

SOLUTIONS

PROGRESS TEST-3

GZBS-1904 & 1905

JEE Advanced PATTERN

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CHEMISTRY

1. (D)

% of H = 7.7

Assume % of C, O, S be 3x, 2x & 4x respectively

Hence, $3x + 2x + 4x + 7.7 = 100$

$$x = 10.256$$

Element	%	% At.wt	Simplest Ratio
H	7.7	7.7	6
C	30.767	2.56	2
O	20.511	1.28	1
S	41.022	1.28	1

CF = C₂H₆SO

Mix M.w. = 78

2. (D)

As distance from nucleus increase; the energy of electron increase. It maximise as zero from ∞ distance from nucleus.

3. (A)

As e move away from nucleus velocity of e decrease hence KE decrease

$$v = 2.181 \times 10^6 \times \frac{Z}{n} \text{ m/s}$$

4. (C)

Energy of 1 quantum = hv

$$= 6.626 \times 10^{-34} \times 7.5 \times 10^{14} \text{ J}$$

Energy absorbed by 1.5 mole

$$1.5 \times 6.023 \times 10^{23} \times hv$$

$$= 4.48 \times 10^5 \text{ J}$$

5. (B)

$$E = \frac{hc}{\lambda}$$

$$= hc \times (\text{wave no.})$$

$$= 6.626 \times 10^{-34} \times 3 \times 10^8 \times 5 \times 10^5 \text{ J}$$

$$= 9.93 \times 10^{-20} \text{ J}$$

$$= 9.93 \times 10^{-23} \text{ kJ}$$

6. (C)

$$V_n = \frac{V_1}{n}$$

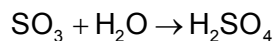
$$V_2 = \frac{V_1}{2}$$

7. (A)

$$KE = \frac{1}{2}(-PE) = \frac{1}{2}(+3.02) = 1.51 \text{ eV}$$

8. (A)

Oleum is $\text{SO}_3 + \text{H}_2\text{SO}_4$



9g

$$n_{\text{SO}_3} = n_{\text{H}_2\text{O}}$$

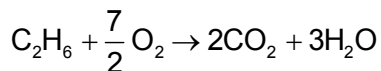
$$\frac{\text{wt}}{80} = \frac{9}{80} \Rightarrow \text{wt}_{\text{SO}_3} = 40 \text{ g in } 100 \text{ g oleum}$$

9. (B, C)

3 mole C_2H_6

$$\frac{+ \frac{60}{30} = 2 \text{ mole } \text{C}_2\text{H}_6}{5 \text{ mole } \text{C}_2\text{H}_6} - \frac{2.4 \times 10^{24}}{6 \times 10^{23}}$$

(5-4) mole $\text{C}_2\text{H}_6 = 1 \text{ mole } \text{C}_2\text{H}_6$



$$V_{\text{CO}_2} = 2 \times 22.4 = 44.8 \text{ lit}$$

$$M_{\text{H}_2\text{O}} = 3 \times 18 = 54 \text{ g}$$

10. (B,C,D)

$$V = 2.18 \times 10^6 \times \left(\frac{Z}{h} \right)$$

$$x = 0.529 \times \frac{h^2}{z}$$

$$KE = 13.6 \times \frac{z^2}{n^2}$$

$$PE = -27.2 \times \frac{z^2}{n^2}$$

11. (A, C)

$$[\text{Cation}] = \frac{1 \times 100 + 3 \times 100 + 1 \times 200}{400} = 6/4 = 3/2 \text{ M}$$

$$[\text{Anion}] = \frac{1 \times 100 + 3 \times 100 + 2 \times 1 \times 200}{400} = 2 \text{ M}$$

12. (A, B, D)

$$\text{Orbit angular momentum} = \frac{nh}{2\pi}$$

$$n = 1, 2, 3, 4, 5$$

$$\text{angular momentum} = 0.5, \frac{h}{\pi}, \frac{1h}{\pi}, \frac{1.5h}{\pi}, \frac{2h}{\pi} \text{ So, on.}$$

