JEE EXPERT

ANSWER KEY

REGULAR TEST SERIES - (RTS-02)
Batch : 11^{TH} (Zenith - B01)
Date 21.07.2019

PHYSICS

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

CHEMISTRY

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

MATHEMATICS

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

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SOLUTIONS

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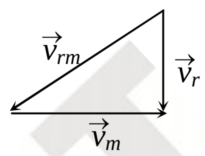
PHYSICS

1. (D) $v_{rm} = \sqrt{v_r^2 + v_m^2} = 5$ km/hr



2. **(D)** $H = \dfrac{u^2 \sin^2\theta}{2g}$ and $R = \dfrac{u^2 \sin 2\theta}{g}$, $\dfrac{45}{180} = \dfrac{1}{4}\tan\theta \Rightarrow \theta = 45°$

3. **(C)** Average acceleration (a) $= \dfrac{\text{Change in velocity}}{\text{Time taken}}$

$\therefore$ Change in velocity = Area of acceleration – time graph

$\therefore$ Average acceleration $= \dfrac{\text{AreaOABE}}{20\text{ s}} = \dfrac{600}{20} = 30\text{m/s}^2$

4. **(A)** $H_{\max} \propto u^2$ $\therefore$ $u \propto \sqrt{H_{\max}}$

i.e. to triple the maximum height, ball should be thrown with velocity $\sqrt{3}u$.

5. **(D)** $v_H = u\cos\theta = 6$, $v_v = \sqrt{v^2 - u^2\cos^2\theta} = 8$

$t_1 = \dfrac{u\sin\theta - 8}{10}$, $t_2 = \dfrac{u\sin\theta + 8}{10}$, $t_2 - t_1 = \dfrac{8\times 2}{10} = 1.6$ s

6. **(D)** $T = \dfrac{2u_y}{g}$, $H = \dfrac{{u_y}^2}{2g}$

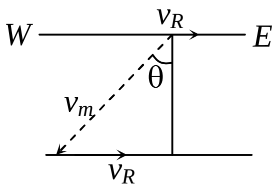
$\therefore H = \dfrac{gT^2}{8} = \dfrac{9.8\times(6)^2}{8}$ = 44.1 m

7. **(C)** Change in velocity $\Delta v = 8-(-8) = 16 m/s$

Time taken $\Delta t = \frac{\pi r}{v} = \frac{\pi \times 6}{8} = \frac{3\pi}{4}$

$\therefore$ Average acceleration $= \frac{\Delta v}{\Delta t} = \frac{16\times 4}{3\pi} = \frac{64}{3\pi}$

8. **(C)** For shortest possible path man should swim at an angle of (90 + θ) with downstream. From the figure,



$\sin\theta = \frac{v_r}{v_m} = \frac{5}{10} = \frac{1}{2}$

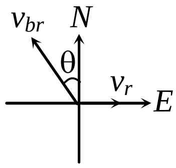
$\Rightarrow \theta = 30°$

9. **(B)** $u\sin\theta = y$, $u\cos\theta = x$

$\therefore\ H = \frac{u^2\sin^2\theta}{2g} = \frac{y^2}{2g}$, $R = \frac{u^2(2\sin\theta\cos\theta)}{g} = \frac{2xy}{g}$

As R = 2H $\Rightarrow \frac{2xy}{g} = \frac{2y^2}{2g} \Rightarrow y = 2x$

10. **(C)** $v_{br}\sin\theta = v_r \Rightarrow \quad \sin\theta = \frac{4}{8} = \frac{1}{2}$



$\therefore$ θ = 30° west of north

11. **(D)** The stopping distance $S \propto u^2$

12. **(C)** $S_r = u_r t + \frac{1}{2}a_r t^2$ **;** $0 = ut - \frac{1}{2}(g+a)t^2 \quad \Rightarrow \quad a = \frac{2u-gt}{t}$

