SOLUTIONS

PROGRESS TEST-3

GZRM-1903-1904, GZR-1910-1912
GZRK-1903-1904 & GZBS-1902-1903

JEE ADVANCD PATTERN

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PHYSICS

1. (A)

Let height of balloon = h

$h = -ut + \frac{1}{2}gt^2 = -4(4) + \frac{1}{2}(9.8)(16) = 62.4$ m

2. (B)

Distance travelled = Area under the given graph $= \frac{1}{2} \times 4 \times 5 + \frac{1}{2}(4+2) \times 3 = 19$m

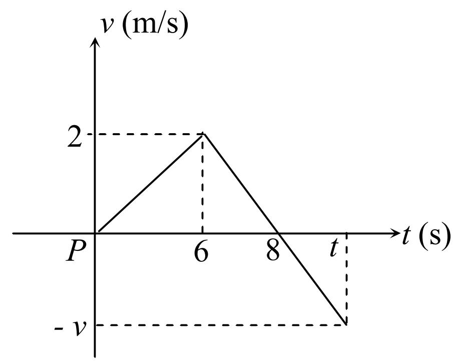
3. (A)

$u = 7$ m/s and $a = 4$ m/s^2

Distance traveled in n^{th} second = $u + \frac{a}{2}(2n-1)$

$\therefore$ Distance traveled in 5^{th} second = $7 + \frac{4}{2}[2(5)-1] = 25$m

4. Let after t second particle will reach at P again,



$\therefore$ area of $v - t$ curve = 0

$\frac{1}{2} \times 2 \times 8 - \frac{1}{2} \times (t-8) \times (t-8) = 0$

$(t-8)^2 = 16$

$t - 8 = 4$

$t = 12$s

$\therefore$ **(C)**

5. (D)

$v = x^3 - 6x^2 + 12$, $\frac{dv}{dx} = 3x^2 - 12x$,

$v(x = 4m) = 64 - 6 \times 16 + 12 = 76 - 96 = -20$ ms^{-1}

$\left(\frac{dv}{dx}\right)_{x=4m} = 3(4)^2 - 12 \times 4$, $a = v\frac{dv}{dx} = 0$

6. (B)

$v = \alpha\sqrt{x} \Rightarrow \frac{dx}{dt} = \alpha x^{1/2}$, $x^{-1/2}dx = \alpha\, dt$,

$\int_0^x x^{-1/2}dx = \alpha\int_0^t dt$, $2\sqrt{x} = \alpha t$, $x \propto t^2$

7. (B)

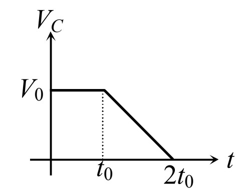
8. (C)

9. **(D)**

10. **(A)**

Let tension be *T* then. $T = ma$. For block *M*, $F - T = MA \Rightarrow A = \frac{F - ma}{M}$

11. **(A)**



The velocity-time graph of cat is shown in figure. For first t_0 seconds V_0 is constant and then V_0 velocity is decreasing linearly for t_0 seconds and it becomes zero.

12. **(D)**

From graph, $v_0 t_0 + \frac{1}{2} v_0 t_0 = 2d$

$$\frac{3}{2} v_0 t_0 = 2d \qquad \text{… (i)}$$

The distance travelled by the cat in $t_0 = v_0 t_0 = \frac{4d}{3}$ (from equation (i))

13. **(A)**

At $t = 0$, $v_A > v_B$

14. **(D)**

$$2b = \frac{1}{2}(2c + 6dt)$$

$$t = \frac{2}{3}\text{s}$$

15. **(A)** **16.** **(A)**

17. **(B)**

In motion M: slope of s-t graph is positive and increasing. Therefore, velocity of the particle is positive and increasing. Hence, it is A type motion. Similarly, N, P and Q can be observed from the slope.

18. **(C)** **19.** **(B)**

20. **(A)**

A : $\vec{a} + \vec{b} + \vec{c} = 0$ (polygon law)

B : $\vec{a} + \vec{b} = \vec{c}$ (Δ law)

C : $\vec{c} + \vec{b} = \vec{a}$ (Δ law)

D : $\vec{c} + \vec{a} = \vec{b}$

CHEMISTRY

21. (D)

Height of aqs. soln, h soln. = hcm

$\rho_{hg} h_{hg} = \rho_{soln.}\, h_{soln}.$

$\Rightarrow$ 13.6 gm/cm^3 x h_{hg} = 2.7 gm/cm^3 x h

$\Rightarrow h_{hg} \simeq 0.2h$

Now, $P_{atmp} = P_{mixt.} + h_{hg}$

$= P_{gas}$ + aq. tension + 0.2 h

$\Rightarrow P_{gas} = P_{atmp}$ - [aq. tension + 0.2h]

22. (B)

The pressure of Hydrogen is double that of helium.

