from the gun} = \frac{R}{2} + R = \frac{3}{2}R = \frac{3}{2} \left[\frac{u^2 \sin 2\theta}{g} \right].$$

9. (B)

From Newton's third law, force F will act on the block in forward direction

$$\text{Acceleration of block } a_1 = \frac{F}{M}$$

$$\text{retardation of bullet } a_2 = \frac{F}{m}$$

relative retardation of bullet

$$a_r = a_1 + a_2 = \frac{F(M+m)}{Mm}$$

Applying $v^2 = u^2 - 2a_l$

$$0 = v_0^2 - \frac{2F(M+m)}{Mm} \cdot l \quad \text{or} \quad v_0 = \sqrt{\frac{2Fl(M+m)}{Mm}}$$

Therefore, minimum value of v_0 is

$$\sqrt{\frac{2Fl(M+m)}{Mm}}.$$

10. (B)

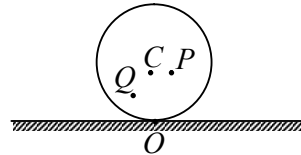
$$OP > OC > OQ$$

$$\therefore V_P > V_C > V_Q$$

11. (C)

$$I_1\omega_1 = I_2\omega_2$$

$$\Rightarrow MK_1^2\omega_1 = MK_2^2\omega_2 \Rightarrow \frac{K_1}{K_2} = \sqrt{\frac{\omega_2}{\omega_1}}.$$



12. (C)

Clearly, the block shall topple about its edge through O. The torque FL of the applied force

is clockwise. The torque $\frac{mgL}{2}$ of the weight is anti-clockwise. Applying condition for

$$\text{rotational equilibrium } -FL + mg\frac{L}{2} = 0 \quad \text{or} \quad F = \frac{mg}{2}.$$

13. (B)

According to law of conservation of energy

$$\frac{1}{2}mv^2 \left(1 + \frac{k^2}{R^2}\right) = Mgh \quad \text{or} \quad h = \frac{3v^2}{4g}.$$

14. (B)

$$y = 0.2 \left(\cos^2 \frac{\pi t}{2} - \sin^2 \frac{\pi t}{2} \right)$$

$$y = 0.2 \cos \pi t$$

$$\therefore A = 0.2, T = \frac{2\pi}{\pi} = 2s.$$

15. (C)

$$F_R = Ma = -(kx + A\sigma gx); \omega = \sqrt{\frac{k + A\sigma g}{M}}; T = 2\pi \sqrt{\frac{M}{k + A\sigma g}}.$$

16. (A)

17. (D)

$$\frac{E_A}{E_B} = \frac{r_B}{r_A} = \frac{2}{1}.$$

18. (A)

Total energy = - kinetic energy = -E

So energy E should be supplied.

19. (D)

The maximum length of the string which can fit into the cube is $\sqrt{3}a$, equal to its body diagonal.The maximum charge inside the cube is $\sqrt{3}a\lambda$, and hence the maximum flux through the

$$\text{cube is } \frac{\sqrt{3}\lambda a}{\epsilon_0}$$

20. (C)

$$\tan 30^\circ = \frac{1}{2} \tan \theta, \tan \theta = \frac{2}{\sqrt{3}}.$$

21. (B)

$$W = -MB(\cos \theta_2 - \cos \theta_1) = 1 \text{ J.}$$

22. (D)

Magnetic moment $M = NIA$

$$M = I_0 \frac{\sqrt{3}}{4} (\sqrt{2}a)^2 = \frac{\sqrt{3}}{2} I_0 a^2$$

23. (A)

$$\tau_{\text{net}} = 0$$

$$mgR = MB_0 \quad (M = \text{magnetic dipole moment})$$

$$mgR = I(\pi R^2)B_0$$

$$I = \frac{mg}{\pi R B_0}.$$

24. (D)

$$\frac{1}{2} L I_0^2 = \frac{1}{2} (C_1 + C_2) V^2, \quad V = \left[\frac{L I_0^2}{(C_1 + C_2)} \right]^{1/2}, \quad Q_1 = C_1 V = C_1 I_0 \sqrt{\frac{L}{C_1 + C_2}}.$$

