Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60_STERLING BT **JEE-MAIN** **Date: 21-09-2025**

Time: 02:00PM to 05:00PM **CTM-03** **Max. Marks: 300**

KEY SHEET

MATHEMATICS

1	**2**	2	**4**	3	**3**	4	**3**	5	**4**
6	**1**	7	**4**	8	**2**	9	**2**	10	**1**
11	**4**	12	**1**	13	**4**	14	**1**	15	**1**
16	**2**	17	**1**	18	**4**	19	**3**	20	**3**
21	**128**	22	**48**	23	**16**	24	**3**	25	**32**

PHYSICS

26	**3**	27	**1**	28	**2**	29	**4**	30	**3**
31	**4**	32	**2**	33	**4**	34	**4**	35	**4**
36	**1**	37	**1**	38	**4**	39	**1**	40	**1**
41	**4**	42	**3**	43	**3**	44	**2**	45	**2**
46	**5**	47	**30**	48	**48**	49	**48**	50	**800**

CHEMISTRY

51	**2**	52	**3**	53	**4**	54	**2**	55	**2**
56	**1**	57	**3**	58	**3**	59	**1**	60	**4**
61	**3**	62	**2**	63	**3**	64	**4**	65	**2**
66	**2**	67	**3**	68	**4**	69	**1**	70	**2**
71	**5**	72	**4**	73	**3**	74	**5**	75	**3**

SOLUTIONS
MATHEMATICS

1. Given,

$$f(x)=\sin x+3x-\frac{2}{\pi}(x^2+x) \quad ; \quad f'(x)=\cos x+3-\frac{2}{\pi}(2x+1) \;=\cos x-\frac{4x}{\pi}-\frac{2}{\pi}+3$$

$$When\, x\in\left[0,\frac{\pi}{2}\right] \Rightarrow 4x\in[0,2\pi] \;\Rightarrow 4x\in[0,2\pi],\;\cos x>0, when\, x\in\left[0,\frac{\pi}{2}\right]$$

$$\therefore f'(x)=\cos x-\frac{4x}{\pi}-\frac{2}{\pi}+3>0 \Rightarrow f'(x) \text{ is increasing}$$

$$Now, f''(x)=-\sin x-\frac{4}{\pi}<0 \quad when\, x\in\left(0,\frac{\pi}{2}\right) \Rightarrow f'(x) \text{ is decreasing}$$

Hence, both statements are true.

2. $f(x)$ is defined When $x^{12}-x^9+x^4-x+1>0$

$\Rightarrow \quad (x^8+1)x(x^3-1)+1>0$

If $x>1$ or $x\le -1$ then above is true.

If $-1<x\le 0$ the above holds.

If $0<x<1$, $x^{12}-x(x^8+1)+x^4+1>0$

Because $x^4+1>x^8+1$ and so $x^4+1>x(x^8+1)$

3. No of solution is 3 by drawing graph

4. $\cos^{-1}x=\theta$

$$tam\left(\frac{\pi}{4}+\frac{\theta}{2}\right)+\tan\left(\frac{\pi}{4}-\frac{\theta}{2}\right) \Rightarrow \quad \cot\left(\frac{\pi}{4}-\frac{\theta}{2}\right)+\tan\left(\frac{\pi}{4}-\frac{\theta}{2}\right)= 2\sec\theta=\frac{2}{x}.$$

5. $$\underset{x\to 0}{Lt}\frac{\cancel{x^{3/2}}\sqrt{2y-x}}{\cancel{x^{3/2}}\left(\sqrt{8y-4x}+\sqrt{8y}\right)}=\frac{1}{4}.$$

6. a) $\int_{-1}^{1}3\left[x+\left[x+[x]\right]\right]dx$ (use property $[x+n]=[x]+n$ if n is integer

$$\int_{-1}^{1}3[x]dx=3\int_{-1}^{1}[x]dx=3\int_{0}^{1}\left([x]+[-x]\right)dx \;=-3(as[x]+[-x]=-1)$$

B) $\int_2^5([x]+[-x])dx=\int_2^5 -1\,dx=-3$

c) $\operatorname{sgn}(x-[x])=\left\{\begin{array}{l}1, if\ x\, is\, not\, an\, integer\\ 0, if\ x\, is\, an\, integer\end{array}\right\}$ Hence , $\int_{-1}^{3}\operatorname{sgn}(x[x])\,dx=4(1-0)=4.$

d) $Let\ I=25\int_0^{\pi/4}(\tan^6(x-[x])+\tan^4(x-[x]))\,dx \quad \left\{\therefore 0<x\le\frac{\pi}{4}\Rightarrow[x]=0\right\}$

$$\therefore I=25\int_0^{\frac{\pi}{4}}(\tan^6 x+\tan^4 x)dx$$

$$=25\int_0^{\frac{\pi}{4}} \tan^4 x(\tan^2 x+1)dx = 25\int_0^{\frac{\pi}{4}} \tan^4 x \sec^2 x\, dx = 25\left(\frac{\tan^5 x}{5}\right)_0^{\frac{\pi}{4}} = 25\times\frac{1}{5} = 5$$

7. By using LHL = RHL = $f(0)$

8. Conceptual

9. $f^1(x) = \dfrac{x^2-9}{3x^2}$

$f^1(x) > 0\ \forall x \in (-\infty,-3)\cup(3,\infty)$

$f^1(x) < 0\ \forall x \in (-3,0)\cup(0,3)$

$\therefore\ \sum \alpha i^2 = 36$.

