07/12/2025

SET-2_ONLINE

Aakash
Medical | IIT-JEE | Foundations

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18,
Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***+91-1244168300

MM : 180 AIATS For One Year JEE(Advanced)-2026 (XII Passed)_Test-2A_Paper-2_ONLINE **Time : 180 Min.**

CHEMISTRY

Section-I

1. (D)

2. (D)

3. (C)

4. (D)

Section-II

5. (A,C,D)

6. (A,B,C)

7. (A,B,C,D)

Section-III

8. (8)

9. (5)

10. (4)

11. (5)

12. (23)

13. (5)

Section-IV

14. (02.00)

15. (07.00)

16. (09.00)

17. (03.00)

MATHEMATICS

Section-I

18. (B)

19. (D)

20. (C)

21. (D)

Section-II

22. (B,C)

23. (A,B)

24. (A,B,D)

Section-III

25. (1)

26. (42)

27. (0)

28. (4)

29. (372)

30. (10)

Section-IV

31. (04.00)

32. (01.00)

33. (25.00)

34. (18.00)

PHYSICS

Section-I

35. (C)

36. (B)

37. (D)

38. (C)

Section-II

39. (B,D)

40. (B,D)

41. (B,C)

Section-III

42. (10)

43. (6)

44. (2)

45. (2)

46. (9)

47. (1)

Section-IV

48. (04.00)

49. (01.50)

50. (02.50)

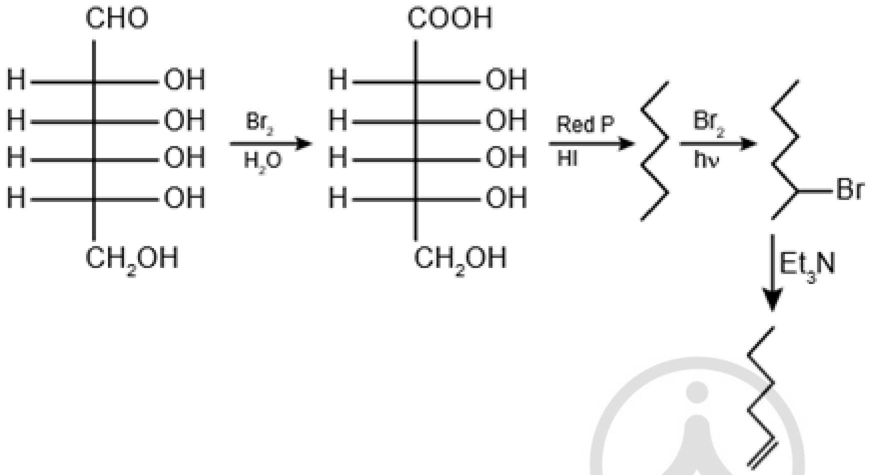
51. (01.00)

Hints and Solutions

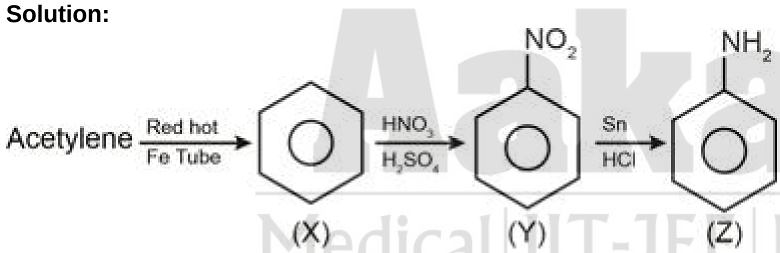
CHEMISTRY

Section-I

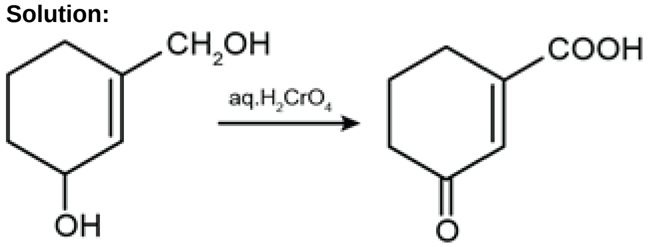
(1) **Answer :** (D)
Hint:
Et_3N is a bulky base.
Solution:



(2) **Answer :** (D)
Hint:
Polymerisation, nitration and reduction.
Solution:



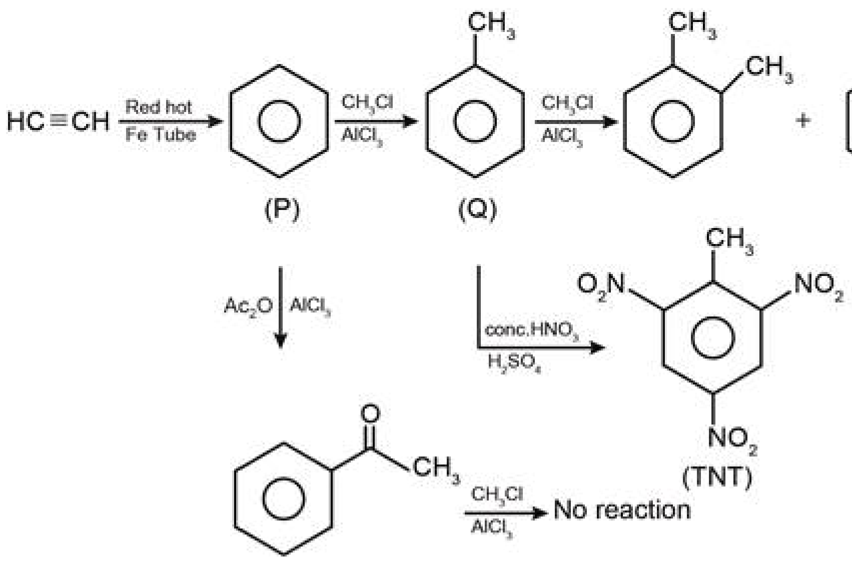
(3) **Answer :** (C)
Hint:
aq. H_2CrO_4 is a strong oxidising agent.
Solution:



