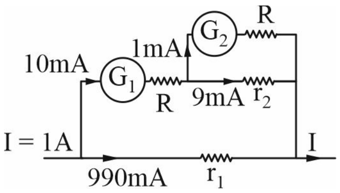
Solutions of JEE Advanced - 1| Paper - 2 | 2024

SECTION-1

1.(C) $B=\frac{\mu_0}{4\pi}\frac{(2i_0\pi R^2)}{d^3}(\hat{k})$

$\tau=(i\,\pi r^2)\frac{\mu_0}{4\pi}.\frac{(2i_0\pi R^2)}{d^3}(\hat{i}\times\hat{k})$; $\tau=\frac{\mu_0}{2}\frac{\pi i_0 iR^2r^2}{d^3}(-\hat{j})$

2.(B) $1A\times\frac{r_1}{\frac{Rr_2}{R+r_2}+R+r_1}=10\,mA$ . . . . (i)



And $10mA\times\frac{r_2}{R+r_2}=1mA$ . . . . .(ii)

From (ii) $r_2=\frac{R}{9}, 10R+R=990r_1$ $r_1=\frac{R}{90}$

3.(C) $\vec{E}=\frac{a\,\hat{r}}{r^2}$

$\int_R^{2R}\frac{1}{2}\varepsilon_0E^2\times4\pi r^2dr$

$\int_R^{2R}\frac{1}{2}\times\varepsilon_0\times\frac{a^2}{r^2\times r^2}\times4\pi r^2dr$

Energy = $\frac{\pi\varepsilon_0a^2}{R}$

4.(D) When voltage is set to $\frac{V_0}{3}$, charge supplied by battery $=\frac{CV_0}{3}$

When voltage is raised to $\frac{2V_0}{3}$, additional charge supplied $=\frac{2CV_0}{3}-\frac{CV_0}{3}=\frac{CV_0}{3}$.

When voltage is raised to V_0, additional charge supplied $=CV_0-\frac{2CV_0}{3}=\frac{CV_0}{3}$

Total energy supplied by cell $=\frac{V_0}{3}\left(\frac{CV_0}{3}\right)+\frac{2V_0}{3}\left(\frac{CV_0}{3}\right)+V_0\left(\frac{CV_0}{3}\right)=\frac{2}{3}CV_0^2$

Final charge on capacitor $=CV_0$; Energy stored in capacitor $=\frac{1}{2}CV_0^2$

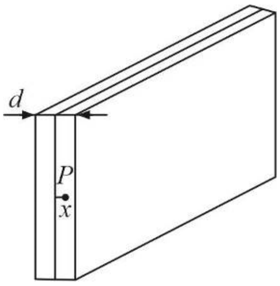
$\therefore$ Energy dissipated across resistor, $E_D=\frac{2}{3}CV_0^2-\frac{1}{2}CV_0^2=\frac{1}{6}CV_0^2$

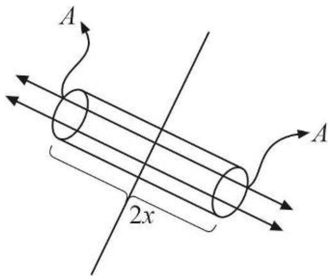
SECTION-2

5.(AD) $\vec{E}.\vec{B}=0$

$\vec{E}\times\vec{B}$ should be along $\hat{k}$

6.(AB)

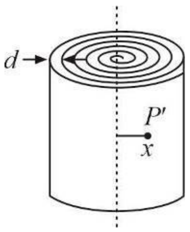


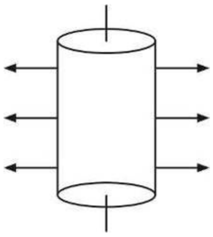


$EA+EA=\rho(2x)\times A$

$2EA=\rho\,2x\,A$

$E=\dfrac{\rho x}{\varepsilon_0}$



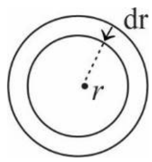


$E\times 2\pi x\times l=\dfrac{\rho\times\pi x^2\times l}{\varepsilon_0}$; $E=\dfrac{\rho x}{2\varepsilon_0}$

