JEE EXPERT

ANSWER KEY

REGULAR TEST SERIES - (RTS-04)

11^{TH} A02 (Zenith)

Date 28.07.2019

PHYSICS

1	(C)	2	(D)	3	(A)	4	(A)	5	(B)
6	(A)	7	(C)	8	(C)	9	(C)	10	(C)
11	(D)	12	(C)	13	(A)	14	(C)	15	(D)
16	(B)	17	(C)	18	(A)	19	(C)	20	(B)
21	(B)	22	(A)	23	(A)	24	(A)	25	(C)
26	(C)	27	(A)	28	(A)	29	(A)	30	(A)

CHEMISTRY

31	(A)	32	(B)	33	(D)	34	(D)	35	(B)
36	(D)	37	(C)	38	(D)	39	(C)	40	(D)
41	(B)	42	(B)	43	(A)	44	(A)	45	(B)
46	(B)	47	(C)	48	(D)	49	(A)	50	(C)
51	(D)	52	(D)	53	(C)	54	(A)	55	(B)
56	(C)	57	(D)	58	(B)	59	(C)	60	(C)

MATHEMATICS

61	(B)	62	(B)	63	(D)	64	(B)	65	(D)
66	(B)	67	(D)	68	(A)	69	(C)	70	(C)
71	(C)	72	(B)	73	(B)	74	(B)	75	(B)
76	(C)	77	(A)	78	(D)	79	(C)	80	(D)
81	(A)	82	(A)	83	(B)	84	(C)	85	(C)
86	(C)	87	(B)	88	(B)	89	(B)	90	(C)

JEE EXPERT

SOLUTIONS

REGULAR TEST SERIES - (RTS-04)

11TH A02 (Zenith)

Date 28.07.2019

CHEMISTRY

31	**(A)**	**32**	**(B)**	**33**	**(D)**	**34**	**(D)**	**35**	**(B)**
36	**(D)**	**37**	**(C)**	**38**	**(D)**	**39**	**(C)**	**40**	**(D)**
41	**(B)**								

42. **(B)** $100 \times N_{H_2O_2} = 50 \times 0.2 \times 2$

$\Rightarrow \quad N_{H_2O_2} = 0.2 \quad M_{H_2O_2} = \dfrac{0.2}{2} = 0.1$

Volume strength of $H_2O_2 = 0.1 \times 11.2 = 1.12$

Alternatively volume strength = $N \times 5.6 = 1.12$

43. **(A)** Meq of H_2O_2 = Meq of $Na_2S_2O_3$

$\Rightarrow \quad 10 \times N = 20 \times 0.1$

$\Rightarrow \quad N = 0.2$

Volume Strength of $H_2O_2 = 5.6 \times$ Normality

$= 5.6 \times 0.2$

$= 1.12$

44. **(A)** $\dfrac{1}{2}$ meq of $Na_2CO_3(nf = 2) = x \times 1$

meq Na_2CO_3 (nf = 2) + meq of $NaHCO_3 = y \times 1$

Hence, meq of $NaHCO_3 = y - 2x$

No. of eq of $NaHCO_3 = \dfrac{y-2x}{1000}$

No. of mole of $NaHCO_3 = \dfrac{y-2x}{1000}$

$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$

No. of mole of CO_2 formed = $\dfrac{y-2x}{2000}$

45. **(B)** Let x g of NH_3 is present in 0.5 g of NH_4Cl

Equivalent of NH_3 = equivalent of H_2SO_4 taken to neutralise it - equivalent of H_2SO_4 left.

$$\frac{x}{17}=\left(\frac{150}{1000}\times\frac{1}{5}\right)-\frac{20\times 1}{1000}$$

$$x=\frac{17}{100}$$

$$\% \text{ of } NH_3 = \frac{17}{100\times 0.5}\times 100 = 34\%$$

46. **(B)** $2Na_2CO_3 + H_2SO_4 \rightarrow 2NaHCO_3 + Na_2SO_4$

$$25\times N_{Na_2CO_3} = 20\times 0.1$$

$$\Rightarrow \quad N_{Na_2CO_3} = \frac{20\times 0.1}{25} = \frac{4}{5}\times 0.1 = \frac{4}{50} = \frac{2}{25}$$

$$M_{Na_2CO_3} = \frac{2}{25}$$

Millimole of $Na_2CO_3 = 250\times\frac{2}{25} = 20$

No. of mole of $Na_2CO_3 = 20\times 10^{-3} = \frac{2}{100}$

Mass of $Na_2CO_3 = \frac{2}{100}\times 106 = 2\times 1.06 = 2.12$ gm.