25. (D)

$$V_R = \sqrt{V^2 - V_2^2} = \sqrt{130^2 - 120^2} = 50 \text{ V}$$

$$V_L = \sqrt{V_1^2 - V_R^2} = \sqrt{100^2 - 50^2} = 86.6 \text{ V}$$

$$V_C = V_2 + V_L = 206.6 \text{ V}.$$

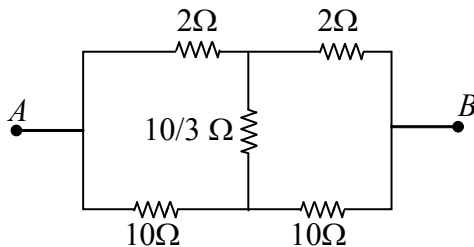
26. (D)

27. (A)

28. (D)

$$i_g (G + R) = V, \quad 10^{-3} (400 + R) = 8, \quad R = 7600 \Omega$$

29. (A)



Equivalent circuit is balanced Wheatstone bridge as shown

$$R_{AB} = \frac{10}{3} \Omega.$$

30. (A)

$$R_{\text{Voltmeter}} = 6\Omega, R_{\text{ammeter}} = 0.5\Omega$$

$$R_{\text{eq}} = 10\Omega$$

$$I = \frac{30}{10} = 3A$$

Reading of voltmeter = $1 \times 3 = 3$ volt.

CHEMISTRY

31. (A)

If P° is the vapour pressure of pure benzene and P the vapour pressure of solution, w the weight of non-volatile substance of molecular mass 'm' and W the weight of solvent benzene with molecular mass M ,

$$\frac{P^\circ - P}{P^\circ} = \frac{w/m}{W/M} = \frac{wM}{Wm} \text{ substituting the values}$$

$$\frac{10}{750} = \frac{2 \times 78}{78 \times m} \quad \text{Or } m = 150$$

32. (B)

Mole fraction of solute $X_2 = 0.2$. Therefore, mole fraction of solvent $X_1 = 0.8$

$$\text{Or } \frac{n_2}{n_1 + n_2} = 0.2 \text{ and } \frac{n_1}{n_1 + n_2} = 0.8$$

$$\therefore \frac{n_2}{n_1} = \frac{0.2}{0.8} = \frac{1}{4}$$

Now, if n_1 (solvent moles) = $1000/78 = 12.8$ moles

$n_2 = 12.8/4 = 3.2$ moles. Therefore, 3.2 moles of the compound are present in one Kg of solvent benzene and so molality = 3.2.

33. (C)

For equimolar solutions, mole fraction of benzene = mole fraction of toluene

$$\text{Or } x_B = x_T = 0.5$$

Now, vapour pressure of benzene $P_B = x_B \cdot P_B^\circ = 0.5 \times 160 = 80$ mm

And, vapour pressure of toluene $P_T = x_T \cdot P_T^\circ = 0.5 \times 80 = 40$ mm

And, total vapour pressure = $80 + 40 = 120$ mm

$$\text{So, mole fraction of toluene in vapour phase} = \frac{40}{120} = \frac{1}{3}$$

34. (C)

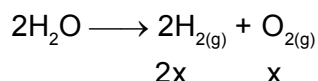
$$\Delta T_b = K_b \cdot m$$

$$\text{Or } m = \frac{\Delta T_b}{K_b} = \frac{0.01}{0.5} = 0.02 \text{ mole Kg}^{-1} \text{ of water}$$

So, the number of moles of glucose in 100 g of water

$$= \frac{0.02 \times 100}{1000} = 0.002 \text{ moles of glucose} = 0.002 \times 6.023 \times 10^{23} = 2 \times 6.023 \times 10^{20} \text{ molecules}$$

35. (C)



$$\therefore 3x = 0.168$$

$$\therefore x = 0.056\text{L}$$

$$V_{\text{H}_2} = 2x = 0.112\text{L}, \quad V_{\text{O}_2} = x = 0.056\text{L}$$

11.2L of H_2 at STP \equiv 1F

0.112L of H_2 at STP \equiv 0.01F

0.056L of O_2 at STP = 0.01F

\therefore The amount of electricity passed = 0.01F = 965C

36. (D)

H^+ ion has the maximum λ_m° which is explainable by Grothus mechanics, Li^+ having the maximum charge density, is the most hydrated ion among the lot and hence the lowest λ_m°

37. (B)

$$t_{1/2} \text{ for } n\text{th order reaction} = \frac{2^{n-1} - 1}{(n-1)k(a)^{n-1}} \text{ On substituting } n = 2, \text{ we obtain } t_{1/2} = \frac{2-1}{1 \cdot k \cdot a} = \frac{1}{ka}$$

Therefore, the order of the reaction is 2.