10. $\int x^3 \sin x\, dx = -x^3\cos x + 3x^2 \sin x + 6x\cos x - 6\sin x + c$

$\therefore\ g(x) = -x^3\cos x + 3x^2\sin x + 6x\cos x - 6\sin x$

$= g\left(\frac{\pi}{2}\right) = \frac{3\pi^2}{4} - 6 = g^1(x) = x^3 \sin x = g^1\left(\frac{\pi}{2}\right) = \frac{\pi^3}{8}$

$\therefore$ required value = 55.

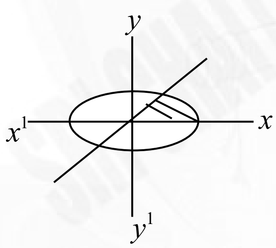
11. $\log_e x = t \quad \Rightarrow \quad \frac{dx}{x} = dt$

$$I = \int_2^4 \frac{e^{\frac{1}{1+t^2}}}{e^{\frac{1}{1+t^2}} + e^{\frac{1}{1+(6-t)^2}}}dt \quad \text{.... (1)}$$

By using $f(a+b-x) = f(x)$

$\therefore\ I = 1$.

12.



Put y = x then $\frac{x^2}{18} + \frac{y^2}{6} = 1$ $\qquad x = \frac{3}{\sqrt{2}} = y$

Required area = $\frac{1}{2}\times\frac{3}{\sqrt{2}}\times\frac{3}{\sqrt{2}} + \int_{\frac{3}{\sqrt{2}}}^{3\sqrt{2}} y\,dx = \sqrt{3}\pi$.

13. $f\left(\frac{x}{y}\right) = \frac{f(x)}{f(y)}$

Put x = y $\Rightarrow$ $f(1) = 1$

Differentiate with respect to 'x' taking y as constant.

$f^1\left(\frac{x}{y}\right)\frac{1}{y} = \frac{f^1(x)}{f(y)}$.

Put x = y

$= f^1(1)\frac{1}{x} = \frac{f^1(x)}{f(x)} \quad = \frac{2024}{x} = \frac{f^1(x)}{f(x)} \quad = 2024 f^1(x) = xf^1(x)$.

14. $f(x)=ax^4+bx^3+cx^2+dx+e$

$f^1(4)=0$ and $f^1(5)=0$

By using L-Hospital rule.

$f(x)=\frac{x^4}{8}-\frac{3x^3}{2}+5x^2 = f(2)=10$.

15. Given integral is in the form of $\int e^x\left(f(x)+f^1(x)\right)dx=e^x f(x)+c$

$\therefore \quad g(x)=e^x\left(\frac{x\sin^{-1}x}{\sqrt{1-x^2}}\right) = g\left(\frac{1}{2}\right)=\frac{\pi}{6}\sqrt{\frac{e}{3}}$.

16. By using L-Hospital rule.

17. $(2y-5)\frac{dy}{dx}=-3 \quad \Rightarrow \quad (2y-5)dy=-3dx$.

= Integrating on both sides

$\frac{2y^2}{2}-5y=-3x+c$ passing through (0, 1)

$\therefore$ c = –4

Equation in $y^2-5y=-3x-4 \Rightarrow \left(y-\frac{5}{2}\right)^2=-3\left(x-\frac{3}{4}\right)$

Which in parabola and vertex $\left(\frac{3}{4},\frac{5}{2}\right)$.

18. Given $10\int_1^x f(t)\,dt=5x\,f(x)-x^5-9$

Put x = 1 $\quad\Rightarrow\quad f(1)=2$

Differentiable with respect to x

$10[f(x)]=5f(x)+5xf^1(x)-5x^4$

$f(x)=x\,f^1(x)-x^4$

$\frac{dy}{dx}-\frac{y}{x}=x^3$ where $y=f(x)$

By solving $f(x)=\frac{x^4}{3}+\frac{5x}{3}$

$f(3)=32$.

19. Given $\bar{a}=\bar{a}$ along $\bar{a}+\bar{b}\perp r\bar{b}$

$\Rightarrow \quad \alpha\bar{i}+\beta\bar{j}+\gamma\bar{k}=\frac{16}{11}\left(3\bar{i}+\bar{j}-\bar{k}\right)+\frac{1}{11}\left(-4\bar{i}-5\bar{k}-17\bar{k}\right)$

$= 4\bar{i}+\bar{j}-3\bar{k} \quad = \alpha^2+\beta^2+\gamma^2=26$.

20. $P=(2t+1,t+2,3t+1)$, $A=(4,4,3)$

Dr's of A.P. $(2t-3,t-2,3t-2)$

By using $2(2t-3)+1(t-2)+3(3t-2)=0 \quad t=1$

$P=(3,3,4)$.

Let $B=(\alpha,\beta,\gamma)$ be the image

Mid-point $\left(\frac{4+\alpha}{2},\frac{4+\beta}{2},\frac{3+\gamma}{2}\right)=(3,3,4)$

$\alpha=2,\ \beta=2,\ \gamma=5 \quad \therefore \quad \alpha+\beta+\gamma=9$.

