JEE EXPERT

ANSWER KEY

REGULAR TEST SERIES - (RTS-04)

11TH A01 (Zenith)

Date 28.07.2019

PHYSICS

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

CHEMISTRY

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

MATHEMATICS

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

JEE EXPERT

SOLUTIONS

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CHEMISTRY

31. **(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.

32. **(C)** **33.** **(C)** **34.** **(B)** **35.** **(D)** **36.** **(D)**

37. **(D)** **38.** **(D)** **39.** **(C)** **40.** **(B)**

41. **(C)** A $\rightarrow$ (S) ; B $\rightarrow$ (P) ; C $\rightarrow$ (Q) ; D $\rightarrow$ (R)

42. **(B)**

43. **(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 × 11.2 = 1.12

Alternatively volume strength = N × 5.6 = 1.12

44. **(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 × Normality

= 5.6 × 0.2

= 1.12

45. **(B)** Mass of H_2SO_4 present in 1 gm oleum = 0.6 gm

Mass of SO_3 present in 1 gm oleum = 0.4 gm

$H_2SO_4 + NaOH \rightarrow Na_2SO_4 + H_2O$

$SO_3 + 2NaOH \rightarrow Na_2SO_4 + H_2O$

Eq. Wt. of $SO_3 = \frac{80}{2} = 40$.

Hence, meq of H_2SO_4 + meq of SO_3 = meq of NaOH

$\Rightarrow \quad \frac{0.6}{49} \times 1000 + \frac{0.4}{40} \times 1000 = 10 \times N$

$\Rightarrow \quad N = 2.22$

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

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

Hence, meq of $NaHCO_3$ = y – 2x

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

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

$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$

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

47. **(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.

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

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

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

48. **(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.

49. **(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)

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

50. **(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 $As_2S_3 = \frac{3}{28}$

51. **(A)**

A $\rightarrow$ (Q) ; B $\rightarrow$ (P) ; C $\rightarrow$ (S) ; D $\rightarrow$ (R);

(P)

$$\begin{array}{llll} CrI_3 & \rightarrow Cr_2O_7^{2-} & & + IO_4^{-1} \\ Cr^{+3} & \rightarrow Cr^{+6} & & + 3e^- \\ (I_3)^{3-} & \rightarrow 3I^{+7} & & + 24e^- \\ \hline CrI_3 & \rightarrow Cr^{+6} + 3I^{+7} & & + 27e^- \\ \hline \end{array}$$

$\therefore$ nf = 27

(Q)

$$\begin{array}{ll} Fe(SCN)_2 & \rightarrow Fe^{+3} + SO_4^{-2} + CO_3^{-2} + NO_3^{-1} \\ Fe^{+2} & \rightarrow Fe^{+3} + e^- \\ (S^{2-})_2 & \rightarrow 2S^{+6} + 16e^- \\ (N^{3-})_2 & \rightarrow 2N^{+5} + 16e^- \\ \hline Fe^{+2} + (S^{2-})_2 + (N^{3-})_2 & \rightarrow Fe^{+3} + 2S^{+6} + 2N^{+5} + 33e^- \\ \hline \end{array}$$

$\therefore$ nf = 33

(R)

$$\begin{array}{ll} NH_4SCN & \rightarrow SO_4^{-2} + CO_3^{-2} + NO_3^{-1} \\ N^{3-} & \rightarrow N^{+5} + 8e^- \\ S^{2-} & \rightarrow S^{+6} + 8e^- \\ N^{3-} & \rightarrow N^{+5} + 8e^- \\ \hline NH_4SCN & \rightarrow SO_4^{2-} + CO_3^{2-} + NO_3^{-1} + 24e^- \\ \hline \end{array}$$

$\therefore$ nf = 24

(S)

$$K_4[Fe(CN)_6] \rightarrow K^+ + Fe^{+3} + CO_3^{2-} + NO_3^{-1}$$
$$Fe^{+2} \rightarrow Fe^{+3} + e^-$$
$$(C^{+2})_6 \rightarrow 6C^{+4} + 12e^-$$
$$(N^{3-})_6 \rightarrow 6N^{+5} + 48e^-$$
$$K_4[Fe(CN)_6] \rightarrow K^+ + Fe^{+3} + CO_3^{2-} + NO_3^{-1} + 61e^-$$
$$\therefore \quad nf = 61$$

52. (C)