So, unit of K = $\text{M}^{-1}\text{s}^{-1}$

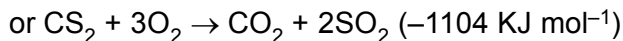
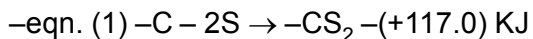
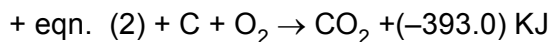
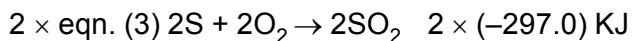
38. (C)

$$t = \frac{2.303}{k} \log \frac{a}{a-x}$$

$$\text{or } t = \frac{2.303}{6} \log \frac{6 \times 0.5}{0.3} = \frac{2.303}{6} \log 10 = \frac{2.303}{6} = 0.384 \text{ min.}$$

39. (B)

The required combustion equation is obtained as

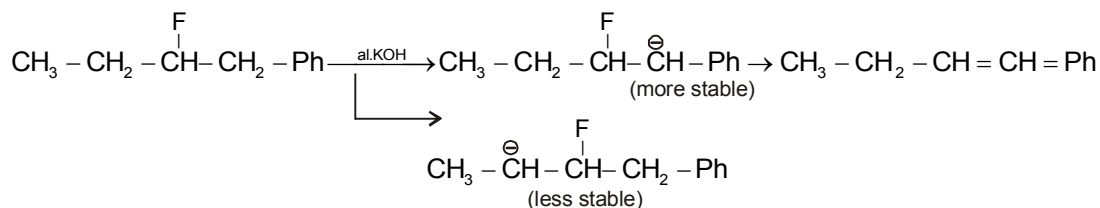


The answer is (B).

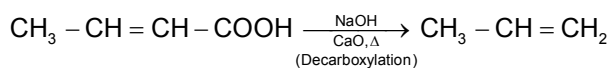
40. (B)

Isothermal expansion of an ideal gas does not change energy and, therefore, $\Delta U = 0$.

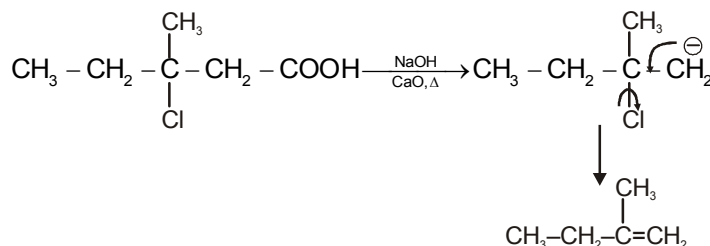
41. (B)



42. (C)

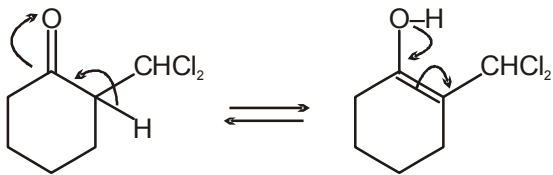


43. (A)



44. (A)

In most cases tautomerism involves interconversion of suitable constitutional isomers by the 1,3-shift of hydrogen from an atom which is itself bonded to a functional group containing a multiple bond. Tautomers differ in the location of the double bond and hydrogen.