21. $\bar{b}\times\bar{d}=\bar{c}\times\bar{a} \quad \Rightarrow \quad \bar{b}-\bar{c} \parallel \bar{d}$

$\therefore \quad \bar{d}=\lambda\left(\bar{b}-\bar{c}\right)$

$\bar{d}=\lambda\left(\bar{i}-2\bar{j}+\bar{k}\right)$

$\bar{a}.\bar{d}=4 \quad \Rightarrow \quad \lambda=-2$

$\therefore \quad \bar{d}=-2\bar{i}+4\bar{j}-2\bar{k}$

$\left|\bar{a}\times\bar{d}\right|^2=128$.

22. S.D. = $\dfrac{\left|\left[\bar{c}-\bar{a},\bar{b},\bar{d}\right]\right|}{\left|\bar{b}\times\bar{d}\right|}$

$\therefore \quad$ k = 2

$\int_0^{3/2}\left[x^2\right]dx=\int_0^1 0\,dx+\int_1^{\sqrt{2}}1\,dx+\int_{\sqrt{2}}^{3/2}2\,dx$

$= \; 2-\sqrt{2}$

$\alpha=2 \quad \Rightarrow \quad 6\alpha^3=48$.

23. Projection if $\bar{b}$ $on\,\bar{a}$ $=\dfrac{\left(\bar{a}.\bar{b}\right)\vec{a}}{|\bar{a}|}$

$\bar{c}=\dfrac{(\lambda+8)}{9}\left(\bar{i}+2\bar{j}+2\bar{k}\right)$

$\left|\bar{c}+\bar{c}\right|=7$

$\Rightarrow \quad 9+\dfrac{(\lambda+8)^2}{81}9+2\dfrac{(\lambda+8)}{9}(9)=49$

$\Rightarrow \quad \lambda=4$

$\therefore \quad \bar{c}=\dfrac{4}{3}\left(\bar{i}+2\bar{j}+2\bar{k}\right)$ = area = 16.

24. $f(x)=2-x, \; x\le -2$

$= -3x-2, \; -2<x\le -2/3$

$= 3x+2, \; -\dfrac{2}{3}<x\le 0$

$= 2-x, \; -\dfrac{2}{3}<x<2$

$= x-2, \; x\ge 2$

By drawing graph, no. of minima m = 2

No. of maxima, n = 1

$m+n=3$.

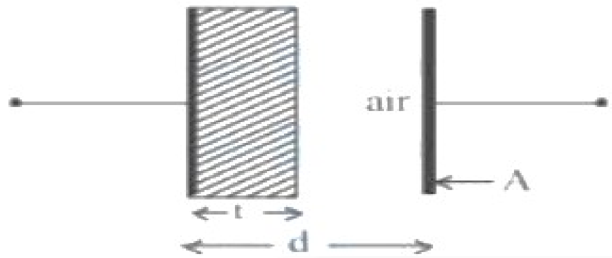
25. $\tan x=x+\dfrac{x^3}{3}+\dfrac{2x^5}{15}+\ldots.$

$P=\underset{x\to 0}{Lt}\left(\dfrac{\tan x}{x}\right)^{1/x^2}$ takes 1^∞

$=\underset{x\to 0}{Lt}\dfrac{\tan x-x}{x^3} \qquad \Rightarrow \; P=e^{1/3}$

$96\log_e p=32$.

PHYSICS

26. 

This can be seen as two capacitors in series combination so

$$\frac{1}{C_{eq}}=\frac{1}{C_1}+\frac{1}{C_2}=\frac{1}{\frac{K\in_0 A}{t}}+\frac{1}{\frac{\in_0 A}{t}}=\frac{t}{K\in_0 A}+\frac{d-t}{\in_0 A}=\frac{1\times10^{-3}}{5\in_0\times40\times10^{-4}}+\frac{1\times10^{-3}}{\in_0 40\times10^{-4}}$$

$$\frac{1}{C_{eq}}=\frac{1}{20\in_0}+\frac{1}{4\in_0}\Rightarrow C_{eq}=\frac{20\times4\in_0}{24}=\frac{10\in_0}{3}\text{F}$$

27. $\gamma=1+\frac{2}{f}\Rightarrow f=\frac{2}{\gamma-1}$

28. $\text{dv}=-\text{Edr}=\frac{k}{r}\text{dr}$

Integrating both sides

$[V]_{v_i}^{v}=k[\ell nr]_{d_i}^{r}$

$V-V_i=K\ell m\frac{r}{d_i}$

$V=V_i+k\ell n\frac{r}{d_i}$

29. For single slit diffraction, $\sin\theta=n\lambda/b$

Position of nth minima from central maxima = $n\lambda D/b$

When $n=2$, then $x2=2\lambda D/b=0.03...(1)$

When $n=4$, then $x4=4\lambda D/b=0.06$ ….(2)

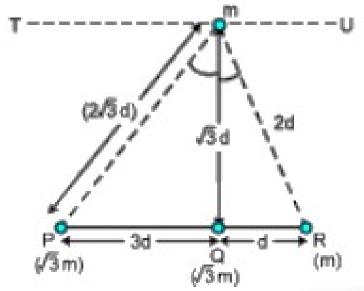
Eqn. (2) – Eqn. (1)

$x4-x2=(4\lambda D/b)-(2\lambda D/b)=0.03$ (or)