13. (8)

$$BE = 246.5 \text{ kJ/mole} = 2.56 \text{ eV/molecule}$$

$$E_{\text{photon}} = \frac{12400}{4450} = 2.78 \text{ eV}$$

$$KE \text{ of iodine atom} = 2.78 - 2.56 = 0.22.$$

$$\% = \frac{0.22}{2.78} \times 100 = 8$$

14. (8)

$$\text{Molality} = \frac{3.2}{1 \times 0.4} = 8 \text{ m}$$

15. (5)

$$M_f = 2.6 = \frac{x \times 5 + 20 \times 2}{(20 + x)} = \frac{40 + 5x}{20 + x} \Rightarrow x = 5$$

16. (3)

17. (3)

$$\Delta E = E_3 - E_2 = 1.9 \text{ eV} \cdot z^2 = 17$$

$$(z^2 = 3)$$

18. (3)

$$\text{No. of 9-atom of C} = \text{no. of mole of CO}_2 = \frac{132}{44} = 3$$

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

$$K \cdot E \cdot \left|_{n=2}^{\text{He}^+} = 13.6 \text{ eV}$$

$$\lambda = \frac{h}{\sqrt{2mK \cdot E}} = \sqrt{\frac{h^2}{2mK \cdot E}} = \sqrt{\frac{150}{13.6}} \text{ \AA}$$

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

PHYSICS

21. (B)

22. [C]

$$a_1 = a_2 = 1 \text{ and}$$

$$a_1^2 + a_2^2 + 2a_1a_2 \cos\theta = (\sqrt{3})^2 = 3$$

$$\text{Or } 1 + 1 + 2\cos\theta = 3 \text{ or } \cos\theta = \frac{1}{2}$$

$$\text{Now } (\vec{a}_1 - \vec{a}_2) \cdot (2\vec{a}_1 + \vec{a}_2) = 2a_1^2 - a_2^2 - a_1a_2 \cos\theta$$

$$= 2 - 1 - \frac{1}{2} = \frac{1}{2}$$

23. (C)

24. (B)

$$\frac{\Delta T}{T} \times 100 = \frac{1}{25} \times 100 = 0.8\%$$

25. (A)

Dimension of $\frac{a}{V^2}$ must be that of pressure

$$\frac{MLT^{-2}}{L^2} = \frac{a}{L^6}$$

$$a = ML^5T^{-2}$$

26. (C)

$$mg - B = mf$$

$$\therefore B - (m - m')g = (m - m')f$$

$$\Rightarrow m'g = (2m - m')f \Rightarrow m' = \frac{2mf}{g + f}$$

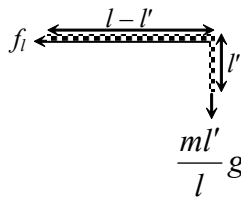
$$\therefore \Rightarrow w' = \frac{2wf}{g + f}$$

27. (C)

Frictional force will balance the weight of hanging portion of rope. $\frac{ml'}{l}g = \mu \frac{m}{l}(l - l')g$

$$l' = \mu l - \mu l'$$

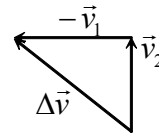
$$l' = \frac{\mu l}{1 + \mu}$$



28. (B)

$$|\Delta \vec{v}| = 5 \text{ m/s}$$

$$\vec{a} = 1 \text{ m/s}^2 \text{ (towards north-west)}$$



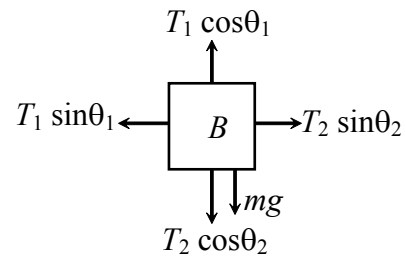
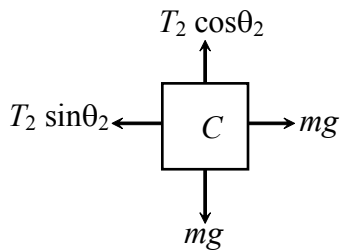
29. (A, C, D)

$$T_2 \sin \theta_2 = mg \quad \dots (i)$$

$$T_1 \cos \theta_1 = mg + T_2 \cos \theta_2$$

$$T_2 \cos \theta_2 = mg \quad \dots (ii)$$

$$T_1 \sin \theta_1 = T_2 \sin \theta_2$$



30. (C, D)