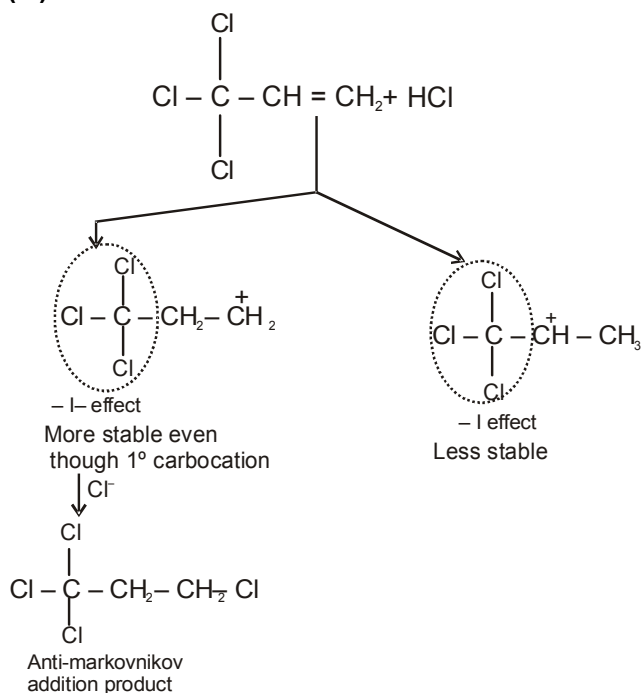


45. (A)

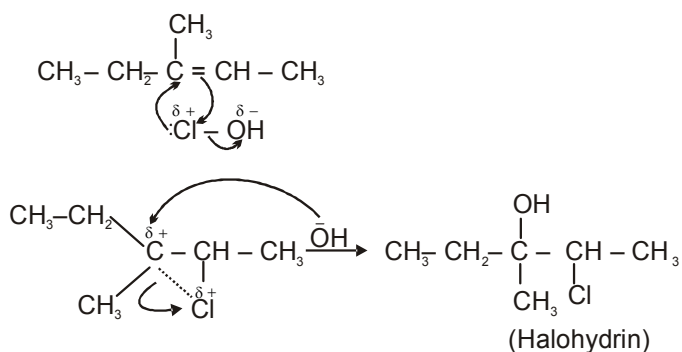
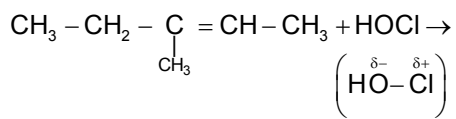


Both are identical because both having same configuration on respective asymmetric centre

46. (B)



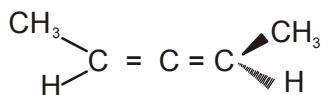
47. (C)



48. (A)



Molecule possessing axial chirality



Chiral (optically active)

49. (B)

50. (A)



51. (C)

52. (C)

53. (B)

Slag formed during extraction of copper is FeSiO_3 .

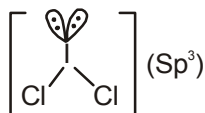
54. (B)

In the cyanide process involving extraction of silver, zinc is used industrially as reducing agent.

55. (B)

Strength of ligands \propto stability of complex. $\text{H}_2\text{O} < \text{NH}_3 < \text{NO}_2^-$ is correct order of stability.

56. (D)

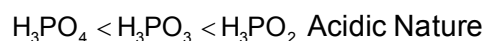


57. (C)

Large sized chlorine atom do not fit in between the small boron atom whereas small sized hydrogen

atom get fitted in between boron atom.

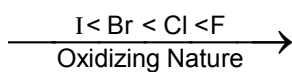
58. (B)



59. (D)

It act as dehydrating agent & absorption of water is highly exothermic.

60. (D)



MATHEMATICS

61. (C)

$$[x] + [-x] = 0 \quad x \in I$$

$$[x] + [-x] = -1 \quad x \notin I$$

62. (B)

$$\int \frac{(x+1)^2 - (x-1)^2}{(x+1)^2(x-1)^2} dx \Rightarrow \int \frac{dx}{(x-1)^2} - \int \frac{dx}{(x+1)^2}$$

$$\Rightarrow -\frac{1}{x-1} + \frac{1}{x+1} + c \Rightarrow \frac{1}{x+1} - \frac{1}{x-1} = -\frac{2}{x^2-1} + c$$

