ADVANCED PART TEST-1 (APT-1)
(JEE ADVANCED PATTERN)
TARGET : JEE (MAIN+ADVANCED) 2020

DATE : 14-07-2019 **COURSE : VIJAY (RJ1)**

HINTS & SOLUTIONS

PAPER-1

PART- I MATHEMATICS

1. Let the solution....................

Sol. $\dfrac{x^2+2x+1+1}{x+1}+\dfrac{x^2+8x+16+4}{x+4}$

$> \dfrac{x^2+4x+4+2}{x+2}+\dfrac{x^2+6x+9+3}{x+3}$

$x+1+\dfrac{1}{x+1}+x+4+\dfrac{4}{x+4}$

$> x+2+\dfrac{2}{x+2}+x+3+\dfrac{3}{x+3}$

$\dfrac{4}{x+4}-\dfrac{2}{x+2}>\dfrac{3}{x+3}-\dfrac{1}{x+1}$

$\dfrac{2x}{(x+2)(x+4)}-\dfrac{2x}{(x+1)(x+3)}>0$

$2x\left(\dfrac{x^2+4x+3-x^2-6x-8}{(x+1)(x+2)(x+3)(2x+4)}\right)>0$

$\dfrac{x(2x+5)}{(x+1)(x+2)(x+3)(x+4)}<0$

$x \in (-4,-3)\cup\left(\dfrac{-5}{2},-2\right)\cup(-1,0)$

2. If the equation....................

Sol. $D \ge 0$

$(2a+b)^2-4(2a^2+b^2-b+\dfrac{1}{2}) \ge 0$

$4a^2+3b^2-4ab-4b+2 \le 0$

$(2a-b)^2+2(b-1)^2 \le 0$

which is only possible when

$b = 1,\ 2a = b$ i.e. $a = \dfrac{1}{2}$

3. Which of the ....

Sol. $\sqrt{2-x} \ \ge \ \sqrt{x^2}$

$2-x \ge x^2$

$x^2+x-2 \le 0$

$\Rightarrow -2 \le x \le 1$ … (i)

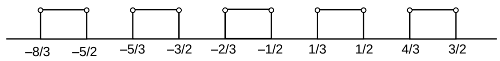
$6\{x\}^2-5\{x\}+1<0$ and $2-x \ge 0 \Rightarrow x \le 2$ …(ii)

$(2\{x\}-1)(3\{x\}-1)<0$

$\Rightarrow \dfrac{1}{3}<\{x\}<\dfrac{1}{2}$

$\Rightarrow n+\dfrac{1}{3}<x<n+\dfrac{1}{2},\ n \in I$

Which can be represented as



Taking its intersection with (i) and (ii)

$x \in \left(-\dfrac{5}{3},-\dfrac{3}{2}\right)\cup\left(-\dfrac{2}{3},-\dfrac{1}{2}\right)\cup\left(\dfrac{1}{3},\dfrac{1}{2}\right)$

4. Consider the ....

Sol. $1-\log_{3^2}(x+1)^2=\dfrac{1}{2}\log_{3^{1/2}}\left(\dfrac{x+5}{x+3}\right)$

$\Rightarrow\ 1-\dfrac{2}{2}\log_3|x+1| = \dfrac{2}{2}\log_3\left(\dfrac{x+5}{x+3}\right)$

$\Rightarrow\ \log_3\left(\dfrac{3}{|x+1|}\right)=\log_3\left(\dfrac{x+5}{x+3}\right)$

$\Rightarrow\ \dfrac{3}{|x+1|}=\dfrac{x+5}{x+3}$

Case- I $x+1>0 \Rightarrow x>-1$

$\Rightarrow\ 3(x+3)=(x+1)(x+5)$

$\Rightarrow\ x^2+3x-4=0$

$\Rightarrow\ x=-4$ or $x=1$

$x=-4$ rejected ($x>-1$)

$\therefore\ x = 1$

Case- II $x+1<0 \Rightarrow x<-1$

$\Rightarrow\ 3(x+3)=-(x+1)(x+5)$

$\Rightarrow\ x^2+9x+14=0$

$\Rightarrow\ x=-2$ or $x=-7$

$\therefore$ Set of value of $x = \{-7,-2,1\}$

6. Which of following....................

Sol. $\sin x - 2$ is always negative

$\therefore\ 2\cos^2x-3\sin x \le 0$

$2(1-\sin^2x)-3\sin x \le 0$

$-2\sin^2x-3\sin x+2 \le 0$

$2\sin^2x + 3\sin x - 2 \geq 0$

$(\sin x + 2)(2\sin x - 1) \geq 0$

$\Rightarrow \sin x \geq \frac{1}{2}$ (sinx + 2 is always positive)

$\Rightarrow x \in \left[2n\pi + \frac{\pi}{6}, 2n\pi + \frac{5\pi}{6}\right]$, $n \in I$

7. Complete solution....................

Sol. $\sqrt{5t+1} \leq 7 - t$

$5t + 1 \geq 0 \Rightarrow t \geq -\frac{1}{5}$ ....(1)

$7 - t \geq 0 \Rightarrow t \leq 7$ ....(2)

and $5t + 1 \leq 49 + t^2 - 14t$

$t^2 - 19t + 48 \geq 0$ ....(3)

$(1) \cap (2) \cap (3)$ gives

$t \in \left[-\frac{1}{5}, 3\right]$

8. If $\sin\frac{\pi}{10}$ is the....................

Sol. $\sin\frac{\pi}{10} = \frac{\sqrt{5}-1}{4}$

Let $\alpha = \frac{\sqrt{5}-1}{4}$

$\therefore \beta = \frac{-\sqrt{5}-1}{4}$

$\alpha + \beta = -\frac{1}{2}$

$\alpha\beta = -\frac{1}{4}$

$\therefore x^2 + \frac{1}{2}x - \frac{1}{4} = 0 \quad \therefore p = \frac{1}{2}, q = -\frac{1}{4}$

10. If x, y are integral....................

Sol. $2x^2 - 4xy + xy - 2y^2 = 7$

$2x(x - 2y) + y(x - 2y) = 7$

$(x - 2y)(2x + y) = 7$

x, y are integers

$\Rightarrow$ $x - 2y$, $2x + y$ are also integers

Four cases are possible

Case I $x - 2y = 1$, $2x + y = 7$

$\Rightarrow x = 3, y = 1$

$|x + y| = 4$

Case II $x - 2y = 7$, $2x + y = 1$

$\Rightarrow x = \frac{9}{5}$ rejected

Case III $x - 2y = -1$, $2x + y = -7$

$\Rightarrow x = -3, y = -1$

$|x + y| = 4$

Case IV $x - 2y = -7$, $2x + y = -1$

$\Rightarrow x = -\frac{9}{5}$ rejected

Hence $|x + y| = 4$

11. The number ....

Sol. Let $x = I + f$,

I is Integer

f is fractional part (i.e. $f \in [0, 1)$)

$\therefore \quad |3[x] - 4x| = 4$

$\Rightarrow \quad |3I - 4I - 4f| = 4$

$\Rightarrow \quad |I + 4f| = 4$

$\Rightarrow \quad I + 4f = \pm 4$

which is only possible if, $f = \frac{1}{4}, 0, \frac{1}{2}$, or $\frac{3}{4}$

$\therefore$ There are 8 solutions.

