MAIN PATTERN CUMULATIVE TEST-1 (MCT-1)

TARGET : JEE (MAIN+ADVANCED) 2021

DATE : 18-08-2019 **CODE-1** **COURSE : VIPUL (JB) | BATCH : 07,08,09,10JB**

HINTS & SOLUTIONS

PART-A : PHYSICS

1. A particle is .....

Sol. $t = \frac{\text{distance}}{\text{speed}}$

Since, speed of fly ≥ speed of particle so time taken by fly is less.

2. A particle, starting .....

Sol. $a = \frac{dv}{dt}$

$\int dv = \int a dt$

$\int dr = \int v dt$

3. A stone, thrown .....

Sol. $T = \frac{2u}{g}$

$u \to 2$ times $\Rightarrow$ $T \to 2$ times (i.e., 10 sec)

4. The velocity .....

Sol. V = a + bx

(V increases as x increases)

$\frac{dV}{dt} = b \frac{dx}{dt} = bV$

hence acceleration increases as V increases with x.

5. If $|\vec{A}| = |\vec{B}| = 1$ .....

Sol. $R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

A = 1 = B = R $\Rightarrow \theta = 120^\circ$

6. Position of .....

Sol. $v = 3t^2 - 12t + 3$

$a = 6t - 12 = 0$

$\Rightarrow t = 2$ sec.

v (t = 2 sec) = – 9 m/s

7. A particle moves .....

Sol. Given figure represents a regular pentagan so magnitude of AE = 10 metre.

8. A particle is .....

Sol. $v = u + at$

$\Rightarrow$ $20 = u + a \times 10$ .....(1)

$s_n = u + \frac{a}{2}(2n - 1)$

$\Rightarrow$ $10 = u + \frac{a}{2}(2 \times 10 - 1)$ .....(2)

on solving (1) and (2) we get

$a = 20$ m/s^2

9. If vectors .....

Sol. $\vec{P}.\vec{Q} = 0$ = $(a^2 - 2a - 3)$

$\Rightarrow a = 3$ & $a = -1$

10. For ground .....

Sol. $T_1 = \frac{2v_{y1}}{g}$

$T_2 = \frac{2v_{y2}}{g}$

$(v_{y2})^2 = (v_{y1})^2 - 2gh$

11. The displacement .....

Sol. Position vector of $\overline{A}$, $\overline{OA}$ $= 3\hat{i} + 4\hat{j} + 5\hat{k}$

Position vector of $\overline{B}$, $\overline{OB}$ $= 4\hat{i} + 5\hat{j} + 6\hat{k}$

Displacement vector $\overline{AB} = \overline{OB} - \overline{OA}$

$= \hat{i} + \hat{j} + \hat{k}$

12. Two particle .....

Sol. $H_A = H_B$

$u_A \sin\theta_A = u_B \sin\theta_B$

$\theta_A > \theta_B$

$u_A < u_B$.

13. If R and H .....

Sol. $\frac{R}{H} = \frac{\left(\frac{u^2 \sin 2\theta}{g}\right)}{\left(\frac{u^2 \sin^2\theta}{2g}\right)} = 4\cot\theta$

14. The displacement .....

Sol. $S = 10t - \frac{1}{2}(0.2)t^2$

$v = 10 - 0.2t = 0$

$t = \frac{10}{0.2} = 50$

15. The magnitude .....

Sol. $R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

A = 5 = B and $\theta = 60^\circ$

$\Rightarrow R = 5\sqrt{3}$ N

16. A body is .....

Sol. $\frac{1}{2}g \times 3^2 = \frac{g}{2}(2n-1)$

$n = 5$ sec.

$h = \frac{1}{2}g \times t^2 = \frac{1}{2} \times 10 \times 5^2$

$= 125$m.