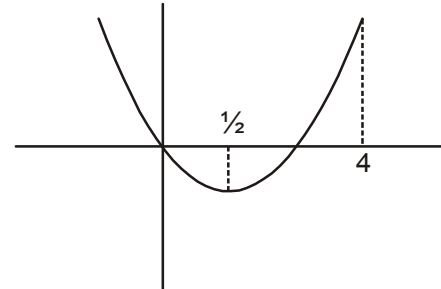
63. (C)

$$\left| \int_{1/2}^1 (x^2 - x) dx \right| + \int_1^4 (x^2 - x) dx$$

$$\left| \left(\frac{x^3}{3} - \frac{x^2}{2} \right)_{1/2}^1 \right| + \left(\frac{x^3}{3} - \frac{x^2}{2} \right)_1^4$$

$$\Rightarrow \left| \left(\frac{1}{3} - \frac{1}{2} \right) - \left(\frac{1}{24} - \frac{1}{8} \right) \right| + \left[\left(\frac{64}{3} - 8 \right) - \left(\frac{1}{3} - \frac{1}{2} \right) \right]$$

$$\left| -\frac{1}{6} - \left(-\frac{1-3}{24} \right) \right| + \left[\frac{40}{3} + \frac{1}{6} \right] = \frac{163}{12}$$



64. (A)

$$xdy - ydx = \sqrt{x^2 - y^2} dx$$

$$d\left(\frac{y}{x}\right) = \frac{\sqrt{1 - \left(\frac{y}{x}\right)^2}}{x} dx$$

$$\int \frac{d\left(\frac{y}{x}\right)}{\sqrt{1 - \left(\frac{y}{x}\right)^2}} = \int \frac{dx}{x}$$

65. (B)

$$\frac{\sin \frac{4x}{2} \cdot \cos \left\{ x + (4-1) \frac{x}{2} \right\}}{\sin \frac{x}{2}} = -\frac{1}{2}$$

$$2 \sin 2x \cdot \cos \frac{5x}{2} = -\sin \frac{x}{2}$$

$$\sin \frac{9x}{2} + \sin \left(-\frac{x}{2} \right) = -\sin \frac{x}{2}$$

$$\frac{9x}{2} = n\pi \Rightarrow x = \frac{2n\pi}{9}$$

66. (B)

$$y = 4x + \sqrt{16a^2 + b^2}$$

$$8^2 = 16a^2 + b^2$$

$$\frac{16a^2 + b^2}{2} \geq \sqrt{16a^2 b^2} \Rightarrow 32 \geq 4ab \Rightarrow (ab)_{\max.} = 8$$

67. (B)

$$(x-2)^2 + (y+3)^2 = 1^2$$

$$(x-5)^2 + (y+7)^2 = 2^2$$

$$\therefore \text{minimum distance} = 5 - 3 = 2$$

68. (A)

$$y = (\sin x - 2)^2 + 1$$

69. (B)

$$6x + 8y + 10 = 0$$

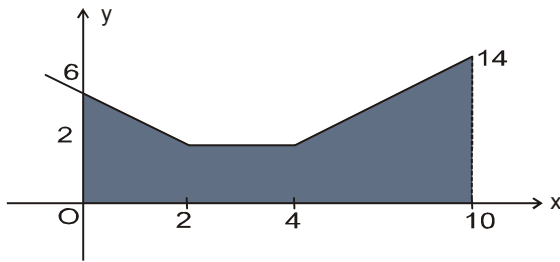
$$6x + 8y - 7 = 0$$

$$D = \frac{17}{10}$$

70. (A)

$$x = 1, 2, \quad |x-2| = 1 \text{ or } x = 2 \pm 1 = 3, 1$$

71. (A)



$$10 \times 2 + \frac{1}{2} \times 2 \times 4 + \frac{1}{2} \times 6 \times 12 \Rightarrow 20 + 4 + 36 = 60$$

72. (A)

$$\left| \int_0^1 x \ln x \, dx \right| = \frac{1}{4}$$

73. (B)

$$x^2 y^2 - x^2 - y^2 + 1 = 0$$

$$x = \pm 1, y = \pm 1$$

74. (B)