47. **(C)** Meq of Salt = Meq. of Na_2SO_3

$50\times 0.1\times n = 25\times 0.1\times 2$

$\therefore$ n = 1 (change in oxidation number)

$\therefore$ $M^{3+} + e^- \rightarrow M^{2+}$

48. **(D)** $$\left[\overset{+3}{As_2}\overset{-2}{S_3} \rightarrow H_3\overset{+5}{As}O_4 + H_2\overset{+6}{S}O_4 + 28e^-\right]\times 3$$

$$\left[3e^- + H\overset{+5}{N}O_3 \rightarrow \overset{+2}{N}O\right]28$$

$\because$ 28 mole HNO_3 oxidises 3 mol As_2S_3

$\therefore$ 1 mole HNO_3 will oxidise $\frac{3}{28}$ mole of As_2S_3.

Alternatively n_{eq} As_2S_3 = n_{eq} HNO_3

Moles of $As_2S_3\times 28 = 1\times 3$

$\Rightarrow$ Moles of $As_2S_3 = \frac{3}{28}$

49. **(A)**

(A) – Q ; (B) – P ; (C) – S ; (D) – R.

(P) $CrI_3 \rightarrow Cr_2O_7^{2-} + IO_4^{-1}$

$Cr^{+3} \rightarrow Cr^{+6} + 3e^-$

$(I_3)^{3-} \rightarrow 3I^{+7} + 24e^-$

$$CrI_3 \rightarrow Cr^{+6} + 3I^{+7} + 27e^-$$

$\therefore$ nf = 27

(Q) $Fe(SCN)_2 \rightarrow Fe^{+3} + SO_4^{-2} + CO_3^{-2} + NO_3^{-1}$

$Fe^{+2} \rightarrow Fe^{+3} + e^-$

$(S^{2-})_2 \rightarrow 2S^{+6} + 16e^-$

$(N^{3-})_2 \rightarrow 2N^{+5} + 16e^-$

$Fe^{+2} + (S^{2-})_2 + (N^{3-})_2 \rightarrow Fe^{+3} + 2S^{+6} + 2N^{+5} + 33e^-$

$\therefore$ nf = 33

(R) $NH_4SCN \rightarrow SO_4^{-2} + CO_3^{-2} + NO_3^{-1}$

$N^{3-} \rightarrow N^{+5} + 8e^-$

$S^{2-} \rightarrow S^{+6} + 8e^-$

$N^{3-} \rightarrow N^{+5} + 8e^-$

$NH_4SCN \rightarrow SO_4^{2-} + CO_3^{2-} + NO_3^{-1} + 24e^-$

$\therefore$ nf = 24

(S) $K_4[Fe(CN)_6] \rightarrow K^+ + Fe^{+3} + CO_3^{2-} + NO_3^{-1}$

$Fe^{+2} \rightarrow Fe^{+3} + e^-$

$(C^{+2})_6 \rightarrow 6C^{+4} + 12e^-$

$(N^{3-})_6 \rightarrow 6N^{+5} + 48e^-$

$K_4[Fe(CN)_6] \rightarrow K^+ + Fe^{+3} + CO_3^{2-} + NO_3^{-1} + 61e^-$

$\therefore$ nf = 61

50. **(C)**

(A) – S ; (B) – Q ; (C) – R ; (D) – P.