Let mass of hydrogen & helium be m

So, $h_{H_2} = \frac{m}{2},\ h_{H_e} = \frac{m}{4}$

$\because P \alpha h'$

So, $\frac{P_{H_2}}{P_{Hc}} = \frac{n_{H_2}}{n_{H_c}} = \frac{\cancel{m}}{\cancel{2}} \times \frac{\cancel{4}^{2}}{\cancel{m}} = 2 \Rightarrow P_{H_2} = 2P_{H_c}$

23. (D)

$\Delta x = \lambda$

$\lambda \Delta P = \frac{h}{4\pi}$

$\frac{h}{mv} \times m\Delta V = \frac{h}{4\pi}$

$\frac{\Delta V}{V} = \frac{1}{4\pi}$

$\%\frac{\Delta V}{V} = \frac{1}{4\pi} \times 100 = \frac{25}{\pi} \cong 8$

24. (D)

$2\pi r = n\lambda$

or $\lambda = \frac{2\pi r}{n} = \frac{2\pi a_0 n^2}{n}$ [$z = 1$ for H] or $\lambda = 2\pi a_0 n$

Also $a = \frac{a_o}{2}$ or $a_o = 2a$ [For first orbit of He^+]

So, $\lambda = 2\pi n \times 2a = 4\pi na$

for $n = 2$; $\lambda = 8\pi a$

25. (D)

$Li_2CO_3 \xrightarrow{\Delta} Li_2O + CO_2$ $\qquad$ $LiBF_4 \xrightarrow{\Delta} Li_2F + BF_3$

$BeSO_4 \xrightarrow{\Delta} BeO + SO_2 + \frac{1}{2}O_2$ $\qquad$ $Na_2O_2 \xrightarrow{\Delta} Na_2O + \frac{1}{2}O_2$

$BeCO_3 \xrightarrow{\Delta} BeO + CO_2$

26. (B)

27. (A)

N^{3-} and O^+ respectively.

28. (B)

I.E. of Mg > I.E. of Al (Due to electronic configuration)

29. (D)

30. (D)

31. (B)

$2SO_2 + O_2 \longrightarrow 2SO_3$

10 mole $\quad$ 4 mole

Limiting reagent

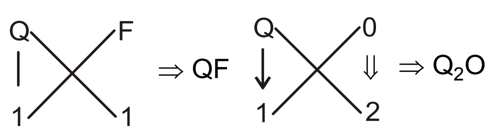
32. (C)

Mole of $SO_3 = \frac{2}{1} \times 2 = 8$ mole.

33. (C)

34. (B)

Q = Alkali metal $\qquad$ F = Fluorine



35. (A)

36. (D)

37. (B)

$A \to Q$; $B \to S$; $C \to P$, $D \to R$

(A) $L = \frac{nh}{2\pi}$ or $n = \frac{L2\pi}{h}$

so, $U = \frac{-13.6 \times 2\, z^2 h^2}{L^2 4\pi^2}$

or $U = \frac{-13.6 \times 2\, z^2 h^2}{4\pi^2} \times \left(\frac{1}{L}\right)^2$

or $UL^2 = k$

(where U, k are –ve and L is positive)

(B) $E = -13.6\frac{z^2}{n^2}$ and $U = -13.6 \times \frac{z^2}{n^2} \times 2$

or $E = \frac{U}{2}$

(Both E and U are – ve)

(C) $U = -13.6\frac{z^2}{n^2} \times 2$ and $V = V_0\frac{z}{n}$

or $\frac{z}{n} = \frac{V}{V_0}$

so, $U = -13.6\frac{V^2}{V_0^2} \times 2$ or $U = KV^2$

where k, U are –ve and V is positive

(D) $V = V_0\frac{z}{n}$ and $L = \frac{nh}{2\pi}$

or $V = \frac{V_0 zh}{2\pi L}$ or $VL = K$

(where k, V, L are +ve)