75. (A)

$$y = x^{\frac{1}{x}}$$

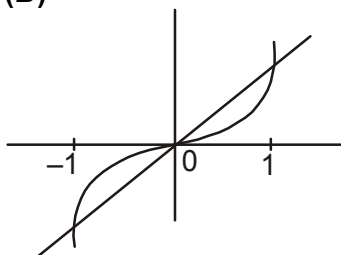
$$\ln y = \frac{1}{x} \ln x$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{x \cdot \frac{1}{x} - \ln x}{x^2} = 0 \Rightarrow x = e$$

76. (B)

$$f'(c) = \frac{f(3) - f(1)}{2} \Rightarrow 6c + 5 = 17 \Rightarrow c = 2$$

77. (B)



78. (B)

$$y - mx = \pm\sqrt{39m^2 - 14}$$

It passes through (3, 4) so, $30m^2 + 24m - 30 = 0$

$$\Rightarrow m_1 m_2 = -1$$

79. (A)

80. (B)

$$S = 5 + 7 + 11 + 17 + 25 \dots\dots\dots + T_n$$

$$S = 5 + 7 + 11 + 17 + \dots\dots\dots + T_{n-1} + T_n$$

$$\Rightarrow T_n = n^2 - n + 5 \quad \therefore S = \sum_{n=1}^n T_n = \frac{n(n^2 + 14)}{3}$$

81. (B)

$$z = x + i y$$

$$z^2 = x^2 - y^2 + 2xy i$$

$$2xy = 10$$

$$xy = 5$$

82. (B)

$$\frac{dy}{dx} = e^x \cdot e^y$$

$$\int \frac{dy}{e^y} = \int e^x dx \Rightarrow -e^{-y} = e^x + c$$

83. (A)

$$y = e^{kx}$$

$$kx = \ln y$$

$$k = \frac{\ln y}{x}$$

$$\frac{x \cdot \frac{1}{y} \frac{dy}{dx} - \ln y \cdot 1}{x^2} = 0$$

$$\frac{x}{y} \left(-\frac{dx}{dy} \right) = \ln y$$

On solving we get, $\frac{y^2}{2} - x^2 = y^2 \ln y + c$

84. (C)

85. (A)

86. (C)

Point of intersection (0, 0) & (-1, -1)

87. (C)

$$\int_0^5 [x] dx + \int_5^{5.6} [x] dx$$

$$0 + 1 + 2 + 3 + 4 + 5 \times 0.6 = 10 + 3 = 13$$

88. (B)

Suppose $n(A) = n$, then number of reflexive relations on A is $= 2^{n^2-n}$ and number of symmetric relations on A is $= 2^{\frac{n^2+n}{2}} \Rightarrow n^2 - 3n = 0 \Rightarrow n = 3$.

89. (B)

As $f(x)$ is an odd cubic polynomial function. So, it must be of the form $f(x) = ax^3 + bx$ Now, $\lim_{x \rightarrow 0} \left(\frac{f(x)}{x} + 1 \right)^{\frac{1}{x^2}}$ exists if $\lim_{x \rightarrow 0} \frac{f(x)}{x} = 0 \Rightarrow b = 0$

$$\lim_{x \rightarrow 0} \left(\frac{f(x)}{x} + 1 \right)^{\frac{1}{x^2}} = e^2 \Rightarrow e^a = e^2 \Rightarrow a = 2 \Rightarrow f(x) = 2x^3$$

$$h(x) = e^{x+1} \int_1^x e^{-t} f(t) dt \Rightarrow h'(x) = e f(x) + e^{x+1} \int_1^x e^{-t} f(t) dt \quad \therefore h'(1) = e f(1) = 2e$$

90. (D)

$$F(x) = \begin{vmatrix} f(x) & f\left(\frac{x}{3}\right) \\ g(x) & g\left(\frac{x}{2}\right) \end{vmatrix} = f(x) \cdot g\left(\frac{x}{2}\right) - g(x) \cdot f\left(\frac{x}{3}\right)$$

Period of $f(x)$ is 3 \therefore Period of $f(x/3)$ is 9Period of $g(x)$ is 2 \therefore Period of $g(x/2)$ is 4 \therefore Period of $F(x)$ is L.C.M. of period of $f(x) \cdot g(x/2) - g(x) \cdot f(x/3) = 36$