TEST NO. :6

ANSWERS

Physics Answer-key

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	1	4	4	3	2	1	1	2	4	2	3	1	2	4	3	2	1	3	3
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35					
Ans.	2	2	2	4	1	1	3	4	2	3	1	3	3	4	4					

Chemistry Answer-key

Que.	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
Ans.	2	3	2	2	4	4	4	2	1	1	1	3	1	2	2	2	2	2	3	2
Que.	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70					
Ans.	4	2	2	4	1	2	3	1	4	4	3	4	2	1	2					

Mathematics Answer-key

Que.	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	3	1	1	4	1	4	2	3	1	3	2	4	2	1	1	1	1	1	2	1
Que.	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105					
Ans.	1	2	2	1	2	2	1	2	2	3	2	3	2	2	1					

TEST NO. : 6

HINTS & SOLUTIONS

PHYSICS

Sol.6 Let u_1, u_2, u_3 and u_4 be velocities at time t = 0, t_1,$(t_1 + t_2)$ and $(t_1 + t_2 + t_3)$ respectively and acceleration is a then

$$v_1 = \frac{u_1 + u_2}{2}, v_2 = \frac{u_2 + u_3}{2} \text{ and } v_3 = \frac{u_3 + u_4}{2}$$

Also $u_2 = u_1 + at_1$, $u_3 = u_1 + a(t_1 + t_2)$

and $u_4 = u_1 + a(t_1 + t_2 + t_3)$

By solving, we get $\frac{v_1 - v_2}{v_2 - v_3} = \frac{(t_1 + t_2)}{(t_2 + t_3)}$

Sol.9 $v^2 = u^2 + 2gh$

$(3u)^2 = (-u^2) + 2gh$

10. $\frac{v_A}{v_B} = \frac{\tan\theta_A}{\tan\theta_B} = \frac{1}{3}$

Sol.11 $S_n = u + a/2\ (2n - 1)$

$S = ut + \frac{1}{2}at^2$

t = n sec.

$S = un + \frac{1}{2}an^2$

but u = 0

$S_n = a/2\ (2n - 1)$ .... (1)

$S = \frac{1}{2}an^2$ ....(2)

Sol.17 From given a – t graph it is clear that acceleration is increasing at constant rate

$\therefore \frac{da}{dt} = k$ (constant) $\Rightarrow$ a = kt (by integration)

$\Rightarrow \frac{dv}{dt} = kt \Rightarrow dv = ktdt$

$\Rightarrow \int dv = k\int tdt \Rightarrow u = \frac{kt^2}{2}$

i.e. v is dependent on time parabolically and parabola is symmetric about u-axis.

and suddenly acceleration becomes zero. i.e. velocity becomes constant

Sol.19 $\frac{ds}{dt} = v = 3t^2$

$a = \frac{dv}{dt} = 6t$

Sol.26 Slope of velocity-time graph measures acceleration. For graph (1) slope is zero. Hence a = 0 i.e. motion is uniform.

Sol.27 In first instant you will apply v = tanθ and say

$v = \tan 30^o = \frac{1}{\sqrt{3}} m/s$

But it is wrong because formula v = tanθ is valid when angle is measured with time axis.

Here angle is taken from displacement axis. So angle from time axis = 90º – 30º = 60º

Now v = tan60º = $\sqrt{3}$.

CHEMISTRY

37. In a carbon 6 proton & 6 Neutron mass of neutron becomes half

$\therefore$ mass due to Neutron = $6 \times \frac{1}{2} = 3$

electron does not effect on mass.

So mass of carbon = 6 + 3 = 9

decrease = 12 – 9 = 3

% decrease = $\frac{3}{12} \times 100 = 25\%$

38. 1 kw = 1000 joule s^{-1}

$n \times h\nu = 1000$

$n = \frac{1000}{6.64 \times 10^{-34} \times 880} = 1.7 \times 10^{33}$

40. E_3 for doubly ionized Li

$= -13.6 \times \frac{2^2}{n^2} = -13.6 \times \frac{3^2}{3^2} = -13.6$

43. $\frac{1}{\lambda} = R_H\left(\frac{1}{2^2} - \frac{1}{5^2}\right) = R_H\left(\frac{25-4}{100}\right) \Rightarrow \frac{1}{\lambda} = R_H \times \frac{21}{100}$