12. The correct graph....................

Sol. The expression becomes

$$y = \begin{cases} -1 & \text{If } x \in (-\infty, -1) \\ 2x + 1 & \text{If } x \in [-1, 1) \\ 3 & \text{If } x \in [1, 3) \\ 2x - 3 & \text{If } x \in [3, \infty) \end{cases}$$

13. If $1 \leq ||x - 1| - 2| < 2$....................

Sol. $1 \leq |x - 1| - 2 < 2$ or $-2 < |x - 1| - 2 \leq -1$

$3 \leq |x - 1| < 4$ or $0 < |x - 1| \leq 1$

$3 \leq x - 1 < 4$ or $-4 < x - 1 \leq -3$ or $-1 \leq x - 1 < 0$

or $0 < x - 1 \leq 1$

$4 \leq x < 5$ or $-3 < x \leq -2$ or $0 \leq x < 1$ or $1 < x \leq 2$

$\therefore \quad x \in (-3, -2] \cup [0, 1) \cup (1, 2] \cup [4, 5)$

$\therefore \quad x^2 \in [4, 9) \cup [0, 1) \cup (1, 4] \cup [16, 25)$

$x^2 \in [0, 1) \cup (1, 9) \cup [16, 25)$

14. Complete set of ....

Sol. $\frac{\log_{0.3}(x-2)}{|x|} \geq 0$

ND ND + 0 –

2 3

$\Rightarrow x \in (2, 3]$

15. The value ....

16. The value of ....

Sol. **(15, 16)**

$p = 3[q] + 5$

$p = 4[q - 6] + 27 = 4[q] - 24 + 27 = 4[q] + 3$

$\therefore \quad [q] = 2$

$\therefore \quad p = 11$

$r = [p + q + 2] = p + 2 + [q] = 15$

$$s = \left[\frac{1}{4}\right] + \left[\frac{1}{4} + \frac{1}{100}\right] + \left[\frac{1}{4} + \frac{2}{100}\right] + \ldots + \left[\frac{1}{4} + \frac{99}{100}\right]$$

$$= \left[\frac{1}{4} + \frac{75}{100}\right] + \left[\frac{1}{4} + \frac{76}{100}\right] + \ldots + \left[\frac{1}{4} + \frac{99}{100}\right]$$

$= 1 + 1 + 1 + 1 + \ldots + 1 = 25$

17. Complete set ....

Sol. $x^3 - 3x - 1 = -\lambda$

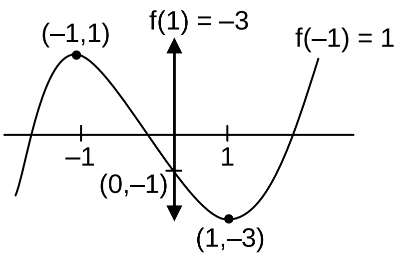
Let $f(x) = x^3 - 3x - 1$

$\Rightarrow f'(x) = 3x^2 - 3 = 3(x + 1)(x - 1)$

$+ \quad - \quad +$

$-1 \quad 1$

$(\max^m) \quad (\min^m)$

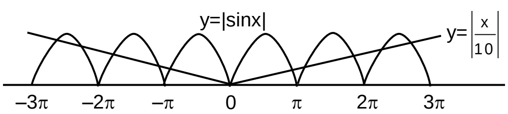


For three real and distinct solution

$-\lambda \in (-3, 1) \Rightarrow \lambda \in (-1, 3)$

18. Number of ....

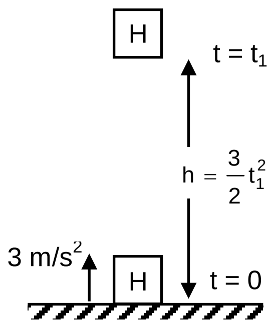
Sol.



PART- II PHYSICS

19. A helicopter takes ………………………..

Sol.



given

time taken by the last pulse to reach ground $= 30 - t_1$

$$\frac{\frac{3}{2}t_1^2}{320} = 30 - t_1$$

$3t_1^2 = 19200 - 640\,t_1$

$3t_1^2 + 640\,t_1 - 19200 = 0$

$$t_1 = \frac{-640 \pm \sqrt{640000}}{6}$$

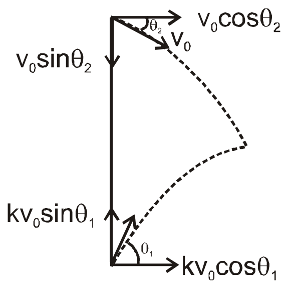
$$= \frac{160}{6} = \frac{80}{3} \text{ sec,}$$

$$h = \frac{3}{2}\left(\frac{6400}{9}\right) = \frac{3200}{3} \text{ m}$$

$v = 3t = 80$ m/s

20. Two boys ………………………..

Sol.



$d = v_0 \cos\theta_2\, t = (kv_0 \cos\theta_1)\, t$

$\cos\theta_2 = k \cos\theta_1$

$$\left[k = \left(\frac{\cos\theta_2}{\cos\theta_1}\right)\right]$$

motion of A w.r.t. B in y direction 7

$(h = V_r\, t)$ here $V_r = (kv_0 \sin\theta_1 + v_0 \sin\theta_2)$

$$t = \frac{h}{v_r} = \left(\frac{h}{kv_0 \sin\theta_1 + v_0 \sin\theta_2}\right)$$

21. For a body ………………………..

Sol. Unit of $\dfrac{bc^2}{a^2} = \dfrac{\frac{m}{\sec^2} \times m^2}{\left(\frac{m}{\sec}\right)^2} = m =$ unit of c

22. A particle is projected from ground...............

Sol. $u_x = 40$ m/s, $u_y = 40$ m/s

$x = 4x.t = 80$ m

$y = 4yt - \frac{1}{2} 8t^2 = 60$ m

$4y = 4y - gt = 20$ m/s

$\tan\theta = \frac{v_x}{v_y} = 2$

$\theta = \tan^{-1}(2)$ with vertical.

23. A car starts ………………………..

Sol. $V_{av} = \frac{s_1 + s_2 + s_3}{t_1 + t_2 + t_3}$

$\Rightarrow \quad 20 = \frac{s_1 + s_2 + s_3}{25}$

$\Rightarrow \quad s_1 + s_2 + s_3 = 500$ .....(1)

Since car accelerated from $0 \to v_{max}$ in time t_1 with acceleration of 5 ms^{-2} and it decelerated from $v_{max} \to 0$ in time t_3 with a retardation of 5 ms^{-2}, hence $t_1 = t_3$ and $s_1 = s_3$.