18. Two stones .....

Sol. $h = \frac{1}{2}gt^2$

$t = \sqrt{\frac{2h}{g}} \Rightarrow t \alpha \sqrt{h} \Rightarrow t_1 : t_2 \sqrt{h_1} : \sqrt{h_2}$

19. A ball is thrown .....

Sol. At heighest point v = 0, so A = 0

20. The magnitude .....

Sol. $AB \sin\theta = \sqrt{3}\, AB \cos\theta$

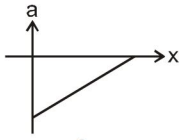
$\tan\theta = \sqrt{3}$

$\theta = \frac{\pi}{3}$

21. A particle moves .....

Sol. The linear relationship between V and x is
$V = -mx + C$ where m and C are positive constants.
$\therefore$ Acceleration

$a = V\frac{dV}{dx} = -m(-mx + C)$



$\therefore a = m^2x - mC$
Hence the graph relating a to x is.

22. The acceleration .....

Sol. $\frac{dV}{dt} = \frac{K}{v}$

$\int_{v_0}^{v} vdv = k\int_{0}^{\frac{v_0^2}{k}} dt$

$V = \sqrt{3}\, v_0$

23. $\frac{d}{dx}\left(x + \frac{1}{x}\right)$ .....

Sol. $\frac{d}{dx}\left(x + \frac{1}{x}\right) = 1 + \left(-\frac{1}{x^2}\right) = \frac{x^2 - 1}{x^2}$

24. A particle is .....

Sol. It is clear from the figure that acceleration does not change sign, i.e., does not change in direction. Only the magnitude of acceleration first increases and then decreases.
$\therefore$ Velocity keeps on increasing.
Hence displacement also keeps on increasing.

25. An object is .....

Sol. $AC = \frac{1}{2}gt^2 = 45$ m

$BC = 45\sqrt{3}$ m = u.t

$u = \frac{45}{\sqrt{3}} = 15\sqrt{3}$ m/s.

26. A juggler keeps .....

Sol. time of flight of each ball

$= 2\sqrt{2H/g} = 2\sqrt{\frac{2\times 20}{10}} = 4\,\text{sec}$

Hence, time interval between throwing two successive balls = 1 s.

Initial velocity $= \sqrt{2gH} = \sqrt{2\times 10\times 20} = 20\,\text{m/s}$

Hence required positions above his hands are

$h_2 = 20\times 1 - \frac{1}{2}\times 10\times 1^2 = 15$ m

$h_3 = 20\times 2 - \frac{1}{2}\times 10\times 2^2 = 20$ m

$h_3 = 20\times 3 - \frac{1}{2}\times 10\times 3^2 = 15$ m

27. A body is projected .....

Sol. Horizontal velocity $V_x = u_x = 18$ m/s

Now, $\tan 45^\circ = \frac{V_y}{V_x}$

$\therefore V_y = V_x = 18$ m/s.

28. A particle is .....

Sol. Let a be the retardation produced by resistive force, t_a and t_d be the time ascent and descent respectively.
If the particle rises upto a height h

then $h = \frac{1}{2}(g + a)t_a^2$ and $h = \frac{1}{2}(g - a)t_d^2$

$\therefore \frac{t_a}{t_d} = \sqrt{\frac{g-a}{g+a}} = \sqrt{\frac{10-2}{10+2}} = \sqrt{\frac{2}{3}}$

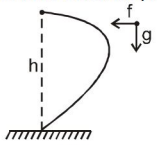
Ans. $\sqrt{\frac{2}{3}}$

29. A stone is .....

Sol. Time taken to reach the ground is

given by $h = \frac{1}{2}gt^2$ .... (1)

Since horizontal displacement in time t is zero



$\therefore t = \frac{2v}{f}$ .... (2)

$h = \frac{2gv^2}{f^2}$

30. If $y = \sqrt{\sin\sqrt{x}}$ .....

Sol. $$\frac{1}{2\sqrt{\sin\sqrt{x}}} \times \cos\sqrt{x} \times \frac{1}{2\sqrt{x}} = \frac{\cos\sqrt{x}}{4\sqrt{x\sin\sqrt{x}}}$$

PART-B : CHEMISTRY

31. Which of the following .....

Sol. Equal moles of gas at STP occupy same volume.