7.(ACD) The correct through cross section of radius r is

$$i=\int_0^r\left(J\,2\pi r dx\right)=\frac{2\pi k r^4}{4}$$

According Amphere's circuital law $\left(r_1<a\right)$



$$\oint\vec{B}\cdot\vec{d\ell}=\mu_0\, i_{\ell n}$$

$$B2\pi r=\mu_0\frac{\pi k r^4}{2} \qquad \therefore \qquad B=\frac{\mu_0 k r^3}{4}$$

For $r>a$

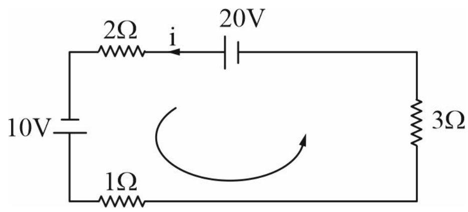
$$B2\pi r=\mu_0\frac{\pi k a^4}{2} \qquad \therefore \qquad B=\frac{\mu k a^4}{4r}$$

SECTION-3

PARAGRAPH FOR Q-1 & 2

1.(28) In steady state three will be no current through the capacitors.

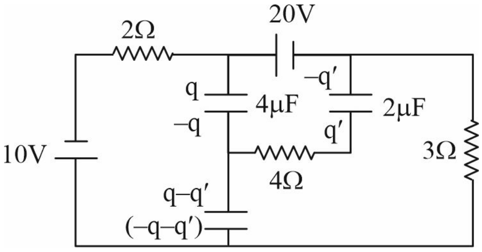
$\therefore$ The given circuit may be redrawn as



Applying Kirchhoff's loop law

$$20 - i \times 2 + 10 - I \times 1 - I \times 3 = 0 \quad \Rightarrow i = \frac{30}{6} = 5A$$

Now again redrawing the original circuit.



Applying KVL II in Loop– 1

$$\frac{q}{4 \times 10^{-6}} - 2 \times 5 + 10 - 5 \times 1 + \frac{q - q'}{4 \times 10^{-6}} = 0$$

$$\Rightarrow \quad \frac{q}{4} + \frac{q}{4} - \frac{q'}{4} = 5 \times 10^{-6} \Rightarrow \frac{q}{2} - \frac{q'}{4} = 5 \times 10^{-6}$$

Apply KVL-II in Loop-2

$$20 - \frac{q}{4 \times 10^{-6}} - \frac{q'}{2 \times 10^{-6}} = 0$$

$$20 \times 10^{-6} = \frac{q}{4} + \frac{q'}{2}$$

Now solving equation (i) and (ii) we get

$q' = 28\mu C$

2.(36) Solving equations (i) and (ii) we get

$q = 24\mu C$

$\therefore$ Charge on one $4\mu F$ capacitor is $24\mu C$, while on the other it is $(24 - 28)\mu C$.

Now we know

Energy stored in a capacitor is given by $\dfrac{q^2}{2C}$

$\therefore \quad E \propto q^2$

$$\therefore \quad \frac{E_1}{E_2} = \frac{(24)^2}{(4)^2} = \frac{36}{1}$$

PARAGRAPH FOR Q-3 & 4

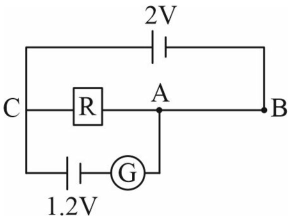
3.(1.32) Let K be the potential drop per unit length of the wire

$$K = \frac{2}{10} = 0.2 Vm^{-1}$$

$1.2 = Kx$

$E = K(x + 0.6) \qquad \therefore \qquad E - 1.2 = K \times 0.6 = 0.2 \times 0.6 = 0.12$

$E = 1.32V$



4.(2.40) P.D. across $AB = 10 \times 1 \times 10^{-3} V = 10\, mV$

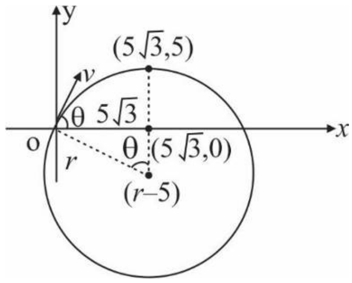
Current throguh $AB = \frac{10}{20} \times 10^{-3} A = 0.5\, mA$