Hence, $t_2 = 25 - 2t_1$ .....(2)

$\Rightarrow \quad s_1 = s_3 = \frac{1}{2}(5)\, t_1^2$ and $v_{max} = 5t_1$

$\Rightarrow \quad s_2 = v_{max}t_2 = 5t_1t_2$

$\therefore$ Substituting values in (1) and using (2) we get, a quadratic in t_1 which one solving gives $t_1 = 5$s.

$\frac{5}{2}t_1^2 + 5t_1t_2 + \frac{5}{2}t_1^2 = 500$

$t_1^2 - 25t_1 + 100 = 0$

$t_1 = 5, 20$

we will take $t_1 = 5$ sec

as otherwise

$t_2 = 25 - 2t_1$, will becomes negative (for $t_1 = 20$)

Hence

$t_2 = 15$s and $v_{max} = 25\ ms^{-1}$

24. If the position of a particle moving..............

Sol. $V = \frac{dx}{dt} = t^2 - 4t + 4$

$V = (t - 2)^2$

$a = 2(t - 2)$

At $t = 2$, $V = 0$, $a = 0$

At $t = 3$, $a = 2\ m/s^2$.

25. The acceleration ………………………..

Sol. $v\,dv = a\,ds$

$\therefore \int_0^v v\ dv = \int_0^{12m} a\ ds$

$\therefore \frac{v^2}{2}$ = area under a-s graph from s = 0 to s = 16m.

$= 2 + 12 + 6 + 12$

$= 32$ m /s

or $v = \sqrt{64}$ m/s = 8 m/s

Ans. 8 m/s

26. If the position ………………………..

Sol. $\vec{r}_{AB} = (t - t^2 + 1)\,\hat{i} + (t^2 - t)\,\hat{j}$

Thus, $x = t - t^2 + 1$

and $y = t^2 - t$

$\therefore \ x = -y + 1$

$x + y = 1$ straight line

27. Acceleration of a particle moving in......................

Sol. $a = -4x(-1 + 0.25\,x^2)$

$\int_{17}^{v} v\,dv = \int_0^4 (4x - x^3)\,dx$

$\frac{1}{2}(v^2 - 17^2) = \frac{4}{2}(x^2)_0^4 - \frac{1}{4}(x^4)_0^4$

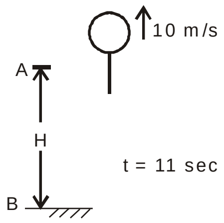
$v^2 - 17^2 = 4(4^2) - \frac{1}{2}(4^4) = 64 - 128$

$V^2 = 289 - 64 = 225$

$V = 15$ m/sec.

28. A balloon is moving upwards with......................

Sol.



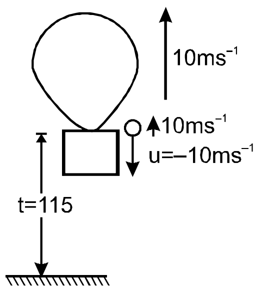
As $s = ut + \frac{1}{2}at^2$

$-H = 10 \times 11 - 5 \times (11)^2$

$-H = 110 - 605$

$H = 495$ m

Aliter :



At the time of release, velocity of stone will be same as that of balloon, hence

$u = -10\ ms^{-1}$, $t = 11$ s

$h = ut + \frac{1}{2}gt^2$

$= (-10) \times 11 + (10)\,(11)^2 = -110 + 605 = 495$ m

"A" Ans

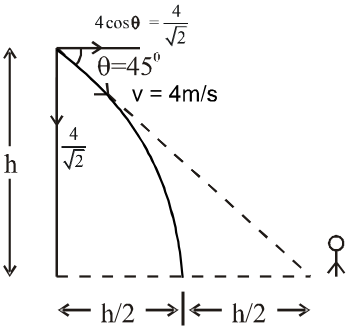
29. A man throws ....

Sol. $\frac{4}{\sqrt{2}}.t = \frac{h}{2}$ ...(i)

& $h = \left(\frac{4}{\sqrt{2}}\right)t + \frac{1}{2}gt^2$ ...(ii)

$\frac{h}{2} = \frac{1}{2}g\,t^2$

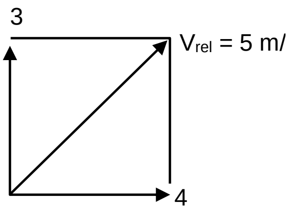
from (i) & (ii)



$\Rightarrow \frac{h}{2} = \frac{1}{2}g\left(\frac{h}{4\sqrt{2}}\right)^2 \Rightarrow h = \frac{16\ x\ 2}{10} = 3.2\text{m}$

30. Two particles ....

Sol.



$a_{rel} = g - g = 0$

Distance = 5 (5) = 25 m

31. A particle starts ....

Sol. $a = kx^2$

$\frac{da}{dx} = 2kx \Rightarrow \tan 60° = 2k\sqrt{3} \Rightarrow k = \frac{1}{2}$

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

$v\frac{dv}{dx} = \frac{x^2}{2} \Rightarrow \frac{v^2}{2} = \frac{x^3}{6} + C_1$ at x = 0, v = 3 m/s

$C_1 = \frac{9}{2}$

$v^2 = \frac{x^3}{3} + 9$

hence a = 1.5 and v = $\sqrt{\sqrt{3} + 9}$

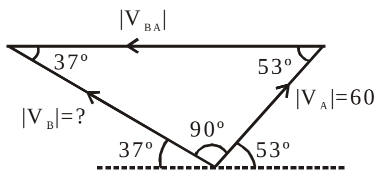
32. A particle is ....

Sol. $\frac{2v^2 \sin\theta \ \cos\theta}{g} = \frac{2v^2 \sin^2\theta}{2g}$

$\Rightarrow \tan\theta = 2, \sin\theta = \frac{2}{\sqrt{5}}, \ \cos\theta = \frac{1}{\sqrt{5}} \Rightarrow R = \frac{4v^2}{5g}$

33. If initial angle ....

Sol. Velocity triangle

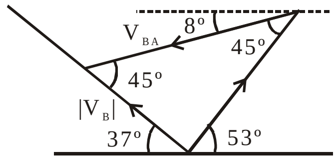


$\frac{60}{\sin 37°} = \frac{|V_B|}{\sin 53°}$

$|V_B| = \frac{60 \times 4/5}{3/5}$ = 80 m/s.

34. An observer ....

Sol. Velocity triangles



$\frac{V_B}{\sin 45°} = \frac{60}{\sin 45°}$

V_B = 60 m/s.