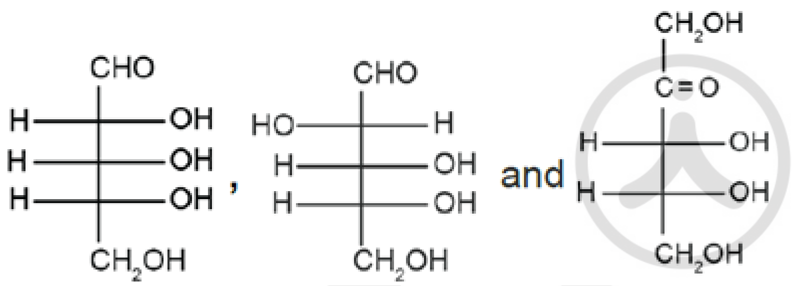
(4) **Answer :** (D)
Hint:
Nylon is a condensation polymer.
Solution:
Nylon is a condensation polymer.

Section-II

(5) **Answer :** (A,C,D)
Hint:
Polymerisation and Friedel Craft reactions.
Solution:

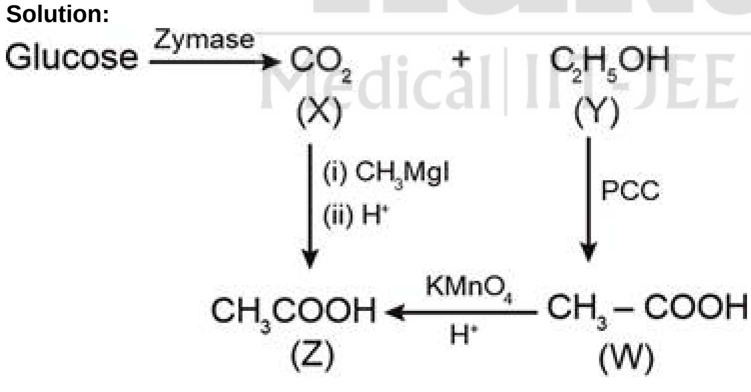


(6) **Answer :** (A,B,C)
Hint:
Osazone forms at top two carbons only.
Solution:



forms same osazone on reaction with Ph – NH – NH_2

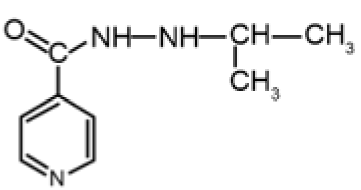
(7) **Answer :** (A,B,C,D)
Hint:
Zymase breaks down glucose to give ethanol and CO_2.
Solution:



Section-III

(8) **Answer :** 8
Hint:
Iproniazid has 8 sp^2 hybridised atoms.
Solution:

Iproniazid:



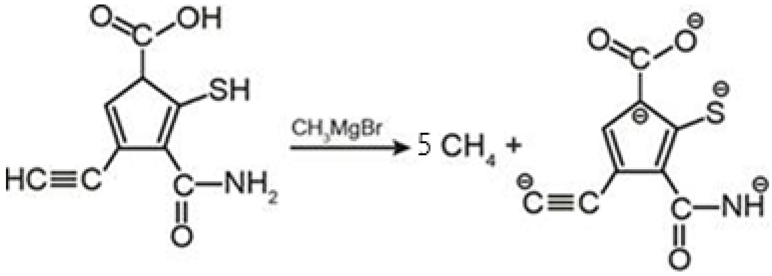
no. of sp^2 hybridised atoms = 6 (C) + 1(N) + 1(O) = 8

(9) **Answer :** 5

Hint:

CH_3MgBr accepts H^+ to give CH_4.

Solution:

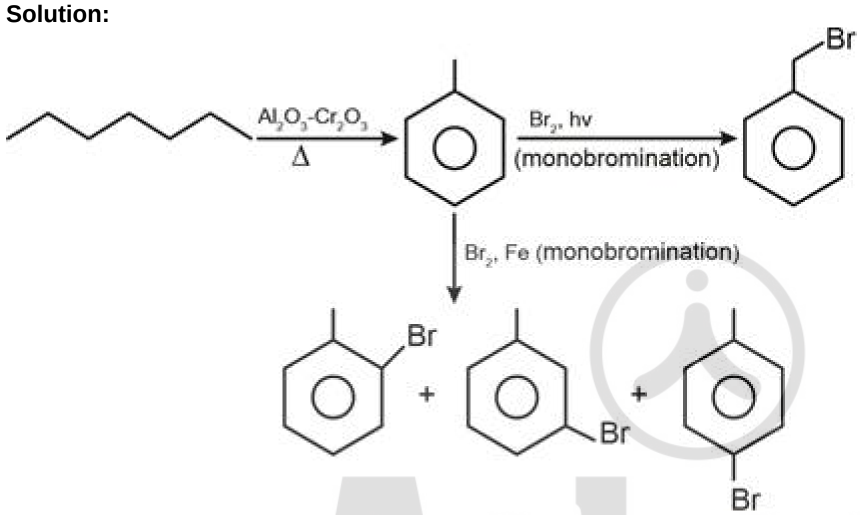


(10) **Answer :** 4

Hint:

Toluene forms due to aromatisation.

