# FINAL TEST SERIES XI JEE
# TEST-02 ANSWER KEY

**Test Date :27-01-2020**

## [PHYSICS]

1. Answer (1)
2. Answer (4)

$$\left.\begin{array}{l} 36 = \dfrac{\omega^2 - \dfrac{\omega^2}{4}}{2\alpha} \\ \theta = \dfrac{\dfrac{\omega^2}{4} - 0}{2\alpha} \end{array}\right\}$$

$$\Rightarrow \frac{\theta}{36} = \frac{1}{3} \Rightarrow \theta = 12$$

3. Answer (2)

$$a = \frac{g\sin 90}{1+1} = \frac{g}{2}$$

4. Answer (4)

$$\frac{1}{2}\frac{ml^2}{3}\omega^2 = mgh$$

$$\Rightarrow \quad h = \frac{l^2\omega^2}{6g}$$

5. Answer (4)

$$m_1 \times d = m_2 \times x$$

6. Answer (3)

$$-\frac{2GM_1m}{d} - \frac{2GM_2m}{d} + \frac{1}{2}mV_e^2 = 0$$

$$\Rightarrow V_e = \sqrt{\frac{4G(M_1+M_2)}{d}}$$

7. Answer (2)
8. Answer (1)

$$\left.\begin{array}{l} U = -2E \\ KE = E \end{array}\right\} \therefore \text{ Total energy} = -E$$

$\therefore$ Binding energy = $E$.

9. Answer (4)

$$\frac{GM}{x^2} = G \times \frac{4m}{(r-x)^2}$$

$$\Rightarrow x = \frac{r-x}{2} \Rightarrow x = \frac{r}{3}$$

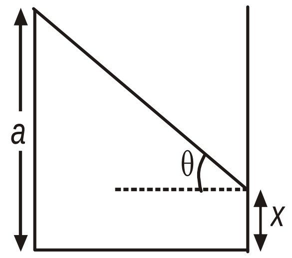
$$\therefore\ V = -\frac{3GM}{r} - \frac{3G \times 4m}{2r} = -\frac{9GM}{r}$$

10. Answer (2)

$$\sqrt{2gx} \times \sqrt{\frac{2h}{g}} = R$$

$4hx = R^2$.

11. Answer (2)




$$\frac{1}{2} \times a^2 \times (a-x) = \frac{a^3}{3}$$

$$3a - 3x = 2a$$

$$x = \frac{a}{3}$$

$$\tan\theta = \frac{\frac{2a}{3}}{a} = \frac{a_0}{g}$$

$$\Rightarrow a_0 = \frac{2g}{3}$$

12. Answer (2)
13. Answer (4)

$$a = \frac{g}{3}$$

$$\therefore\ a_{cm} = \frac{m\left(\frac{g}{3}\right) - 2m \times \frac{g}{3}}{3m} = -\frac{g}{9}$$

14. Answer (4)

$$0 = m(v_0 - v) - 2mV$$

$$v_0 - v = 2v \Rightarrow v = \frac{v_0}{3}$$

$\therefore$ Velocity of girl $= v_0 - \frac{v_0}{3} = \frac{2v_0}{3}$

15. Answer (3)

$$I = \frac{MR^2}{2} - \left[\frac{3}{2} \times \frac{M}{4}\left(\frac{R}{2}\right)^2\right] = \left(\frac{1}{2} - \frac{3}{32}\right)MR^2 = \frac{13}{32}MR^2$$

16. Answer (2)

$$u_1 = \frac{P}{m}, u_2 = 0,\ I = p - mv_1,\ I = mv_2$$

$$\Rightarrow v_1 = \frac{p - I}{m} \quad \Rightarrow v_2 = \frac{I}{m}$$

$$\therefore e = \frac{\frac{I}{m} - \frac{p}{m} + \frac{I}{m}}{u_1} = \frac{2I - p}{p}$$

17. Answer (3)
18. Answer (4)

$$T = \left(\frac{M}{2}\right)\left(\frac{3l}{4}\right)\omega^2 = \frac{3}{8}ml\omega^2$$