The width of central maximum = $2\lambda D/b=2\times(0.03/2)=0.03\ m=3\ cm$

30. Net force = $\frac{G\sqrt{3}\,mm}{12d^2}\cos30^0-\frac{Gm^2}{4d^2}\cos60^0=\frac{Gm^2}{8d^2}-\frac{Gm^2}{8d^2}=0$

In vertical direction



Net force = $\dfrac{G\sqrt{3}\,m^2}{12d^2}\cos 60^0 + \dfrac{G\sqrt{3}\,m^2}{3d^2} + \dfrac{Gm^2}{4d^2}\cos 30^0$

$= \dfrac{\sqrt{3}Gm^2}{24d^2} + \dfrac{\sqrt{3}\,Gm^2}{3d^2} + \dfrac{\sqrt{3}\,Gm^2}{8d^2} = \dfrac{\sqrt{3}Gm^2}{d^2}\left[\dfrac{1+8+3}{24}\right] = \dfrac{\sqrt{3}Gm^2}{2d^2}$ along SQ

31. Case I : $u = -10\ cm,\ v = 10\ cm,\ f = ?$

Using lens formula, $(1/f) = [(1/v) - (1/u)]$

$1/f = [(1/10) - (1/-10)]$

$f = 5\ cm$

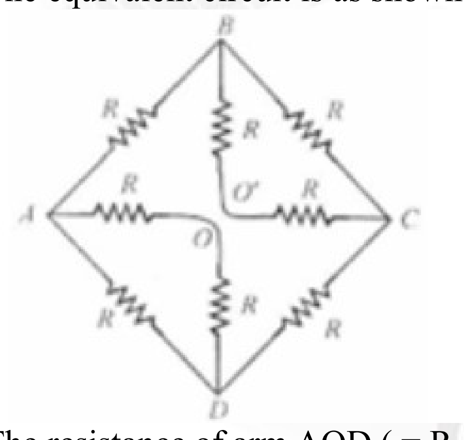
Case II : Die to introduction of slab, shift in the source is =

$t[1-(1/\mu)] = 1.5\left[1-\left(\dfrac{2}{3}\right)\right] = 0.5$

Now, $u = -9.5\ cm., v = 10.55\ cm,\ d = 10.55 - 10 = 0.55\ cm$ away from the lens.

32. $SinC = \dfrac{V_P}{V_Q} = \dfrac{2.2\times10^8\ m/\sec}{2.4\times10^8\ m/\sec} = \dfrac{11}{12} \Rightarrow C = \sin^{-1}\left(\dfrac{11}{12}\right)$

33. The equivalent circuit is as shown in figure.



The resistance of arm AOD (= R + R) is in parallel to the resistance R of arm AD.

Their effective resistance $R_1 = \dfrac{2R\times R}{2R+R} = \dfrac{2}{3}R$

The resistance of arms AB, BC and CD is

$R_2 = R + \dfrac{2}{3}R + R = \dfrac{8}{3}R$

The resistance R_1 and R_2 are in parallel. The effective resistance between A and D is

$$R_3 = \frac{R_1 \times R_2}{R_1 + R_2} = \frac{\frac{2}{3}R \times \frac{8}{3}R}{\frac{2}{3}R + \frac{8}{3}R} = \frac{8}{15}R$$

34. Heat loss, $H = \frac{C_1C_2}{2(C_1 + C_2)}(V_1 - V_2)^2$

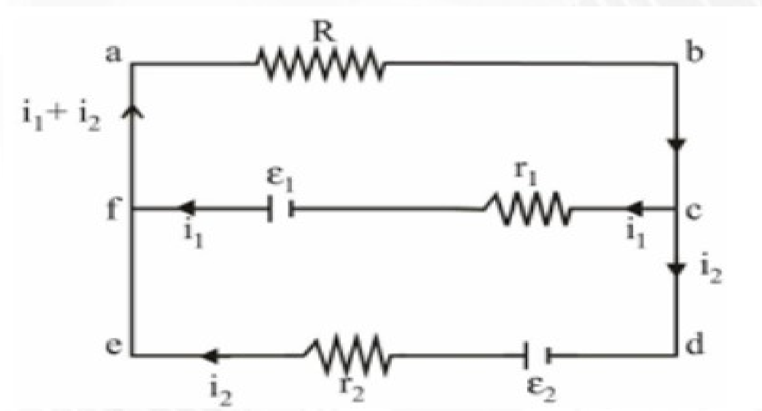
In the equation, put $V_2 = 0, V_1 = V_0$

$C_1 = C, C_2 = \frac{C}{2}$

Loss of heat = $= \frac{C \times \frac{C}{2}}{2\left(C + \frac{C}{2}\right)}(V_0 - 0)^2 = \frac{C}{6}V_0^2$

$H = \frac{1}{6}CV_0^2$

35.