38. (C)

(A) — (Q); (B) — (S); (C) — (R); (D) — (P)

39. (A)

(A – R ; B – P; C – Q ; D – S)

(A) 32 g each of O_2 and S = $\frac{32}{32}$ = 1 mole

(B) 2 gram-molecule of $K_3\,[Fe(CN)_6]$ $\Rightarrow$ has 2 moles of Fe

(C) 144 g of oxygen atom = $\frac{144}{16}$ = 9 mole of 'O' atom

$\therefore$ Moles of $O_3 = \frac{9}{3} = 3$

(D) from 1680 g i.e. 30 moles Fe $\Rightarrow$ 10 mole Fe is removed i.e. $\Rightarrow$ 20 moles of Fe is left.

40. (D)

(A) — (P); (B) — (R) ; (C) — (S); (D) — (Q)

MATHEMATICS

41. (C)

M –2, T – 2, A – 2, H – 1, E – 1, 1 – 1, C – 1, S – 1.

Number of words in which both M are together + number of words in which both T are together – Number of words in which both T and both M are together = required number of words

Required number of words = $\frac{10!}{2!2!} + \frac{10!}{2!2!} - \frac{9!}{2!} = \frac{5\cdot 9! + 5\cdot 9! - 9!}{2!} = \frac{9\cdot 9!}{2!}$.

42. (D)

$ab = \log_4 5.\log_5 6 = \log_4 6 = \frac{1}{2}\log_2 6$

$ab = \frac{1}{2}(1+\log_2 3) \Rightarrow 2ab - 1 = \log_2 3$

$\therefore \log_3 2 = \frac{1}{2ab-1}$.

43. (A)

$(2\sin^2 91^\circ - 1)(2\sin^2 92^\circ - 1)...(2\sin^2 180^\circ - 1)$

In this product there exists a factor

$(2\sin^2 135^\circ - 1)$ which is equal to zero.

$\therefore$ The product of all terms is zero.

44. (C)

$$\cot\frac{\pi}{24}=\frac{1+\cos\frac{\pi}{12}}{\sin\frac{\pi}{12}}$$

$$=\frac{1+\frac{\sqrt{6}+\sqrt{2}}{4}}{\frac{\sqrt{6}-\sqrt{2}}{4}}=\frac{4+\sqrt{6}+\sqrt{2}}{\sqrt{6}-\sqrt{2}}\times\frac{\sqrt{6}+\sqrt{2}}{\sqrt{6}+\sqrt{2}}=\sqrt{6}+\sqrt{2}+2+\sqrt{3}=\sqrt{2}+\sqrt{3}+\sqrt{4}+\sqrt{6}$$

45. (C)

a, ar, ar^2, ar^3 (G.P.)

$a-2, ar-7, ar^2-9, ar^3-5$ (A.P.)

$\therefore\ 2(ar-7)=(a-2)+(ar^2-9)$

$\Rightarrow\ 2ar-14=a(1+r^2)-11$

$\Rightarrow\ a(1-r)(r-1)=3$ ....(i)

Also $2(ar^2-9)=(ar-7)+(ar^3-5)$

$\Rightarrow\ 2ar^2-18=ar(1+r^2)-12$

$\Rightarrow\ a.r(r-1)(1-r)=6$ ....(ii)

From (i) & (ii), $r=2$ and $a=-3$

$\therefore$ third term of A. P. $=ar^2-9=(-3).(2)^2-9=-12-9=-21$

46. (B)

Point I and I_1 divide AD in the same ratio internally & externally respectively

47. (A)

Since A_1 is always ahead of A_2. Hence, number of ways $=\frac{10!}{2}$ or $8!\times{}^{10}C_2$

48. (A)

$$t_r=\frac{8r}{4.r^4+1}=\frac{8r}{\left(2r^2\right)^2+1}$$

$$=\frac{8r}{\left(2r^2\right)^2+2.2r^2+1-2.2r^2}=\frac{8r}{\left(1+2r^2\right)^2-(2r)^2}=\frac{8r}{\left(1+2r^2+2r\right)\left(1+2r^2-2r\right)}$$

$$=\frac{2}{\left(2r^2-2r+1\right)}-\frac{2}{2r^2+2r+1}$$

$\therefore t_1 = 2 - \frac{2}{5}$

$t_2 = \frac{2}{5} - \frac{2}{13}$

$t_3 = \frac{2}{13} - \frac{2}{25}$

. . . .