32. An element having .....

Sol. If element is B

$x = B_2$, molar mass (x) = $2\times\frac{a}{2}$ gram = a gram

$y = B_3$, molar mass (y) = $3\times\frac{a}{2}$ gram = $\frac{3a}{2}$ gram

let c moles are taken of both of the gases . So average molar mass = $\frac{\text{total mass}}{\text{total moles}}$

$$= \frac{\left(a+\frac{3a}{2}\right)c}{2c}$$

$$= \frac{5a}{4}.$$

34. A person adds .....

Sol. No. of carbon atom in glucose

$= \frac{1.71}{342} \times 12\ N_A = 3.6 \times 10^{22}$

35. The simplest radius .....

Sol. $r = 0.529 \times \frac{n^2}{z}$ Å

$$\frac{r_1}{r_2} = \frac{n_1^2\times Z_2}{Z_1\times n_2^2} = \frac{9\times 6}{3\times 16} = \frac{9}{8} = \frac{x}{y}$$

x + y = 17

37. Which of the following .....

Sol.

Sample	wt	Mol. wt.	n	n_C	w_C
Glucose $C_6H_{12}O_6$	20 g	180	$\frac{1}{9}$	$\frac{2}{3}$	$\frac{2}{3}\times 12 = 8$ g
Sucrose $C_{12}H_{22}O_{11}$	9.5 g	342	$\frac{1}{36}$	$\frac{1}{3}$	$\frac{1}{3}\times 12 = 4$ g
Urea NH_2CONH_2	40 g	60	$\frac{2}{3}$	$\frac{2}{3}$	8 g
Ethylene glycol $HO-CH_2-CH_2-OH$	$\frac{62}{3}$ g	62	$\frac{1}{3}$	$\frac{2}{3}$	8 g

38. A metal X has 1V .....

Sol. $K.E._{max} = 1$ eV

$\Rightarrow 1 = 3 - W$

$\Rightarrow W = 2$eV (work function)

$$\Rightarrow \lambda_0 = \frac{hc}{W}$$

$$= \frac{12400\text{ eV Å}}{2\text{ eV}} = 6200\text{ Å}$$

But $\lambda \le \lambda_0$ for photoelectric effect.

So, (1) and (4) are incorrect.

Also $\bar{\nu}_0 = \frac{1}{6200\times 10^{-10}} = \frac{10^8}{62}/\text{m} = \frac{10^6}{62}$ /cm

for photoelectric effect $\bar{\nu} \ge \bar{\nu}_0$

$\Rightarrow 2.5 \times 10^5$ /cm

$= \frac{10^6}{4}/\text{cm} = \frac{10^7}{40}$ /cm is more than $\bar{\nu}_0$.

Hence will cause photoelectric effect.

Also λ_{photon} of $\nu = 3 \times 10^{14}$ Hz

$$\lambda = \frac{3\times 10^8}{3\times 10^{14}} = 10^{-6}\text{ m}$$

$= 10000\text{ Å} > \lambda_0$

So no photoelectric effect.

39. A sodium street light .....

Sol. $\nu = \frac{c}{\lambda} = \frac{3\times 10^8}{5000\times 10^{-10}} = 6 \times 10^{14}\ s^{-1}$

$\bar{\nu} = \frac{1}{\lambda} = \frac{1}{5000\times 10^{-10}} = 2 \times 10^6\ m^{-1}$

40. Which of the following .....

Sol. (1) $E_2 - E_1 = 10.2 \times Z^2$ eV.

for any value of Z (1, 2, ...),

$E_2 - E_1 > 3.1$ eV

(2) $E_4 - E_3 = -0.85\ Z^2 + 1.51\ Z^2$ eV

$= 0.66\ Z^2$ eV

for Z = 2, $E_4 - E_3 = 2.64$ eV

which lie in visible region.

(3) $2 \rightarrow 6$ is absorption line in visible region in H-atom

(4) $E_5 - E_4 = -0.54\ Z^2 + 0.85\ Z^2 = 0.31\ Z^2$

if Z = 2, = 1.2 4 eV

if Z = 3 = 2.79 eV

41. Which of following .....

Sol. For H atom ($2 \longrightarrow 1$) transition, He^+ ($4 \longrightarrow 2$) transition and Li^{2+} ($6 \longrightarrow 3$) transition, emitted energy will be same $\left(\text{by } \frac{n_1}{n_3} = \frac{n_2}{n_4} = \frac{z_1}{z_2}\right)$

42. Which of the following .....

Sol. For both SO_2 & O_3, Atomicity = total number of atoms in 1 molecule = 3.

