

# PART-I

## One Mark Questions

### MATHEMATICS

1. **Sol-** Let  $a, a_1, a_2, \dots$  be the length of sides of square inscribed in circle  $c_0, c_1, c_2, \dots$  and  $r_1, r_2, r_3, \dots$  be radius of circle  $c_1, c_2, \dots$   
then,  $a_0^2 = 2 = \pi r_1^2$

$$r_1 = \sqrt{\frac{2}{\pi}}$$

$$2a_1^2 = \frac{8}{\pi}$$

$$a_1^2 = \frac{4}{\pi} = \pi r_2^2$$

$$r_2 = \frac{2}{\pi}$$

$$\sum_{i=0}^{\infty} \text{Area}(C_i) = \pi \cdot i$$

$$= \pi + 2 + \frac{4}{\pi} + \frac{8}{\pi^2} = \frac{\pi}{1 - \frac{2}{\pi}} = \frac{\pi^2}{\pi - 2}$$

**Ans. (D)**

2. **Sol. (A)**  $[x + y] \leq [x] + [y]$

$$\text{for } x = \frac{3}{2}, y = \frac{5}{3}$$

$$\left[ \frac{3}{2} + \frac{5}{3} \right] \leq \left[ \frac{3}{2} \right] + \left[ \frac{5}{3} \right]$$

$$\Rightarrow \left[ \frac{9+10}{6} \right] \leq 1+1$$

$$\Rightarrow 3 \leq 2 \text{ false}$$

$$(B) [xy] \leq [x][y]$$

$$\text{for } x = \frac{3}{2}, y = \frac{5}{3}$$

$$\left[ \frac{15}{6} \right] \leq 1 \times 1$$

$$\Rightarrow 2 \leq 1 \text{ false}$$

$$(C) [2^x] \leq 2^{[7/2]}$$

$$\text{for } x = 7/2$$

$$[2^{7/2}] \leq 2^{[7/2]}$$

$$\Rightarrow [(128)^{1/2}] \leq 2^3$$

$$\Rightarrow 11 \leq 8 \text{ false}$$

$$\therefore (D) \left[ \frac{x}{y} \right] \leq \frac{[x]}{[y]} \text{ true } \forall x \in R$$

**Ans. (A)**

3. **Sol-** When 'n' is even

$$\frac{A_n}{A_{n-1}} = \frac{{}^n C_{n/2}}{{}^{n-1} C_{n-1/2}} = 2$$

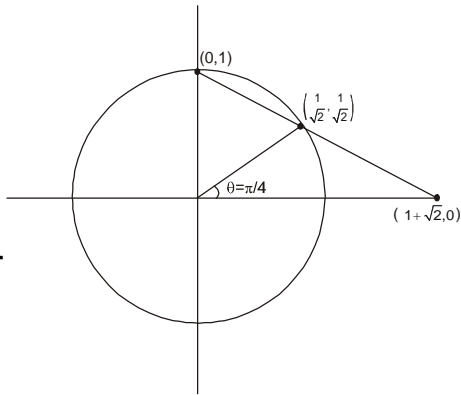
then  $n = \{2, 4, \dots, 20\}$   
when 'n' is odd

$$\frac{A_n}{A_{n-1}} = \frac{{}^n C_{n-1/2}}{{}^{n-1} C_{n-1/2}} = \frac{2n}{n+1}$$

is true of or  $n = 19$

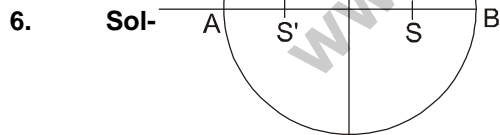
**Ans-(C)**

4. **Ans-(B)**



5. **Sol-**

**Ans - (B)**



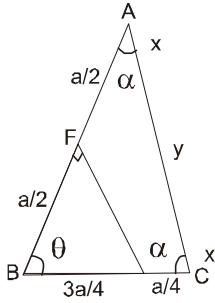
$$AS' = SS' = SB$$

$$\Rightarrow e = 1/3$$

$$\Rightarrow a = 3$$

**Ans - (D)**

7. Sol-  $AB=BC$



$$\cos\theta = \frac{2}{3} \text{ and } \sin\frac{\theta}{2} = \frac{1}{\sqrt{6}}$$