35. The distance ....

36. The displacement ....

Sol. **(35 & 36)**

(Easy)

The velocity of particle changes sign at t = 1 sec.

for t<1 v<0 and for t>1 v>0

$\therefore$ Distance from t = 0 to t = 2 sec. is = $\int_1^0 vdt + \int_1^2 vdt$

$= \left[(t^3 - \frac{3}{2}t^2)\right]_1^0 + \left[(t^3 - \frac{3}{2}t^2)\right]_1^2 = 3$ m

Displacement from t = 0 to t = 2 sec. is $\int_0^2 vdt$

$$= \left[(t^3 - \frac{3}{2}t^2)\right]_0^2 = 2 \text{ m.}$$

PART- III CHEMISTRY

37. For Cr, how many ....

Sol. ${}_{24}Cr$ – $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

Only 2p, 3p and 4s orbital satisfy the relation

$n + l + |m| = 4$ ($m = \pm 1$)

For 2p ($2e^-$), 4s (0 or $1e^-$), 3p ($1e^-$)

so number of e^- can be 3 or 4

38. A compound contains ....

Sol. In 100 g

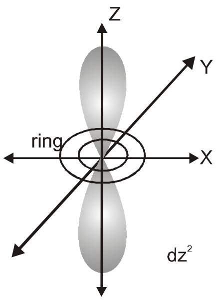
$Ca_{\frac{2}{40}}\ Mg_{\frac{2.4}{24}}\ S_{\frac{12.8}{32}}$ ......

$Ca_{\frac{1}{20}}\ Mg_{\frac{1}{10}}\ S_{\frac{2}{5}}$ ......

(In 2000 g/mol)

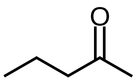
$CaMg_2S_8$ ....

40. The electron present ....

Sol. 

Finding probability at xy, xz & yz planes.

41. Which of the following is/are ....

Sol. 

is pentan-2-one

42. Which of the following ....

Sol. (D) $CH_3–\underset{\underset{CH_3}{|}}{CH}–CH_2– CH_2–$

It is isopentyl

43. The graph below can ....

Sol. The given graph is for 3s orbital since it shows two radial node but does not represent 4p orbital because for 4p orbital $\psi(r) = 0$ at $r = 0$.

44. A 75 g, 4%$\left(\frac{w}{w}\right)$ aqueous ....

Sol. $W_{solute} = 3$ g, $W_{solution\ left} = 75 – 25 = 50$g

$$n_{OH^-} = \frac{3}{40} + \frac{X}{56}, \quad m = 5 = \frac{\left(\frac{3}{40} + \frac{X}{56}\right)}{47} \times 1000$$

$X \simeq 9$ g

45. 24 g of carbon reacts with ....

Sol. $C + O_2 \longrightarrow CO + CO_2$

Apply POAC on C and O

$1 \times n_C = 1 \times n_{CO} + 1 \times n_{CO_2}$

$2 = n_{CO} + n_{CO_2}$ ...(i)

$2 \times n_{O_2} = 1 \times n_{CO} + 2 \times n_{CO_2}$

$2.5 = n_{CO} + 2n_{CO_2}$

From equation (i) and (ii)

$n_{CO} = 1.5$, $n_{CO_2} = 0.5$

So, ratio $\frac{n_{CO}}{n_{CO_2}} = \frac{1.5}{0.5} = 3$

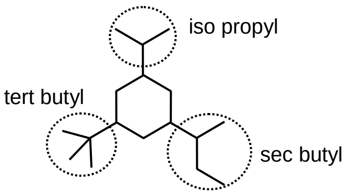
47. A compound of ....

Sol. $Mn = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 5s^2$

$\Rightarrow$ In Mn^{4+} number of unpaired electrons = 3

So, Charge on Manganese ion = 4 + . So, x = 4

48. Which of the following ....

Sol. 

Isobutyl is absent in above compound.

49. Which of the following ....

Sol. (A, B, C) (A), (B) and (C) are self-explanatory.

(D) is wrong; alkyne consists of one triple-bond.

50. Which of the following ....

Sol. Isooctane is 2,2,4-trimethylpentane.

51. A 3 M binary solution of ....

Sol. $3 = \frac{n_{solute}}{V_{sol.}}$

Let us assume 1 L solution.

$n_{solute} = 3$ mol

$m_{solute} = 3 \times 46$ g = 138 g

$m_{sol.} = 1500 – 138 = 1362$ g

molality = $\frac{3}{1.362} = 2.2$ m

52. If mole fraction of urea ....

Sol. $\dfrac{n_{urea}}{n_{water}} = \dfrac{1}{30}$

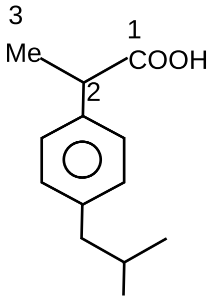
Let us assume

n_{water} = 1 mol, $n_{urea} = \dfrac{1}{30}$ mol, m_{H_2O} = 18 g , m_{urea} = 2g

$m_{sol.}$ = 20 g

53. The IUPAC name of (P) ....

Sol.



(P)

2-(4-Isobutylphenyl) propanoic acid

54. The number of sp^3 hybridised ....

Sol. Number of sp^3 hybridised carbon atom is 6.

PAPER-2

PART- I MATHEMATICS

1. If $\alpha + \beta + \gamma = 3$................

Sol. $\alpha\beta + \beta\gamma + \gamma\alpha$

$= \dfrac{1}{2}\ [(\alpha + \beta + \gamma)^2 - (\alpha^2 + \beta^2 + \gamma^2)] = 1$ ....(1)

$\alpha^3 + \beta^3 + \gamma^3 - 3\alpha\beta\gamma + 3\alpha\beta\gamma = 12$

$3\alpha\beta\gamma = 12 - (\alpha + \beta + \gamma)\ ((\alpha + \beta + \gamma)^2 - 3(\alpha\beta + \beta\gamma + \gamma\alpha))$

$\boxed{\alpha\beta\gamma = -2}$

........(2)

$(\alpha^2 + \beta^2 + \gamma^2)^2 = \alpha^4 + \beta^4 + \gamma^4 + 2(\alpha^2\beta^2 + \gamma^2\alpha^2 + \beta^2\gamma^2)$

$(7)^2 = \Sigma\,\alpha^4 + 2\,[(\Sigma\,\alpha\beta)^2 - 2\alpha\beta\gamma\,\Sigma\,\alpha]$

$\Sigma\,\alpha^4 = 49 - 2\,(1 + 2(2)3)$

$\boxed{\Sigma\,\alpha^4 = 49 - 26 = 23}$

2. Find the value ....

Sol. $2\left(2\sin\dfrac{7\pi}{10}\cos\dfrac{3\pi}{5}\right) - 4\sin\dfrac{\pi}{10}\sin\dfrac{13\pi}{10}$

$= 4\sin\dfrac{3\pi}{10}\cos\dfrac{3\pi}{5} + 4\sin\dfrac{\pi}{10}\sin\dfrac{3\pi}{10}$