(A) $(P_2)^{-4} \rightarrow P^{-3} + (P_4)^{-2}$

$2e^- + (P_2)^{-4} \rightarrow 2P^{-3} \quad \times 3$

$2(P_2)^{4-} \rightarrow (P_4)^{2-} + 6e^-$

$5(P_2)^{4-} \rightarrow 6P^{3-} + P_4^{2-}$

$\therefore$ nf = $\frac{6}{5}$

(B) $I_2 \rightarrow I^- + IO_3^{-1}$

$2e^- + I_2 \rightarrow 2I^- \quad \times 5$

$I_2 \rightarrow 2I^{+5} + 10\,e^-$

$6I_2 \rightarrow 10I^- + 2I^{+5}$

$\therefore$ nf = $\frac{10}{6} = \frac{5}{3}$

(C) $2Mn^{+7} + Mn^{+2} \rightarrow Mn_3O_4$

$3\,Mn^{+7} + 13e^- \rightarrow (Mn_3)^{+8} \quad \times 2$

$3\,Mn^{+2} \rightarrow (Mn_3)^{+8} + 2e^- \quad \times 13$

$$39\,Mn^{+2} + 6\,Mn^{+7} \rightarrow 15\,(Mn_3)^{+8}$$

$\therefore$ nf $Mn_3O_4 = \dfrac{26}{15}$

(D)

$$H_3PO_2 \rightarrow PH_3 + H_3PO_3$$
$$P^{+1} \rightarrow P^{3-} + P^{+3}$$
$$4e^- + P^{+1} \rightarrow P^{3-}$$
$$P^{+1} \rightarrow P^{+3} + 2e^- \times 2$$
$$3P^{+1} \rightarrow 2P^{+3} + P^{3-}$$

$\therefore$ nf $= \dfrac{4}{3}$

51. **(D)**

52. **(D)** $\dfrac{1}{\lambda} = R_H Z^2 \left(\dfrac{1}{n_1^{\,2}} - \dfrac{1}{n_2^{\,2}}\right)$

53. **(C)**

54. **(A)** Six different lines

$$\frac{1}{970.6\times10^{-8}} = 109678\times1\left(\frac{1}{1}-\frac{1}{N_2^{\,2}}\right)$$

$$\frac{9.1176\times10^{-6}}{970.6\times10^{-8}} = 1-\frac{1}{n_2^{\,2}}$$

$$\frac{1}{n_2^{\,2}} = 0.0606$$

$$n_2 = 4$$

Number of lines $= \dfrac{(4-1)(4)}{2} = 6$

55. **(B)** $\dfrac{1}{\lambda_{He^+}} = R_H Z^2\left[\dfrac{1}{2^2}-\dfrac{1}{3^2}\right] = 109678 \times 4\left[\dfrac{5}{36}\right]$; λ_{He^+} = **1641.1 Å**

56. **(C)** Number of lines in the spectrum = $\dfrac{(n_2-n_1)(n_2-n_1+1)}{2} = \dfrac{(7-2)(7-2+1)}{2}$ = **15**.

57. **(D)** Solubility increases down the group and decreases on moving from left to right in a period.

58. **(B)** Carbonate being a bigger anion is stabilised by bigger cation.

59. **(C)** Out of N and P, N has higher IE, and out of O and S, O has higher IE and out of N and O, N has higher IE, due to greater stability of the exactly half–filled 2p–subshell.

60. **(C)** $h\nu = h\nu_0 + KE$ i.e. $\dfrac{hc}{\lambda} = \dfrac{hc}{\lambda_0} + \dfrac{1}{2}mv^2$

$$v = \left(\frac{2hc}{m}\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)\right)^{1/2}$$

MATHEMATICS

61. **(B)** $\sin 10^\circ = \dfrac{a}{2b} \Rightarrow \sin 30^\circ = 3\sin 10^\circ - 4\sin^3 10^\circ$

$$\frac{1}{2} = \frac{3a}{2b} - \frac{4a^3}{8b^3}$$

$$1 = \frac{3a}{b} - \frac{a^3}{b^3} = a^3 + b^3 = 3ab^2$$

62. **(B)** $OM = c$ (Clear from normal form of the line)