$$2\alpha = \pi - \theta \qquad \cos\alpha = \sin\frac{\theta}{2} = \frac{1}{\sqrt{6}}$$

$$\cos\alpha = \frac{y}{2a} = \frac{1}{\sqrt{6}}$$

$$\frac{a}{y} = \sqrt{\frac{3}{2}}$$

**Ans-(C)**

8. 
$$\cos^4 x + \frac{1}{\cos^2 x} = \sin^4 x + \frac{1}{\sin^2 x}$$

$$\Rightarrow \cos^4 x - \sin^4 x = \frac{1}{\sin^2 x} - \frac{1}{\cos^2 x}$$

$$\Rightarrow (\cos^2 x - \sin^2 x) \cdot 1 = \frac{\cos^2 x - \sin^2 x}{\sin^2 x \cdot \cos^2 x}$$

$$\Rightarrow \cos 2x \left[ 1 - \frac{1}{\sin^2 x \cdot \cos^2 x} \right] = 0$$

$$\Rightarrow \cos 2x = 0$$

$$2x = t, \quad t \in [0, 4\pi]$$

$$\sin^2 x \cdot \cos^2 x = 1$$

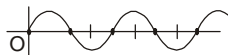
$$\sin^2 x (1 - \sin^2 x) = 1$$

$$\Rightarrow t(1 - t) = 1$$

$$\Rightarrow t - t^2 = 1$$

$$\Rightarrow t^2 - t + 1 = 0$$

$$D < 0$$



9. **Sol.**  $f(x) = \begin{cases} \frac{x+5}{x-2}, & x \neq 2 \\ 1, & x = 2 \end{cases}$

$f(x)$  is discontinuous at  $x = 2$

$f(x) = 2$

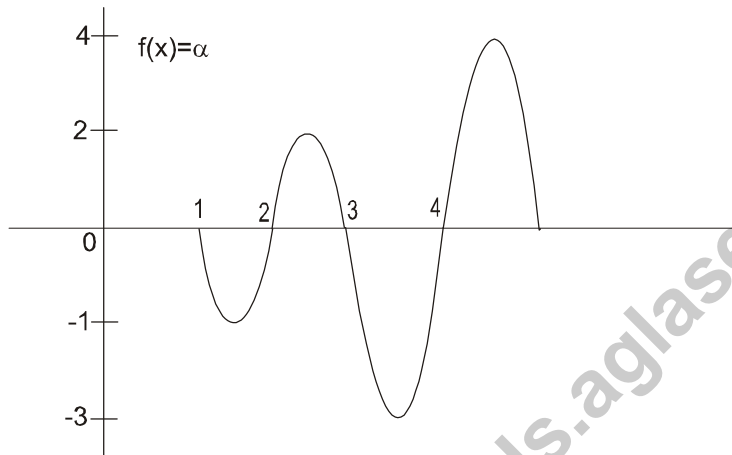
$\Rightarrow \frac{x+5}{x-2} = 2$

$\Rightarrow x+5 = 2x-4$

$\Rightarrow x = 9.$

**Ans(B)**

10. **Sol-**  $f(x) = [x] \sin \pi x$

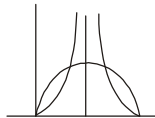


**Ans - (D)**

11. **Sol.**  $\sin x = \tan^2 x$   
 $\sin^2 x = \sin x (1 - \sin^2 x)$   
 $\sin x (\sin^2 x + \sin - 1) = 0$

$\sin x = 0$        $\sin x = \frac{\sqrt{5}-1}{2}$

$x = 0, \pi, \sin^{-1} \frac{\sqrt{5}-1}{2}, \pi - \sin^{-1} \frac{\sqrt{5}-1}{2}$



**Ans(B)**

12. **Sol-**  $I = \int_0^1 f(x^2) dx$

Let  $x^2=t$

$$dx = \frac{1}{2\sqrt{t}} dt$$

$$I = \int_0^1 f(t) \frac{dt}{2\sqrt{t}}$$

**Q**  $\frac{1}{2} \leq \frac{1}{2\sqrt{t}}$

$$\int_0^1 f(t) \frac{dt}{2} \leq \int_0^1 f(t) \frac{dt}{2\sqrt{t}} \quad 5 \leq I$$