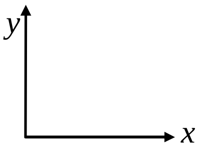
13. **(B)**

14. **(B)** $u_x = 4\cos 30^0 = 2\sqrt{3}$ m/s and $u_y = 4\sin 30^0 = 2$ m/s

$T = \frac{2u_y}{12} = \frac{u_y}{6} = \frac{2}{6} = \frac{1}{3}s$

15. **(B)** $t = \frac{d}{\sqrt{u_m^2 - u_r^2}} = \frac{\frac{1}{2}}{\sqrt{4^2-3^2}} = \frac{1}{2\sqrt{7}}$ hr

16. **(C)** $\vec{V}_w = \frac{v}{\sqrt{2}}\hat{i} + \frac{v}{\sqrt{2}}\hat{j}$



$\vec{V}_m = (at)\hat{j}$

$\vec{V}_{wm} = \frac{v}{\sqrt{2}}\hat{i} + \left(\frac{v}{\sqrt{2}} - at\right)\hat{j}$

It appears due east when, $\frac{v}{\sqrt{2}} - at = 0$

$\therefore t = \frac{v}{\sqrt{2}a}$

17. **(C)** $16 = 8t - \frac{1}{2} \times 2t^2$ (equation relative to bus)

t = 4s

18. **(B)** Equation of trajectory**,** $y = x\tan\theta - \frac{1}{2}\frac{gx^2}{u^2\cos^2\theta}$

$\tan\theta = 1$ … (i)

$u\cos\theta = \sqrt{g}$ … (ii)

$T = \frac{2u\sin\theta}{g} = \frac{2\sqrt{g}}{g} = \frac{2}{\sqrt{g}}$

19. **(C)** Horizontal component of velocity of A is 10 cos 60° or 5 m/s which is equal to the velocity of B in horizontal direction. They will collide at C if time of flight of both the particles are equal i.e.

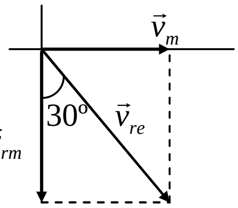
$t_A = t_B$

$\frac{2u\sin\theta}{g} = \sqrt{\frac{2h}{g}} \quad \left(h = \frac{1}{2}gt_B^2\right)$

or h = $\frac{2u^2\sin^2\theta}{g}$

$\frac{2(10)^2\left(\frac{\sqrt{3}}{2}\right)^2}{10}$ = 15 m

20. **(C)** Velocity of man $|\vec{v}_m| = 10ms^{-1}$



v_m = velocity of man
v_{re} = velocity of rain w.r.t. earth
v_{rm} = velocity of rain w.r.t. man

Using $\sin 30^o = \frac{v_m}{v_{re}}$

or $v_{re} = \frac{v_m}{\sin 30} = \frac{10}{1/2}$

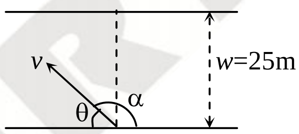
$= 20\ ms^{-1}$

Again $\cos 30^o = \frac{v_{rm}}{v_{re}}$

or $v_{rm} = v_{re} \cos 30$

$= 20 \times \frac{\sqrt{3}}{2} = 10\sqrt{3}\ ms^{-1}$

21. **(A)** $t = \frac{w}{v \sin\theta} \Rightarrow 10 = \frac{25}{5 \sin\theta}$



$\sin\theta = \frac{1}{2} \Rightarrow \theta = 30°$

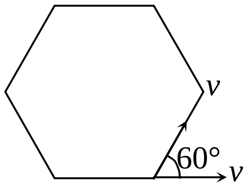
$\therefore \alpha = 180° - \theta = 150°$

22. **(D)**At maximum height speed becomes half of initial speed,

So, height = $H = \frac{u^2 \sin^2 \alpha}{2g} = \frac{(40)^2 \cdot \sin^2 60°}{2 \times 10} = \frac{1600 \times 3/4}{20} = 60$ m

23. **(C).:**Velocity of approach = $v - \frac{v}{2} = \frac{v}{2}$

$\therefore$ time taken = $\frac{\text{initial separation}}{\text{velocity of approach}} = \frac{2a}{v}$



24. **(B)** $v_{avg} = \frac{\frac{1}{2} \times \frac{t}{2} \times v + \frac{t}{2} \times v}{t} = \frac{3v}{4}$

25. **(B)** Let x be the distance between the particles after t seconds.

