SOLUTIONS

PROGRESS TEST-2

RB-1813-1814, RBK-1806

RBS-1803

(JEE ADVANCED PATTERN)

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PHYSICS

1. (A)

2. (C)

$v_B = 3v_A = 3\,m/s$ in downward direction

3. (A)

$\frac{g}{5}\uparrow$

4. (B) **5. (A)** **6. (A)** **7. (C)**

8. (A) **9. (C)**

10. (C)

Using $\frac{1}{v} + \frac{1}{u} = \frac{2}{R}$

$\Rightarrow \frac{1}{v} - \frac{1}{15} = -\frac{1}{10}$ $\Rightarrow$ v = –30 cm

Now, using $V_{im} = -\frac{v^2}{u^2} V_{om}$

$\Rightarrow (V_i - V_m) = -\frac{v^2}{u^2}(V_o - V_m)$

$\Rightarrow V_i - (1) = -\frac{(-30)^2}{(-15)^2}[(-10) - (+1)]$

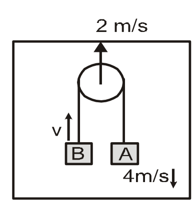
$\Rightarrow V_i = 45$ cm/s

So the image will move with velocity 45 cm/s.

11. (B, C) **12. (B, C)** **13. (B, C)** **14. (A, B)**

15. (A, B, C) **16. (2)** **17. (3)** **18. (6)**

19. (8)



V = (velocity of B w.r.t ground)

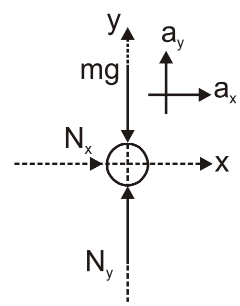
$v_{pulley} = \frac{V - 4}{2} = 2m/s$; V is velocity of B w.r.t ground

Solving we get

v = 8 m/s

20. (5)

The velocity of the sphere is same as that of the cube, which is given as $\vec{v} = 5t\hat{i} + 2\hat{j}$



Hence, acceleration of the sphere: $\vec{a} = \frac{d\vec{v}}{dt}$

or $\vec{a} = (5\hat{i} + 0\hat{j})ms^{-2}$

Hence, $a_x = 5ms^{-2}$ and $a_y = 0ms^{-2}$

From FBD of sphere,

$N_x = ma_x = 2 \times 5 = 10N$

$N_y - mg = ma_y \Rightarrow N_y = 2 \times 10 + 2 \times 0 = 20N$

Total force $= \sqrt{N_x^2 + N_y^2} = \sqrt{(10)^2 + (20)^2} = 10\sqrt{5}\,N$

CHEMISTRY

21. (D)

Mass of S_8 in sample = 160 g;

Mole of $S_8 = \frac{160}{32 \times 8} = 0.625$

Number of moles of O_2 required =0.625×8

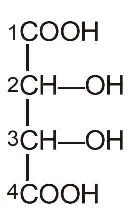
Volume of O_2 required = 22.4 × 5

$\therefore$ Vol. of air required $= 22.4 \times 5 \times \frac{100}{21} = 533.33$ L

22. (C)

Order of –R effect $-NO_2 > -CN > -CHO > -Ph$

23. (B)



Priority order : —COOH > —OH

—COOH: acts as principal f.g. (suffix : –oic acid)

—OH: acts as substituent (hydroxy)

24. (B)

25. (A)

$$\underset{0.1}{4Ca_5(PO_4)_3F} + \underset{0.36}{\overset{L.R.}{18SiO_2}} + \underset{0.9}{30C} \longrightarrow 3P_4 + 2CaF_2 + 18CaSiO_3 + 30CO$$

18 mole SiO_2 gives 3 mole P_4

0.36 mole SiO_2 will give $= \frac{3}{18} \times 0.36 = 0.06$ mole

26. (D)

CO_2 exhaled in 5 minutes =0.667 × 5 = 3.33 g

moles of CO_2 = 0.0756 mole

moles of KO_2 consumed = 0.0756 mole

mass of KO_2 consumed = 5.38 g

27. (C)

Let mass of Ag_2O = x g

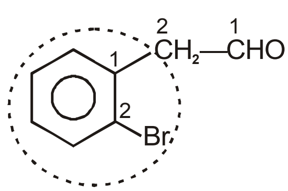
$$Ag_2O \longrightarrow 2Ag + \frac{1}{2}O_2$$