Resultant force may not be zero for coplanar forces. Hence (a) is not true

Since magnitudes are not equal (b) can not be true. In (c) and (d), net force is zero

31. (A) (B) (C)

$$a_1 > 0 \text{ when } \frac{F}{4} > 50, F > 200$$

$$a_2 > 0 \text{ when } \frac{F}{4} > 100, F > 400$$

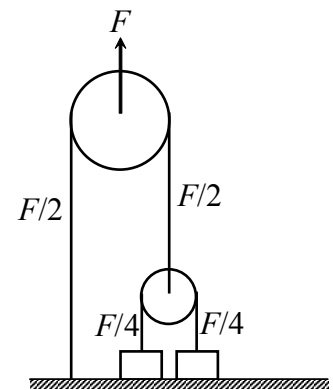
$$F = 300 \text{ N}$$

$$a_1 = \frac{F/4 - 50}{5} = \frac{300/4 - 50}{5} = 5 \text{ m/s}^2$$

$$a_2 = 0$$

$$\text{If } F = 500 \text{ N}$$

$$a_1 = 15 \text{ m/s}^2, a_2 = 2.5 \text{ m/s}^2$$



32. (A), (B)

$$\Delta u = (u^2 + u^2 + 2u^2 \cos 120^\circ)^{\frac{1}{2}}$$

$$\Delta u = u = 60 \text{ ms}^{-1}$$

$$\text{Average acceleration} = \frac{\Delta u}{t} = \frac{u}{\frac{r\theta}{4}} = 11.5 \text{ ms}^{-2}$$

$$\text{Instantaneous acceleration} = \frac{u^2}{r} = 12 \text{ ms}^{-2}$$

33. (4)

$$\because \sin x + \cos x = \sqrt{2}$$

$$\text{on squaring} \Rightarrow \sin^2 x + \cos^2 x + 2 \sin x \cos x = 2$$

$$\sin 2x = 1 \quad \dots\dots\dots(1)$$

$$\text{and } \frac{1}{\sin^6 x + \cos^6 x} = \frac{1}{1 - 3 \sin^2 x \cos^2 x}$$

$$= \frac{1}{1 - \frac{3}{4} \sin^2 2x} = \frac{1}{1 - \frac{3}{4} (1)^2} \quad \text{using eq}^n \dots\dots\dots (1)$$

$$= \frac{4}{4 - 3} = 4$$

34. (9)

$$y = \sqrt{3 + x^2}$$

$$\frac{dy}{dx} = \frac{x}{\sqrt{3 + x^2}}$$

$$\frac{d^2y}{dx^2} = \frac{\sqrt{(3 + x^2)} - \frac{x^2}{\sqrt{3 + x^2}}}{(3 + x^2)}$$

$$= \frac{3 + x^2 - x^2}{(3 + x^2)^{3/2}} = \frac{3}{(3 + x^2)^{3/2}}$$

$$\left(\frac{d^2y}{dx^2} \right) = \frac{3}{(3 + 6)^{3/2}} = \frac{3}{27}$$

$$\frac{1}{\frac{d^2y}{dx^2}} = 9$$

35. (2)

$$y = \frac{x^3}{3} - \frac{5}{2}x^2 + 6x + 4$$

$$\frac{dy}{dx} = x^2 - 5x + 6 \dots\dots(1)$$

$$\text{if } x^2 - 5x + 6 = 0$$

$$x = 2, 3$$

Again diff. (1)

$$\frac{d^2y}{dx^2} = 2x - 5$$

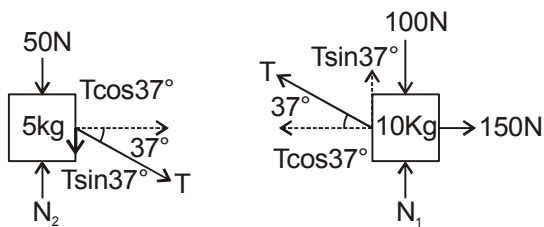
$$\text{at } x = 2 \quad \frac{d^2y}{dx^2} = -1 < 0$$

so maximum at $x = 2$.