Applying Kirchhoff's rule in loop abcfa $\varepsilon_1 - (i_1 + i_2)R - i_1 r_1 = 0$

36. Change in length in both rods are same i.e. $\Delta\ell_1 = \Delta\ell_2$

$\ell\alpha_1\Delta\theta_1 = \ell\alpha_2\Delta\theta_2$

$\frac{\alpha_1}{\alpha_2} = \frac{\Delta\theta_2}{\Delta\theta_1} \quad \left[\because \frac{\alpha_1}{\alpha_2} = \frac{4}{3}\right]$

$\frac{4}{3} = \frac{\theta - 30}{180 - 30}$

$\theta = 230^0 C$

37. As we know,

$\Delta Q = \Delta u + \Delta w$ (1st law of thermodynamics)

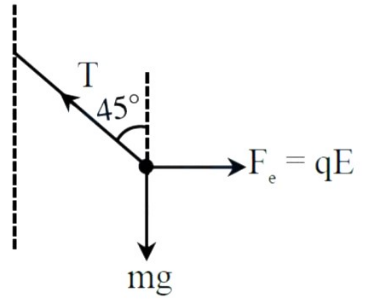
$\Rightarrow \Delta Q = \Delta u + P\Delta v$ (or) $150 = \Delta u + 100(1-2)$

$= \Delta u - 100$

$\therefore \Delta u = 150 + 100 = 250\ J$

Thus the internal energy of the gas increases by 250 J

38.



$qE = mg$

$q\left[\frac{\sigma}{2\varepsilon_0}\right] = mg$

$\sigma = \frac{2\varepsilon_0 mg}{q}$

$\sigma = \frac{2\times 8.85\times 10^{-12}\times 100\times 10^{-6}\times 10}{10\times 10^{-6}}$

$\sigma = 17.7\times 10^{-10}\ C/m^2$

$\sigma = 1.77\ nC/m^2$

39. $\frac{dA}{dt} = \frac{L}{2m}$

Due to central force torque is zero & angular momentum is constant

40. Electric field of outside charge is zero inside conductor

41. $C' = \frac{\Delta Q}{\Delta T} = JK^{-1}$

$S = \frac{\Delta Q}{m\Delta T} = JKg^{-1}K^{-1}$

$L = \frac{\Delta Q}{m\Delta T} = JKg^{-1}$

$\Delta Q = \frac{KA\Delta T}{L} \Rightarrow K = \frac{\Delta Q(L)}{\mathrm{A}\Delta\mathrm{T}} = Jm^{-1}K^{-1}s^{-1}$

42. The conductivity (σ) of a semiconductor increases with increase in temperature in temperature i.e. the resistivity (*f*) decreases with increase in temperature as $P = \frac{1}{\sigma}$

In a conducting solid, the collisions become more frequent with increase of temperature

43. Statement 1 is true: In denser medium like glass, light shows down, and since frequency remains constant,

Wavelength decreases

Statement 2 is false: Frequency remains constant when light passes from one medium to another. Only speed and wavelength change.

44. Parallel: $C_P = C + 2C = 3C$

Now series with $3C: \frac{1}{C_{eq}} = \frac{1}{3C} + \frac{1}{3C} = \frac{2}{3C}$

So $C_{eq} = \frac{3C}{2} = 1.5\,C$.

45. In steady state the heat current is the same through both rods, so the temperature drops are in the ratio of thermal resistances :

$$\frac{\Delta T_1}{\Delta T_2} = \frac{R_1}{R_2} = \frac{L/(k_1 A)}{L/(k_2 A)} = \frac{k_2}{k_1} = \frac{50}{200} = \frac{1}{4}$$

Total drop = $100^0 C \Rightarrow \Delta T_1 + \Delta T_2 = 100$ with $\Delta T_2 = 4\Delta T_1$. Hence

$5\Delta T_1 = 100 \Rightarrow \Delta T_1 = 20^0 C$.

Junction temperature $T_j = 100 - 20 = 80^0 C$

46. Using ideal gas equation, $PV = nRT$

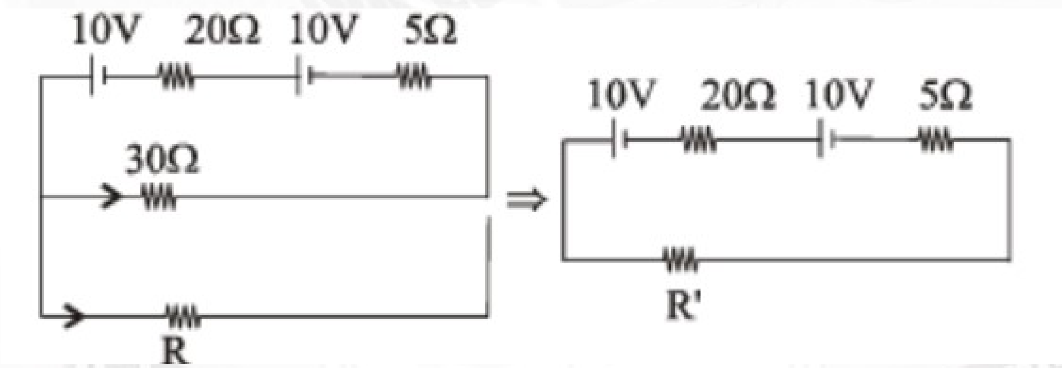
$\Rightarrow P_1 V_1 = nR \times 250 \quad [\because T_1 = 250\ K]$ ……..(i)

$P_2(2V_1) = \frac{5n}{4} R \times 2000 \qquad [\because T_2 = 2000\ K]$ …….. (ii)

Dividing eq, (i) by (ii).

$\frac{P_1}{2P_2} = \frac{4 \times 250}{5 \times 2000} \Rightarrow \frac{P_1}{P_2} = \frac{1}{5} \qquad \therefore \frac{P_2}{P_1} = 5$

47.