$= 4\sin\dfrac{3\pi}{10}\left[\cos\dfrac{3\pi}{5} + \sin\dfrac{\pi}{10}\right]$

$= 4\sin\dfrac{3\pi}{10}\left[-\sin\dfrac{\pi}{10} + \sin\dfrac{\pi}{10}\right] = 0$

3. Number of integral.................

Sol. Let $f(x) = \dfrac{x}{x-1}$ $\qquad$ g(x) = x

$f(x) + g(x) = \dfrac{x}{x-1} + x$

$\dfrac{x^2}{x-1}$

$|f(x)| + |g(x)| = |f(x) + g(x)|$

$f(x).g(x) \geq 0$

$\dfrac{x^2}{x-1} \geq 0$

$\begin{array}{ccc} - & - & + \\ \hline & 0 & 1 \end{array}$

$x \in (1, \infty) \cup \{0\}$

4. What is the ....

Sol. Putting the quadratic in its standard form :

$(2k-1)x^2 - 8x + 6 = 0$

we see that the discriminant D is 64 - 4(2k - 1)6 = 88 - 48k = 8(11 - 6k). A quadratic equation has no real roots if and only if its discriminatant is negative. D is negative if 11 - 6k < 0, that is, when

k > 11/6; the smallest integral value of *k* for which the equation has no real roots is 2.

5. If $M = \sum\limits_{r=1}^{4} \log_2\left(\sin\left(\dfrac{r\pi}{5}\right)\right)$ ....

Sol. $M = \log_2\left(\sin\dfrac{\pi}{5}.\sin\dfrac{2\pi}{5}.\sin\dfrac{3\pi}{5}.\sin\dfrac{4\pi}{5}\right)$

$\Rightarrow\ M = \log_2\left(\sin\dfrac{\pi}{5}.\sin\dfrac{4\pi}{5}.\sin\dfrac{2\pi}{5}.\sin\dfrac{3\pi}{5}\right)$

$M = \log_2\left(\sin^2\dfrac{\pi}{5}.\sin^2\dfrac{2\pi}{5}\right)$ $(\because\ \sin(\pi - \theta) = \sin\theta)$

$M = \log_2\left(\dfrac{1}{4}\left(1 - \cos\dfrac{2\pi}{5}\right)\left(1 - \cos\dfrac{4\pi}{5}\right)\right)$

$M = \log_2\left((1 - \cos 72^\circ)(1 - \cos 144^\circ)\right) - 2$

$= \log_2\left((1 - \sin 18^\circ)(1 + \cos 36^\circ)\right) - 2$

$$= \log_2\left\{\left(1 - \frac{\sqrt{5}-1}{4}\right)\left(1 + \frac{\sqrt{5}+1}{4}\right)\right\} - 2$$

$$M = \log_2\left(\frac{20}{16}\right) - 2 = \log_2 5 - 4$$

$$M + 4 = \log_2 5 \Rightarrow (2)^{M+4} = (2)^{\log_2 5} = 5$$

6. If $\frac{2x}{2x^2+5x+2} > \frac{1}{x+1}$ ....

Sol. Given $\frac{2x}{2x^2+5x+2} > \frac{1}{x+1}$

$$\Rightarrow \frac{2x}{(2x+1)(x+2)} > \frac{1}{(x+1)}$$

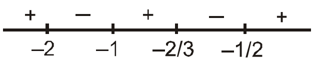
$$\Rightarrow \frac{2x}{(2x+1)(x+2)} - \frac{1}{(x+1)} > 0$$

$$\Rightarrow \frac{2x(x+1)-(2x+1)(x+2)}{(x+1)(2x+1)(x+2)} > 0$$

$$\Rightarrow \frac{2x^2+2x-2x^2-4x-x-2}{(x+1)\ (x+2)\ (2x+1)} > 0$$

$$\Rightarrow \frac{-3x-2}{(x+1)(x+2)(2x+1)} > 0$$

$$\Rightarrow \frac{3x+2}{(x+1)(x+2)(2x+1)} < 0$$



$\therefore\ x \in (-2, -1) \cup \left(-\frac{2}{3}, -\frac{1}{2}\right)$

7. If y = 2 [x] + 3y ....

Sol. 2[x] + 3 = 3 [x – 2] + 5

2[x] + 3 = 3 [x] – 6 + 5

[x] = 4 $\Rightarrow$ $4 \le x < 5$

x = 4 + f

y = 2 [x] + 3 = 11

[x + y] = [15 + f] = 15

8. The number ....

Sol. tan x + sec x = 2 cos x ; $x \ne (2n \pm 1)\ \pi/2$

sin x + 1 = 2 $\cos^2$ x

sin x + 1 = 2 (1 – $\sin^2$ x)

$\Rightarrow$ sin x = – 1, 1/2

$\Rightarrow$ sin x = 1/2 ($\because$ sin x $\ne$ – 1)

x = π/6, 5π/6

9. Find the sum ....

Sol. |x| + 2 is always positive

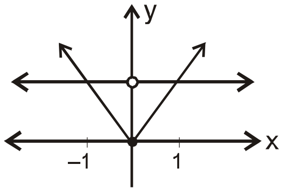
$\therefore\ 0 \le |x| + 2 < 5$

or $-2 \le |x| < 3$

$\Rightarrow -3 < x < 3$

10. The number ....

Sol.



Number of solutions = 3

11. The number ....

Sol. $\frac{[x]}{x-[x]} = 6 \Rightarrow [x] = 6\{x\}$

x – { x } = 6 { x }

$\frac{x}{7} = \{x\}$

$\frac{x}{7} = x - n$; $\forall\ x \in (n, n+1)$

$x = \frac{7n}{6}$

accepted solution for n = 1, 2, 3, 4, 5

12. Solution of ....

Sol. $[x]^2 - 9[x] - 52 < 0$

([x] – 13)([x] + 4) < 0

– 4 < [x] < 13

– 3 $\le$ [x] $\le$ 12

x $\in$ [–3, 13)

13. Let f(x) = $2x^3$ ....

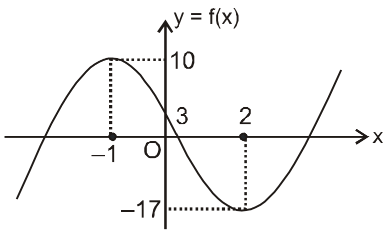
Sol. f(0) = 3, f(1) < 0.

f′(x) = $6x^2$ – 6x – 12 = 0

$\Rightarrow$ x = 2, –1

f(–1) = –2 –3 + 12 + 3 = 10 > 0

f(2) = 16 –12 – 24 + 3 = –17 < 0



14. The set of all.................

Sol. $x^2 - 3x < -2$

$x^2 - 3x + 2 < 0$

$(x-2)(x-1) < 0$

$x \in (1, 2)$

15. If $\log_4 5 = x$ ....

Sol. $xy = \log_4 5 \cdot \log_5 6 = \log_4 6$

$\Rightarrow$ (A) is correct

Also $xy = \dfrac{\log_2 6}{\log_2 4} \Rightarrow 2xy = 1 + \log_2 3$

$2xy - 1 = \log_2 3 \Rightarrow$ (C) is correct

16. Which of the ....

Sol. (A) $e^x = -x^2 + x - 6$

$e^x > 0$ and $-x^2 + x - 6 < 0 \quad \forall x \in R$

$\therefore$ (A) has no solution

(B) $2\sin^2\dfrac{\pi x}{2} = x^2 + \dfrac{1}{x^2}$

The equality holds when x = 1, –1

(C) $0 < \{x\} < 1$

$\therefore \log_{\{x\}}\dfrac{1}{2} > 0$

$\therefore$ (C) has no real solution.