19. Answer (3)
20. Answer (2)
21. $A_1V_1 = A_2V_2$

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

$$= v = 1 \text{ m/s}$$

22. **5**
23. **9**
24. **2**
25. **9**

# [CHEMISTRY]

26. Answer (3)

$H_2O_2 \longrightarrow O_2 + 2e^-$

$5e^- + ClO_2 \longrightarrow Cl^-$

1 mol of $ClO_2 = \frac{5}{2}$ mole of $H_2O_2$

27. Answer (3)

$$3Cl_2 + 6OH^- \longrightarrow ClO_3^- + 5Cl^- + 3H_2O$$

28. Answer (3)

$^{+4}CO_2$

29. Answer (2)

$Mn^{+2} \longrightarrow Mn^{+4} + 2e$

n-factor = 2

30. Answer (2)

$$\rho = \frac{PM}{RT}$$

31. Answer (1)

$$\frac{v_2}{v_1} = \sqrt{\frac{1200}{300}} \times 0.3 = 0.6 \text{ ms}^{-1}$$

32. Answer (2)

Fact

33. Answer (3)

Slope of the adiabatic curve $\propto \gamma$

He ($\gamma$ = 1.66), $O_2$ ($\gamma$ = 1.44)

34. Answer (1)

$$W = -2.303 \text{ nRT} \log \frac{P_1}{P_2}$$

$$= -2.303 \times 1 \times 8.314 \times 273 \log \frac{1}{0.1} = -5.227 \text{ kJ}$$

q = –W = +5.227 kJ

35. Answer (1)

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

| $N_2$ | $3H_2$ | $2NH_3$ |
|---|---|---|
| 0.2 | 0.6 | 0 |
| 0.2 – x | 0.6 – 3x | 2x |

$$0.4 = \frac{x}{0.2} \Rightarrow x = 0.08$$

$$\frac{V_f}{V_i} = \frac{0.8 - 2x}{0.8} = \frac{4}{5}$$

36. Answer (2)

$$\alpha = \frac{46 - 38.3}{38.3} = 0.2$$

$2\alpha = 2 \times .2 = 0.4$

37. Answer (4)

$$2HI \rightleftharpoons H_2 + I_2$$

$(2-2\alpha)$ $\quad \alpha \quad \alpha$

$$K = \frac{0.5 \times 0.5}{(2 - 2 \times 0.5)^2} = 0.25$$

38. Answer (1)

Fact

39. Answer (1)

$[NH_4^+] = [NH_2^-] = \sqrt{KNH_3} = 10^{-15}$ M

1 $mm^3$ solution contains = $6.02 \times 10^{23} \times 10^{-15} \times 10^{-6}$
= 602

40. Answer (1)

$$[H^+]_{mix} = \sqrt{1.8 \times 10^{-4} \times 0.1 + 3.1 \times 10^{-4} \times 0.1}$$

$$= \sqrt{4.9 \times 10^{-5}} = 7 \times 10^{-3}$$

41. Answer (2)

Fact

42. Answer (4)

$\Delta H$ = – 20.6 – 8.8 = – 29.4 J

43. Answer (2)

$2KCN + AgNO_3 \longrightarrow [Ag(CN)_2]^- + KNO_3 + K^+$

(.1 – 0.06) 0 0.03 0.03 0.03

$[Ag(CN)_2]^- \rightleftharpoons Ag^+ + 2CN^-$

(0.03 – a) a (0.04 + a)

$K_C = \frac{a \times (0.04)^2}{0.03} = 4 \times 10^{-19}$ $[0.03 - a \approx a \text{ as } K_C = 4 \times 10^{-19}]$

44. Answer (1)

$2AB_2\,(g) \rightleftharpoons 2AB\,(g) + B_2\,(g)$

2 – 2x 2x x

$$K_P = \frac{\left(\frac{2x}{2+x}\right)P^2 \times \left(\frac{x}{2+x}\right)P}{\frac{(2-2x)^2}{2+x}P^2} = \frac{x^3P}{(2+x)(1-x)^2}$$

45. Answer (1)

Number of meq of $H^+ = 10 \times 1 + 20 \times 2 = 50$

Number of meq of $OH^- = 30 \times 1 = 30$

Number of meq of $H^+$ left = 50 – 30 = 20

46. $n = \frac{PV}{RT} = \frac{1.56 \times 10}{0.082 \times 317} = 0.6$ mol

Let ${}^nC_xH_8 = a$

${}^nC_xH_{12} = (0.6 - a)$

Total mass of C in mixture

= 12 ax + 12 (.6 – a)x = 7.2x

% of C in mixture = $\frac{7.2x}{41.4} \times 100 = 87\%$

or $\frac{720x}{41.4} = 87$ or x = 5

47. $A + B \rightleftharpoons C + D$

| | | | |
|---|---|---|---|
| 4 | 4 | 0 | 0 |
| 4 – x | 4 – x | x | x |

x = 2

$K = \frac{2 \times 2}{2 \times 2} = 1$

48. Buffer capacity = $\frac{2}{3.4 - 2.9} = 4$

49. pH = $-\log_{10}(2 \times 0.05) = 1$

50. Meq of $Mg^{+2} \equiv$ Meq of washing soda

$\frac{W}{E} \times 1000 = Mg^{+2}$; $EW = \frac{24}{2} = 12$

$\frac{12 \times 10^{-3}}{12} \times 1000 = 1$.