36. (2)

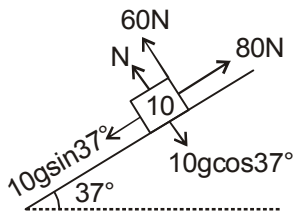
$$a = 10\text{ms}^{-2}$$

$$150 - T\cos 37^\circ = 10a$$



$$\therefore T = \frac{125}{2} \text{ N}$$

37. (2)



$$a = \frac{80\text{N} - 100 \sin 37^\circ}{10} = \frac{80 - 60}{10} = 2\text{ms}^{-2}$$

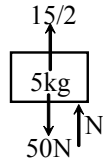
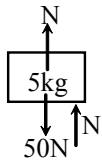
38. (1)

$$\int_1^2 y dx = \text{area under the graph} = \frac{1}{2} \times 2 \times 1 = 1 \text{ a}$$

39. (A – q) ; (B – s) ; (C – p) ; (D – r)

No force is acting on 3 kg block.

$$\frac{15}{3} = 5 \text{ m/s}^2$$



$$N = 50 \text{ N}$$

$$N = 50 - 15/2 = 42.5 \text{ N}$$

40. (A – q) ; (B – p) ; (C – r) ; (D – s)

Acceleration of 2kg relative to wedge = 2 m/s²

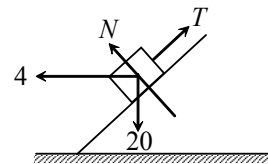
Acceleration of 2 kg relative to ground

$$= \sqrt{2^2 + 2^2 + 2 \times 2 \times \cos 120^\circ} = 2 \text{ m/s}^2$$

$$20 \sin 60^\circ + 4 \cos 60^\circ - T = 4$$

$$N = 20 \cos 60^\circ - 4 \sin 60^\circ = 10 - 2\sqrt{3} \text{ N}$$

$$\text{Net force} = 2 \times 2 = 4 \text{ N}$$



MATHEMATICS

41. (C)

$$a, ar, ar^2, ar^3 \quad (\text{G.P.})$$

$$a - 2, ar - 7, ar^2 - 9, ar^3 - 5 \quad (\text{A.P.})$$

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

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

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

$$\text{Also } 2(ar^2 - 9) = (ar - 7) + (ar^3 - 5)$$

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

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

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

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

42. (B)

$$x = \frac{z^{1/3}}{2}, y = \frac{z^{1/6}}{5}; \text{ if } xy = z^{3/2}, \frac{z^{1/3}}{2} \cdot \frac{z^{1/6}}{5} = z^{3/2} \Rightarrow z = \frac{1}{10}$$

43. (C)

Let $s = \cos 0 + \cos 2\theta + \cos 4\theta + \dots + \cos 10\theta$, then

$$2 \sin \theta \cdot s = 2 \sin \theta [\cos 0 + \cos 2\theta + \cos 4\theta + \dots + \cos 10\theta]$$

$$= (\sin \theta + \sin \theta) + (\sin 3\theta - \sin \theta) + \dots + (\sin 11\theta - \sin 9\theta)$$

$$\Rightarrow 2 \sin \theta \cdot s = (\sin \theta + \sin 11\theta)$$

$$\text{or, } 2 \sin \theta \cdot s = 2 \sin 6\theta \cdot \sin 5\theta$$

$$\therefore s = \frac{2 \sin 6\theta \cdot \cos 5\theta}{2 \sin \theta} = \frac{\sin n\theta \cdot \cos m\theta}{\sin \theta}$$

$$\therefore n = 6, m = 5$$

44. (C)

$$\cos \frac{\pi}{7} \cdot \cos \frac{2\pi}{7} \cdot \cos \frac{4\pi}{7} - \cos \left(\frac{\pi}{2} - \frac{\pi}{14} \right) \cos \left(\frac{\pi}{2} - \frac{3\pi}{14} \right) \cos \left(\frac{\pi}{2} - \frac{5\pi}{14} \right)$$