232 g $\quad \frac{1}{2} \times 32 = 16 g\, O_2$

x g $\quad \frac{16}{232} \times x = 0.104 \Rightarrow x = 1.508 g$

$$\%\text{ of } Ag_2O = \frac{1.508}{1.6} \times 100 = 94.25\%$$

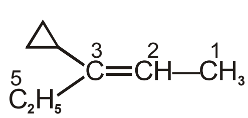
28. (A)



29. (B)

Be has stable configuration $2S^2$

30. (C)



3-Cyclopropyl-2-pentene

31. (A,B)

32. (A), (B), (D)

33. (A,B)

(A) 46g of $70\%\frac{W}{V}HCOOH(d_{Solution}=1.4\,g/mL)$ $70\%\frac{W}{V}HCOOH\longrightarrow 70g\ HCOOH$ in 100 mL solution.

Mass of solution = 1.4×100=140g So, in 140g solution, mass of HCOOH = 70g in 46g, mass of $HCOOH=\frac{70}{140}\times 46=23g$

(B) $10M\ HCOOH\longrightarrow 10mole$ HCOOH in 1000 mL solution mass of solution=1000g

Mass of HCOOH = 10×46= 460g

So in 50g solution mass of $HCOOH=\frac{460}{1000}\times 50=23g$

(C) $25\%\frac{W}{W}HCOOH\longrightarrow 25g\,HCOOH$ in 100g solution.

So in 50g solution, mass of HCOOH = 12.5 g

34. (B), (D)

35. (A,C,D)

$V_{strength}$= 28;

$\therefore\ M-\frac{28}{11.2}=2.5$

$\therefore$ 1 L contain 2.5 moles of H_2O_2

or 2.5 × 34 = 85 g H_2O_2

Mass of 1 litre solution = 265 g

$(\because\ d=265g/L)$

$\therefore\ w_{H_2O}=180g$ of moles of H_2O = 10

$$X_{H_2O_2}=\frac{2.5}{2.5+10}=0.2$$

$$\%\frac{w}{v}=\frac{2.5\times 34}{1000}\times 100=8.5$$

$$m=\frac{2.5}{180}\times 1000=13.88$$

36. (8)

Number of moles of Ba $(OH)_2 = \frac{20 \times 342}{100 \times 171} = 0.4\,\text{mole}$

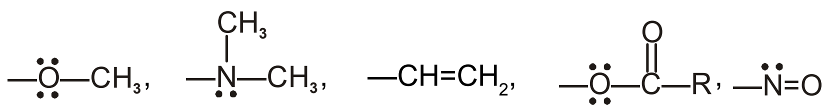
or moles of OH^- = 0.4 × 2

Number of moles of HNO_3 = 1.2 × 2=2.4 mole

Hence, the final solution is acidic due to presence of excess H^+

$$\left[H^+\right] = \frac{(2.4 - 0.8) \times 1000}{1200 + \frac{343}{0.57}} = 0.888\,M$$

37. (5)



38. (3)

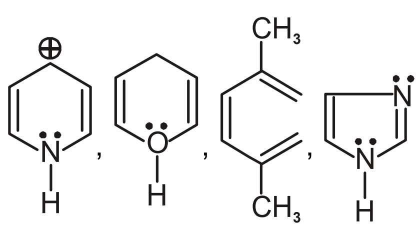
$Zn + 2HCl \longrightarrow ZnCl_2 + H_2;$

moles of H_2 evovled = 2

$\therefore$ moles of HCl required = 4

$\therefore \quad \frac{V \times 1.2 \times 0.365}{36.5} = 4; \quad V = 333.33\,mL$

39. (4)



40. (4)

$C_2H_6 + 3.5O_2 \longrightarrow 2CO_2 + 3H_2O;$

$C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$

Let volume of ethane is x litre, 22.4 × 4 = 3.5x + 3(28–x)

$\Rightarrow$ x = 11.2 litre

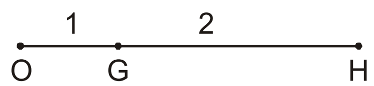
at constant T and P, V α n;

$\therefore$ Mole fraction of C_2H_6 in mixture $= \frac{11.2\,\text{litre}}{28} = 0.4$