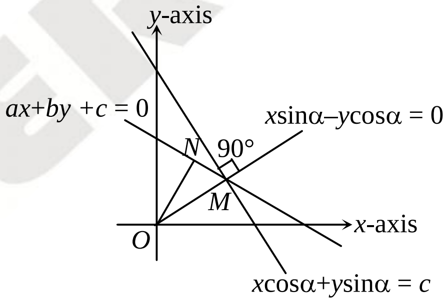
ON = $\dfrac{c}{\sqrt{a^2 + b^2}}$

Also $\angle$OMN = 45°

So, ON = OM cos45°

$$\frac{c}{\sqrt{a^2 + b^2}} = \frac{c}{\sqrt{2}}$$

$\Rightarrow$ $a^2 + b^2 = 2$

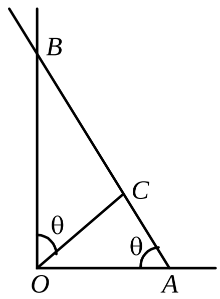


63. **(D)** tan (180° – θ) = slope of AB = –3

$\therefore$ tanθ = 3

$\therefore$ $\dfrac{OC}{AC} = \tan\theta$, $\dfrac{OC}{BC} = \cot\theta$

$\Rightarrow$ $\dfrac{BC}{AC} = \dfrac{\tan\theta}{\cot\theta} = \tan^2\theta = 9.$

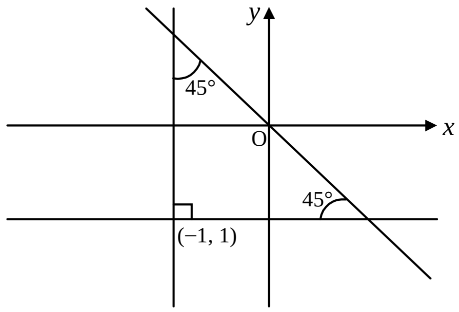


64. **(B)** The sides are x + y – 4 = 0, x – 1 = 0, y – 2 = 0. So, the triangle is right angled at (1, 2).

The hypotenuse is x + y – 4 = 0 whose ends are (1, 3) and (2, 2).

The circumcentre = $\left(\dfrac{1+2}{2}, \dfrac{3+2}{2}\right)$ and circumradius $= \dfrac{1}{2}\sqrt{(1-2)^2 + (3-2)^2} = \dfrac{1}{\sqrt{2}}$.

65. **(D)** Clearly joint equation of lines is (y + 1) (x + 1) = 0



$\Rightarrow$ x + y + xy + 1 = 0

66. **(B)** The pair of straight lines $6xy - 2x - 3y + 1 = 0$ are perpendicular to each other i.e., (2x – 1) (3y – 1) = 0. So orthocentre is the point of intersection of these lines.

67. **(D)** Given pair of lines is $y^2 - 9xy + 18x^2 = 0$ …(i)

or $(y - 3x)(y - 6x) = 0$

Hence given lines are $y - 3x = 0$ …(ii)

$y - 6x = 0$ …(iii)

and y = a …(iv)

Vertices of triangle formed are $(0,\ 0), \left(\frac{a}{3},\ a\right), \left(\frac{a}{6},\ a\right)$

Area of the triangle = $\frac{1}{2}\left|\left(\frac{a}{3}.a - a.\frac{a}{6}\right)\right| = \frac{a^2}{12}$

68. **(A)** $(x + y - 1)p + (2x - 3y + 1)q = 0$

Hence, x + y – 1 = 0 …(i)

2x – 3y + 1 = 0 …(ii)

$\therefore$ (i) and (ii), passes through $\left(\frac{2}{5},\ \frac{3}{5}\right)$

69. **(C)** The vertices of the triangle are (36, 15), (0, 0) and (–20, 15) and the lengths of opposite sides are 25, 56 and 39 respectively. Hence, the incentre is

$$\left(\frac{25(36) + 39(-20)}{120}, \frac{25(15) + (39)(15)}{120}\right).$$

70. **(C)** Any line through (1, 2) can be written as $\frac{x - 1}{\cos\theta} = \frac{y - 2}{\sin\theta} = r$

where θ is the angle which this line makes with positive direction of x-axis. Any point on this line is (r cosθ + 1, r cosθ + 2) when $|r| = \frac{1}{3}\sqrt{6}$, this point lies on the line x + y = 4.