(D) $\cos x = |x|$

graph of cosx and |x| interesect at two points

17. If the solution ....

Sol. $\dfrac{1-\log_{1/2}(-x)}{\sqrt{-6x-2}} < 0$

$\Rightarrow -6x - 2 > 0 \Rightarrow x < -\dfrac{1}{3}$ …(1)

and $1 - \log_{1/2}(-x) < 0$

$\Rightarrow \log_{1/2}(-x) > 1$

$\Rightarrow -x < \dfrac{1}{2}$

$\Rightarrow x > -\dfrac{1}{2}$ …(2)

Also $-x > 0 \Rightarrow x < 0$ ....(3)

intersection of (1), (2), (3) gives $x \in \left(-\dfrac{1}{2}, -\dfrac{1}{3}\right)$

$b - a = -\dfrac{1}{3} + \dfrac{1}{2} = \dfrac{1}{6}$

$\log_{36\sqrt{6}}\dfrac{1}{6} = y \Rightarrow (36\sqrt{6})^y = 6^{-1}$

$\Rightarrow y = -\dfrac{2}{5}$

18. Let a & b ....

Sol. $D > 0$

$(a+b)^2 - (a-b+8)^2 > 0 \quad \forall\ a \in R$

$a^2 + a(2b-1) + b^2 + b - 8 > 0$

so $D < 0$

$(2b-1)^2 - 4(b^2 + b - 8) < 0$

$-8b + 33 < 0$

$b > \dfrac{33}{8}$

$b_{min} = 5$ (as b is integer)

PART- II PHYSICS

19. The velocity …………………….

Sol. Speed of particle is

$$|V| = \sqrt{(2)^2 + (1)^2 + (2)^2}$$

$$|V| = 3 \text{ m/sec}$$

$$S \int_0^{10} |V|\,dt = \int_0^{10} 3\,dt = |3t|_0^{10}$$

S = 30 m **Ans. 30 m**

20. A particle moving …………………….

Sol. u = + 8 m/s

$a = -4 \text{ m/s}^2$

v = 0

$\Rightarrow 0 = 8 - 4t$ or t = 2 sec.

displacement in first 2 sec.

$S_1 = 8 \times 2 + \dfrac{1}{2}.(-4).2^2 = 8$ m

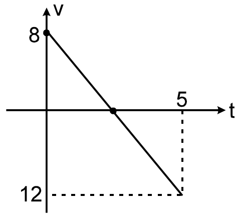
displacement in next 3 sec.

$S_2 = 0 \times 3 + \dfrac{1}{2}(-4)3^2 = -18$ m.

distance travelled = $|S_1| + |S_2|$ = 26 m.

Ans. 26 m.

ALITER :



total distance = $\dfrac{1}{2} \times 2 \times 8 + \dfrac{1}{2} \times 3 \times 12 = 8 + 18 = 26$ m

21. Consider a car …………………….

Sol. Velocity of car at point A

$V^2 = u^2 + 2as$

$V^2 = 10^2 + 2 \times 4 \times 48$

$= 100 + 384$

$V^2 = 484$

$\Rightarrow \quad V = 22$ m/sec

Time taken in reaching at pole A

$V = u + at$

$\Rightarrow \ t = \frac{v-u}{a} = \frac{22-10}{4} = 3$ sec

distance travelled in 3 sec. after reaching at A.

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

$X = (22 \times 3 + \frac{1}{2} \times 4 \times 3^2)$ m

$= (66 + 18)$ m

Ans. $\quad$ **X = 84 m**

22. A balloon …………………….

Sol. At position A balloon drops first particle

So, $u_A = 0$, $a_A = -g$, $t = 3.5$ sec.

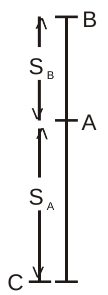
$S_A = \left(\frac{1}{2}gt^2\right)$ ....(i)

Balloon is going upward from A to B in 2 sec.so distance travelled by balloon in 2 second.

$\left(S_B = \frac{1}{2}a_B t^2\right)$ ....(ii)

$a_B = 0.4$ m/s^2 , $\quad t = 2$ sec.

$S_1 = BC = (SB + SA)$ ....(iii)



Distance travelled by second stone which is droped from balloon at B

$u_2 = u_B = a_B t = 0.4 \times 2 = 0.8$ m/s $\ t = 1.5$ sec.

$\left(S_2 = u_2 t - \frac{1}{2}gt^2\right)$ ....(iv)

Distance between two stone

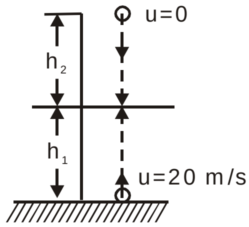
$\Delta S = S_1 - S_2$.

23. A stone is …………………….

Sol. Height of the building

$H = h_1 + h_2$

$= \frac{1}{2} gt^2 + ut - \frac{1}{2} gt^2$



$= \quad ut = 60$ m.

24. Two balls …………………….

Sol. $\frac{1}{2} gt^2 - \frac{1}{2} g \ (t-1)^2 = 15$ m

$t = 2$ sec.

25. A particle is moving along a straight...............

Sol. Displacement $= \int_0^t v\,dt = \int_0^4 (6-2t)dt = 2$m

Distance $= \int_0^4 |v|\,dt = \int_0^3 (6-2t)dt + \int_3^4 (2t-6)dt = 10$ m

$\therefore$ Distance – displacements = 10 – 8 = – 2

26. A particle is projected from ground in..................

Sol. Taking upward direction as positive

initial velocity can be obtained by II equ. of motion i.e.