The resistance of $30\ \Omega$ is in parallel with R. Their effective resistance

$\frac{1}{R'} = \frac{1}{30} + \frac{1}{R}$

$R' = \frac{30R}{30+R}$ ……..(i)

Also, $V = IR \Rightarrow 10 = \frac{20 \times 20}{R' + 25}$

$\Rightarrow R' + 25 = 40 \Rightarrow R' = 15$

$R' = 15 = \frac{30R}{30+R}$ Using (i)

$\Rightarrow 30 + R = 2R \quad \Rightarrow R = 30\ \Omega$

48. $C_{eq} = \frac{6 \times 3}{6+3} = 2\mu F$

Charge Q = C_{eq} V $= 24\mu C \Rightarrow V_1 = Q / C_1 = 4\,\text{V}$

Energy in $C_1 : U_1 = \frac{1}{2} C_1 V_1^2 - \frac{1}{2}(6\mu F)\left(4^2\right) = 48\ \mu J$

49. Volume constant $\Rightarrow A' = \frac{A}{2}$. New resistance

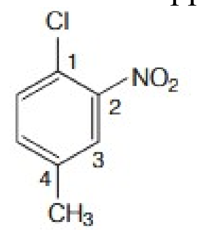
$R' = \rho \frac{2L}{A/2} = 4\rho \frac{L}{A} = 4R_0 = 48\ \Omega$

50. $P = \frac{k}{V^2}$, so $W = \int_{V_1}^{2V_1} \frac{k}{V^2}\, dV = \frac{k}{2V_1}$

With $k = P_1 V_1^2 \Rightarrow W = \frac{P_1 V_1}{2} = \frac{\left(8.0 \times 10^4\right)\left(2.0 \times 10^{-2}\right)}{2} = 800\ J$

CHEMISTRY

51. For tri or higher substituted benzene derivatives, the compounds are named by identifying substituent, positions on the ring by following the lowest locant rule. Substituent of the base compound is assigned number 1 and then the direction of numbering is chosen such that the next substituent gets the lowest number. The substituents appear in the name in alphabetical order.

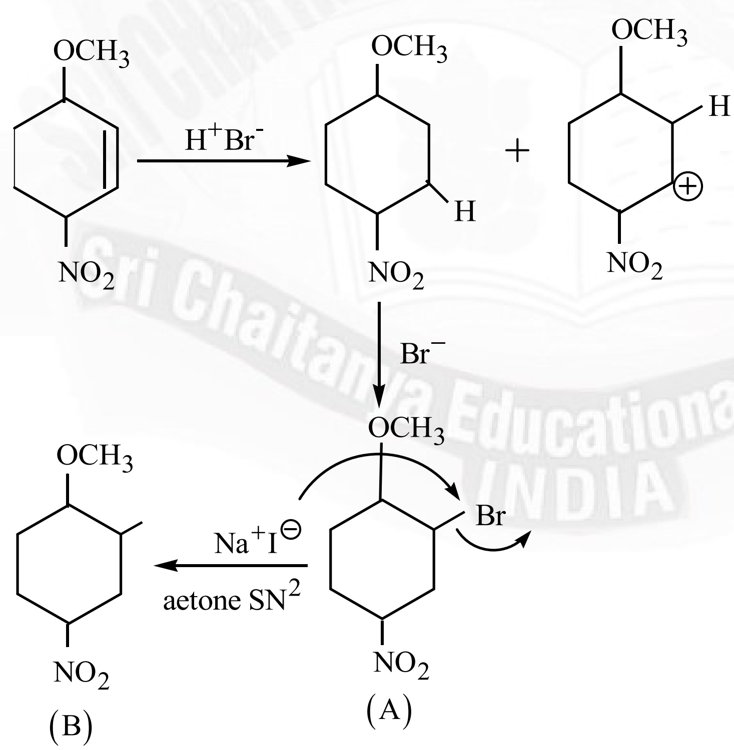


52. During incomplete combustion of alkanes with insufficient amount of air or dioxygen carbon black is formed which is used in the manufacture of ink, printer ink, black pigments and as filters. Thus,

$$CH_4(g)+O_2(g)\xrightarrow[\text{combustion}]{\text{incomplete}}C(s)+2H_2O(l)$$

53. Thin layer chromatography (TLC) is an another type of adsorption which involves separation of substances of a mixture over a thin layer of an adsorbent coated on a glass plate.
A thin layer of an adsorbent is spread over a glass plate and glass plate is placed in an eluant. As eluant rises, components of the mixture move up along with the eluant to different distances depending on their degree of adsorption and separation takes place. Therefore, this TLC technique will give best results in identifying the different types of ink used at different places in the documents

54.