**Ans-(D)**

13. **Sol.**  $f'(x) = 1 + f(x) \quad f(0) = 0$

$$\frac{f(x)}{1 + f(x)} = 1$$

$\ln(1 + f(x)) = x$

then  $f(x + y) = f(x) + f(y) \quad f(x) f(y)$

**Ans(C)**

14. **Sol.**  $\int_0^n \cos(2p[x]\{xy\})$

$$n \int_0^1 \cos(2p[x]1) dx = n \int_0^1 1 dx = n$$

**Ans(C)**

15. **Sol-**  $P(B) = 1 \cdot \frac{5}{6} + 1 \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{5}{6} + \dots = \frac{6}{7}$

**Ans-(B)**

16. **Sol.**  $\hat{m} = \frac{\sum_{i=1}^n y_i}{n} = m$

$$\hat{s}^2 = \frac{1}{n} \sum y_i^2 - \hat{m}^2$$

$$= \hat{s}^2 - \frac{1}{2n} (x_1 + x_2)^2$$

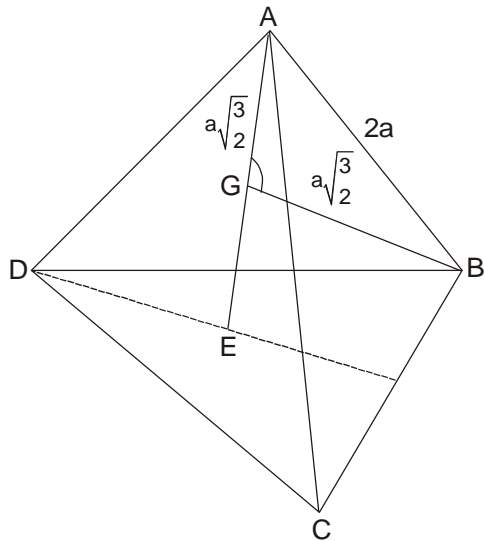
$\hat{s} > s$

**Ans()**

17. **Sol-** Let side length = 2a

$$\Rightarrow GA=GB=a\sqrt{\frac{3}{2}}$$

$\therefore \cos \theta = -\frac{1}{3}$



Ans-(C)

18. Ans-(A)

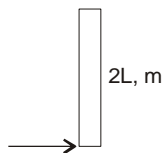
19. Ans-(D)

20. Sol.  ${}^5C_2 \cdot 2 + {}^5C_3 \cdot \frac{3}{1} + {}^5C_4 \left[ \frac{4 \cdot 2}{1 \cdot 3} + \frac{4}{1 \cdot 2} \right] + \frac{5 \cdot 2}{1 \cdot 4} + \frac{5 \cdot 2}{2 \cdot 3}$   
 $20 + 10 \times 6 + 5[8 + 6] + 10 + 20 = 180$

Ans - (C)

**PHYSICS**

21.



$J = mv$

$v_{cm} = J/M$

$J \cdot L = \frac{M(2L)^2}{12} \omega$

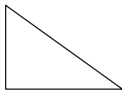
$J \cdot L = \frac{ML^2}{3} \omega$

$\omega = \frac{3J}{ML}$

$ke = \frac{J^2}{2m} + \frac{3J^2}{2m} = 2J^2/m$

Ans. (C)

22.



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

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2} \cdot \frac{MR^2\omega^2}{2}$$

$$gh = \frac{1}{2}v^2 + \frac{1}{4}v^2 = \frac{3}{4}v^2$$

$$v^2 = \sqrt{\frac{4gh}{3}} \quad v = \sqrt{\frac{4gh}{3}}$$

$$v = \sqrt{2gh}$$

$$\frac{V_p}{V_R} = \sqrt{\frac{4}{3 \times 2}} = \sqrt{2/3}$$

Ans. (C)

23.  $V(r) = kr$

$$U(r) = mkr \quad \omega^2 = \frac{k}{r}$$

$$F = -\frac{du}{dr} = -mk \quad \omega = \sqrt{\frac{k}{r}}$$

$$T = \frac{2\pi\sqrt{r}}{\sqrt{k}}$$

Ans. (A)