$s = ut + 1/2\ at^2$

considering motion from C to A

$14 = u \times 0.8 - \frac{1}{2} \times 10 \times 0.8^2$

so, $u = \frac{43}{2}$ m/s

Let velocity magnitude at point A = v

so, $v = u - gt$

$v = \frac{43}{2} - 10 \times 0.8 = \frac{27}{2}$ m/s

Hence time taken from A to B i.e. till same level $= \frac{2v}{g} = 2.7$ s

Hence the time instant at which the particle comes to same level = 0.8 + 2.7 = 3.5 s $\quad$ **Ans.**

27. A particle is projected with speed.........................

Sol. $\frac{2v^2 \sin\theta \ \cos\theta}{g} = \frac{2v^2 \sin^2\theta}{2g}$

$\Rightarrow \tan\theta = 2, \sin\theta = \frac{2}{\sqrt{5}}, \; \cos\theta = \frac{1}{\sqrt{5}}$

$R = \frac{4v^2}{5g}$

28. The graph shows the variation of $\frac{1}{V}$ ....

Sol. At t = 3

$\text{Slope} = \frac{d\left(\frac{1}{V}\right)}{dt} = -1$

$\Rightarrow \; -\frac{1}{V^2}\frac{dV}{dt} = -1$

$\Rightarrow \; \left(\frac{1}{\sqrt{3}}\right)^2 \frac{dV}{dt} = 1 \Rightarrow a = \frac{dV}{dt} = 3 \text{ m/s}^2$

29. The position vector of a particle is given........................

Sol. $\vec{r} = (t^2 - 4t + 6)\hat{i} + t^2\hat{j}$;

$\vec{v} - \frac{d\vec{r}}{dt} = (2t-4)\;\hat{i} + 2t\;\hat{j} = (2t-4) + 2t,$

$\vec{a} = \frac{d\vec{v}}{dt} = 2\hat{i} + 2\hat{j}$

if $\vec{a}$ and $\vec{v}$ are perpendicular

$\vec{a}.\;\vec{v} = 0$

$2\hat{i} + 2\hat{j}).((2t-4)\hat{i} + 2t\hat{j}) = 0$

8t – 8 = 0

t = 1 sec.

Ans. t = 1 sec.

30. A particle moves in a straight line...............

Sol. Speed decreasing to zero uniformly. Let a be a positive constant (acceleration) then

v = a (T – t)

$s = \int_0^T v\;dt = \left[aTt - \frac{1}{2}at^2\right]_0^T = aT^2 - \frac{aT^2}{2} = \frac{1}{2}aT^2$

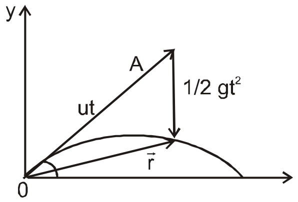
$a = \frac{2s}{T^2}$

$v = \frac{2S}{T^2}(T-t)$

Ans. $v = \frac{2S}{T^2}(T-t) = 1$ m/s

31. A particle is …………………….

Sol.



AB = 1/2 g(T/2)^2 = 1/8 gT^2

CD = 1/2 gT^2

T = 6 sec

32. A particle is moving along x-axis...............

Sol. $v = \frac{dx}{dt} = 0 - 9 + \frac{3t^2}{3}$

$v = t^2 - 9$

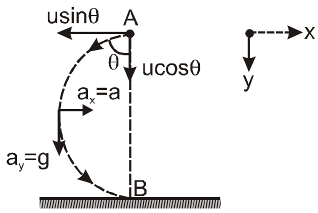
v = 0 at t = 3

Also, a = 2t

The particle's velocity will be zero at t = 3 sec. where it changes its direction of motion. For 0 < t < 3 sec. v is –ve and a is +ve so particle is slowing down.

33. A particle is …………………….

Sol.



For A to B

$s_x = u_x t + \frac{1}{2}a_x t^2$

$0 = -u\sin\theta\, t + \frac{1}{2}at^2$

$t = \frac{2u\sin\theta}{a} = \frac{2(5)\sin 37°}{6} = 1 \text{ sec.}$

$s_y = h = AB = u_y t + \frac{1}{2}a_y t^2 = u\cos\theta\, t + \frac{1}{2}gt^2$

$= (5)\left(\frac{4}{5}\right)(1) + \frac{1}{2}(10\,(1)^2 = 9 \text{ m}$

34. A particle which …………………….

Sol. At t = 2 sec (t = 2 sec)

$v_x = u_x + a_x t = 0 + 10 \times 2 = 20$ m/s

$v_y = u_y + a_y t = 0 - 5 \times 2 = -10$ m/s

$v = \sqrt{v_x^2 + v_y^2} = \sqrt{(20)^2 + (-10)^2} = 10\sqrt{5}$ m/s

From t = 0 to t = 4 sec

$x = \left[\frac{1}{2}\;(10)\;(2)^2\right]_{(0\to 2)} + \left[(10\times 2)\;\;2 - \frac{1}{2}(10)\;\;(2)^2\right]_{(2\to 4)}$

x = 40 m

$$y = \left[-\frac{1}{2}5\ \ (2)^2\right]_{(0 \to 2)} - \left[(10(2) - \frac{1}{2}(10)\ \ (2)^2\right]_{(2 \to 4)}$$

y = – 10 m

Hence, average velocity of particle between t = 0 to t = 4 sec is

$$v_{av} = \frac{|\Delta \vec{r}|}{\Delta t} = \frac{\sqrt{(40)^2 + (-10)^2}}{4}$$

$$v_{av} = \frac{5}{2}\sqrt{17}\ \text{m/s}$$

At t = 2 sec, u = 10 × 2 = 20 m/s

After t = 2sec

v = u + at

0 = 20 – 10 t

t = 2 sec.

Hence, at t = 4 sec. the particle is at its farthest distance from the y-axis.

The particle is at farthest distance from y-axis at $t \geq 4$. Hence the available correct choice is t = 4.

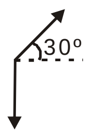
35. A particle is ……………………

Sol. For motion $\perp$ to incline $0 = (u \sin 30^o)\,t - \frac{1}{2}(g \cos 30^o)t^2$

$\Rightarrow$ $t = \frac{2u \sin 30^o}{g \cos 30^o}$ = 3 sec = Time of flight

$\Rightarrow$ at 1.5 sec, velocity is parallel to incline

$\Rightarrow$ angle between velocity & acceleration is 120º



for motion parallel to incline

$R = (u \cos 30^o)\,t - \frac{1}{2}(g \cos 30^o)\,t^2$ & t = 3 sec

$\Rightarrow$ R = 45 m

36. Two balls are ……………………

Sol. $T_1 = T_2 = T = \frac{2u \sin \alpha}{g \cos \theta}$

$$R_1 = u\cos\alpha T - \frac{1}{2}g \sin \theta T^2$$

$$R_2 = u\cos\alpha T + \frac{1}{2}g \sin \theta T^2$$

$R_2 - R_1 = g \sin \theta\, T_2^2$; $R_2 - R_1 = g \sin \theta\, T_1^2$

PART- III CHEMISTRY

37. Determine the sum ....

Sol. Total nodes (n – 1)

$5s \to 4$

$5p_x \to 4$

$5d_{xy} \to 4$

38. A mixture of 4.9 g ....

Sol. Moles of H_2SO_4 = 0.05 mol

$n_{H^+} = 0.1$ mol

$$n_{H_3PO_3} = \frac{200 \times \frac{1}{4}}{1000} = 0.05\ \text{mol}$$

$n_{H^+} = 0.1$ mol

$\left(n_{H^+}\right)_{total} = 0.2 = n_{OH^-}$

39. Given is : $aMn^{2+} + bPbO_2$..........

Sol The balanced chemical equation is

$$2Mn^{2+} + 5PbO_2 + 4H^+ \longrightarrow 2MnO_4^- + 5Pb^{2+} + 2H_2O$$

40. The average molar ....

Sol. $40 = \frac{16 \times 1 + 17 \times 2 + 2 \times M}{5}$

M = 75

41. The volume of Earth's ....

Sol. 1 g/mL = 1000 kg/m^3 = 10^{12} kg/(km)^3

Mass of water = density × volume = 10^{21} kg = 10^{24} g.