Solution:



(11) **Answer :** 5

Hint:

Green house gases are:

Carbon dioxide, methane, ozone, chlorofluorocarbon, water vapour

Solution:

Green house gases are:

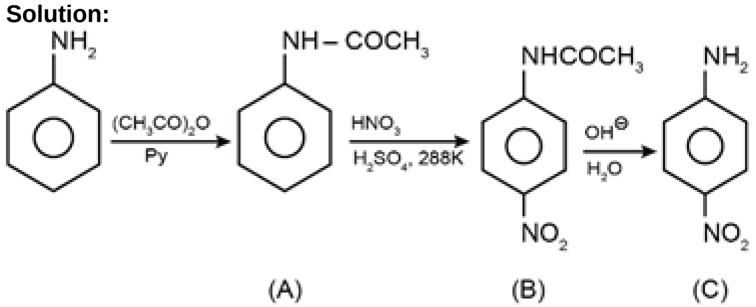
Carbon dioxide, methane, ozone, chlorofluorocarbon, water vapour

(12) **Answer :** 23

Hint:

Acetylation of aniline

Solution:



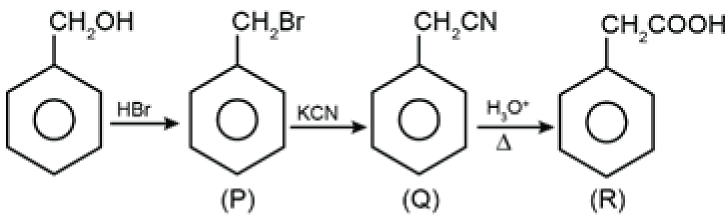
molar mass of C = 138 g/mol

(13) **Answer :** 5

Hint:

S_N1, S_N2 followed by hydrolysis

Solution:



D.U. of (R) = 5

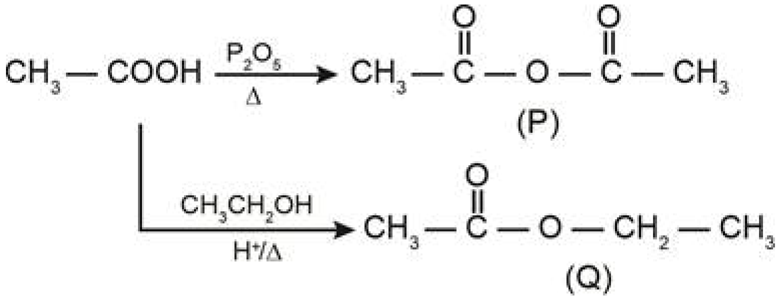
Section-IV

(14) **Answer :** 02.00

Hint:

P_2O_5 forms anhydride by dehydration.

Solution:



x = 4, y = 3, u = 4, v = 2

(x – v) = 4 – 2 = 2

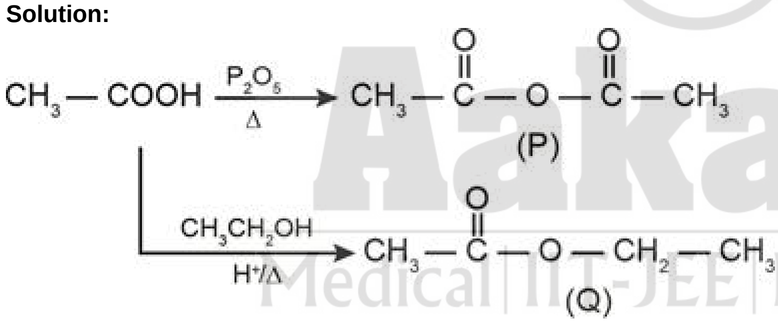
(y + u) = 3 + 4 = 7

(15) **Answer :** 07.00

Hint:

P_2O_5 forms anhydride by dehydration.

Solution:



x = 4, y = 3, u = 4, v = 2

(x – v) = 4 – 2 = 2

(y + u) = 3 + 4 = 7

(16) **Answer :** 09.00

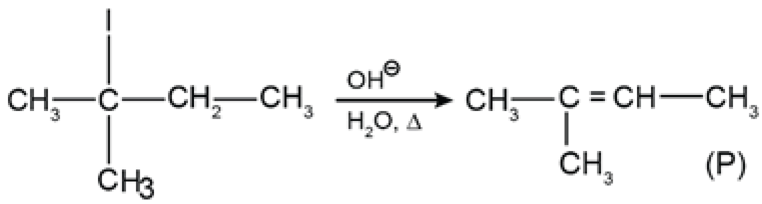
Hint:

Reaction-I follows E_1 while

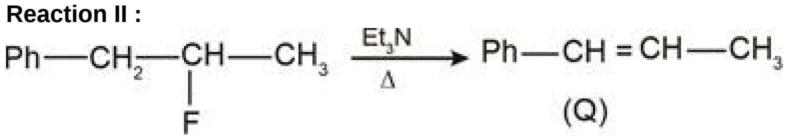
Reaction-II follows E_1cb mechanism

Solution:

Reaction I :



Reaction II :



x = 9, y = 3

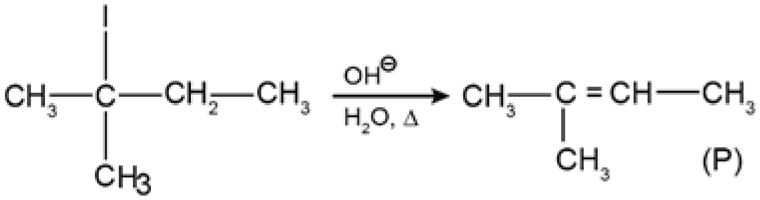
(17) **Answer :** 03.00

Hint:

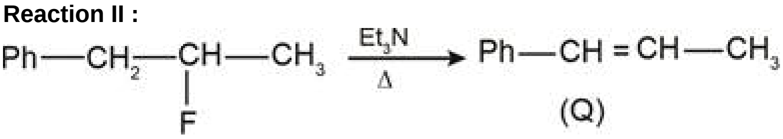
Reaction-I follows E_1 while
Reaction-II follows E_1cb mechanism

Solution:

Reaction I :



Reaction II :



x = 9, y = 3

MATHEMATICS

Section-I

(18) **Answer :** (B)

Hint:

$f'(0^+) = \lim\limits_{x \to 0^+} \left(\frac{f(x)-f(0)}{x-0}\right)$

Solution:

At $x = 0$

$f'(0^+) = \lim\limits_{x \to 0^+} \left(\frac{f(x)-f(0)}{x-0}\right)$

$= \lim\limits_{x \to 0^+} \left(\frac{3x^3\left|\sin\left(\frac{2\pi}{x}\right)\right|-0}{x-0}\right) = 0$

$\lim\limits_{x \to 0^-} \left(\frac{3x^3\left|\sin\left(\frac{2\pi}{x}\right)\right|-0}{x-0}\right) = 0$

At $x = 2$,

$f'(2^+) = \lim\limits_{x \to 2^+} \left(\frac{f(x)-f(2)}{x-2}\right)$

$= \lim\limits_{x \to 2^+} \left(\frac{3x^3\left|\sin\left(\frac{2\pi}{x}\right)\right|-0}{x-2}\right)$

$= \lim\limits_{x \to 2^+} \frac{3x^3\left(\sin\frac{2\pi}{x}\right)}{x-2}$

$= 12\pi$

$f'(2^-) = \lim\limits_{x \to 2^-} \left(\frac{f(x)-f(2)}{x-2}\right)$

$= \lim\limits_{x \to 2^-} \left(\frac{3x^3\left|\sin\left(\frac{2\pi}{x}\right)\right|-0}{x-2}\right)$

$= \lim\limits_{x \to 2^-} \frac{-3x^3\sin\frac{2\pi}{x}}{x-2} = -12\pi$

LHD ≠ RHD for $x = 2$

(19) **Answer :** (D)

Hint:

$2a \geq \frac{5}{x^2} - \frac{3}{x^3}$

Solution:

$2ax^2 + \frac{3}{x} \geq 5$

$2ax^2 > 5 - \frac{3}{x}$

$\Rightarrow\ 2a \geq \frac{5}{x^2} - \frac{3}{x^3}$

Let us consider,

$f(x) = \frac{5}{x^2} - \frac{3}{x^3}$

$f'(x) = \frac{-10}{x^3} + \frac{9}{x^4} = 0$

⇒ $f'(x) = 0$, when $x = \frac{9}{10}$

$2a \geq \frac{5.10^2}{9^2} - \frac{3.10^3}{9^3}$

$2a \geq \frac{4500-3000}{9^3}$

$a \geq \frac{1500}{2.9^3}$

$a \geq \frac{250}{243}$

(20) **Answer :** (C)

Hint:

Centroid = $\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$

Solution:

Take point $A(x_1, y_1)$ & $D(\alpha,\beta)$

$D = \left(\frac{1+5+x_1}{3}, \frac{3+7+y_1}{3}\right) = (\alpha, \beta)$

$x_1 = 3\alpha - 6$

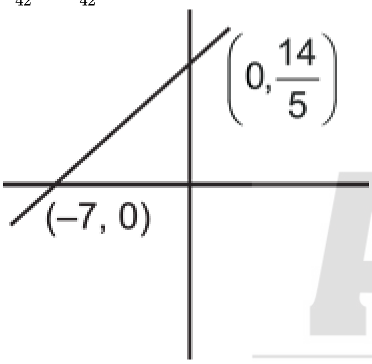
$y_1 = 3\beta - 10$

Point $A(x_1, y_1)$ moves on $2x - 5y + 4 = 0$

$2x_1 - 5y_1 + 4 = 0$

$2(3\alpha - 6) - 5(3\beta - 10) + 4 = 0$

$\frac{-6\alpha}{42} + \frac{15\beta}{42} = 1$



Area = $\frac{1}{2} \times 7 \times \frac{14}{5} = \frac{98}{10} = \frac{49}{5}$

(21) **Answer :** (D)

Hint:

$x \in (2,3)$ ⇒ $[x] = 2$

Solution:

$f : (4, 5) \rightarrow \left(\frac{1}{34}, \frac{4}{29}\right)$

$f(x) = \frac{16-3x}{5x+9} = y$

⇒ $5xy + 9y + 3x = 16$

$x = \frac{16-9y}{5y+3}$ ⇒ $f^{-1}(x) = \frac{16-9x}{5x+3}$

$f^{-1}\left(\frac{5}{63}\right) = \frac{9}{2}$

Section-II

(22) **Answer :** (B,C)

Hint:

$n_1 = 16.15.14.13 = 43680$

Solution:

$n_1 = 16.15.14.13 = 43680$

$n_2 = {}^{16}C_4 = 1820$

$n_4 = 16.16.16 = 4096$

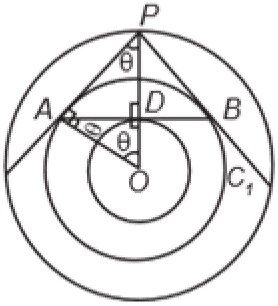
$n_3 = a \geq 1,\ b \leq 14$

For $a = 1, 2$ $b = 1, 2, \ldots, 14$

$a = 3$
$b = 2, 3, \ldots, 14$

$\vdots$
$a = 15$
$b = 14$
$n_3 = (1 + 2 + \ldots +14) + 14 = 119$

(23) **Answer :** (A,B)
Hint:
$r_2^2 = r_1 r_3$
Solution:



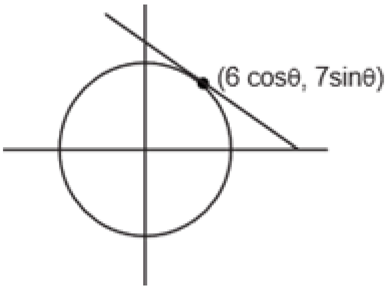
Take $OP = r_3$, $OA = r_2$
$OD = r_1 = \sqrt{4+16-6} = \sqrt{14}$
$r_3 = \sqrt{4+16+24} = \sqrt{44}$
In ΔAPO,
$\sin\theta = \frac{r_2}{r_3}$
In ΔADO,
$\sin\theta = \frac{r_1}{r_2}$
$\Rightarrow r_2^2 = r_1 r_3$
$4 + 16 - C = 2\sqrt{154}$
$C = 20 - 2\sqrt{154}$

(24) **Answer :** (A,B,D)
Hint:
$n(A - B) = n(A) - n(A \cap B)$
Solution:
$= n(A - B) = n(A) - n(A \cap B)$
$= 4 - n(A \cap B)$
$= 0 \le n(A-B) \le 4$
$5 \le n(B-A) \le 9$
$n(A\Delta B) = n(A\cup B) - n(A\cap B)$
$9 \le n(A\cup B) \le 13$
$5 \le n(A\Delta B) \le 13$

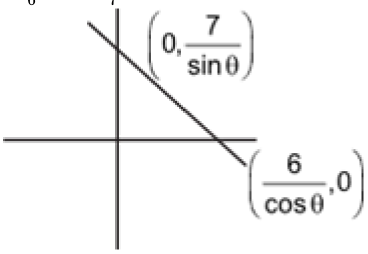
Section-III

(25) **Answer :** 1
Hint:
kln6.ln3 = ln6.ln3
Solution:
$\lim\limits_{x\to 0^+} \frac{6^x(3^x-1)-(3^x-1)}{x^2}$
$= \lim\limits_{x\to 0^+} \frac{(6^x-1)}{x} \cdot \frac{(3^x-1)}{x}$
$= \lim\limits_{x\to 0^+} \ln 6 \cdot \ln 3$
$= \ln 6 \cdot \ln 3$
$\Rightarrow k\ln 6 \cdot \ln 3 = \ln 6 \cdot \ln 3$
$\Rightarrow k = 1$

(26) **Answer :** 42
Hint:
$\frac{x\cos\theta}{6} + \frac{y\sin\theta}{7} = 1$
Solution:
Equation of tangent at (6cosθ, 7sinθ) is:



$\frac{x\cos\theta}{6} + \frac{y\sin\theta}{7} = 1$



Minimum Area = $\left|\frac{1}{2} \times \frac{6\times7}{\sin\theta\cos\theta}\right|$ = 42

(27) **Answer :** 0

Hint:

$5x = -\sin(\pi + \sin^{-1} 2x)$

Solution:

$\sin^{-1} 5x = -\pi - \sin^{-1} 2x$

$5x = -\sin(\pi + \sin^{-1} 2x)$

$5x = \sin(\sin^{-1} 2x)$

$3x = 0$

$\Rightarrow x = 0$

But $x = 0$, doesn't satisfy given equation

(28) **Answer :** 4

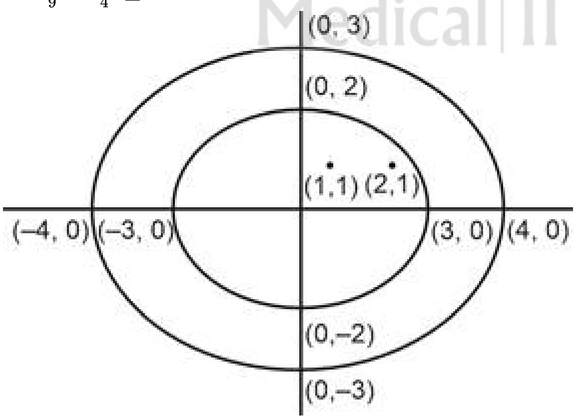
Hint:

Number of relations from set A to set $B = 2^{mn}$

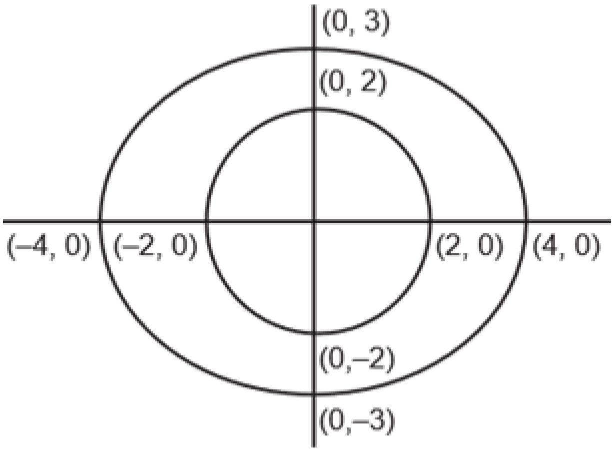
Solution:

$A : \frac{x^2}{16} + \frac{y^2}{9} \le 1$

$B : \frac{x^2}{9} + \frac{y^2}{4} \le 1$



$n(A \cap B) = 2$



$n(A \cap C) = 1$
Number of relations from $A \cap B$ to $A \cap C$ is
$2^{2\times1} = 4$

(29) **Answer :** 372
Hint:
Let $f(t) = t^4 + at^3 + bt^2 + ct + d$
Solution:
Let $f(t) = t^4 + at^3 + bt^2 + ct + d$
$\Rightarrow f(0) = 0$
$\Rightarrow d = 0$
$f(1) = 2 \Rightarrow 1 + a + b + c = 2$
$a + b + c = 1$
$f(2) = 4 = 16 + 8a + 4b + 2c$
$4a + 2b + c = –6$
$f(3) = 6 = 81 + 27a + 9b + 3c$
$\Rightarrow a = –6, b = 11, c = –4$
$f(t) = t^4 – 6t^3 + 11t^2 – 4t$
$f(6) = 372$

(30) **Answer :** 10
Hint:
$g'(–2) = g'(2) = 0$
Solution:
Say $g(x) = (x^2 – 4)^3\, h(x)$
where $h(x) = a_0 + a_1x – a_2x^2 + a^3x^3 – a_4x^4$
$g(2) = g(–2) = 0$
$\Rightarrow g'(\alpha) = 0,\ \alpha \in (-2, 2)$
& $g'(–2) = g'(2) = 0$
so $g'(x) = 0$ has atleast 3 roots
so $g''(x) = 0$ will have atleast 2 roots, say β, γ
such that
$–2 < \beta < \alpha < \gamma < 2$
& also $g''(x) = 0$ for $x = –2, 2$
so $g''(x)$ has minimum 4 roots
i.e. $–2, \beta, \gamma, 2$
so $g'''(x)$ has minimum 3 roots
Say $\delta_1, \delta_2, \delta_3$ such that
$–2 < \delta_1 < \beta < \delta_2 < \gamma < \delta_3 < 2$
so $n_{g'} + n_{g''} + n_{g'''} = 3 + 4 + 3 = 10$

Section-IV

(31) **Answer :** 04.00
Hint:
Equation of PQ: $\frac{y-2}{2} = 2(–x) + \frac{3}{2}(x-1)+1$
Solution:
Equation of PQ: $\frac{y-2}{2} = 2(–x) + \frac{3}{2}(x-1)+1$
$y – 2 = –4x + 3x – 3 + 2$
$y = –x + 1$ …(1)
Tangent at $y^2 = 4ax$

is given by $y = mx + \frac{a}{m}$ …(2)
By equation (1) and (2)
$m = -1$ and $a = -1$
so parabola will be $y^2 = -4x$
Length of latus rectum $|4a| = 4$
Equation of common tangent of $y^2 = 4ax$
and $x^2 = 4ay$ is $x + y + a = 0$
so $k = 1$

(32) **Answer :** 01.00
Hint:
Equation of PQ: $\frac{y-2}{2} = 2(-x) + \frac{3}{2}(x-1)+1$
Solution:
Equation of PQ: $\frac{y-2}{2} = 2(-x) + \frac{3}{2}(x-1)+1$
$y - 2 = -4x + 3x - 3 + 2$
$y = -x + 1$ …(1)
Tangent at $y^2 = 4ax$
is given by $y = mx + \frac{a}{m}$ …(2)
By equation (1) and (2)
$m = -1$ and $a = -1$
so parabola will be $y^2 = -4x$
Length of latus rectum $|4a| = 4$
Equation of common tangent of $y^2 = 4ax$
and $x^2 = 4ay$ is $x + y + a = 0$
so $k = 1$

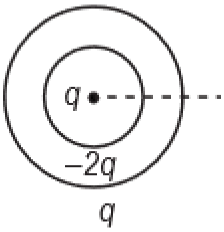
(33) **Answer :** 25.00
Hint:
$\left[\frac{x^2}{2+x^2}\right] = 0$
Solution:
$f(x) = 25\{x\}$; as $\sum_{n=1}^{25}\left[\frac{nx^2}{2+nx^2}\right] = 0$
$0 \le \{x\} < 1$
$0 \le 25\{x\} < 25$
Total 25 integers
$f(\sqrt{3}) = 25\{\sqrt{3}\} = 25 \times 0.73 = 18.25$
$[f\sqrt{3}] = 18$

(34) **Answer :** 18.00
Hint:
$\left[\frac{x^2}{2+x^2}\right] = 0$
Solution:
$f(x) = 25\{x\}$; as $\sum_{n=1}^{25}\left[\frac{nx^2}{2+nx^2}\right] = 0$
$0 \le \{x\} < 1$
$0 \le 25\{x\} < 25$
Total 25 integers
$f(\sqrt{3}) = 25\{\sqrt{3}\} = 25 \times 0.73 = 18.25$
$[f\sqrt{3}] = 18$

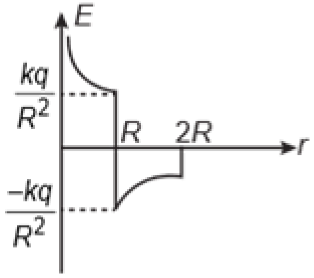
PHYSICS

Section-I

(35) **Answer :** (C)
Hint:
Follow field formula
Solution:



Inside 1st sphere $q_{in} = q$
between two sphere, $q_{in} = –2q + q = –q$
outside both sphere, $q_{in} = 0$