Then $x = vt - \frac{1}{2}at^2$ … (i)

For x to be maximum , $\frac{dx}{dt} = 0$ or $t = \frac{v}{a}$

From (i), we get

$$x = \frac{v^2}{2a}$$

26. **(B)** The velocity of balloon at height h, $v = \sqrt{2\left(\frac{g}{8}\right)h} = \sqrt{\frac{gh}{4}}$

When the stone released from this balloon, it will go upward with velocity $v = \sqrt{\frac{gh}{4}}$

(Same as that of balloon).

$$h = -\sqrt{\frac{gh}{4}}t + \frac{1}{2}gt^2$$

$$gt^2 - \sqrt{gh}\,t - 2h = 0$$

$$\therefore t = 2\sqrt{\frac{h}{g}}$$

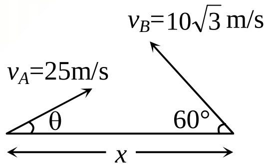
27. **(D)** For collision,

$v_A \sin\theta = v_B \sin 60°$

$25 \sin\theta = 10\sqrt{3} \times \frac{\sqrt{3}}{2}$

$\sin\theta = \frac{3}{5}$

or $\theta = 37°$



28. **(B)** Distance = $\int_0^2 v\,dt = \int_0^2 2t\,dt$ = 4 m

Average speed = $\frac{4}{2}$ = 2 m/s

$\omega = \frac{v}{R} = (2t)$ rad/s, $\theta = \int_0^2 \omega\,dt$ = 4 rad

$\therefore$ Displacement = $2R\sin\frac{\theta}{2}$ = (2 sin 2) m

Average velocity = $\sin 2$ m/s

29. **(B)** For train B, $-\frac{dv}{dt} = 0.3t$, $-\int_{15}^{0} dv = 0.3\int_{0}^{t} t\,dt \Rightarrow$ t = 10 s

In this 10 s, the train B travels a distance of 100 m.

$\therefore$ Train A can travel a distance of 125 m before coming to rest.

$v^2 = u^2 + 2as$, $a = -2.5\,\text{m/s}^2$

30. **(B)** The displacement between first stone and aeroplane after t second $(h_1) = \frac{1}{2}(g+f)t^2$

After time t,

Velocity of aeroplane $= u + ft$

Velocity of first stone $= u - gt$

Where u is velocity of aeroplane when first stone is dropped.

The relative speed of second stone with respect to first stone $= (u+ft) - (u-gt)$

$= (g+f)t$

The relative displacement between first and second stone after time $t'(h_2)$

$= (g+f)tt'$

$$h_1 + h_2 = \frac{1}{2}(g+f)t^2 + (g+f)tt' = \frac{1}{2}(g+f)(t+2t')t$$

y **(B)**

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51. **(A)** $E = 2.18 \times 10^{-18} \times N_{av} = 13.13 \times 10^5 = 1313$ kJ/mol

52. **(B)** Wavelength of 1st line in Balmer series,

$$\frac{1}{\lambda_B} = Z^2 R_H\left[\frac{1}{2^2} - \frac{1}{3^2}\right]$$

$$= \frac{5}{36} R_H Z^2$$

or $$\lambda_B = \frac{36}{5R_H Z^2}$$

Wavelength of 1st line in Lyman series is,

$$\frac{1}{\lambda_L} = Z^2 R_H \left[\frac{1}{1^2} - \frac{1}{2^2}\right]$$

or $$\lambda_L = \frac{4}{3 \times R_H Z^2}$$

Difference $\lambda_B - \lambda_L = 59.3 \times 10^{-7} = \dfrac{36}{5R_H Z^2} - \dfrac{4}{3R_H Z^2}$

$$= \frac{1}{R_H Z^2}\left[\frac{36}{5} - \frac{4}{3}\right]$$

$$Z^2 = \frac{88}{59.3 \times 10^{-7} \times 109678 \times 15} = 9.0$$

or $Z = 3$

Hydrogen-like species is Li^{2+}]