i.e. r cosθ + 1 + r sinθ + 2 = 4,

$$|r| = \frac{1}{3}\sqrt{6} \quad \Rightarrow \quad r(\cos\theta + \sin\theta) = 1, |r| = \frac{1}{3}\sqrt{6}$$

$$\Rightarrow \quad r^2 (1 + 2\sin\theta\cos\theta) = 1, r^2 = \frac{6}{9} \quad \Rightarrow 1 + \sin 2\theta = \frac{1}{r^2} = \frac{9}{6} \quad \Rightarrow \quad \sin 2\theta = \frac{1}{2}$$

$$\Rightarrow \quad 2\theta = \frac{\pi}{6} \text{ or } \frac{5\pi}{6} \quad \Rightarrow \quad \theta = \frac{\pi}{12} \text{ or } \frac{5\pi}{12}$$

71. **(C)** If the image of a point P in a line l is P′, then mid point of [PP′] lies on the line l and the line PP′ is perpendicular to the line l.

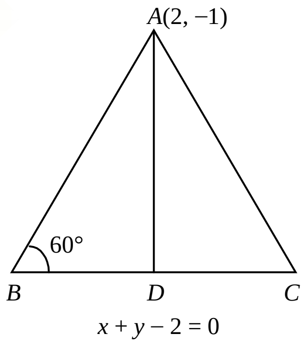
72. **(B)** $\sqrt{3}x + y = 0$ makes an angle of 120° with OX and $\sqrt{3}x - y = 0$ makes an angle 60° with OX. So, the required line is y – 2 = 0.

73. **(B)** Let A(2, –1) be one vertex of an equilateral triangle ABC. Then its altitude is the length of the perpendicular from A(2, –1) on x + y – 2 = 0 i.e.

$$AD = \left|\frac{2-1-2}{\sqrt{1+1}}\right| = \frac{1}{\sqrt{2}}$$

In ΔABD, sin60° = $\frac{AD}{AB}$

$$\therefore \quad AB = AD \ \operatorname{cosec} 60° = \frac{1}{\sqrt{2}} \times \frac{2}{\sqrt{3}} = \sqrt{\frac{2}{3}}.$$



75. The extremities of a diagonal of a parallelogram are the points (3, –4) and (–6, 5). If third vertex is (–2, 1) then the coordinates of the fourth vertex are

(A) (1, 0) (B*) (–1, 0) (C) (1, 1) (D) none of these

76. **(C)** Let $\alpha = t^2, \beta = t + 1 \quad \Rightarrow \quad t = \beta - 1$

$\therefore \quad \alpha = (\beta - 1)^2 \quad \Rightarrow \quad x = (y-1)^2$

77. **(A)** The centroid of the triangle coincides with the centroid of the triangle formed by joining the middle points of the sides of the triangle. Hence, the coordinates of the centroid of the given triangle are $\left(\frac{4+3+2}{3}, \frac{2+3+2}{3}\right)$ i.e. $\left(3, \frac{7}{3}\right)$.

78. **(D)** The given lines can be written as

y – 2x – 4 = 0 and y – 2x + 5/3 = 0

∴ Distance between the || lines

$$= \left|\frac{c_2 - c_1}{\sqrt{(a^2 + b^2)}}\right| = \left|\frac{5/3 - (-4)}{\sqrt{(1+4)}}\right| = \frac{17\sqrt{5}}{15}$$

79. **(C)** A(0, 0), B(2, 0) and C(0, 2) form a right angled triangle, right angle at A (0, 0) and BC hypotenuse.

So A(0, 0) is orthocentre and mid-point D of BC i.e. (1, 1) is circumcentre.

$\therefore$ distance between circumcentre and orthocentre = AD = $\sqrt{2}$.

80. **(D)** Let (h, k) be the centroid of the given triangle ABC with coordinates of C as (α, β) then

$$h=\frac{\alpha+2+4}{3},\ k=\frac{\beta+5-11}{3}$$

$\Rightarrow$ $\alpha = 3h - 6,\ \beta = 3k + 6$

Since C(α, β) lies on $L_1 : 9x + 7y + 4 = 0$

$9(3h - 6) + 7(3k + 6) + 4 = 0$

$\Rightarrow$ $3(9h + 7k) - 8 = 0$

so that locus of (h, k) is $9x + 7y - 8/3 = 0$, which is parallel to L_1.