$\frac{100}{21R_H} = \lambda$

53. For a specific Series

$n_2 \uparrow \rightarrow E \uparrow \rightarrow \lambda \downarrow$

55. $R_3(He^+) = r_1(H) \times \frac{9}{2}$

57. $\frac{V_1}{V_2} = \sqrt{\frac{r_2}{r_1}}$

$\frac{r_2}{r_1} = \frac{1}{4}$

$\frac{T_1}{T_2} = \left(\frac{r_1}{r_2}\right)^{3/2}$

$= \left(\frac{4}{1}\right)^{3/2} = 2^3 : -1 = 8 : 1$

58. According to Bohr's model $\Delta E = E_1 - E_3$

$= 2.179 \times 10^{-11} - \frac{2.179 \times 10^{11}}{9} = \frac{8}{9} \times 2.179 \times 10^{-11}$

$= 1.91 \times 10^{-11} = 0.191 \times 10^{-10}$ erg

Since electron is going from n = 1 to n = 3 hence energy is absorbed

59. $\left(\frac{q}{m}\right)_\alpha = \frac{1}{2}\left(\frac{q}{m}\right)_p = \frac{1}{2} \times 9.6 \times 10^7 = 4.8 \times 10^7 \, C\,kg^{-1}$

61. CO and CN^- are isoelectronic

CO = 6 + 8 = 14 and CN^- = 6 + 7 + 1 = 14

67. We known that the line in Balmer series of hydrogen spectrum the highest wavelength of lowest energy is between $n_1 = 2$ and $n_2 = 3$. And for Balmer series of hydrogen spectrum, the value of $n_1 = 2$ and $n_2 = 3, 4, 5$. Therefore the Assertion is false but the Reason is true.

68. We know that electrons are revolving around the nucleus at high speed in circular paths. The centrifugal force (which arises due to rotation of electrons) acting outwards, balances the electrostatic force of attration (which arised due to attraction between electrons and nuclear. This prevent the electron from falling into the nucleus. We also know that Rutherford's model of atom is comparable to the "solar system". The nucleus represent the sun whereas revolving electrons represent the planets revolving around the sun. Thus revolving electron are also called planetary electrons. Therefore both Assertion and Reason are true but Reason is not a correct explanation of Assertion.

69. Both assertion and reason are true and reason is the correct explanation of assertion.

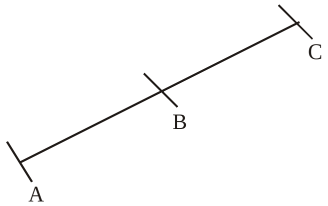
Radius, $r = \frac{n^2h^2}{4\pi e^2 mZ} = \frac{n^2}{Z} \times 0.529 \text{Å}. r_n$ also increases indicating a greater separation between the orbit and the nucleus.

70. both assertion and reason are true but reason is not the correct explanation of assertion. The difference between the energies of adjacent energy levels decreases as we move away from the nucleus. Thus in H atom

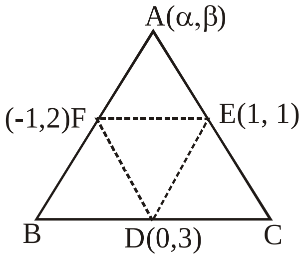
$E_2 - E_1 > E_3 - E_2 > E_4 - E_3$ ......

MATHEMATICS

MATHEMATICS

74. 

$\because$ A, B, C are collinear, then area of (ΔABC) = 0 and also Ab + BC = AC

75. 

Let A $\equiv$ (α, β)

then B $\equiv$ ($-2-\alpha$, $4-\beta$) and C $\equiv$ ($2-\alpha$, $2-\beta$)

$\because$ D is mid point of B and C

76. $(a-3)^2 + (2-4)^2 = 8^2$

$\Rightarrow (a-3)^2 = 60$

$\Rightarrow a - 3 = \pm 2\sqrt{15}$

$\Rightarrow a = 3 \pm 2\sqrt{15}$

77. Let the point be (x, x), so according to the condition $(x-1)^2 + (x-0)^2 = (x-0)^2 + (x-3)^2$

$= -2x + 1 \quad = -6x + 9 \quad \Rightarrow \; = x = 2$

78. $a = \sqrt{(8+2)^2 + (-2-2)^2} = \sqrt{116}$

$b = \sqrt{(-4-8)^2 + (-3+2)^2} = \sqrt{145}$

$c = \sqrt{(-4+2)^2 + (-3-2)^2} = \sqrt{29}$

79. $\dfrac{5+b}{2} = 3, \; \dfrac{a+7}{2} = 5$

b = 1, a = 3

80. Centroid is $\left(\dfrac{1+2+c^2}{3}, \dfrac{a+b+3}{3}\right)$

Now on y-axis x = 0;