24. Ans. (D)

25.  $A_1V_1 = A_2V_2$

$$P + \frac{1}{2}dv^2 = \text{Const.}$$

$d = \text{density}$

$$P_1V_1 = P_2V_2$$

Ans. (B)

26. Ans. (B)

27. Ans. (D)

28.  $PV^2 = C$

$$PV.V = K$$

$$nRT.V = K$$

$$VT = K$$

$$V_1T_1 = V_2T_2$$

$$V_2 > V_1 \quad T_2 < T_1$$

$$P_1V_1^2 = P_2V_2^2$$

$$\frac{V_2^2}{V_1^2} = \frac{P_1}{P_2}$$

$$P \cdot \frac{K^2}{T^2} = C$$

$$\frac{P}{T^2} = k$$

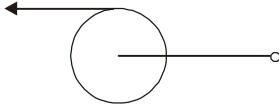
$$\frac{P_1}{T_1^2} = \frac{P_2}{T_2^2}$$

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$$\frac{P_1}{P_2} = \frac{T_1^2}{T_2^2}$$

Ans. (B)

29.



$$n' = n \left[ \frac{v - 0}{v + v_s} \right]$$

$$n'' = n \left[ \frac{v}{v + v_s} \right]$$

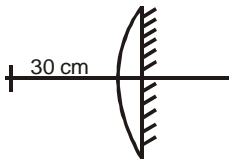
$$\frac{n'}{n''} = \frac{v - v_s}{v + v_s}$$

$$\frac{n'}{n''} = \frac{v + v_s}{v - v_s} = \frac{330 + 30}{330 - 30} = \frac{360}{300} = 1.2$$

Ans. (C)

30. (A)

31.



$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{f} = \frac{1}{fm} - \frac{2}{fl}$$

$$\frac{1}{f} = \frac{1}{\infty} - \frac{2}{10} = -\frac{1}{5}$$

$$f = -5$$

$$\frac{1}{v} + \frac{1}{-30} = -\frac{1}{5}$$

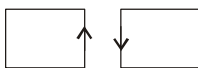
$$\frac{1}{v} - \frac{1}{5} + \frac{1}{30}$$

$$= \frac{-6 + 1}{30} = \frac{-5}{30}$$

$$v = -6\text{cm}$$

Ans. (B)

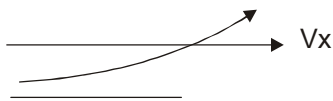
32.



Ans. (D)



33.



$$v_y = ay.t$$

$$v_y = \frac{eE}{m} \cdot \frac{l}{u}$$

$$v_x = u$$

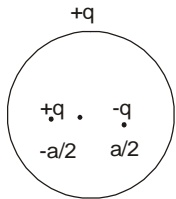
$$\tan \theta = \frac{eEl}{mu^2}$$

$$\frac{\tan \theta_1}{\tan \theta_2} = 4$$

$$\tan \theta_2 = \frac{\tan \theta_1}{4} = 0.1$$

Ans. (A)

34.



$$W_1 = q \left( \frac{kQ}{R} \right)$$

$$W_2 = \left( \frac{kQ}{R} + \frac{kq}{a} \right) (-q)$$

$$W = \frac{-kq^2}{a}$$

Ans. (C)

35.

$$Q = \frac{C}{2} E$$

$$C_{eq} = \frac{C.KC}{C+KC} = \frac{C^2K}{C(1+k)} = \frac{CK}{1+K}$$

$$Q = \frac{CK}{1+k} E$$

$$\Delta Q = \left( \frac{CK}{1+k} - \frac{C}{2} \right) E$$

$$\Delta Q = \left( \frac{CK}{1+k} - \frac{C}{2} \right) E$$

$$= \frac{2ck - c(k-1)}{2(1+k)}$$

$$= \frac{2ck - ck - c}{2(1+k)} = \frac{ck - c}{2(1+k)}$$

Ans. (B)

36.  $V = ed$   
 $E = \frac{100}{20\mu\text{m}}$   
 $V^1 = \frac{100}{20} \times 1 = 5\text{v}$

Ans. (A)

37.  $\frac{dN}{dt} = n\lambda$   
 $\frac{dN}{dt} = \lambda dt$   
 $\frac{6.93}{6.9} \times 10^{-4}$   
 $= 10^{-4}$

Ans. (D)