Moles of water molecules = 10^{24} / 18

Number of water molecules = $N_A \times 10^{24} / 18 = 3.33 \times 10^{46}$

42. On heating 4.9 g $KClO_3$..........

Sol. $KClO_3(s) \xrightarrow{\Delta} KCl(s) + 3/2\ O_2(g)$

Thus, loss in mass is due to O_2 escaped and so mass of O_2 formed is 0.384 g.

or Moles of $O_2 = \frac{0.384}{32} = 1.2 \times 10^{-2}$ mole

$\therefore$ Moles of $KClO_3 = \frac{2}{3} \times$ Moles of O_2

$\therefore$ Moles of $KClO_3 = \frac{1.2 \times 10^{-2}}{1.5} = 8 \times 10^{-3}$ Mole

and mass of $KClO_3$ decomposed = $8 \times 10^{-3} \times 122.5$

= 0.980 g

$\therefore$ % of decomposition = $\frac{0.980}{4.9} \times 100 = 20\%$

43. The formula of the ....

Sol. $Mg(OH)_2 + 2HA \longrightarrow MgA_2.nH_2O \xrightarrow[\Delta]{} MgO$

1 g   0.2 g

Apply POAC on Mg

$$\frac{1}{146+18n} = \frac{0.2}{40}$$

n = 3

44. For 1s orbital of hydrogen..........

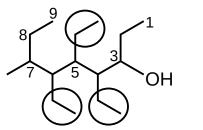
Sol. $\dfrac{R^2(a_o)}{R^2(0)} = \dfrac{(1/\pi a_o^3)\cdot e^{-2r/a_o}}{(1/\pi a_o^3)\cdot e^{o}} = e^{-2}$

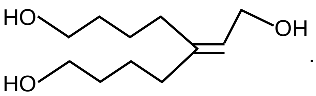
$\Rightarrow$ x = 1 & y = 2

$\Rightarrow$ x + y = 3

45. How many ethyl groups..........

Sol. Substituent ethyl groups are marked with circles:



46. 

....

Sol. Priority of functional group, followed by multiple bond.

47. How many of following ....

Sol. i, ii, iii, v, vi, viii & ix

have four DU and general formula is C_nH_{2n-6}.

49. Select incorrect ....

Sol. Number of electrons having $(n + \ell) \geq 4 = 17$ in $_{29}Cu$.

(in 3p, 3d, 4s)

50. An equimolar mixture ....

Sol. $NO + \frac{1}{2} O_2 \longrightarrow NO_2$

a   a   0

0 a/2   a

Initially $M_{avg} = \dfrac{a \times 30 + a \times 32}{2a} = 31$

"after reaction" LR is NO

Hence $M_{avg} = \dfrac{\frac{a}{2} \times 32 + a \times 46}{\frac{a}{2} + a}$

51. Which of the following ....

Sol. n = 4, ℓ = 2 and rFkk m = 0

52. A metal M can exist in ....

Sol. Let no. of atom for M^{+2} = a,

So no. of atom for M^{+3} = 0.8-a

2a + 3(0.8 – a) = 2

So, a = 0.4

54. Find out correct ....

Sol. Compound is heterocyclic aromatic containing 5 π bonded C atoms.

Resonance®
Educating for better tomorrow

ADVANCED PART TEST-1 (APT-1)
(JEE ADVANCED PATTERN)
TARGET : JEE (MAIN+ADVANCED) 2020

DATE : 14-07-2019 **COURSE : VIJAY (RJ1)**

ANSWER KEY

CODE-1

PAPER-1

PART- I MATHEMATICS

1.	(ACD)	**2.**	(CD)	**3.**	(ABD)	**4.**	(D)	**5.**	(BC)	**6.**	(ABCD)	**7.**	(A)
8.	(B)	**9.**	(D)	**10.**	(B)	**11.**	(E)	**12.**	(C)	**13.**	(A)	**14.**	(C)
15.	(B)	**16.**	(C)	**17.**	(D)	**18.**	(D)						

PART- II PHYSICS

19.	(BCD)	**20.**	(AC)	**21.**	(ABCD)	**22.**	(ABCD)	**23.**	(ABCD)	**24.**	(BD)	**25.**	(D)
26.	(B)	**27.**	(B)	**28.**	(A)	**29.**	(C)	**30.**	(C)	**31.**	(A)	**32.**	(A)
33.	(A)	**34.**	(C)	**35.**	(B)	**36.**	(B)						

PART- III CHEMISTRY

37.	(BC)	**38.**	(BC)	**39.**	(AD)	**40.**	(ABCD)	**41.**	(ABC)	**42.**	(ABC)	**43.**	(B)
44.	(B)	**45.**	(C)	**46.**	(C)	**47.**	(D)	**48.**	(B)	**49.**	(D)	**50.**	(C)
51.	(A)	**52.**	(B)	**53.**	(B)	**54.**	(C)						

PAPER-2

PART- I MATHEMATICS

1.	(23)	**2.**	(00)	**3.**	(10)	**4.**	(02)	**5.**	(05)	**6.**	(25)	**7.**	(09)
8.	(02)	**9.**	(00)	**10.**	(03)	**11.**	(05)	**12.**	(56)	**13.**	(BD)	**14.**	(BD)
15.	(AC)	**16.**	(AC)	**17.**	(ABC)	**18.**	(AB)						

PART- II PHYSICS

19.	(30)	**20.**	(26)	**21.**	(84)	**22.**	(52)	**23.**	(60)	**24.**	(16)	**25.**	(02)
26.	(07)	**27.**	(12)	**28.**	(03)	**29.**	(01)	**30.**	(01)	**31.**	(AD)	**32.**	(BCD)
33.	(AB)	**34.**	(ABC)	**35.**	(ACD)	**36.**	(ACD)						

PART- III CHEMISTRY

37.	(12)	**38.**	(40)	**39.**	(15)	**40.**	(75)	**41.**	(46)	**42.**	(20)	**43.**	(30)
44.	(27)	**45.**	(03)	**46.**	(07)	**47.**	(07)	**48.**	(05)	**49.**	(BD)	**50.**	(C)
51.	(AB)	**52.**	(AD)	**53.**	(BCD)	**54.**	(BC)						