43. Three different .....

Sol. Volume of I^{st} gas = 3 × 22.4 = 67.2 L

Volume of II^{nd} gas = 2 × 22.4 = 44.8 L

Volume of III^{rd} gas = 4 × 22.4 = 89.6 L

So, order of volume will be III > I > II

44. Which graph shows .....

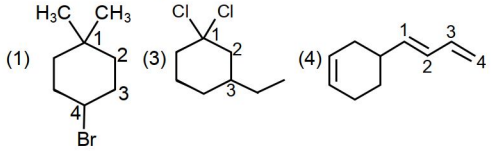
Sol. $E = \frac{hc}{\lambda} \quad \Rightarrow E\alpha\frac{1}{\lambda}$

45. Energy of electron .....

Sol. $E_n = \frac{-13.6Z^2}{n^2}$ eV

46. Which of the following .....

Sol. Correct numbering are :



47. In which of the .....

Sol. Compound having same type of atoms and same IHD possess same general formula.

48. Which of the following .....

Sol. Correct common name is : Ph—C(=O)—Ph-Benzophenone

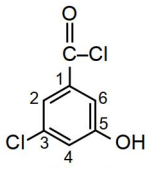
49. Which of the .....

Sol. $CH_3\overset{5}{-}CH(Br)\overset{4}{-}CH(Ph)\overset{3}{-}\overset{2}{C}H_2\overset{1}{-}CN$

4-Bromo-3-phenyl pentanitrile

50. What is the correct .....

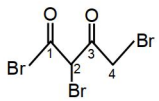
Sol.



3-Chloro-5-hydroxybenzenecarbonyl chloride

51. The correct IUPAC .....

Sol.



2,4-Dibromo-3-oxobutanamide

52. The number of metamers .....

Sol. $CH_3–O–CH_2–CH_2–CH_2–CH_3$; $CH_3–O–CH(CH_3)–CH_2–CH_3$;

$CH_3–O–CH_2–CH(CH_3)–CH_3$; $CH_3–O–C(CH_3)_2–CH_3$;

$CH_3–CH_2–O–CH_2–CH_2–CH_3$; $CH_3–CH_2–O–CH(CH_3)–CH_3$

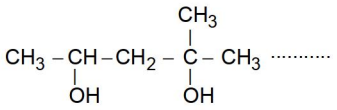
53. Ratio of σ to π bond .....

Sol. Number of σ bonds = 16

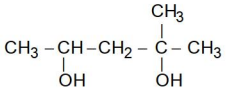
π bonds = 4

ratio = $\frac{16}{4} = \frac{4}{1}$.

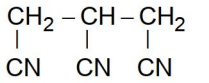
55. The IUPAC name of .....



Sol.



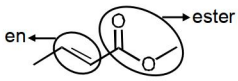
2-Methyl-2,4-pentanediol

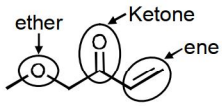


1,2,3-propanetricarbonitrile

56. Following compounds .....

Sol.





57. How many tertiary .....

Sol.

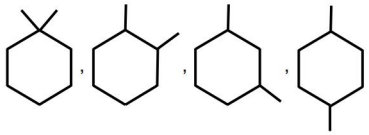
(Only one tertiary alcohol with $C_5H_{12}O$)

58. Relation between Ethyl.....

Sol. $Ph–\overset{O}{\overset{\|}{C}}–O–C_2H_5$ and $CH_3–CH_2–\overset{O}{\overset{\|}{C}}–O–Ph$ are metamers.

60. Total positional isomers.....

Sol.