38.  $\frac{N}{4\pi R^2}$   $N = \frac{160 \times 6200 \times 10^{-10}}{6.62 \times 10^{-34} \times 3 \times 10^8}$   
 $= \frac{5 \times 10^{19} \times 10}{4 \times 3.14 \times 3.24}$   $= \frac{16 \times 62 \times 10^{-7}}{20 \times 10^{-34} \times 10^8}$   
 $= \frac{5 \times 10^{19} \times 10}{4 \times 3.14 \times 3.24}$   $= \frac{496}{10} \times 10^{19}$   
 $= 1.25 \times 10^{19}$

Ans. (C)

39.  $\frac{\lambda_1}{\lambda_2} = \frac{\frac{1}{2^2} - \frac{1}{3^2}}{\frac{1}{3^2} - \frac{1}{5^2}} = \frac{\frac{1}{4} - \frac{1}{9}}{\frac{1}{9} - \frac{1}{25}} = \frac{125}{64}$

$$\lambda_2 = \frac{125}{64} \lambda_1$$

Ans. (B)

40.  $10 \times 8 = 80$   
 $11 \times 7.5 = 82.5$   
 Energy required =  $82.5 - 80$   
 $= 2.5$

Ans. (A)

## CHEMISTRY

41.  $K_{SP} \text{AgBr} = (\text{Ag}^+) (\text{Br}^-) = (5 \times 10^{-10}) (10^{-3}) = 5 \times 10^{-13}$   
 Concentration of Br is  $10^{-2}\text{M}$   $\text{eq AgNO}_3 = \frac{Kp \text{Agbr}}{[\text{Ag}^+]}$   
 $= \frac{5 \times 10^{-13}}{(10^{-2})} = 5 \times 10^{-11}\text{m}$

Ans. (D)

42. Over bromination take place in activated Anilive  
 Ans. (A)

43. +6 is maximum oxidation state of Cr  
 Ans. (D)

44. Ans. (C)

45.  $\text{Al}_2\text{O}_3$  is amphoteric oxide  
 Ans. (C)

46.  $\ln k = \ln A - \frac{E_a}{R} \times \frac{1}{T}$   
 Ans. (A)

47.  $\text{Ni}(\text{CO})_4$  is tetrahedral with  $d^{10}$  configuration  
 Ans. (C)

48. Ozonolysis and intramolecular aldol  
 Ans. (B)

49. Ans. (B)

50. Energy of  $t_{2g} < e_g$  orbitals in octahedral complexes  
 Ans. (A)

51. When  $Q_c > K_c$   
 Reaction moves in backward direction  
 Ans. (A)

52. SN-1 Reaction, most stable carbocation is formed  
 Ans. (C)

53.  $\uparrow \text{KOH} = \uparrow \text{KCl} + \uparrow \text{NaOH} - \uparrow \text{KCl}$   
 Ans. (D)

54. Wolf kishner Reduction  
 Ans. (B)

55. Compound is  $\text{AsCl}_3$   
 Ans. (C)

56. Valency factor of  $\text{KMnO}_4 = 5$   
 $\text{Se}^- + \text{MnO}_4^- + 8\text{H}^+ \rightarrow \text{Mn}^{+2} + 4\text{H}_2\text{O}$   
 Ans. (D)

57. Ans. (C)

58.  $\Delta S = \frac{\Delta H}{T} = \frac{6000\text{J}}{213\text{K}} \cong 22\text{J/K.mol}$   
 Ans. (A)

59. Ullmann reaction  
 Ans. (A)

60. Ans. (C)

## BIOLOGY

- |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 61. | (C) | 62. | (A) | 63. | (B) | 64. | (D) | 65. | (C) | 66. | (B) | 67. | (D) |
| 68. | (B) | 69. | (A) | 70. | (D) | 71. | (C) | 72. | (A) | 73. | (D) | 74. | (C) |
| 75. | (D) | 76. | (A) | 77. | (A) | 78. | (B) | 79. | (A) | 80. | (B) |     |     |