Since G shows null deflection, $V_{CA} = 1.2V$

$= 0.5\, R \times 10^{-3}$ volt

$$R = \frac{1.2}{0.5 \times 10^{-3}} = 2.4 \times 10^3 \Omega = 2.4\, k\Omega$$

SECTION-4



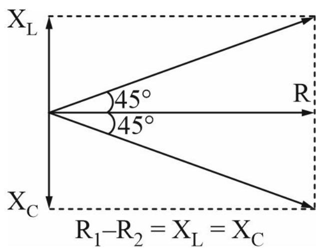
5.(2) $(r-5)^2 + \left(5\sqrt{3}\right)^2 = r^2$

$\therefore \quad r = 10m$

$$v = \frac{rqB}{m} = \frac{10 \times 15^6 \times 10}{5 \times 15^{-5}} = 2m/s$$

6.(2) Speed in medium $= \frac{\omega}{k} = \frac{6 \times 10^8}{4} = 1.5 \times 10^8\, m/s$

Refraction index $= \frac{3 \times 10^8}{1.5 \times 10^8} = 2$



7.(5) Peak current through R_1, $I_1 = \frac{50}{10\sqrt{2}} = \frac{5}{\sqrt{2}} A$

Peak current through R_2, $I_2 = \frac{50}{10\sqrt{2}} = \frac{5}{\sqrt{2}} A$

Phase difference between I_1 and I_2 is $\frac{\pi}{2}$

$\therefore$ Peak current through the source is

$$I = \sqrt{I_1^2 + I_2^2} = \sqrt{\left(\frac{5}{\sqrt{2}}\right)^2 + \left(\frac{5}{\sqrt{2}}\right)^2} = \frac{5}{\sqrt{2}} \times \sqrt{2}$$

8.(3) Flux of magnetic field at any time t is $\phi = \int_t^{2t} \alpha x t l dx = \frac{3}{2} \alpha t l^3$

$\therefore \quad |e| = \frac{3}{2} \alpha l^3$

$\therefore$ Charge on capacitor $= \frac{3}{2} C \alpha l^3$

$\therefore \quad n = 3$

9.(3) Total charge $Q = \int_0^{R/2} \rho(r)\ 4\pi r^2 dr + \int_{R/2}^{R} \rho(r) 4\pi r^2 dr$

$$= 4\pi\rho_0 \left[\frac{r^3}{3}\right]_0^{\pi/2} + 8\pi\rho_0 \int_{R/2}^{R} \left(r^2 - \frac{r^3}{R}\right) dr = \frac{\pi\rho_0 R^3}{6} + 8\pi\rho_0 \left[\frac{1}{3}\left(R^3 - \frac{R^3}{8}\right) - \frac{1}{4R}\left(R^4 - \frac{R^4}{16}\right)\right]$$

$$= \frac{\pi\rho_0 R^3}{6} + 8\pi\rho_0 \left[\frac{7}{24}R^3 - \frac{15}{64}R^3\right] = \frac{\pi\rho_0 R^3}{6} + \frac{88}{192}\pi\rho_0 R^3 = \frac{15}{24}\rho_0 R^3 \pi = \frac{5}{8}\pi\rho_0 R^3$$

$$\therefore \quad \rho_0 = \frac{8Q}{5\pi R^3}$$

Let an electron be placed at P at a distance r from O. Let E be the electric field pointing outward at P.

$$E = \frac{\rho_0}{3\varepsilon_0}.r$$

Force on electron eE acting towards the centre is given by

$$-eE = m\frac{d^2r}{dt^2}$$

$$\therefore \quad \frac{d^2r}{dt^2} + \frac{e}{m}\frac{\rho_0}{3\varepsilon_0}.r = 0 \Rightarrow \text{SHM for } -\frac{R}{2} \le r \le \frac{R}{2},$$

With $T = 2\pi\sqrt{\dfrac{3m\varepsilon_0}{e\rho_o}} = 2\pi\left[\dfrac{15m\varepsilon_0\pi R^3}{8Qe}\right]^{1/2}$

10.(2) Let v be the speed of rod at any time. Then the equivalent circuit and free body diagram of rod are shown in figure (A) and figure (B) respectively.