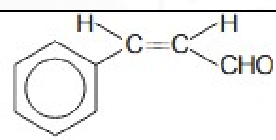
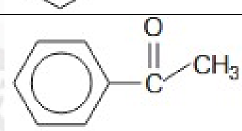
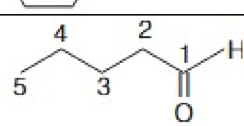
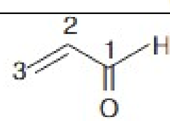
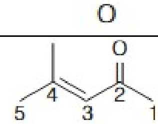
55. Presence of electron withdrawing group on phenols, increases its acidic strength. So,

both compounds i.e., p-nitrophenol (II) and m-nitrophenol (IV) are stronger acid than (I). If this ¾ NO2 group is present at p-position, then it exerts both - I and ¾ R effect but if it is present at meta position, then it exerts only - I effect. Therefore, p-nitrophenol is much stronger acid then m-nitrophenol.
On the other hand, presence of electron releasing group on phenol, decreases its acidic strength. If ¾ OCH3 group is present at meta position, it will not exert + R effect but exert - I effect.
But, if it is present at para position, then it will exert + R effect. Therefore, m-methoxy phenol is more acidic than p-methoxy phenol.

56. Both assertion and reason are correct and reason is the correct explanation of assertion.
According to Huckel rule Aromaticity is shown by compounds possessing following characteristics
(i) Compound must be planar and cyclic
(ii) Complete delocalisation of π electrons in the ring
(iii) Presence of conjugated $(4n+2)\pi$ electrons in the ring where n is an integer $(n=0,1,2,...)$ cyclo octatetraene (given) has a tub like structure. It loses planarity.
No. of πe− delocalised = 8. and n is not integer. Hence, cycloctatetraene is a non-aromatic compound.

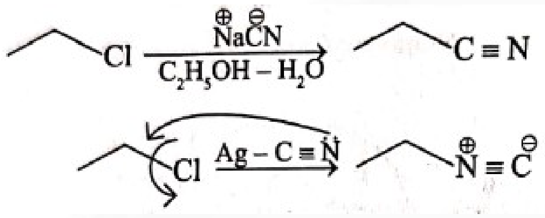
57. Phenol is also known as, carbolic acid' cannot be considered as aromatic alcohol. It is quite separate branch of compound called phenols. So, compound (A) i.e., phenol and compound (D) i.e., a derivative of phenol cannot be considered as aromatic alcohol.
On the other hand, compound (B) and (C), - OH group is bonded to sp3 hybridised carbon which inturn is bonded to benzene ring.

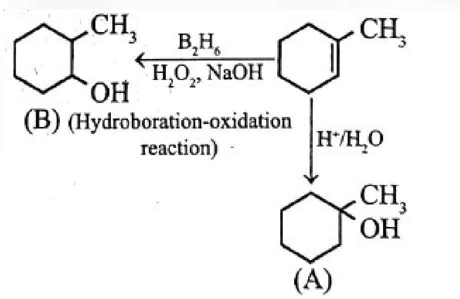
58.

Common names	Structure	IUPAC names
A. Cinnamaldehyde		3-phenylprop-2 -en-al
B. Acetophenone		1-phenylethanone
C. Valeraldehyde		Pentanal
D. Acrolein		Prop-2-en-al
E. Mesityl oxide		4-methyl pent-3-en-2-one

59. Both assertion and reason are correct and reason is the correct explanation of assertion. N-ethylbenzene is soluble in alkali because hydrogen attached to nitrogen in sulphonamide is strongly acidic and forms a salt during reaction between these two.

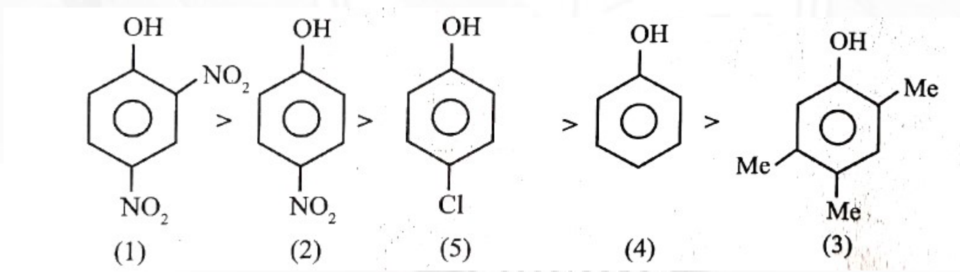
60. DNA contains following four bases (a) adenine (A) (b) thymine (T) (c) guanine (G) (d) cytosine (C). It does not contain uracil.

61. 

62. 

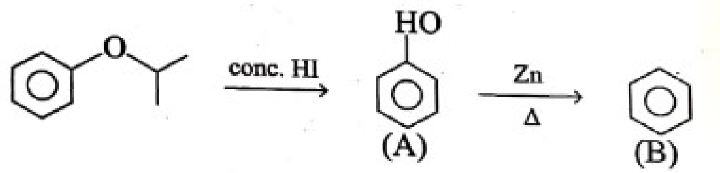
63. Acidity $\propto \dfrac{1}{Pk_a}$

Order of acidity for following phenol is



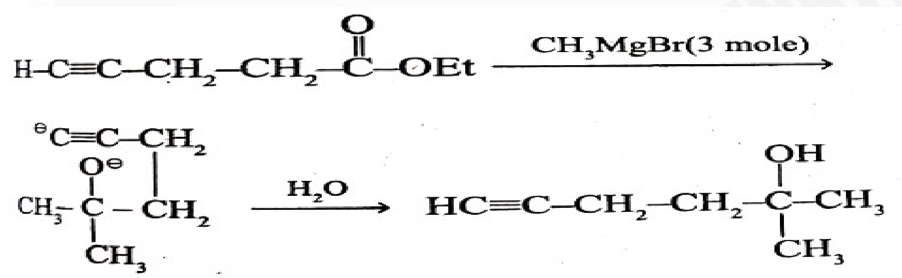
-M and -I increases acidity, + M and + I decreases acidity,

-NO_2 group has -M and -I effect. and -me has + e effect.