# [MATHEMATICS]

51. Answer (2)

$$\frac{S_n}{S_n^1} = \frac{\frac{n}{2}[2a_1 + (n-1)d_1]}{\frac{n}{2}[2a_2 + (n-1)d_2]}$$

$$= \frac{7n+1}{4n+17}$$

$$\frac{a_1 + \left(\frac{n-1}{2}\right)d_1}{a_2 + \left(\frac{n-1}{2}\right)d_2} = \frac{7n+1}{4n+17}$$

Put $n$ = 19

Required ratio = $\frac{134}{93}$

∴ They are in G.P.

52. Answer (1)

Order of letter are ELMOUV 601th word will be VELMOU

53. Answer (1)

Let the 4 persons be given *a, b, c, d* things respectively.

Then $a + b + c + d = 16$,

where $a, b, c, d \geq 3$ ...(1)

$\Rightarrow a - 3 \geq 0, b - 3 \geq 0, c - 3 \geq 0, d - 3 \geq 0$

Put $a - 3 = x, b - 3 = y, c - 3 = z, d - 3 = t$

$\Rightarrow a = 3 + x, b = 3 + y, c = 3 + z, d = 3 + t$

∴ from (1) $3 + x + 3 + y + 3 + z + 3 + t = 16$

$\Rightarrow x + y + z + d = 4, x, y, z, t \geq 0$

∴ Required number = number of ways of distributing 4 identical things among 4 persons when each person can get zero or more things

$$= {}^{4+4-1}C_{4-1} = {}^7C_3 = \frac{7!}{3! \times 4!} = \frac{7.6.5.4!}{6.4!} = 35$$

54. Answer (2)

Twenty pearls ≡ 10 pearls of one colour and 10 pearls of another colour.

**Step-1:** First arrange pearls of same colour in necklace in $\frac{1}{2}(10-1)! = \frac{1}{2} \times 9!$.

**Step-2:** Now arrange pearls of another colour in between the arranged 10 pearls in 10! ways.

∴ Required number of ways $= \frac{1}{2} \times 9! \times 10!$

$$= \frac{1}{2} \times 9! \times 10 \times 9! = 5 \times (9!)^2$$

55. Answer (2)

$(1 + x^3 + 3x^2 + 3x)^{10} = (1 + x)^{30}$

Largest binomial coeff. = ${}^{30}C_{15}$

56. Answer (2)

Clearly locus is a circle

57. Answer (1)

Without restriction, total number of ways

$$= \frac{7!}{2! \times 2!} = \frac{7 \times 6 \times 5 \times 4 \times 3 \times 2!}{2! \times 2 \times 1}$$

= 1260

58. Answer (1)

Let the six digit numbers be $x_1\ x_2\ x_3\ x_4\ x_5\ x_6$.

Then, $x_1$ can take values 2 or 4 in 2 ways

$x_2$ can take vaules 1 or 3 or 5 in 3 ways

$x_3$ can take values as 0 and the digit that $x_1$ cannot occur

$x_4$ can take two remaining digit that $x_2$ cannot occur

Lastly $x_5$ and $x_6$ each can take 1 value.

$\therefore$ Total number of possibilities

$= 2 \times 3 \times 2 \times 2 \times 1 \times 1 = 24$

59. Answer (3)

Let $b = a + d$ and $c = a + 2d$, where $d = c.d.$ of A.P.

Given equation is $a + b + c = 21$ ...(1)

$\Rightarrow a + a + d + a + 2d = 21$

$\Rightarrow a + d = 7 \quad \Rightarrow b = 7$

$\therefore$ From (1), $a + c = 14$ ...(1)

$\therefore$ No. of positive integral solutions of equation (1)

$= {}^{14-1}C_{2-1} = {}^{13}C_1 = 13$

$\therefore$ Possible number of values of $a, b, c = 13$

60. If number of balls is a, b and c in different boxes, then a + b + c = 9

Number of solutions is ${}^{11}C_2$ = 55.55 ways include those ways in this

(i) a, b, c are same (ii) two of a, b, c are equal

(iii) all a, b, c are distinct

Now a, b, c are same in exactly one way (a= b = c = 3). Also three are 12 ways out of 55 ways in which exactly two of a, b, c are same. These 12 will be counted as $\frac{12}{3}$ = 4 ways (as 3,3,1:3, 1, 3 and 1, 3, 3 are same ways. Thus total number of required ways is 1+4+7 = 12.