MATHEMATICS

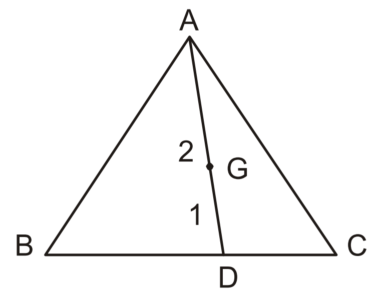
41. (A)

Circum-centre O, ortho-centre H centroid G



$\therefore G \equiv \left(1, \frac{8}{9}\right)$

$AG : GD = 2 : 1$



42. (B)

For f(x) to be defined,

$$x^2 - x - 6 \neq 0, \left[x + \frac{1}{2}\right] > 0, \left[x + \frac{1}{2}\right] \neq 1 \Rightarrow (x-3)(x+2) \neq 0, x + \frac{1}{2} \geq 1, x + \frac{1}{2} \notin [1,2)$$

$$\Rightarrow x \neq 3, -2, x \geq \frac{1}{2}, x \notin \left[\frac{1}{2}, \frac{3}{2}\right) \Rightarrow x \in \left[\frac{3}{2}, 3\right) \cup (3, \infty).$$

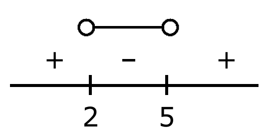
43. (B)

$$\tan 20^\circ + 4\sin 20^\circ = \frac{\sin 20^\circ + 4\sin 20^\circ \cdot \cos 20^\circ}{\cos 20^\circ} = \frac{\sin 20^\circ + 2\sin 40^\circ}{\cos 20^\circ}$$

$$= \frac{\sin 20^\circ + \sin 40^\circ + \sin 40^\circ}{\cos 20^\circ} = \frac{\sin 80^\circ + \sin 40^\circ}{\cos 20^\circ}$$

$$= \frac{2 \cdot \sin 60^\circ \cdot \cos 20^\circ}{\cos 20^\circ} = \sqrt{3}$$

44. (B)



$\therefore$ Positive integral solutions = {3, 4} i.e. two

45. (B)

From 3 tanA + 4 = 0, we get tanA = – 4/3, so that

$\sin A = \dfrac{-\tan A}{\sqrt{1+\tan^2 A}} = \dfrac{4/3}{\sqrt{1+16/9}} = \dfrac{4}{5}$ $[\because \sin A > 0 \text{ and } \tan A < 0 \text{ in quad.II}]$

and $\cos A = -\dfrac{1}{\sqrt{1+\tan^2 A}} = -\dfrac{3}{5}$ $[\because \cos A \text{ is negative in quad.II}]$

Hence $2\cot A - 5\cos A + \sin A = 2\left(-\dfrac{3}{4}\right) - 5\left(-\dfrac{3}{5}\right) + \dfrac{4}{5} = \dfrac{23}{10}$

46. (C)

According to property $|f(x)| = -f(x)$, then $f(x) \le 0$

$|x-1|\,|x-2| = -(x-2)(x-1) \Rightarrow (x-1)(x-2) \le 0 \Rightarrow 1 \le x \le 2$

$\therefore$ Option (C) is correct.

47. (A)

$x^2-5x+6\overline{\big)\,x^{2007}\,}\big(\,Q(x)$

$\underline{\underline{\quad}}$

$R(x) = ax+b$

hence $x^{2007} = Q(x)\cdot(x^2 - 5x + 6) + ax + b$

$x^{2007} = Q(x)\cdot(x-2)(x-3) + \underbrace{ax+b}_{R(x)}$ ....(1)

now $R(0) = b = ?$

Put x = 2 in (1)

$2a + b = 2^{2007}$ ....(2)

put x = 3 in (1)

$3a + b = 3^{2007}$ ....(3)

(3) – (2) gives

$a = 3^{2007} - 2^{2007}$

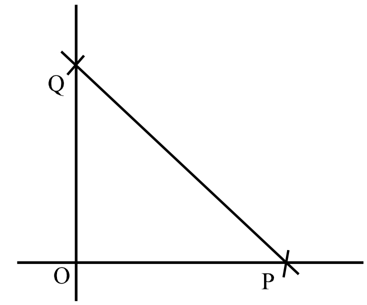
now $b = 2^{2007} - 2a = 2^{2007} - 2(3^{2007} - 2^{2007}) = 2^{2007} + 2\cdot 2^{2007} - 2\cdot 3^{2007})$

$= 3\cdot 2^{2007} - 2\cdot 3^{2007} = 6[2^{2006} - 3^{2006}] = 2\cdot 3[2^{2006} - 3^{2006}] \equiv ab(a^c - b^c)$

hence a = 2; b = 3; c = 2006

$\therefore$ a + b + c = 2 + 3 + 2006 = 2011 Ans.