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

(P)

$$(P_2)^{-4} \rightarrow P^{-3} + (P_4)^{-2}$$
$$2e^- + (P_2)^{-4} \rightarrow 2P^{-3} \quad \times 3$$
$$2(P_2)^{4-} \rightarrow (P_4)^{2-} + 6e^-$$
$$5(P_2)^{4-} \rightarrow 6P^{3-} + P_4^{2-}$$
$$\therefore \quad nf = \frac{6}{5}$$

(Q)

$$I_2 \rightarrow I^- + IO_3^{-1}$$
$$2e^- + I_2 \rightarrow 2I^- \quad \times 5$$
$$I_2 \rightarrow 2I^{+5} + 10\,e^-$$
$$6I_2 \rightarrow 10I^- + 2I^{+5}$$
$$\therefore \quad nf = \frac{10}{6} = \frac{5}{3}$$

(R)

$$2Mn^{+7} + Mn^{+2} \rightarrow Mn_3O_4$$
$$3\,Mn^{+7} + 13e^- \rightarrow (Mn_3)^{+8} \quad \times 2$$
$$3\,Mn^{+2} \rightarrow (Mn_3)^{+8} + 2e^- \quad \times 13$$
$$39\,Mn^{+2} + 6\,Mn^{+7} \rightarrow 15\,(Mn_3)^{+8}$$
$$\therefore \quad nf\ Mn_3O_4 = \frac{26}{15}$$

(S)

$$H_3PO_2 \rightarrow PH_3 + H_3PO_3$$
$$P^{+1} \rightarrow P^{3-} + P^{+3}$$
$$4e^- + P^{+1} \rightarrow P^{3-}$$
$$P^{+1} \rightarrow P^{+3} + 2e^- \quad \times 2$$
$$3P^{+1} \rightarrow 2P^{+3} + P^{3-}$$
$$\therefore \quad nf = \frac{4}{3}$$

53. (D)

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

55. **(C)**

56. **(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

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

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

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

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

60. **(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**.

MATHEMATICS

61	**(A)**	**62**	**(B)**	**63**	**(B)**	**64**	**(A)**	**65**	**(C)**
66	**(B)**	**67**	**(B)**	**68**	**(D)**				

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

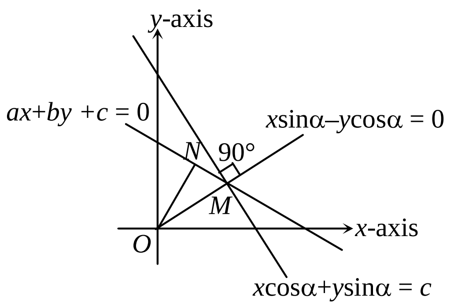
ON = $\dfrac{c}{\sqrt{a^2+b^2}}$

Also $\angle$OMN = 45°

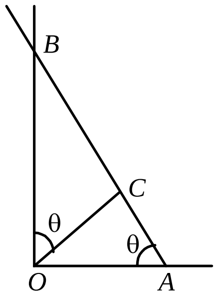
So, ON = OM cos45°

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

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



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



$\therefore$ $\tan\theta = 3$

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

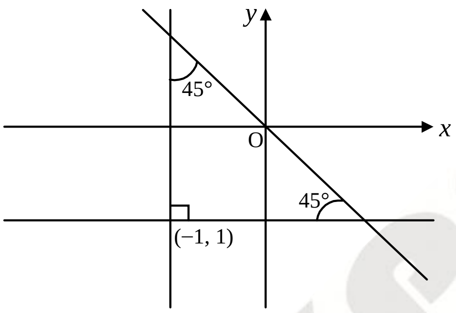
$\Rightarrow$ $\dfrac{BC}{AC} = \dfrac{\tan\theta}{\cot\theta} = \tan^2\theta = 9.$

71. **(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 $= \dfrac{1}{2}\sqrt{(1-2)^2 + (3-2)^2} = \dfrac{1}{\sqrt{2}}$.

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



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

73. **(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.

74. **(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 $(0, 0), \left(\dfrac{a}{3}, a\right), \left(\dfrac{a}{6}, a\right)$

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

75. **(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 $\left(\frac{2}{5}, \frac{3}{5}\right)$

76. **(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,

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

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

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

77. **(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.

78. **(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.

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

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

80. **(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 = $\sqrt{2}$.

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

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

$\Rightarrow$ α = 3h – 6, β = 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.

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

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

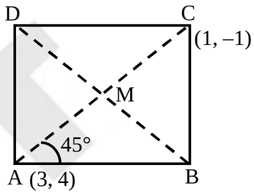
$\Rightarrow \quad (6m + 8)^2 = 144\,(1 + m^2)$

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

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

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

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



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

If D is D(h, k) …(i)

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

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

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

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

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

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