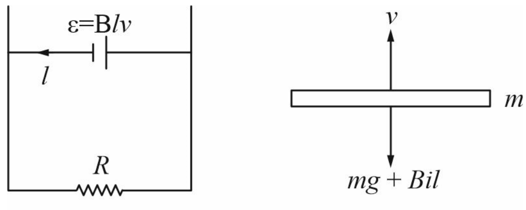


Figure (A) Figure (B)

Applying Newton's second law to rod

$$\frac{mdv}{dt} = -(mg + Bil) \qquad \text{. . . . (i)}$$

where $i = \dfrac{Blv}{R}$ . . . . (ii)

from equation (i) and (ii) $\dfrac{mdv}{dt} = -\left(mg + \dfrac{B^2l^2v}{k}\right)$

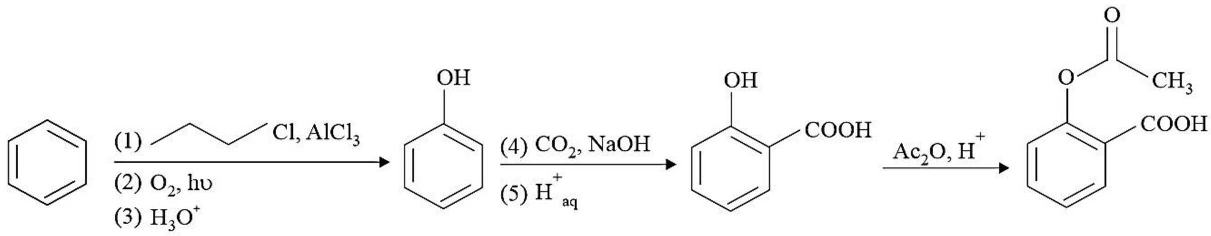
integrating between proper limits we get $\displaystyle\int_u^0 \frac{mdv}{mg + \frac{B^2l^2v}{R}} = \int_0^t -dt$,

$$t = \frac{mR}{B^2l^2}\ln\frac{mg + \frac{B^2l^2u}{R}}{mg} \approx 2$$

CHEMISTRY

SECTION-1

1.(B)

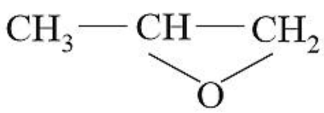


2.(C)

$$\underset{(1\,\text{mole})}{^{238}_{92}U_{(s)}} \longrightarrow {}^{206}_{82}Pb_{(s)} + \underset{(8\,\text{mole})\,(\because\,8\,\text{mole helium})}{8\,{}^{4}_{2}\alpha + 6\,{}^{0}_{-1}\beta}$$

$$\frac{P_F}{P_i} = \frac{(8+2)RT/V}{(2)RT/V} = 5$$

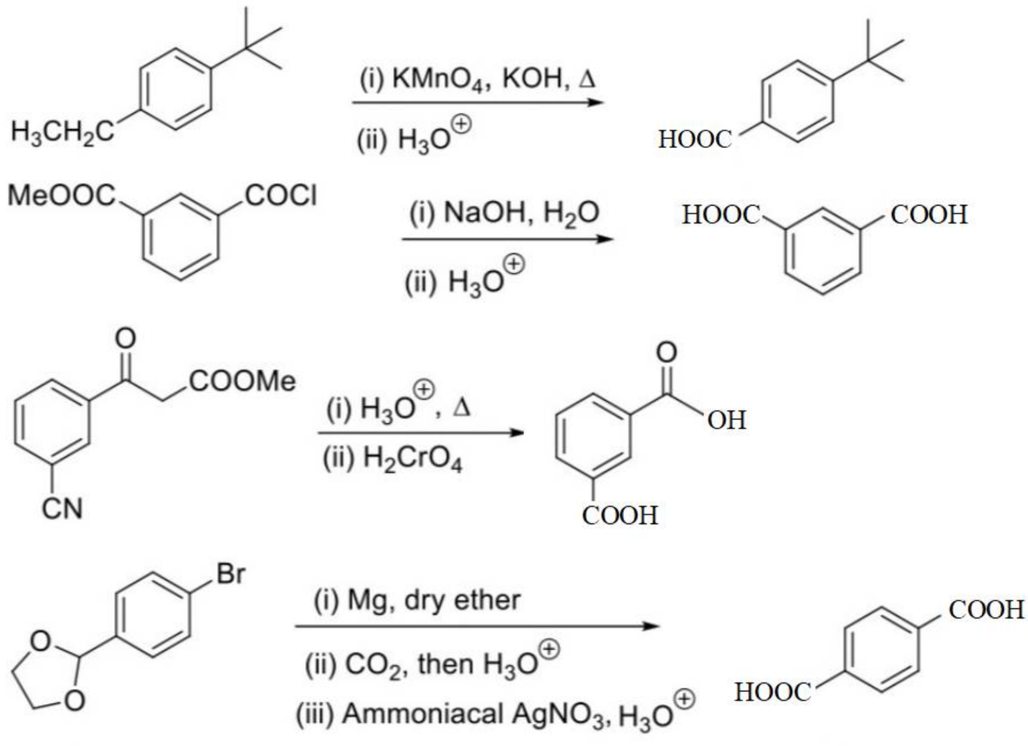
3.(B)