PART-C : MATHEMATICS

61. The value of.....

Sol. $4\left[3\log_2\frac{81}{80}+5\log_2\frac{25}{24}+7\log_2\frac{16}{15}\right]$

$= 4\left[\log_2\left\{\left(\frac{81}{80}\right)^3\cdot\left(\frac{25}{24}\right)^5\cdot\left(\frac{16}{15}\right)^7\right\}\right]$

$= 4\log_2 2 = 4$

62. The solution of.....

Sol. Since $0 < \sin\frac{\pi}{3} < 1$, the inequality

$$\log_{\sin\frac{\pi}{3}}(x^2-3x+2) \geq 2$$

$$\Rightarrow x^2-3x+2 \leq \sin^2\frac{\pi}{3} \text{ and } x^2-3x+2>0$$

$$\Rightarrow 4x^2-12x+5 \leq 0 \text{ and } x^2-3x+2>0$$

$\Rightarrow$ $(2x-1)(2x-5) \leq 0$ and

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

$$\Rightarrow \frac{1}{2} \leq x \leq \frac{5}{2} \text{ and } (-\infty < x < 1 \text{ or } 2 < x < \infty)$$

$$\Rightarrow \left[\frac{1}{2},1\right) \cup \left(2,\frac{5}{2}\right]$$

63. A real polynomial.....

Sol. $p(x) = (ax+b)(x-4)(x+3)$

$p(3) = (3a+b)(-1)(6) = 24$

$3a + b = -4$ .....(1)

$p(7) = (7a+b)(3)(10) = 120$

$7a + b = 4$ .....(2)

$-4a = -8$

$a = 2$, $b = 4 - 7.2 = -10$

$\therefore p(x) = (2x-10)(x-4)(x+3)$

64. The value of a for which.....

Sol. Multiply by $x \rightarrow x^3 + ax + 1 = 0$

$\Rightarrow x^4 + ax^2 + x = 0$ ...(1)

$x^4 + ax^2 + 1 = 0$ ....(2)

(1) – (2) $\Rightarrow$ $x = 1$ is common roots

so $1 + a + 1 = 0 \Rightarrow a = -2$

65. If $\log_{10}(\log_{10}x^3 - 2)$ .....

Sol. $\log_{10}\{(3\log_{10}x - 2)\log_{10}x\} = 0$

$\Rightarrow$ $(3\log_{10}x - 2)\log_{10}x = 10^0 = 1$

$\Rightarrow$ $(3\log_{10}x+1)(\log_{10}x - 1) = 0$

$$\Rightarrow \log_{10}x = -\frac{1}{3}, 1 \Rightarrow x = 10^{-1/3}, 10$$

$$\Rightarrow x = \frac{1}{\sqrt[3]{10}}, 10 ;$$

$x = \frac{1}{(10)^{1/3}}$ is rejected. Since it does not lie in domain.

66. If α, β are the roots.....

Sol. $\alpha + \beta = -\frac{b}{a}$, $\alpha\beta = \frac{c}{a}$

$a\alpha + b = -a\beta$

$a\beta + b = -a\alpha$

$$\therefore \frac{\alpha}{a\beta+b} + \frac{\beta}{a\alpha+b} = -\frac{2}{a}$$

67. The number of positive.....

Sol. $$\frac{x^2(3x-4)^3(x-2)^4}{(x-5)^5(2x-7)^6} \leq 0$$

$$x \in \{0\} \cup \left[\frac{4}{3},\frac{7}{2}\right) \cup \left(\frac{7}{2},5\right)$$

$\Rightarrow$ 3

68. Sum of all the positive.....

Sol. $f(x) = (x-1)(x^2 - 7x + 13)$ is prime

$\Rightarrow x - 1 = 1$ or $x^2 - 7x + 13 = 1$

$x = 2, 3, 4$

69. Number of ordered.....

Sol. $x^2 + y^2 - 24x - 26y + 12^2 + 13^2 = 0$

$\Rightarrow (x-12)^2 + (y-13)^2 = 0$

$\Rightarrow x = 12; y = 13$

$\Rightarrow$ exactly one ordered pair (12, 13)

70. If the sum of all the.....

Sol. Let n denote the number of sides of the given convex polygon and x the number of degrees in the excepted angle. Then $180(n-2) = 2190 + x$, so that

$$n - 2 = \frac{2190}{180} + \frac{x}{180}$$

Since the polygon is convex, $0 < x < 180$; it follows that

$$\frac{2190}{180} < n - 2 < \frac{2190}{180} + 1,$$

i.e $12\frac{1}{6} < n - 2 < 13\frac{1}{6}$ Since n is an integer, this forces $n - 2 = 13$, so $n = 15$.