$= \dfrac{3+c^2}{3} = 0 \qquad c^2 = -3$

Which is impossible, hence it can't lie on y-axis

81. Let $A\left(\dfrac{a}{\sqrt{3}}, a\right)$, $B\left(\dfrac{2a}{\sqrt{3}}, 2a\right)$ and $C\left(\dfrac{a}{\sqrt{3}}, 3a\right)$

then $AB^2 = \left(\dfrac{a}{\sqrt{3}} - \dfrac{2a}{\sqrt{3}}\right)^2 + (a-2a)^2 = \dfrac{a^2}{3} + a^2$

$= \dfrac{4a^2}{3} \qquad$ Similarly $BC^2 = \dfrac{4a^2}{3}$

and $AC^2 = 4a^2$

Hence it is an isosceles triangle

82. Let S(x, y), then

$(x+1)^2 + y^2 + (x-2)^2 + y^2 = 2[(x-1)^2 + y^2]$

$\Rightarrow 2x + 1 + 4 - 4x \quad = -4x + 2$

$x = -\dfrac{3}{2}$

Hence it is a straight line parallel to y-axis.

83. Let ratio be k:1 and coordinates of x-axis are (a, 0).

Therefore $0 = \dfrac{k \times 6 + 1 \times (-3)}{k+1}$

$= k = \dfrac{1}{2} \qquad$ Hence the ratio is 1 : 2

84. The points are collinear if the area of triangle fromed by these three points is zero

$= \dfrac{1}{2}[k\{2k-(6-2k)\} + (1-k)\{(6-2k)-(2-2k)\}$

$+ (-4-k)\{(2-2k)-2k\}] = 0$

On simplification, we get $k = -1$ or $\dfrac{1}{2}$

85. Let the point be (x, y)

(i) Point B(x, y) divides AD in 1 : 2

$x = \dfrac{0+9}{3} = 3$ and $y = \dfrac{0+12}{3} = 4$

(ii) Now point C (x, y) divides AD in 2 : 1, then x

$= \dfrac{0+18}{3} = 6$ and $y = \dfrac{0+24}{3} = 8$

86. $\dfrac{a - a' - a'}{a' - a} = \dfrac{b - b' - b'}{b' - b}$

$$\Rightarrow \frac{a-2a'}{a'-a} = \frac{b-2b'}{b'-b}$$

$$\frac{a}{a'} = \frac{b}{b'} \qquad \Rightarrow ab' = a'b$$

87. Let the four points be P(–a, –b), O(0, 0), Q(a, b) and R(a^2 , ab). Then

m_1 = Slope of OP = $\frac{b}{a}$

m_2 = Slope of OQ = $\frac{b}{a}$

m_3 = Slope of OR = $\frac{b}{a}$

Clearly $m_1 = m_2 = m_3$

So O, P, Q, R are collinear.

88. Let R be the mid point of PQ. Then

PR = RQ

AP + PR = AP + RQ

AP + PR = BQ + RQ

AR = BR

R is the mid point of PQ

89. Let BE be the median from B on AC. Then E is the mid point of AC. Coordinates of E are

$\left(\frac{5-1}{2}, \frac{1+3}{2}\right)$ i.e. (2, 2)

BE = $\sqrt{(2-1)^2 + (2+1)^2} = \sqrt{10}$

90. 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. $\left(3, \frac{7}{3}\right)$

91. Let A (–36, 7), B (20, 7) C(0, –8) be the triangle Then a = BC = 25, b = CA = 39 and c = AB = 56. Therefore, the coordinates of the incentre are

$$\left(\frac{ax_1 + bx_2 + cx_3}{a+b+c}, \frac{ay_1 + by_2 + cy_3}{a+b+c}\right)$$

$$\left(\frac{36 \times 25 + 39 \times 20 + 56 \times 0}{25+39+56}, \frac{25 \times 7 + 39 \times 7 + 56 \times -8}{25+39+56}\right)$$

or (–1, 0)

92. Ans **2**

93. Ans. 1

94. Let (x, y) be the coordinates of the fourth vertex. Since the diagonals of a rhombus bisect each other, therefore $\frac{x+3}{2} = \frac{2-2}{2}$ and