81. **(A)** Let the equation of any line through (4, –5) be $y + 5 = m(x - 4)$

then $$\frac{3+5-m(-2-4)}{\sqrt{1+m^2}}=\pm 12$$

$\Rightarrow$ $(6m + 8)^2 = 144(1 + m^2)$

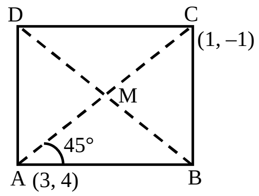
$\Rightarrow$ $27m^2 - 24m + 20 = 0$

which does not give any real value of m as the discriminant $24^2 - 80 \times 27 < 0$.

82. **(A)** $\dfrac{\Delta DBC}{\Delta ABC}=\dfrac{1}{2}$ $\Rightarrow$ $2\begin{vmatrix} x & 3x & 1 \\ -3 & 5 & 1 \\ 4 & -2 & 1 \end{vmatrix}=\begin{vmatrix} 6 & 3 & 1 \\ -3 & 5 & 1 \\ 4 & -2 & 1 \end{vmatrix}$ $\Rightarrow$ $x=\dfrac{11}{8}$

83. **(B)** $\sqrt{3}x+y=0$ makes an angle of 120° with OX and $\sqrt{3}x-y=0$ makes an angle 60° with OX. So, the required line is $y - 2 = 0$.

84. **(C)** Middle point M of diagonal AC is



$$M\left(\frac{3+1}{2},\ \frac{4-1}{2}\right)=M\left(2,\ \frac{3}{2}\right)$$

If D is D(h, k) …(i)

and $B(x_1,\ y_1)$, then $2=\dfrac{x_1+h}{2},\ \dfrac{3}{2}=\dfrac{y_1+k}{2}$

$\Rightarrow$ $x_1 = 4-h,\ y_1 = 3-k$

Now, $B(x_1,\ y_1)$ is $B(4-h,\ 3-k)$ …(ii)

Suppose slope of AB is m and slope of AC is $\dfrac{4+1}{3-1}=\dfrac{5}{2}$

Then $\tan(45°) = \left|\dfrac{m - \frac{5}{2}}{1 + \frac{5m}{2}}\right| \Rightarrow (2m-5) = \pm(2+5m)$

$\Rightarrow \quad m = -\dfrac{7}{3}, \dfrac{3}{7} \Rightarrow$ Equation of AB is $y - 4 = -\dfrac{7}{3}(x-3)$

or $\quad 7x + 3y - 33 = 0$ and equation of BC is $y + 1 = \dfrac{3}{7}(x-1)$ or $3x - 7y - 10 = 0$

solving these two equations we get B $\left(\dfrac{9}{2}, \dfrac{1}{2}\right)$

$\Rightarrow \quad \dfrac{9}{2} = 4 - h, \dfrac{1}{2} = 3 - k$ by (ii)

$\Rightarrow \quad h = -\dfrac{1}{2}, k = \dfrac{5}{2} \Rightarrow D(h, k) = \left(-\dfrac{1}{2}, \dfrac{5}{2}\right)$

85. **(C)** $\tan\theta = \left|\dfrac{2+1}{1-2}\right| = 3$

$\Rightarrow \quad \theta = \tan^{-1} 3$

86. **(C)** $(3x - y + 1)(x + 2y - 5)\big|_{(0,\,0)} < 0$

So, $(3x - y + 1)(x + 2y - 5)\big|_{a^2,\, a+1} < 0 \quad \Rightarrow \quad (3a^2 - a)(a^2 + 2a + 2 - 5) < 0$

$\Rightarrow \quad a(3a-1)(a-1)(a+3) < 0 \quad \Rightarrow \quad a \in (-3, 0) \cup \left(\dfrac{1}{3}, 1\right)$

87. **(B)**

88. (B)

89. (B)

90. **(c)** Since the diagonals are perpendicular, so the given quadrilateral is a rhombus.

$\therefore$ Distance between two pairs of parallel side are equal

$\Rightarrow \left|\dfrac{c' - c}{\sqrt{a^2 + b^2}}\right| = \left|\dfrac{c' - c}{\sqrt{a'^2 + b'^2}}\right| \Rightarrow a^2 + b^2 = a'^2 + b'^2$