 $\xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } LiAlD_4} CH_3-\underset{\substack{|\\ OH}}{CH}-CH_2-D$

$$CH_3-\underset{\substack{|\\ F}}{CH}-CH_2-Ph \xrightarrow{tBuO^-K^+} CH_3-CH=CH-Ph$$

$$CH_3OCH_2CH_3 \xrightarrow{\text{Conc. HBr}} CH_3-Br + CH_3CH_2OH$$

4.(A)



SECTION-2

5.(A,C) For spontaneous reactions ΔG must be negative. $E^{\circ}_{AgBr/Ag,Br^-_{aq.}}$ is lower than $E^{\circ}_{Ag^+/Ag_{(s)}}$.

6.(B, D) For reaction I $k_f = 2\times10^3$ and $k_b = 5\times10^3$, $E_f > E_b$, $\Delta H = (+)$ve

For reaction II $k_f = 2\times10^2$ and $k_b = 1.5\times10^3$, $E_f > E_b$, $\Delta H = (+)$ve

7.(A,B,D) (i) As $\Delta T_b = K_b m$

$T_b - T_b^{\circ} = K_b m$

$T_b = T_b^{\circ} + K_b m$

Similarly $T_f = T_f^{\circ} - K_f m$

(ii) Addition of H^+ will cause hydrolysis of sucrose.

(iii) $\Delta H_{mix} \approx 0$ for ideal solution of two volatile liquids.

(iv) If $K_H = 500$ torr and P = 760 torr than $X_g > 1$. (X_g is mole fraction)

SECTION-3

1.(51.15) $R = k_2[Br][H_2]$

as $\dfrac{[Br]^2}{[Br_2]} = K_{eql} = \left(\dfrac{k_f}{k_b}\right)$

$[Br] = \sqrt{\dfrac{k_f}{k_b}}[Br_2]^{1/2} \Rightarrow \text{Rate} = k_2\sqrt{\dfrac{k_f}{k_b}}[Br_2]^{1/2}[H_2]$

$k_{net} = \dfrac{k_2[k_f]^{1/2}}{[k_b]^{1/2}}$

$E_{net} = E_2 + \dfrac{1}{2}(E_f)_I - \dfrac{1}{2}[E_b]_I$

$= 56.30 + \dfrac{1}{2}[20.52 - 30.81] = 56.30 + \dfrac{1}{2}[-10.29] = 56.30 - 5.145 = 51.155$

2.(8) As rate $\alpha[H_2]^1[Br_2]^{1/2}$, $\dfrac{R_{New}}{R_{original}} = (4)^1(4)^{1/2} = 8$

3.(8.33) $96Ti^{2+} \Rightarrow 192$ (positive charge)

$100\ O^{2-} \Rightarrow 200$ (negative charge)

Replacement of $8Ti^{2+}$ by $8Ti^{3+}$ will balance the charge in the solid for electrical neutrality.

% of $Ti^{3+} = \dfrac{8}{96}\times100 = \dfrac{800}{2} = 8.33$

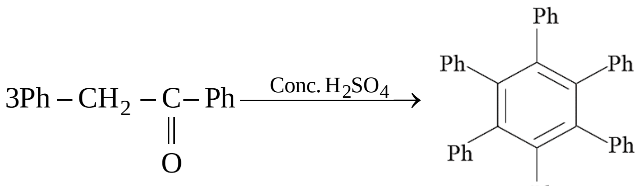
4.(71.15) $\dfrac{\text{pyknometer density}}{\text{x − ray diffraction density}} = \left(\dfrac{5.20}{5.35}\right) = \dfrac{M^{\circ}_{actual}}{M^{\circ}_{Theoritical}}$

$M^{\circ}_{actual} = (45+16)\left[\dfrac{5.20}{5.35}\right]$

$\therefore$ mass of 1.2 mole sample = 1.2 (61) $\left[\dfrac{5.20}{5.35}\right] = 71.15$ g = 71.15