(Incidentally,(13)(180) = 2340 = 2190 + 150, so the excepted angle has measure 150^0.)

71. If a, b and c are real.....

Sol. $a^2 + b^2 + c^2 + 6a + 4c + 2b = -14$

$(a+3)^2 + (b+1)^2 + (c+2)^2 = 0$

$\Rightarrow$ $a = -3$, $b = -1$ and $c = -2$

$$\text{so } \frac{a^2+b^2+c^2}{2} = \frac{9+1+4}{2} = 7$$

72. If $\frac{\log_5(x^2-5x+7)}{\log_5(0.001)} > 0$.....

Sol. $\log_5(0.001) < 0$

$\log_5(x^2 - 5x + 7) < 0$

$\Rightarrow x^2 - 5x + 7 > 0$ $\Rightarrow \forall\, x \in R$

and $x^2 - 5x + 7 < 1$

or $x^2 - 5x + 6 < 0$

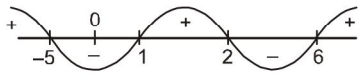
$\Rightarrow$ $x \in (2, 3)$

73. The complete solution.....

Sol. $\frac{x^2(x^2-3x+2)}{x^2-x-30} \geq 0 \Rightarrow \frac{x^2(x-1)(x-2)}{(x+5)(x-6)} \geq 0$

$x \neq -5,6$

$x \in (-\infty, -5) \cup [1, 2] \cup (6, \infty) \cup \{0\}$



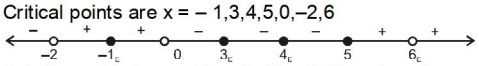
74. The set of all real.....

Sol. Given $\frac{(x+1)^2(x-3)^4(x-5)^5(x-4)^8(x-2)}{x(x^2-4)(x-6)^2} \leq 0$

$x - 2 \neq 0$

then $\frac{(x+1)^2(x-3)^4(x-5)^5(x-4)^8}{x(x+2)(x-6)^2} \leq 0$

Critical points are x = – 1,3,4,5,0,–2,6



Solution set is $(-\infty, -2) \cup (0, 5] \cup \{-1\}$ and $x \neq 2$

Ans. $(-\infty, -2) \cup (0, 2) \cup (2, 5] \cup \{-1\}$

75. If $x = \sqrt{3} + \sqrt{4}$ .....

Sol. $x = \sqrt{3} + \sqrt{4}$

$\frac{1}{x} = \sqrt{4} - \sqrt{3}$

$x + \frac{1}{x} = 4$

$\left(x^3 + \frac{1}{x^3}\right) = \left(x + \frac{1}{x}\right)^3 - 3\left(x + \frac{1}{x}\right)$

$= 4^3 - 3 \times 4 = 52$

76. If a, b, c ∈ R and the.....

Sol. a > 0, Let $f(x) = ax^2 + bx + c$

$\left.\begin{array}{l} f(1) = a+b+c > 0 \\ f(0) = c > 0 \end{array}\right\}$ .....(1)

a < 0

$\left.\begin{array}{l} f(1) = a+b+c < 0 \\ f(0) = c < 0 \end{array}\right\}$ .....(2)