48. (B)



$P \equiv \left(\frac{c}{a},0\right)$, $Q \equiv \left(0,\frac{c}{b}\right)$

$\Delta OPQ = \frac{1}{2}$ (OP)(OQ)

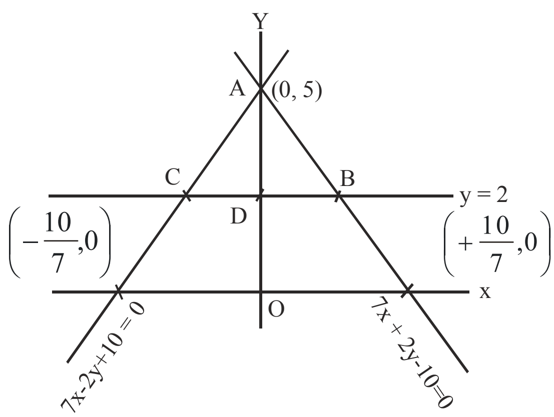
$= \frac{1}{2}\frac{c^2}{ab}$ clearly ΔOPQ will not depend upon a, b and c if $c^2 = ab$,

i.e. a, c, b are in G.P.

49. (C)

We have, $B \equiv \left(\frac{6}{7},2\right), C \equiv \left(-\frac{6}{7},2\right)$

$\Rightarrow \quad BC = \frac{12}{7}$, AD = 3



$\Rightarrow \quad \Delta_{ABC} = \frac{1}{2}.\frac{12}{7}.3 = \frac{18}{7}$ sq. units

50. (A)

This will formed right angled triangle with vertices (0,0), (10,0) & (0,24), right angle at (0,0) so orthocentre is (0,0)

51. (A)

We have,

$$9^{\log_3(\log_2 x)} = \log_2 x - (\log_2 x)^2 + 1$$

$\Rightarrow\ 3^{2\log_3(\log_2 x)} = \log_2 x - (\log_2 x)^2 + 1 \ \Rightarrow\ 3^{\log_3(\log_2 x)^2} = \log_2 x - (\log_2 x)^2 + 1$

$\Rightarrow\ (\log_2 x)^2 = \log_2 x - (\log_2 x)^2 + 1 \ \Rightarrow\ 2(\log_2 x)^2 - \log_2 x - 1 = 0$

$\Rightarrow\ (2\log_2 x + 1)(\log_2 x - 1) = 0$

$\Rightarrow\ \log_2 x = -\frac{1}{2}, \log_2 x = 1 \ \Rightarrow\ x = 2^{-1/2}, 2$

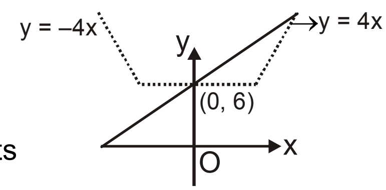
52. (A,C,D)

When

(i) P = 0 then it has infinte solution

(ii) if –4 < P < 0 or 0 < P < 4 then it intersect at 2 points

(iii) P $\geq$ 4 or P $\leq$ –4 then it has only one solution



53. (A, C, D)

As $\frac{2+\sqrt{3}}{2-\sqrt{3}} > 1 \Rightarrow \log_{0.5}\left(\frac{2+\sqrt{3}}{2-\sqrt{3}}\right) < 0$.

As, $\sqrt{65} > 8 \ \Rightarrow \sqrt{65} - 7 > 1 \ \Rightarrow \log_{12}\left(\sqrt{65} - 7\right) > 0$.