$t_{16} = \frac{2}{481} - \frac{2}{545}$

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on summation , we get $S_{16} = 2 - \frac{2}{545} = \frac{1090-2}{545} = \frac{1088}{545}$

49. (D)

50. (B)

S = 1 + 4x + 7x^2 + 10x^3 + ...

x.S = x + 4x^2 + 7x^3 + ...

Subtract

S (1 – x) = 1 + 3x + 3x^2 + 3x^3 + ...

S (1 – x) = 1 + 3x $\left(\frac{1}{1-x}\right)$ |x| < 1

S = $\frac{1+2x}{(1-x)^2}$

Given $\frac{1+2x}{(1-x)^2} = \frac{35}{16}$

$\Rightarrow$ 16 + 32x = 35 + 35x^2 – 70x $\Rightarrow$ $35x^2 - 102x + 19 = 0$

$\Rightarrow$ (5x – 1) (7x – 19) = 0 $\Rightarrow$ x = $\frac{1}{5}, \frac{19}{7}$

But |x| < 1 $\therefore$ x = $\frac{1}{5}$

51. (A)

100 numbers can be arranged in $\underline{|100}$ ways and for each number, flags can be chosen in 3 ways.

52. (D)

50 red colour flags can be arranged in ${}^{100}P_{50}$ ways

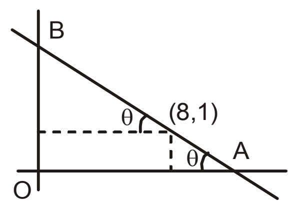
25 green flags can be arranged in ${}^{50}P_{25}$ ways

25 blue flags can be arranged in ${}^{25}P_{25}$ ways

Total number of ways ${}^{100}P_{50}\ {}^{50}P_{25}\ {}^{25}P_{25} = \underline{|100}$ ways

53. (D)

OA = 8 + cotθ ; OB = 1 + 8tanθ



$$\Delta = \frac{1}{2}(1 + 8\tan\theta)(8 + \cot\theta)$$

$$= 8 + \frac{1}{2}(64\tan\theta + \cot\theta)$$

For Δ to be minimum tanθ = 1/8

$\therefore\ \Delta_{min} = 16$

54. (A)

Let centroid of triangle OAB is (x,y)

$\Rightarrow 8 + \cot\theta = 3x,\ 1 + 8\tan\theta = 3y \Rightarrow \tan\theta\cot\theta = 1$

55. (C)

$$\sin\frac{9\pi}{14}\sin\frac{11\pi}{14}\sin\frac{13\pi}{14} = \sin\frac{5\pi}{14}\sin\frac{3\pi}{14}.\sin\frac{\pi}{14}$$

$$= \cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{3\pi}{7} = -\cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{4\pi}{7}$$

$$= -\frac{\sin\frac{8\pi}{7}}{8\sin\frac{\pi}{7}} = \frac{1}{8}$$

56. (B)

$$\cos 2^3\frac{\pi}{10}\cos 2^4\frac{\pi}{10}.\cos 2^5\frac{\pi}{10}\ldots\cos 2^{10}\frac{\pi}{10}$$

$$= \frac{\sin 2^{11}\frac{\pi}{10}}{256\sin 2^3\frac{\pi}{10}} = \frac{1}{256}$$

57. (C)

(P) Let $(x^3 + ax^2 + bx + c) \equiv (x + p)(x^2 + 1) \equiv x^3 + px^2 + x + p$

$\therefore$ $a = c$ and $b = 1$

$\therefore$ Number of such polynomials = 20 = K

(Q) All required arrangements must contain one of 'E I E E' or ' E E I E'

$\therefore$ No. of required arrangements $= \frac{\lfloor 5}{\lfloor 2} \times 2 = 120$

(R) Required number = no. of numbers starting with 1 2 3 + no. of numbers starting with 13 + no. of numbers starting with 2 or 3

$= \frac{\lfloor 3}{\lfloor 2} + \frac{\lfloor 4}{\lfloor 2 \lfloor 2} + \frac{\lfloor 5}{\lfloor 3} + \frac{\lfloor 5}{\lfloor 2 \lfloor 2} = 59 = K$

(S) Vowels and consonants must come alternately.