(1) & (2) $\Rightarrow$ c (a + b + c) > 0

77. If $6P_6 - 9P_4 + \lambda = 0$ .....

Sol. on calculation we get $2P_6 - 3P_4 = -1$

$\Rightarrow \lambda = 3 \Rightarrow 2\lambda = 6.$

78. If a, b, c, d ∈ R.....

Sol. $D = 16a^2 b^2 c^2 d^2 + 4(a^4 + b^4)(c^4 + d^4)$

$= 4(a^4c^4 + b^4 d^4 + 2a^2 b^2 c^2 d^2 + a^4 d^4 + b^4c^4 + 2a^2b^2 c^2 d^2)$

$= 4[(a^2c^2 + b^2d^2)^2 + (a^2d^2 + b^2c^2)^2] > 0$

$\therefore$ roots are real and distinct

79. Let $f(x) = ax^2 + bx + c$.....

Sol. $D = b^2 - 4ac$

$= (2a + c)^2 - 4ac = 4a^2 + c^2 > 0$

Alter

$\because 2a + b + c = 0$

$\Rightarrow 4a + 2b + c + c = 0$

$\Rightarrow f(2) + f(0) = 0$

$\Rightarrow$ either f(2) = 0 = f(0) or f(0).f(2) < 0

$\Rightarrow$ either 0 and 2 are roots or one root lies in (0, 2)

80. If p and q are the.....

Sol. $\sqrt{7^{2x^2-5x-6}} = \left(\sqrt{2}\right)^{3\log_2 49}$

squaring both sides, we get

$7^{2x^2-5x-6} = 2^{3\log_2 49} = (49)^3 = 7^6$

$\Rightarrow 2x^2 - 5x - 6 = 6 \Rightarrow 2x^2 - 5x - 12 = 0$

$\Rightarrow (x - 4)(2x + 3) = 0$

$\Rightarrow x = 4$ or $x = -\frac{3}{2}$

$\therefore 5p + 2q = 20 - 3 = 17$

81. If one root of equation.....

Sol. roots $\rightarrow \alpha, 2\alpha$

product $= 2\alpha^2 = 1 \Rightarrow \alpha = \pm \frac{1}{\sqrt{2}}$

a = – sum of roots $= \pm\left(\sqrt{2} + \frac{1}{\sqrt{2}}\right) = \pm \frac{3}{\sqrt{2}}$

$a = \frac{3}{\sqrt{2}}$

82. If in a triangle ABC.....

Sol. $\frac{\tan A}{\tan B} = \frac{1}{3} \Rightarrow \frac{\sin A.\cos B}{\cos A.\sin B} = \frac{1}{3}$

Put $\sin A.\cos B = \frac{1}{4}$ $\therefore \cos A.\sin B = \frac{3}{4}$

$\therefore \sin(A + B) = \frac{1}{4} + \frac{3}{4} = 1$

or या $\sin C = 1 = \sin \frac{\pi}{2}$

$\therefore C = \frac{\pi}{2}$ hence triangle is right angled.