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

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

$$= 2 \frac{\sin \frac{8\pi}{7}}{2^3 \sin \frac{\pi}{7}} = -\frac{1}{4}$$

45. (B)

A.M \geq G.M

$$\frac{a+b+c}{3} \geq (abc)^{\frac{1}{3}}; \text{ for } (a, b, c > 0)$$

$$\Rightarrow a + b + c \geq 3(abc)^{\frac{1}{3}}$$

but given $ab^2c^3, a^2b^3c^4, a^3b^4c^5$ are in A.P

$$\text{Hence } 2abc = 1 + a^2b^2c^2 \Rightarrow (abc - 1)^2 = 0 \Rightarrow abc = 1$$

hence minimum value of

$$a + b + c = 3(abc)^{\frac{1}{3}} = 3.(1)^{\frac{1}{3}} = 3$$

46. (A)

The given expression is

$$1 + 2\sin 3x \sin 2x + \frac{1 - \cos 4x}{2} + \frac{1 - \cos 6x}{2}$$

$$\Rightarrow 1 + 2\sin 3x \sin 2x + \sin^2 2x + \sin^2 3x$$

$$\Rightarrow 1 + (\sin 2x + \sin 3x)^2$$

Thus least value is 1

47. (A)

$$S_n = \sum_{r=1}^n (r^2 - r + 1)(r!)$$

$$T_r = (r^2 - r + 1)(r!) = [(r^2 - 1) - (r - 2)]r!$$

$$= (r - 1).(r + 1)! - (r - 2).r!$$

$$\therefore T_1 = (1 - 1).(1 + 1)! - (1 - 2)1!$$

$$T_2 = (2 - 1).(2 + 1)! - (2 - 2)2!$$

$$T_3 = (3 - 1).(3 + 1)! - (3 - 2).3!$$

.

$$T_{n-1} = (n - 2).n! - (n - 3).(n - 1)!$$

$$T_n = (n - 1).(n + 1)! - (n - 2).n!$$

$$\therefore S_n = (n - 1).(n + 1)! + 1 = 1 + (n - 1)!(n - 1)(n + 1)n$$

$$= 1 + (n - 1)!(n^3 - n)$$

48. (B)

$$B \cap (A \cup B) = B$$

49 (A, C, D)

$$T_r = \frac{r\sqrt{r+1} - (r+1)\sqrt{r}}{r^2(r+1) - (r+1)^2r} = \frac{(r+1)\sqrt{r} - r\sqrt{r+1}}{r(r+1)} = \frac{1}{\sqrt{r}} - \frac{1}{\sqrt{r+1}}$$

$$\frac{T_r}{T_{r+1}} = \frac{\sqrt{r+1} - \sqrt{r}}{\sqrt{r+2} - \sqrt{r+1}} \cdot \frac{\sqrt{r+2}}{\sqrt{r}} = \frac{\sqrt{r+2} + \sqrt{r+1}}{\sqrt{r+1} + \sqrt{r}} \cdot \frac{\sqrt{r+2}}{\sqrt{r}} > 1 \Rightarrow T_r > T_{r+1}$$

$$\sum_{r=1}^n T_r = \left(\frac{1}{1} - \frac{1}{\sqrt{2}}\right) + \left(\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{3}}\right) + \dots + \left(\frac{1}{\sqrt{n}} - \frac{1}{\sqrt{n+1}}\right) = 1 - \frac{1}{\sqrt{n+1}} < 1$$

50. (B, D)

51. (B, D)