Hence (D) is the correct answer.

61. General term in the expansion is ${}^{10}C_r \left(\frac{x}{3}\right)^{\frac{r}{2}} \left(\frac{3}{2x^2}\right)^{\frac{10-r}{2}} = {}^{10}C_r\ x^{\frac{3r}{2}-10} \cdot \frac{3^{5-r}}{2^{\frac{10-r}{2}}}$

For constant term, $\frac{3r}{2} = 10 \Rightarrow r = \frac{20}{3}$

which is not an integer. Therefore, there will be no constant term.

Hence (D) is the correct answer.

62. **(A).** Let x be the first term and d be the c . d of A.P.

a = x + (p – 1 ) d

b = x + ( q – 1)d

$\Rightarrow d = \frac{a-b}{p-q}$ . . . . . (1)

so, $x = a - \frac{(p-1)(a-b)}{p-q}$

$= \frac{pa - qa - pa + pb + a - b}{p-q} = \frac{pb - qa + a - b}{p-q}$

Hence, $S_{p+q} = \frac{p+q}{2}\left[a + b + \frac{a-b}{p-q}\right]$.

63. The numbers should be divisible by 6. Thus, the number of favourable ways is ${}^{16}C_3$ (as there are 16 numbers in first 100 natural numbers, divisible by 6).

Required probability is $\frac{{}^{16}C_3}{{}^{100}C_3} = \frac{16 \times 15 \times 14}{100 \times 99 \times 98} = \frac{4}{1155}$.

64. The number is divisible by 4 if last two digits are 12, 24, 32 and 52. Remaining three places can be filled by 3! ways.

$\therefore$ Favouable cases = $3! \times 4$

Required probability = $\frac{3! \times 4}{5!} = \frac{1}{5}$.

65. $49^n + 16n - 1 = (1 + 48)^n + 16n - 1$

$1 + {}^nC_1(48) + {}^nC_2(48)^2 + .... + {}^nC_n(48)^n + 16n - 1$

$= (48n + 16n) + {}^nC_2(48)^2 + {}^nC_3(48)^3 + ... + {}^nC_n(48)^n$

$= 64n + 8^2[{}^nC_2.6^2 + {}^nC_3.6^3.8 + {}^nC_4.6^4.8^2 + .. + {}^nC_n.6^n.8^{n-2}]$

Hence, $49^n + 16n - 1$ is divisible by 64.

66. $\left(\frac{1+i}{1-i}\right)^x = 1 \Rightarrow \left[\frac{(1+i)^2}{1-i^2}\right]^x = 1$

$\Rightarrow \left(\frac{1+i^2+2i}{1+1}\right)^x = 1 \Rightarrow i^x = 1$

$\therefore x = 4n, n \in I^+$.

67. $z = x - iy,\ z^{1/3} = p + iq$

$z = (p+iq)^3 = p^3 - iq^3 + 3p^2qi - 3pq^2$

$z = (p^3 - 3pq^2) + i(3p^2q - q^3)$

Equating real and imaginary part we get

$x = p^3 - 3pq^2,\ y = -(3p^2q - q^3)$

$x = p(p^2 - 3q^2)$ , $y = q(q^2 - 3p^2)$

$\frac{x}{p} = p^2 - 3q^2$ .....(i) $\frac{y}{q} = q^2 - 3p^2$ ......(ii)

Adding (i) and (ii), we get

$\frac{x}{p} + \frac{y}{q} = p^2 + q^2 - 3(q^2 + p^2) = -2p^2 - 2q^2$

$\frac{x}{p} + \frac{y}{q} = -2(p^2 + q^2)$ . Hence $\frac{\frac{x}{p} + \frac{y}{q}}{p^2 + q^2} = -2$ .

68. $\frac{1-ix}{1+ix} = a - ib \Rightarrow \frac{(1-ix)(1-ix)}{(1+ix)(1-ix)} = a - ib$

$\Rightarrow \frac{1-x^2-2ix}{1+x^2} = a - ib \Rightarrow \frac{1-x^2}{1+x^2} = a$ and $\frac{2x}{1+x^2} = b$

Now we can write $x$ as $x = \frac{\frac{2x}{1+x^2}}{\frac{2}{1+x^2}} = \frac{\frac{2x}{1+x^2}}{\frac{1-x^2}{1+x^2} + 1}$

$= \frac{b}{1+a} = \frac{2b}{1+1+2a} = \frac{2b}{1+(a^2+b^2)+2a} = \frac{2b}{(1+a)^2+b^2}$

**Trick :** $\frac{1-ix}{1+ix} = \frac{1-x^2-2ix}{1+x^2} = a - ib$

Let $a = 0 \Rightarrow x = \pm 1$ and $b = \pm 1$ .