Also, $\log_2\left(\frac{\log_3}{\log_5} \times \frac{\log_5}{\log_7} \times \frac{\log_7}{\log_3}\right) = \log_2 1 = 0.$

As, $\log_7\left(\frac{3}{2}\right)^{\frac{-2}{3}} = \log_7\left(\frac{2}{3}\right)^{\frac{2}{3}} = \frac{2}{3}\log_7\frac{2}{3} < 0$. **Ans.**]

54. (B, D)

Dividing by $\cos(2012°)$, we get

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

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

$\Rightarrow$ Hence θ = k (180^0) + 2057^0

Put k = –10

θ = 2057° – 1800° = 257°

If k = –11 $\Rightarrow$ θ = 77°

55. (A,B,C)

$x-2\neq 0 \Rightarrow x\neq 2$

$$f\left(\frac{2}{x-2}\right)=\frac{(x-2)^2}{(24-11x)(14-6x)} \Rightarrow x\neq \frac{24}{11} \ \& \ \frac{7}{3}$$

56. (4)

$$S = \frac{1}{\cos\alpha} + \frac{2\cos\alpha}{\cos 2\alpha} = \frac{2\sin\alpha}{2\sin\alpha\cos\alpha}+\frac{2\cos\alpha}{\cos 2\alpha} = \frac{2\sin\alpha}{\sin 2\alpha}+\frac{2\cos\alpha}{\cos 2\alpha}$$

$$= \frac{2\cdot 2(\sin\alpha\cos 2\alpha+\cos\alpha\sin 2\alpha)}{2\sin 2\alpha\cos 2\alpha} = 4\frac{\sin 3\alpha}{\sin 4\alpha} = 4$$ **Ans.** if $\alpha = \frac{\pi}{7}$

57. (3)

$$2n\{x\}=3x+2[x] \Rightarrow (2n-3)\{x\}=5[x] \Rightarrow \{x\}=\frac{5[x]}{2n-3}$$

Also, $0\le\{x\}<1$

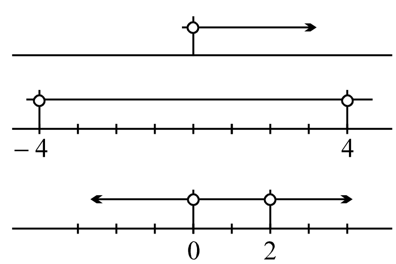
$$\Rightarrow \ 0\le\frac{5[x]}{2n-3}<1 \Rightarrow 0\le[x]<\frac{2n-3}{5}, \{n\ge 2\}$$

It has 5 solutions, [x] = 0, 1, 2, 3, 4 only, if $4<\frac{2n-3}{5}\le 5$

$$\Rightarrow \ \frac{23}{2}<n\le 14$$

$\Rightarrow$ $n=12,13,14$ are 3 values of n.

58. (1)



Domain of $\sqrt{x}$ is $x\ge 0$ ....(i)

domain of $\sqrt{16-x^2}$ is $x\in[-4, 4]$ ....(ii)

domain of $\log_2 x(x-2)$ is $(-\infty, 0)\cup(2,\infty)$ ....(iii)

intersect of (i), (ii) and (iii) is (2, 4] ....(iv)

domain of $\sqrt{\sin\frac{\pi x}{2}}$ is such that $\frac{\pi x}{2}\in[2n\pi, (2n+1)\pi]$, $n\in I$

$\Rightarrow$ $x\in[4n, 4n+2]$, $n\in I$ ....(v)

intersection of (iv) and (v) is $x = 4$

$\Rightarrow$ hence domain of f (x) is $x\in\{4\}$. Hence range of f is {5}]

59. **(2)**

If $\sin\theta_1 \sin\theta_2 - \cos\theta_1 \cos\theta_2 = 1$

$\Rightarrow \cos(\theta_1 + \theta_2) = -1 \Rightarrow \theta_1 + \theta_2 = \pi$ (since $\theta_1 + \theta_2 \in (0, 2\pi)$)

$$\Rightarrow \frac{\theta_1 + \theta_2}{4} = \frac{\pi}{4} \Rightarrow \frac{\theta_2}{4} = \frac{\pi}{4} - \frac{\theta_1}{4}$$

$$1 + \tan\frac{\theta_2}{4} = \frac{1 - \tan\frac{\theta_1}{4}}{1 + \tan\frac{\theta_1}{4}} + 1$$

$$\therefore \left(1 + \tan\left(\frac{\theta_1}{4}\right)\right)\left(1 + \tan\left(\frac{\theta_2}{4}\right)\right) = 2$$

60. **(5)**

Put $\theta = 0$, then $2^7 = 1 + a + b + c + d$

$\Rightarrow a + b + c + d = 127$

$$\therefore (a + b + c + d - 2)^{\frac{1}{3}} = (125)^{\frac{1}{3}} = 5$$