(36) **Answer :** (B)
Hint:
$F = \frac{\mu_0 \mathrm{l}_0^2 L}{2\pi x} = mv.\frac{dv}{dx}$
Solution:
$\overline{F} = id\overline{l} \times \overline{B}$
Let rod is at distance *x* at any instant then
$F = \frac{\mu_0 \mathrm{l}_0^2 L}{2\pi x} = mv.\frac{dv}{dx}$

$$\int_0^v v\,dv = \frac{\mu_0 \mathrm{l}^2 L}{2\pi m}\int_d^D \frac{dx}{x}$$

$V = \sqrt{\frac{\mu_0 \mathrm{l}^2 L \ln(3)}{\pi m}}$

(37) **Answer :** (D)
Hint:
$a = -\frac{kx}{m}$
Solution:
acc = $-\frac{kx}{m}$
$\frac{md^2x}{dt^2} = -kx$
$w = \sqrt{\frac{k}{m}}$
Let displacement of ball at any instant is
$\frac{mg}{k}\cos\left(\sqrt{\frac{k}{m}}\,t\right)$

(38) **Answer :** (C)
Hint:

$$G = \int_{n=0}^{n=r}\left[\sigma_1 + \left(\frac{\sigma_2 - \sigma_1}{r}\right)x\right]\frac{2\pi x}{\mathrm{l}}dx$$

Solution:
At a radius *x*, σ = σ + $\left(\frac{\sigma_2 - \sigma_1}{r}\right)x$
conductance, $dG = \frac{\sigma(2\pi x - dx)}{\mathrm{l}}$

$$G = \int_{n=0}^{n=r}\left[\sigma_1 + \left(\frac{\sigma_2 - \sigma_1}{r}\right)x\right]\frac{2\pi x}{\mathrm{l}}dx$$

$G = \frac{\pi r^2(\sigma_1 + 2\sigma_2)}{3\mathrm{l}}$, $R = \frac{3\mathrm{l}}{\pi r^2(\sigma_1 + 2\sigma_2)}$

$R = \frac{3l}{7\pi r^2\sigma_0}$, $i = \frac{7\pi\sigma_0 v_0 r^2}{3l}$

Section-II

(39) **Answer :** (B,D)

Hint:

$C = C_V + \frac{Rp\cdot dV}{p\cdot dV + V\cdot dp}$

Solution:

$C = C_V + \frac{Rp\cdot dV}{p\cdot dV + V\cdot dp}$

$P = \frac{RT}{V} = \frac{R}{V}\ (T_0 + \alpha V)$

Heat capacity $C = C_V + \frac{RP\cdot dV}{P.dV + V.dP}$

$P.dV + V.dP = \alpha R dV$

So, $C = C_P + \frac{RT0}{\alpha V}$

$= \frac{5R}{2} + \frac{RT_0}{2v} = \left(5 + \frac{T_0}{v}\right)\ \frac{R}{2}$

at volume V_1

$T_1 = T_0 + 2V_1$

at volume V_2

$T_2 = T_0 + 2V_2$

So, $V = \frac{T - T_0}{2}$

$Q = \int dQ = \int_{T_1}^{T_2} c.\,dT$

$= \int_{T_1}^{T_2}\left(C_P + \frac{RT_0}{2V}\right)dT$

$= C_P\,(T_2 - T_1) + RT_0 \ln\left(\frac{T_2 - T_0}{T_1 - T_0}\right)$

$= 2C_P\,(V_2 - V_1) + RT_0 \ln\left(\frac{V_2}{V_1}\right)$

$= 5RV_0 + RT_0\ln(2)$

(40) **Answer :** (B,D)

Hint:

$QE - V\ \frac{dm}{dt} = m\ \frac{dv}{dt}$

Solution:

$QE - V\ \frac{dm}{dt} = m\ \frac{dv}{dt}$

$QE - V\ \frac{dm}{dt} = m\ \frac{dv}{dt}$

$QE - V\ (nm) = (m_0 + nm)\ \frac{dv}{dt}$

For V_{max}, $\frac{dv}{dt} = 0$

$V_{max} = \frac{QE}{nm} = V_0$

Again

$\frac{QE – nmv}{m_0 + nmt} = \frac{dv}{dt}$

$\int_0^t \frac{dt}{m_0 + nmt} = \int_0^{\frac{v_0}{2}} \frac{dv}{QE - nmv}$

$t = \frac{m_0}{nm}$

(41) **Answer :** (B,C)

Hint:

$W = \Delta U$ + Heat

Solution:

$Q = CV$

$C_{eq} = 2C$

$E_i = \frac{1}{2}\cdot 2C\cdot V^2$

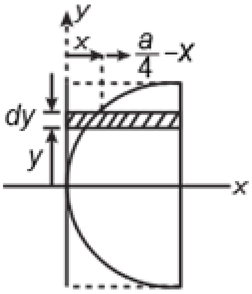
$= CV^2$

heat loss = CV^2

Section-III

(42) **Answer :** 10
Hint:
$PV = nRT$
Solution:
$PV = nRT$
For A:
$P_1 = \left(\frac{m_A}{M}\right)\left(\frac{RT}{v_1}\right)$, $P_2 = \left(\frac{m_A}{M}\right)\left(\frac{RT}{v_2}\right)$
$\Delta P_1 = \frac{RT}{M}\left(\frac{1}{v_1} - \frac{1}{v_2}\right)m_A = \left(\frac{RT}{M}\right)\frac{m_A}{2v}$
For B : $\Delta P_2 = \left(\frac{RT}{M}\right)\frac{m_B}{2v}$
$\frac{m_B}{m_A} = \frac{6}{5}$