53. **(D)** Wave number of first Lyman transition

$$\bar{\nu}_{\text{First Lyman}} = 109677\left\{\frac{1}{1^2} - \frac{1}{2^2}\right\} = 109677\left\{\frac{3}{4}\right\} cm^{-1}$$

and wave number of first Paschen transition

$$\bar{\nu}_{\text{First Paschen}} = 109677\left\{\frac{1}{3^2} - \frac{1}{4^2}\right\} = 109677\left\{\frac{16-9}{9 \times 16}\right\} cm^{-1} = 109677 \times \frac{7}{9 \times 16}\ cm^{-1}$$

$$\frac{\bar{\nu}_{\text{First Lyman}}}{\bar{\nu}_{\text{First Paschen}}} = \frac{3/4}{\frac{7}{16 \times 9}} = \frac{3 \times 16 \times 9}{7 \times 4} = \frac{12 \times 9}{7} = 108 : 7$$

54. **(B)** $$\frac{\Delta E_1}{\Delta E_2} = \frac{\left(\frac{1}{1} - \frac{1}{4}\right)}{\left(\frac{1}{4} - \frac{1}{9}\right)} = \frac{3 \times 9}{5} = \frac{27}{5}$$

55. **(D)**

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

57. **(C)**

58. **(A)** $Cr_2O_7^{2-} \rightarrow 2Cr^{3+}$ n-factor = 6

$Fe^{2+} \rightarrow Fe^{3+}$ n-factor = 1

No. of equivalent of $K_2Cr_2O_7$ = No. of equivalent of $FeSO_4$

$\Rightarrow$ No. of moles of $K_2Cr_2O_7$ × n-factor of $K_2Cr_2O_7$ = No. of moles of $FeSO_4$ × n-factor of $FeSO_4$

$6M_1V_1 = M_2V_2$

59. **(B)** $A^{n-} \rightarrow A^{a+} + (a+n)e^-$

$6e^- + Cr_2^{6+} \rightarrow 2Cr^{3+}$

Meq of A = Meq of $K_2Cr_2O_7$

$$3.26 \times 10^{-3} (a + n) = 1.68 \times 10^{-3} \times 6$$

$$a + n = 3$$

$$a = 3 - n$$

60. **(B)**

Let Weight of KOH = a g

Weight of $Ca(OH)_2$ = b g

$\therefore \quad a + b = 4.2 \quad \ldots(1)$

For reaction,

Meq. of KOH + Meq. of $Ca(OH)_2$ = Meq. of acid

$$\frac{a \times 1000}{56} + \frac{b \times 1000}{74/2} = 0.1 \times 1000 \quad \ldots(2)$$

$\therefore \quad 37a + 56b = 207.2 \quad \ldots(3)$

Solving Eqs. (1) and (3),

$b = 2.73$ g

$a = 1.47$ g

$\therefore \quad$ % of KOH = $\frac{1.47}{4.2} \times 100 = 35\%$

% of $Ca(OH)_2$ = 100 – 35 = 65%

MATHEMATICS

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71	**(D)**	**72**	**(D)**	**73**	**(C)**	**74**	**(A)**	**75**	**(B)**
76	**(D)**	**77**	**(C)**	**78**	**(B)**	**79**	**(D)**	**80**	**(B)**
81	**(D)**	**82**	**(C)**	**83**	**(B)**	**84**	**(C)**	**85**	**(C)**
86	**(B)**	**87**	**(C)**	**88**	**(B)**	**89**	**(C)**	**90**	**(C)**