$\frac{y+4}{2} = \frac{-1+3}{2} \qquad \Rightarrow x = –3, y = –2$

95. The coordinates of D and E are (a/2, 0) and (a/2, b/2) respectively

Now, m_1 =Slope of AD = $\frac{b-0}{0-a/2} = -\frac{2b}{a}$

m_2 = Slope of BE = $\frac{b/2-0}{a/2-0} = \frac{b}{a}$

Since AD and BE aer perpendicular, therefore

$m_1 m_2 = –1 \qquad -\frac{2b}{a}.\frac{b}{a} = –1$

a = $\pm\sqrt{2}b$

96. The coordinates of the point dividing the line joining (–1, 1) and (5, 7) in the ratio λ : 1 are

$\left(\frac{5\lambda-1}{\lambda+1}, \frac{7\lambda+1}{\lambda+1}\right)$ This point lies on x + y = 4, therefore

5λ – 1 + 7λ + 1 = 4λ + 4

$8\lambda = 4 \qquad \lambda = \frac{1}{2}$

97. Let A (x_1, y_1), B(x_2, y_2) and C(x_3, y_3) be the coordinates of the vertices of the given triangle, then

$\frac{x_1 + x_2}{2} = 5 \qquad \frac{y_1 + y_2}{2} = 0$

$\frac{x_2 + x_3}{2} = 5 \qquad \frac{y_2 + y_3}{2} = 12$

$$\frac{x_3 + x_1}{2} = 0 \qquad \frac{y_3 + y_1}{2} = 12$$

Adding these results, we get

$x_1 + x_2 + x_3 = 10$ and $y_1 + y_2 + y_3 = 12$

Putting $x_1 + x_2 = 10$ and $x_1 + x_2 + x_3 = 10$ we get $x_3 = 0$

Similarly $y_1 = 0, y_2 = 0$ and $y_3 = 24$.

98. Let the coordinates of C be (x, y). Then

BC = 5

$x^2 + (y + 1)^2 = 5^2$ ....(1)

Since $AB \perp AC$, therefore $\frac{y-3}{x-2} \times \frac{4}{2} = -1$

$2y - 6 = -x + 2 \qquad x = -2y + 8$ ..... (2)

from (1) and (2) $(-2y + 8)^2 + (y + 1)^2 = 5^2$

$5y^2 - 30y + 40 = 0$

$y^2 - 6y + 8 = 0 \qquad y = 2, 4$

Putting y = 2 and y = 4 in (2), we get x = 4, x = 0 repectively Hence, the coordinates of C are (4, 2) or (0, 4)

99. Let Px + Qy = 1 be a variable line, where P, Q are variables. By hypothesis

$$\frac{Px_1 + Qy_1 - 1}{\sqrt{p^2 + Q^2}} + \frac{Px_2 + Qy_2 - 1}{\sqrt{p^2 + Q^2}} + \frac{Px_3 + Qy_3 - 1}{\sqrt{p^2 + Q^2}} = 0$$

$\Rightarrow P(x_1 + x_2 + x_3) + Q(y_1 + y_2 + y_3) = 3$

$= \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$ lies on

Px + Qy = 1

Hence, the variable line passes through the centroid of thje triangle

100. Ans **3**

101. Let the ratio be $\lambda : 1$ Then the point

$\left(\frac{\lambda x_2 + x_1}{\lambda + 1}, \frac{\lambda y_2 + y_1}{\lambda + 1}\right)$ lies on Ax + By + C = 0

$$\lambda = -\frac{Ax_1 + By_1 + C}{Ax_2 + By_2 + C}$$

102. Ans **3**

103. Let the coordinates of the third vertex A be (h, k) Then

$AD \perp BC \Rightarrow OA \perp BC$

$\Rightarrow \frac{k-0}{h-0} \times \frac{4}{-7} = -1 \qquad \Rightarrow 7h = 4k$ .... (i)

and $OB \perp AC = \frac{k-3}{h+2} \times \frac{-1}{-5} = -1$

$5h - k + 13 = 0$ .... (ii)

Solving (i) and (ii), we get h = –4, k = –7

Hence the coordinates of the third vertex are (–4, –7)

104. Here the given triangle is a right angled triangle at the vertex (2, –1/2). Hence the orthocentre is at (2, –1/2)

105. Let the vertices of the triangle be O (0, 0), A(8, 0) and B(4, 6). The equation of an altitude through O and $\perp$ to AB is y = 2/3 x and the equation of an altitude through A(8, 0) and $\perp$ to OB is

3y = –2x + 16. The two altitude intersect at (4, 8/3)