(43) **Answer :** 6
Hint:
$c = \frac{A\varepsilon_0}{d - t + \frac{t}{k}}$
Solution:
$c = \frac{A\varepsilon_0}{d - t + \frac{t}{k}}$



Here $y^2 = ax$
$\int_0^c dc = \int_{\frac{-a}{2}}^{+\frac{a}{2}} \frac{\varepsilon_0\, a dy}{\frac{a}{4k} + \left(1 - \frac{1}{k}\right)x}$
$C = \frac{4\varepsilon_0 ak}{\sqrt{k-1}} \tan^{-1}\left(\sqrt{k-1}\right)$
$= 12\ \varepsilon_0 \tan^{-1}(\sqrt{2})$

(44) **Answer :** 2
Hint:
$\frac{dV}{dt} + V\frac{dP}{dt} = 0$
Solution:
PV = constant
$P\frac{dV}{dt} + V\frac{dP}{dt} = 0$
$\int_{P_0}^{P} \frac{dP}{P} = -\frac{1}{V}\int_0^t \alpha . dt$

(45) **Answer :** 2
Hint:
$\frac{1}{2}mV_x^2 = eV$
Solution:
$\frac{1}{2}mV_x^2 = eV$
Inside plates, $E = \frac{V_P}{d}$
$a = \frac{eV_P}{md}$
$t = \frac{1}{v_x}$
so, $y = y_0 + \frac{1}{2}at^2$
$y = \frac{l^2 V_P}{4dV}$
The maximum deflection which still allows the

electrons to miss the plate is $y = \frac{d}{2}$

So, V_P = $2V\left(\frac{d}{1}\right)^2$

(46) Answer : 9

Hint:

Conceptual

Solution:

$\frac{\partial y}{\partial t} = \frac{2b^3(x-\sqrt{3}t)\sqrt{3}}{\left[b^2+(x-\sqrt{3}t)^2\right]^2}$

at t = 0, V_P = $\frac{2\sqrt{3}b^3x}{(b^2+x^2)^2}$

$\frac{dV_P}{dx}$ = 0, x = $\frac{b}{\sqrt{3}}$

$(V_P)_{max}$ = $\frac{2b^3\sqrt{3}\left(\frac{b}{\sqrt{3}}\right)}{\left(b^2+\frac{b^2}{3}\right)^2}$ = $\frac{18}{16}$ m/s = $\frac{9}{8}$ m/s

(47) Answer : 1

Hint:

$\frac{dT}{dt} = -k(T-T_0)$

Solution:

$\frac{dT}{dt} = -k(T-T_0)$

$\frac{d\theta}{dt} = -k(\theta-\theta_0)$

Let $\theta_1 = 2\theta_0$

θ_2 = $\frac{3\theta_0}{2}$

and θ_3 = $\frac{5\theta_0}{4}$

$\int_{\theta_1}^{\theta_2} \frac{d\theta}{\theta-\theta}$ = $-\int_0^{t_1} k.dt$

$\ln\left(\frac{\theta_2-\theta_0}{\theta_1-\theta_0}\right) = -kt_1$ ...(i)

Again $\int_{\theta_2}^{\theta_3} \frac{d\theta}{\theta-\theta_0} = -\int_0^{t_2} k.dt$

$\ln\left(\frac{\theta_3-\theta_0}{\theta_2-\theta_0}\right) = -kt_2$ ...(ii)

From equation (i) and (ii)

$t = t_0$

Section-IV

(48) Answer : 04.00

Hint:

$dF = BIdx$

Solution:

B = $\frac{\mu_0 I}{2\pi x}$

$dF = BIdx$

F = $\frac{\mu_0 I^2}{2\pi}\int_a^{4a}\frac{dx}{x}$

= $\frac{\mu_0 I^2}{\pi}\ln(2)$

(49) Answer : 01.50

Hint:

Point of application = $\frac{\int x.dF}{F}$

Solution:

Point of application = $\frac{\int x.dF}{F}$

$= \frac{\int_a^{4a} x\left(\frac{\mu_0 I}{2\pi x}\right) I\, dx}{\left(\frac{\mu_0 I^2 \ln(2)}{\pi}\right)}$

$= \frac{3a}{2\ln(2)}$

(50) **Answer :** 02.50

Hint:

$dQ = I^2 R.dt$

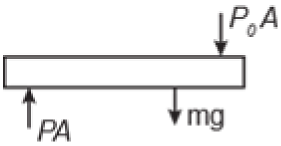
Solution:

$dQ = I^2 R.dt$

$\Delta Q = \Delta U + \Delta W$

$I^2 rdt = C_V \Delta T + P.dV$

$I^2 r = C_v \frac{dT}{dt} + R \frac{dT}{dt} = C_P \frac{dT}{dt}$



$T = T_0 + \alpha t + \beta t^2$

$\frac{dT}{dt} = (\alpha + 2\beta t)$

$I = \sqrt{\frac{5R}{2r}(\alpha + 2\beta t)}$

(51) **Answer :** 01.00

Hint:

$v = \frac{dx}{dt} = \frac{R}{PA}\left(\frac{dT}{dt}\right)$

Solution:

$Pv = nRt$

$PA.dx = R.dT$

$v = \frac{dx}{dt} = \frac{R}{PA}\left(\frac{dT}{dt}\right)$

$v = \frac{R}{PA}(\alpha + 2\beta t)$

$v = \frac{R}{(mg + P_0 A)}(\alpha + 2\beta t)$