$\therefore$ Required no. of arrangements $= 2 \times 1 \times \lfloor 3 = 12 = K$

58. (B)

(P) $a = \frac{p}{2}\{2a_1 + (p-1)d\}$,

$b = \frac{q}{2}\{2a_1 + (q-1)d\}$,

$c = \frac{r}{2}\{2a_1 + (r-1)d\}$

$\therefore \sum \frac{a}{p}(q - r) = 0$

(Q) $R = ak^{r-1}$

$R^{s-t} = a^{s-t} k^{(s-t)(r-1)}$

$S^{t-r} = a^{t-r} k^{(s-1)(t-r)}$

$T^{r-s} = a^{r-s} k^{(t-1)(r-s)}$

$\therefore$ $R^{s-t} S^{t-r} T^{r-s} = 1$.

(R) $x^{y-z}.y^{z-x} z^{x-y} = (AR^{m-1})^{(n-p)d} (AR^{n-1})^{(p-m)d} (AR^{p-1})^{(m-n)d} = 1$

(S) $\Sigma a(b - c)\log a = \frac{1}{abc}\sum\left(\frac{1}{c} - \frac{1}{b}\right)\log a = \frac{1}{abc}\sum(r-q)d(\log A + (p-1)\log R) = 0$

59. (D)

(P) AH ⊥ BC. $\Rightarrow \left(\frac{k}{h}\right)\left(\frac{3+1}{-2-5}\right) = -1$

4k = 7h .....(i)

BH ⊥ AC. $\Rightarrow \left(\frac{0+1}{0-5}\right)\left(\frac{k-3}{h+2}\right) = -1$

k – 3 = 5 (h + 2) ......(ii)

⇒ 7h – 12 = 20h + 40

13h = – 52

h = – 4

∴ A (–4, – 7)

(Q) x + y – 4 = 0 .....(i)

4x + 3y – 10 = 0 .....(ii)

Let (h, 4 – h) be the point on (i),

then $\left|\frac{4h+3(4-h)-10}{5}\right| = 1$ i.e. h + 2 = ± 5 i.e. h = 3 ; h = – 7

∴ required point is either (3,1) or (–7, 11)

(R) Orthocentre of ΔBCH is A i.e. (–1, 2)

(S) points are collinear $\begin{vmatrix} \lambda+1 & 1 & 1 \\ 2\lambda+1 & 3 & 1 \\ 2\lambda+2 & 2\lambda & 1 \end{vmatrix} = 0$

$\Rightarrow 2\lambda^2 - 3\lambda - 2 = 0 \Rightarrow \lambda = 2, -1/2$

60. (C)

(P)

$$\tan 20° + 4\sin 20° = \frac{\sin 20° + 4\sin 20° \cdot \cos 20°}{\cos 20°} = \frac{\sin 20° + 2\sin 40°}{\cos 20°}$$
$$= \frac{\sin 20° + \sin 40° + \sin 40°}{\cos 20°} = \frac{\sin 80° + \sin 40°}{\cos 20°}$$
$$= \frac{2 \cdot \sin 60° \cdot \cos 20°}{\cos 20°} = \sqrt{3}$$

(Q) $\sqrt{3}\,\text{cosec}\,20° - \sec 20°$

$$= \frac{\sqrt{3}}{\sin 20°} - \frac{1}{\cos 20°} = \frac{\sqrt{3}\cos 20° - \sin 20°}{\sin 20° \cos 20°}$$

$$= \frac{2\left(\frac{\sqrt{3}}{2}\cos 20° - \frac{1}{2}\sin 20°\right)}{\sin 20° \cos 20°} = \frac{4\cos 50°}{\sin 40°} = 4$$

(R) 4 cos 36° – 4 cos 72° + 4 sin 18° . cos 36°

$$= 4\left(\frac{\sqrt{5}+1}{4}\right) - 4\left(\frac{\sqrt{5}-1}{4}\right) + 4\left(\frac{\sqrt{5}-1}{4}\right)\left(\frac{\sqrt{5}+1}{4}\right) = \sqrt{5}+1-\sqrt{5}+1+1=3$$

(S) $\sin^2\alpha + \sin\left(\frac{\pi}{3}-\alpha\right).\sin\left(\frac{\pi}{3}+\alpha\right)$

$$= \sin^2\alpha + \sin^2\frac{\pi}{3} - \sin^2\alpha = \frac{3}{4}$$