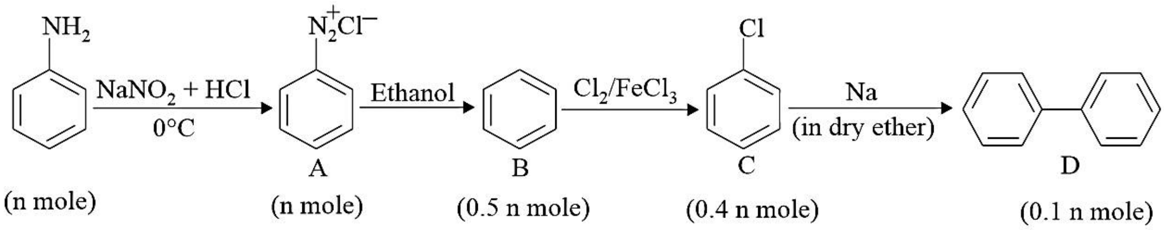
SECTION-4

5.(72)



Maximum atoms in same plane $= 11 \times 6 + 6 = 72$

6.(1)



$\therefore$ moles of D produced = 0.1(10) = 1 mole

7.(4) As per the given mechanism, Rate $= k_3\left[\dfrac{k_2}{k_{-2}}\right]\left[\dfrac{k_1}{k_{-1}}\right][HCHO]^2[OH^-]^2$

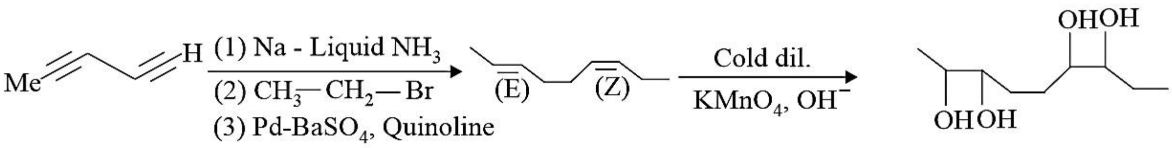
$\therefore \quad x + y = 4$

8.(100) $k_{sol.} = k_{Na^+} + k_{Cl^-} = \dfrac{\lambda^{\circ}_{Na^+}[Na^+]}{1000} + \dfrac{\lambda^{\circ}_{Cl^-}\left[Cl^-\right]}{1000}$

$= \dfrac{150[1/2]10^{-2}}{1000} + \dfrac{250[1/2]10^{-2}}{1000} = 2 \times 10^{-3}\ S\ cm^{-1}$

As $\quad Rk = \dfrac{\ell}{A}, \qquad R = \dfrac{1}{k}\left[\dfrac{\ell}{A}\right] = \dfrac{1000}{2}[0.2] = 100\ \Omega$

9.(4)



Total 4 stereoisomers

10.(10) $t_{99.9\%} = 10t_{50\%}$

MATHEMATICS

SECTION-1

1.(C) $g(x) = \dfrac{1}{f(|x|)}$

$g(x) \Rightarrow$ even function $\Rightarrow$ symmetric about y-axis

$\Rightarrow \quad x \to \infty \qquad f(x) \to 0$

At $\quad x = x_1 \qquad f(x) = 0 \Rightarrow g(x_1) \to \infty$

2.(B) $1 + tan^2\left(tan^{-1} 2\right) + 1 + cot^2\left(cot^{-1} 3\right) = 1 + 2^2 + 1 + 3^2 = 15$

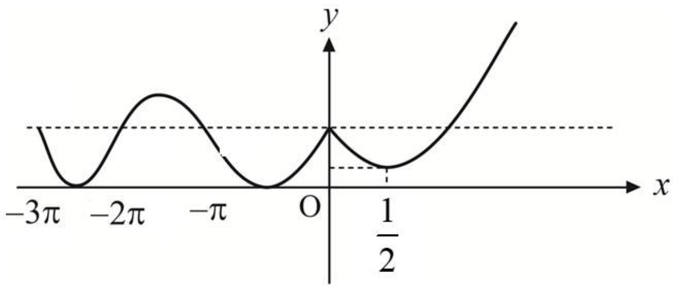
3.(A) $g(x) = f^{-1}(x) \qquad f(4) = 2 \Rightarrow g(2) = 4$