Dividing by $\cos(2012^\circ)$, we get

$$\tan \theta = \frac{1 + \tan 2012^\circ}{1 - \tan 2012^\circ}$$

$$\Rightarrow \tan \theta = \tan(2012^\circ + 45^\circ) = \tan 2057^\circ$$

$$\Rightarrow \text{Hence } \theta = k(180^\circ) + 2057^\circ$$

Put $k = -10$

$$\theta = 2057^\circ - 1800^\circ = 257^\circ$$

$$\text{If } k = -11 \Rightarrow \theta = 77^\circ$$

52. (A, B, D)

$$P(x) = \left(1 + \cos \frac{\pi}{6x}\right) \left(1 + \sin \frac{\pi}{6x}\right) \left(1 - \sin \frac{\pi}{6x}\right) \left(1 - \cos \frac{\pi}{6x}\right)$$

$$P(x) = \frac{1}{4} \sin^2 \left(\frac{\pi}{3x}\right)$$

53. (1)

$$x = \frac{1}{9}(999\dots9) = \frac{1}{9}(10^{20} - 1); \quad y = \frac{1}{3}(999\dots9) = \frac{1}{3}(10^{10} - 1); \quad z = \frac{2}{9}(999\dots9) = \frac{2}{9}(10^{10} - 1)$$

54. (4)

If $A + B = 45^\circ$ then $(1 + \tan A)(1 + \tan B) = 2$

55. (3)

56. (4)

57. (1)

 $3x, 4y, 5z$ are in G.P.

$$\therefore 16y^2 = 15xz \quad \dots(1)$$

$$\text{and} \quad y = \frac{2xz}{x+z} \quad \dots(2)$$

using (2) in (1)

$$16 \times 4x^2z^2 = 15(x+z)^2xz$$

$$\frac{(x+z)^2}{xz} = \frac{64}{15}; \quad \frac{x}{z} + \frac{z}{x} + 2 = \frac{64}{15}; \quad \therefore \frac{x}{z} + \frac{z}{x} = \frac{34}{15}$$

$$\therefore m = 34 \text{ and } n = 15$$

$$\therefore m + n = 34 + 15 = 49$$

58. (4)

$$2\sin^2x + 5\sin x - 3 = 0$$

$$\Rightarrow \sin x = -3, \frac{1}{2}$$

$$x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{13\pi}{6}, \frac{17\pi}{6}$$

59. (A \rightarrow p; B \rightarrow p; C \rightarrow p; D \rightarrow p)

$$f_n(\theta) = \tan \frac{\theta}{2} \cdot \frac{2\cos^2 \frac{\theta}{2}}{\cos \theta} \cdot \frac{2\cos^2 \theta}{\cos 2\theta} \cdot \dots \cdot \frac{2\cos^2 2^{n-1}\theta}{\cos 2^n \theta}$$

$$= \frac{\sin \theta}{\cos 2^n \theta} \cdot 2^n \cdot \left\{ \frac{2 \sin \theta \cdot \cos \theta \cdot \cos 2\theta \cdot \dots \cdot \cos 2^{n-1}\theta}{2 \sin \theta} \right\}$$

$$= \frac{\sin \theta}{\cos 2^n \theta} \cdot 2^n \cdot \frac{\sin 2^n \theta}{2^n \sin \theta} = \tan 2^n \theta$$

60. (A \rightarrow s; B \rightarrow r; C \rightarrow q; D \rightarrow p)

$$(B) \left(\frac{5}{13}\right)^x + \left(\frac{12}{13}\right)^x \geq 1$$

$$\therefore \cos^x \alpha + \sin^x \alpha \geq 1, \text{ where } \cos \alpha = \frac{5}{13}$$

Equally holds for $x = 2$. If $x < 2$, both $\cos \alpha$ $\sin \alpha$ increase (being positive fractions). So, $\cos^x \alpha + \sin^x \alpha > 1$ if $x < 2$. Thus $x \leq 2$.

$$(C) \frac{x^2 - 4x + 3}{x + 1} > 0 \Rightarrow (x - 1)(x - 3)(x + 1) > 0, x \neq -1.$$

(D) Solve the inequation $x^2 - 3x + 2 \leq 0$ and $2x^2 - 3x - 5 \geq 0$. and take intersection of both.