64. 

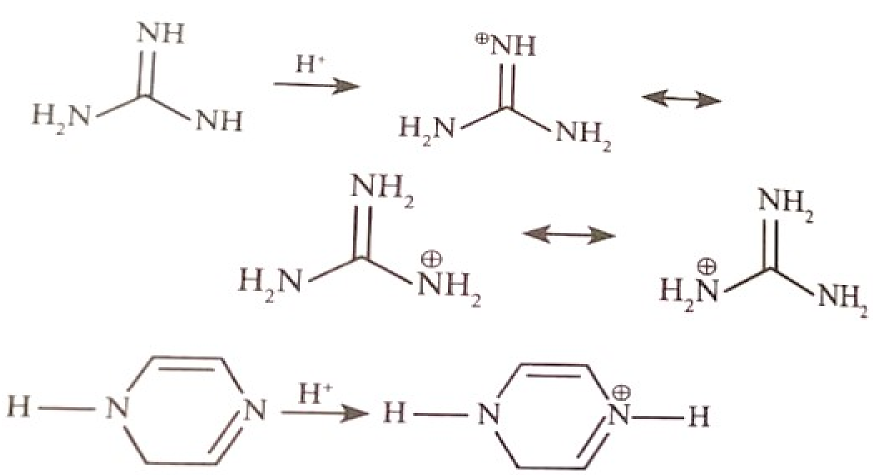
65. (b) Butanal, 3 – pentanone, Pentanal and 3-pentanol will not give iodoform reaction due to absence of $\left(CH_3CO^-\right)$ and $\left(-CH_3CH(OH)\right)$ groups.

66. Vanillin, with its phenolic – OH group, is acidic enough to react with NaOH, which is a strong base. It also reacts with Tollen's reagent due to presence of aldehyde group. Vanillin does not undergo self-aldol condensation due to the absence of an acidic – hydrogen atom, which is necessary for the reaction to occur,

67. 

So, statement 1 is true but statement 2 is false.

68. Stronger base has stable conjugate acid



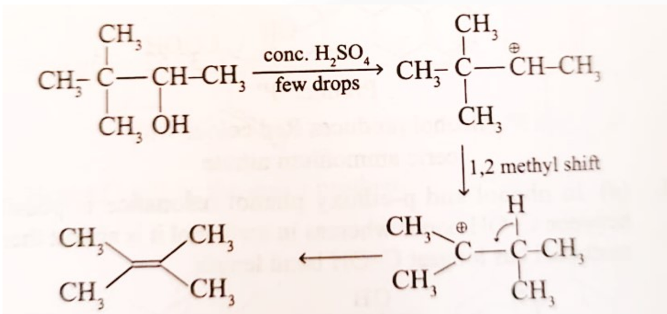
First one is less basic because lone pairs of electrons are in conjugation with double bond and hence have less donating power as compare to IV.

69.

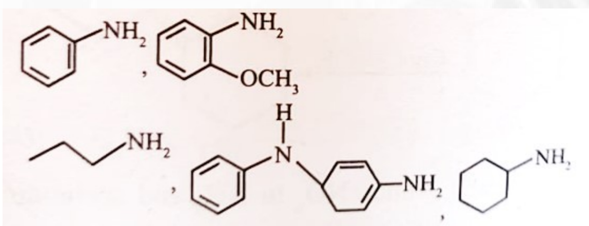
$$CH_2 = CH - \ddot{O}CH_3 \longleftrightarrow CH_2 - CH = O - CH_3$$

$$CH_3 - \underset{\displaystyle Br}{CH} - OCH_3 \xleftarrow{Br^{\ominus}} CH_3 - \overset{\oplus}{C}H - \ddot{O}CH_3 \longleftrightarrow CH_3 - CH = \overset{\oplus}{O} - CH_3$$

70.

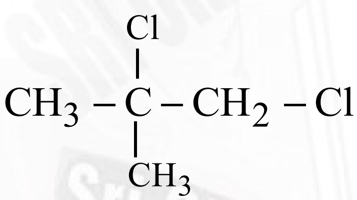


71. 1^0 amine give an ionic solid upon reaction with Hinsberg reagent which is soluble in NaOH. So the following amine compounds will be soluble :

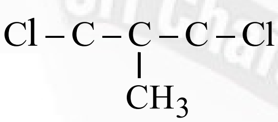


72. 2,3,4,5,6

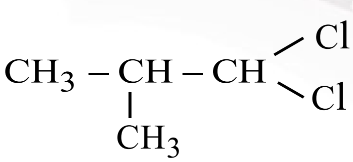
73.



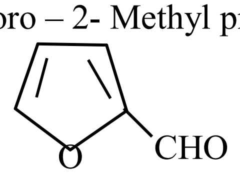
1,2 – dichloro – 2- Methyl propane



1,3-dichloro – 2- Methyl propane



1,1-dichloro – 2- Methyl propane

74. C_6H_5CHO, C_6H_5COCHO, C_6H_5COCHO and  , $(CH_3)_3C - CHO$

75. PCl_3, PCl_5, $SOCl_2$