Also option (b) gives $\pm 1$ .

69. Let the G.P. be $a, ar, ar^2$......., then

$\alpha = \sum_{n=1}^{100} a_{2n} = a_2 + a_4 + $.......upto 100 terms

$= ar + ar^3 + $.......upto 100 terms

$= ar(1 + r^2 + r^4 + ......r^{198})$

and $\beta = \sum_{n=1}^{100} a_{2n-1} = a + ar^3 + $.....upto 100 terms

$= a(1 + r^2 + ...... + r^{198})$

Obviously $\frac{\alpha}{\beta} = r$ .

70. As given, $(a^2+b^2+c^2)p^2 - 2(ab+bc+cd)p + (b^2+c^2+d^2) \le 0$ ..... (i)

But L.H.S.

$= (a^2p^2 - 2abp + b^2) + (b^2p^2 - 2bcp + c^2) + (c^2p^2 - 2cdp + d^2)$

$= (ap-b)^2 + (bp-c)^2 + (cp-d)^2 \ge 0$ .....(ii)

Since the sum of squares of real numbers is non-negative.

Therefore from (i) and (ii)

$\Rightarrow (ap-b)^2 + (bp-c)^2 + (cp-d)^2 = 0$

$\Rightarrow ap - b = 0 = bp - c = cp - d \Rightarrow \frac{b}{a} = \frac{c}{b} = \frac{d}{c} = p$

$\therefore a, b, c, d$ are in G.P.

71. A.M. $\ge$ G.M.

$\frac{\frac{a}{b} + \frac{b}{c} + \frac{c}{a}}{3} \ge (1)^{1/3}$

$\Rightarrow \frac{a}{b} + \frac{b}{c} + \frac{c}{a} \ge 3$

72. $3^{51} = 3.3^{50} = 3.(3^2)^{25} = 3(1+8)^{25}$

$= 3[1 + {}^{25}C_1.8 + {}^{25}C_2.8^2 + ... + {}^{25}C_{25}.8^{25}]$

$= 3 + 3.8[{}^{25}C_1 + {}^{25}C_2.8 + ... + {}^{25}C_{25}.8^{24}]$

$= 3 + 24K$, where $K = {}^{25}C_1 + {}^{25}C_2.8 + ... + {}^{25}C_{25}.8^{24}$

= an integer.

$\therefore$ $3^{51}$ when divided by 24 leaves the remainder 3.

73. In the expansion of $(1+x)^n$, it is given that ${}^nC_1, {}^nC_2, {}^nC_3$ are in A.P.

$\Rightarrow 2.{}^nC_2 = {}^nC_1 + {}^nC_3$

$\Rightarrow 2.\frac{n(n-1)}{1.2} = \frac{n}{1} + \frac{n(n-1)(n-2)}{1.2.3}$

$\Rightarrow 6(n-1) = 6 + (n-2)(n-1)$

$\Rightarrow n^2 - 9n + 14 = 0 \Rightarrow n = 2$ or $n = 7$ .

But $n = 2$ is not acceptable because, when $n$=2, there are only three terms in the expansion of $(1+x)^2$ , $\therefore$ $n = 7$ .

74. $\left|\frac{\beta-\alpha}{1-\bar{\alpha}\beta}\right| = \left|\frac{\beta-\alpha}{\beta\bar{\beta}-\bar{\alpha}\beta}\right| = \left|\frac{\beta-\alpha}{\beta(\bar{\beta}-\bar{\alpha})}\right|$

$= \frac{1}{|\beta|}\left|\frac{\beta-\alpha}{(\overline{\beta-\alpha})}\right| = \frac{1}{|\beta|} = 1$ $\{\because |z| = |\bar{z}|\}$

75. Let the numbers be $a, ar, ar^2$

$a + ar + ar^2 = 14 \Rightarrow a(1 + r + r^2) = 14$ .....(i)

and $2(ar+1) = (a+1) + (ar^2 - 1)$

$a(r^2 - 2r + 1) = 2$ ..... (ii)

Put the value of $a$ from (i) to (ii),

$\Rightarrow 2r^2 - 5r + 2 = 0 \Rightarrow r = 2, \frac{1}{2}$ and $a = 2,8$

$\therefore$ Numbers are 2, 4, 8 or 8, 4, 2. So lowest term in series is 2.