## PART-II Two Mark Questions

### MATHEMATICS

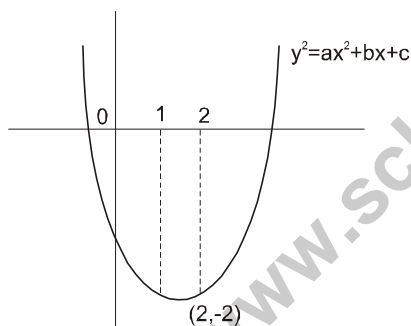
81. **Ans-(A)**

82. 
$$\left| e^{\sum_{k=0}^n \binom{n}{k} w^k} \right| = \left| e^{(1+w)^n} \right| = \left| e^{(-w^2)^n} \right|$$

∴ when n is multiplying of 3, then  
 $S=e, 1/e$   
 when n is not multiple of three, then  
 $s=e^{1/2}e^{-1/2}$

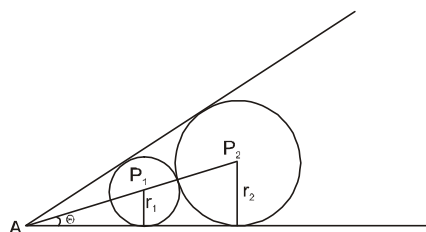
**Ans-(C)**

83. **Sol-**  $y = ax^2 + bx + c$   
 $a > 0, b < 0, c < 0$   
 Also  $y(1) = a + b + c < 0$



**Ans-(B)**

84.



**Sol-**  $\sin\theta = \frac{1}{\sqrt{3}} = \frac{r_1}{AP_1} = \frac{r_2}{AP_2}$

$AP_2 = AP_1 + r_1 + r_2$

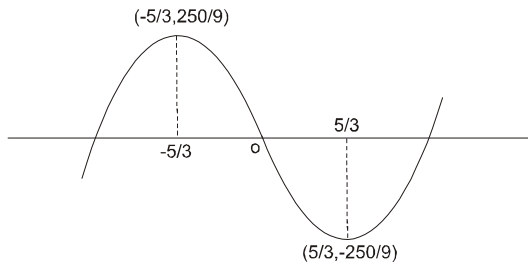
$r_2\sqrt{3} = r_1\sqrt{3} + r_1 + r_2$

$r_2(\sqrt{3} - 1) = r_1(\sqrt{3} + 1)$

$\frac{r_2}{r_1} = 2 + \sqrt{3}$

**Ans-(D)**

85.



**Sol-** Let  $f(x) = 3x^3 - 25x$

$$f'(x) = 9x^2 - 25$$

$$f'(x) = 0 \Rightarrow \pm \frac{5}{3}$$

$$f(-5/3) = 250/9 ; 27.7$$

$$f(5/3) = -250/9 ; -27.7$$

$\therefore$  n can take 55 values

**Ans-(C)**

86. **Ans-()**

87. **Sol-**  $I_n = \int_0^{\pi/2} x^n \cos x dx$

$$\Rightarrow I_n + n(n-1)I_{n-2} = \left(\frac{\pi}{2}\right)^n \quad \text{.....(1)}$$

$$\text{Also } \sum_{n=2}^{\infty} \left( \frac{I_n}{n!} + \frac{I_{n-2}}{(n-2)!} \right) = \sum_{n=2}^{\infty} \left( \frac{I_n + (n-2)!I_{n-2}}{n!} \right) = \sum_{n=2}^{\infty} \left( \frac{(\pi/2)^n}{n!} \right) = e^{\pi/2} - 1 - \frac{\pi}{2}$$

**Ans-(A)**

88. **Sol-**  $\int_1^n [x][\sqrt{x}] dx = \int_1^n 2dx + \dots\dots\dots$

$$= \begin{cases} 50 & \text{for } n = 8 \\ \{66 & \text{for } n = 9 \end{cases}$$

**Ans - (B)**

89. **Ans- (B)**, Check for  $n = 1, 2, 3, \dots\dots$

90. **Sol-** No correct Option

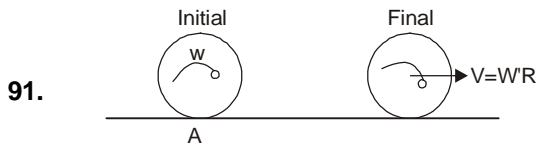
$(1, 17), (2, 17), (3, 17), (4, 17), (4, 17), (6, 17), (7, 17)$  -----  $(16, 17), (18, 17) = 17$  points

Also  $(17, 1), (17, 2),$  -----  $(17, 16), (17, 18) = 17$  points

So there are more than 34 points.