83. If $x \cos\alpha + y \sin\alpha = 2a$.....

Sol. α and β are the roots of

$x \cos\theta + y \sin\theta = 2a$

$2a - x \cos\theta = y \sin\theta$

$4a^2 + x^2 \cos^2\theta - 4a\, x \cos\theta = y^2 \sin^2\theta$

$(x^2 + y^2)\cos^2\theta - 4a\, x \cos\theta + 4a^2 - y^2 = 0$

$\cos\alpha + \cos\beta = \frac{4ax}{x^2 + y^2}$

$\cos\alpha \cos\beta = \frac{4a^2 - y^2}{x^2 + y^2}$

$4\sin^2\frac{\alpha}{2}\sin^2\frac{\beta}{2} = 1$

$(1 - \cos\alpha)(1 - \cos\beta) = 1 \Rightarrow y^2 = 4a(a - x)$

84. If α, β, γ are the roots.....

Sol. $x^3 + px^2 + qx + r = (x - \alpha)(x - \beta)(x - \gamma)$

$1 + p + q + r = (1 - \alpha)(1 - \beta)(1 - \gamma)$

$-1 + p - q + r = -(1 + \alpha)(1 + \beta)(1 + \gamma)$

$(1 + q)^2 - (p + r)^2 = (1 - \alpha^2)(1 - \beta^2)(1 - \gamma^2)$

85. The product of roots.....

Sol. $x^2 - 3kx + 2k^2 - 1 = 0, \quad k > 0$

roots be real

$D \geq 0$

$9k^2 - 8k^2 + 4 \geq 0$

$k^2 + 4 \geq 0 \qquad \forall\ k \in R$

$2k^2 - 1 = 7$

$2k^2 = 8$

$k^2 = 4$

$k = \pm 2$

$\therefore \quad k = 2$accepted

86. If the difference between.....

Sol. $x^2 + ax + 1 = 0$

Let α, β be roots of above equation

$\alpha + \beta = -a$

$\alpha\beta = 1$

$|\alpha - \beta| = 2\sqrt{3}$

$\Rightarrow \quad (\alpha - \beta)^2 = 12$

$\Rightarrow \quad (\alpha + \beta)^2 - 4\alpha\beta = 12$

$\Rightarrow \quad a^2 - 4 = 12$

$\Rightarrow \quad a^2 = 16 \quad \Rightarrow \qquad a = \pm 4$

87. The complete set of.....

Sol. $D < 0$

$4(k-2)^2 - 4(-2k^2 - 5k + 6) < 0$

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

$(3k - 2)(k + 1) < 0$

$k \in \left(-1, \frac{2}{3}\right)$

88. If the equation $2x^2 + x$.....

Sol. Since roots of $2x^2 + x + 1 = 0$ are imaginary

so both roots must be common

$\frac{a}{2} = \frac{b}{1} = \frac{2}{1} \quad \therefore \quad a = 4, b = 2$

89. Which of the following.....

Sol. $a > 0$ & $c < 0$ is satisfied by (2) only

[$\because$ $f(0) = 0$ & $a > 0$] Further in (2)

$-\frac{b}{2a} > 0 \quad \Rightarrow b < 0 \quad [\because\ a > 0].$

90. If $\cos\alpha + \cos\beta = a$.....

Sol. $\frac{\cos 3\theta}{\cos\theta} = \frac{4\cos^3\theta - 3\cos\theta}{\cos\theta} = 4\cos^2\theta - 3$

$= 2(1+\cos 2\theta) - 3$

$= 2\cos 2\theta - 1$

$= 2\cos(\alpha - \beta) - 1$

$= 2(\cos\alpha\cos\beta + \sin\alpha\sin\beta) - 1$ .....(1)

Now $a^2 + b^2 = 2 + 2\cos\alpha\cos\beta + 2\sin\alpha\sin\beta$

so from (1) $\frac{\cos 3\theta}{\cos\theta} = a^2 + b^2 - 2 - 1$

$= a^2 + b^2 - 3$

MAIN PATTERN CUMULATIVE TEST-1 (MCT-1)

TARGET : JEE (MAIN+ADVANCED) 2021

DATE : 18-08-2019 **CODE-1** **COURSE : VIPUL (JB) | BATCH : 07,08,09,10JB**

ANSWER KEY

PART-A (PHYSICS)

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

PART-B (CHEMISTRY)

31.	(4)	**32.**	(2)	**33.**	(3)	**34.**	(1)	**35.**	(1)	**36.**	(4)	**37.**	(2)
38.	(3)	**39.**	(3)	**40.**	(1)	**41.**	(3)	**42.**	(3)	**43.**	(2)	**44.**	(4)
45.	(3)	**46.**	(2)	**47.**	(1)	**48.**	(3)	**49.**	(4)	**50.**	(3)	**51.**	(2)
52.	(4)	**53.**	(4)	**54.**	(3)	**55.**	(3)	**56.**	(3)	**57.**	(1)	**58.**	(1)
59.	(4)	**60.**	(2)										

PART-C (MATHEMATICS)

61.	(2)	**62.**	(3)	**63.**	(4)	**64.**	(1)	**65.**	(1)	**66.**	(2)	**67.**	(2)
68.	(1)	**69.**	(2)	**70.**	(2)	**71.**	(2)	**72.**	(1)	**73.**	(2)	**74.**	(4)
75.	(2)	**76.**	(4)	**77.**	(3)	**78.**	(3)	**79.**	(4)	**80.**	(1)	**81.**	(3)
82.	(1)	**83.**	(3)	**84.**	(1)	**85.**	(2)	**86.**	(4)	**87.**	(1)	**88.**	(3)
89.	(2)	**90.**	(2)										