**Ans-()**

# PHYSICS



From cons. of angular momentum about A

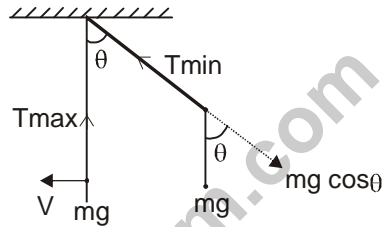
$$\Rightarrow v = \frac{2R\omega}{7}$$

$$\Rightarrow \omega' = \frac{2\omega}{7}$$

Ans. (C)

92. Ans. (A)

93.  $T_{\max} - mg = \frac{mv^2}{R} \dots (i)$



from energy cons.  
 $k_i + u_i = k_f + u_f$

$$0 + mg(R - R \cos \theta) = \frac{1}{2}mv^2 + 0$$

$$V^2 = 2gR(1 - \cos \theta)$$

Put in eq. (i)

$$T_{\max} = 3mg - 2mg \cos \theta$$

$$\frac{T_{\max}}{T_{\min}} = 4$$

$$\theta = 60^\circ$$

Ans. (B)

94. Heat cap. is define as  $C = C_v + \frac{R}{1-\gamma}$

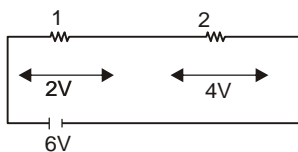
$$C = \frac{3}{2}R + \frac{R}{1-3} + R$$

Ans. (D)

95. Ans. (A)

96. Ans. (C)

97. At steady state capacitor will behave as open circuit



So charge store in  $1 \mu F = 1 \times 4 = 4 \mu C$

in  $2 \mu F = 2 \times 4 = 8 \mu C$

Ans. B

98.  $F = \frac{2P}{C}$

$$mg = \frac{2 \times 1.5 \times 10^3}{3 \times 10^8}$$

$$m = 10^{-6} \text{kg}$$

Ans. (D)

99.  $E = \phi + eV$

$$E = \phi + e \text{ (.9)}$$

$$1.1E = \phi + e \text{ (.9)}$$

$$.1E = .3e$$

$$E = 3eV \text{ put}$$

$$\phi = 2.4eV$$

Ans. (B)

100.  $(ML^{\circ}T^{-2}\theta^{-4}) = (ML^2T^{-1})^{\gamma} (ML^2T^{-2}\theta^{-1})^{\beta} (LT^{-1})^{\gamma}$

Solving we get

Ans. (C)

## CHEMISTRY

101. Ans. (A)

102.  $d = \frac{PM}{RT}$                        $M = \frac{dRT}{P}$

$$M = 123$$

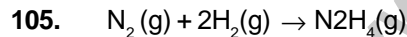
∴ acetic acid exist as dimer

Ans. (B)

103.  $\Delta E = \Delta H - \Delta(PV) = \Delta H - \Delta ngRT$

Ans. (D)

104. Ans. (C)



$$\Delta = \sum (\text{BDE})_{\text{Reacant}} - \sum (\text{BDE})_{\text{Products}}$$

Ans. (B)

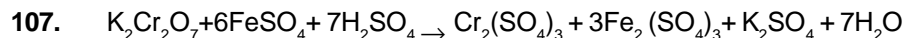
106.  $V_{K^+} + V_{Cl^-} = 133 + 181$

KCl form FCC Lattice

$$\therefore 2(V_{K^+} + V_{Cl^-}) = a = \text{edge length of unit cell}$$

$$V = a^3$$

Ans. (C)



Ans. (B)

108.  $E^{\circ}_{\text{Cell}} = \text{SRP cathode} - \text{SRP anode}$

$$= -0.44 - (-0.74) = 0.3V$$

$$\Delta G = -nF E^{\circ}_{\text{Cell}} \text{ (n = 6 ele}^{-}\text{)}$$

Ans. (C)

109. Ans. (A)



$XeO_3$  is  $sp^3$  hybrid and pyramidal

Ans. (C)

**BIOLOGY**

111. (B) 112. (D) 113. (D) 114. (A) 115 (C) 116. (D) 117. (C)  
118. (B) 119. (A) 120. (A)

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