$G(x) = \dfrac{1}{g(x)} \qquad f'(4) = \dfrac{1}{16} \Rightarrow g'(2) = 16$

$G'(x) = \dfrac{-1}{(g(x))^2} \cdot g'(x) \Rightarrow G'(2) = \dfrac{-1}{(g(2))^2} \cdot g'(2) = \dfrac{-1}{16}.16 = -1$

Therefore, $(g'(2))^2 = (-1)^2 = 1$

4.(A)



$f(x)$ has local maximum at $x = 0$

SECTION-2

5.(AC) **(A)** $g\left(f(x)\right) = \ell n(sin\,x)$

(B) $x^2 + (a-1)x + 9 > 0 \ \forall \ x \in R$; $(a-1)^2 - 36 < 0 \Rightarrow -5 < a < 7$

(C) $f\left(f(x)\right) = \left(2011 - \left(2011 - x^{2012}\right)\right)^{1/2012} = x$

6.(ABD) Given $|f(x)| \le sin^2 x$

Clearly $|f(0)| \le 0 \Rightarrow f(0) = 0$; $\lim\limits_{x\to 0} |f(x)| = \left|\lim\limits_{x\to 0} f(x)\right| = 0$

$$|f'(0)| = \left|\lim_{x\to 0} \frac{f(x) - f(0)}{x}\right| = \left|\lim_{x\to 0} f(x)\right| \le 0$$

7.(BD) Point (1, 2) lies on $y = mx + 5$ $\Rightarrow$ $m = -3$ ....(i)

Point (1, 2) lies on $x^3y^3 = ax^3 + by^3$ $\Rightarrow$ $8b + a = 8$ ....(ii)

$3x^2y^3 + x^3 \cdot 3y^2y^1 = 3ax^2 + 3by^2y^1$ $\Rightarrow$ $a - 12b = -4$ ....(iii)

$\Rightarrow \quad a = \dfrac{16}{5}, b = \dfrac{3}{5}$

SECTION-3

1.(1), 2.(5)

$$f(x) = x^2 + \int_0^x e^{-t} f(x-t)\,dt \qquad \text{....(i)}$$

$$= x^2 + \int_0^x e^{-(x-t)} f(x-(x-t))\,dt \qquad \left[\text{Using } \int_a^b f(x)dx = \int_a^b f(a+b-x)dx\right]$$

$$= x^2 + e^{-x}\int_0^x e^t f(t)\,dt \qquad \text{....(ii)}$$

Differentiating w.r.t. x, we get :

$$\Rightarrow \quad f'(x) = 2x - e^{-x}\int_0^x e^t f(t)\,dt + e^{-x}e^x f(x) = 2x - e^{-x}\int_0^x e^t f(t)\,dt + f(x)$$

$$\Rightarrow \quad f'(x) = 2x + x^2 \qquad \text{[Using equation (ii)]}$$

$$\Rightarrow \quad f(x) = \frac{x^2}{3} + x^2 + c$$

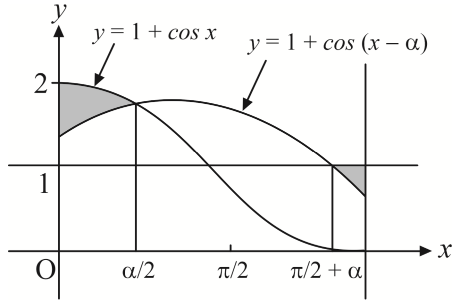
Also $f(0) = 0$ [Using equation (i)]

$$\Rightarrow \quad f(x) = \frac{x^3}{3} + x^2$$

$$\int_0^1 f(x)dx = \int_0^1 \left(\frac{x^3}{3} + x^2\right)dx = \left[\frac{x^4}{12} + \frac{x^3}{3}\right]_0^1 = \frac{1}{12} + \frac{1}{3} = \frac{5}{12}$$

3.(1) $1 + \cos x = 1 + \cos(x - \alpha)$

$x = \alpha - x \Rightarrow x = \dfrac{\alpha}{2}$



Now $\displaystyle\int_0^{\alpha/2} \left((1+\cos x) - (1+\cos(x-\alpha))\right)dx$

$$= \int_{\frac{\pi}{2}+\alpha}^{\pi} \left(1 - (1+\cos(x-\alpha))\right)dx$$

$$\Rightarrow \quad \left[\sin x - \sin(x-\alpha)\right]_0^{\alpha/2} = \left[\sin(x-\alpha)\right]_{\pi}^{\pi/2+\alpha}$$

$$\Rightarrow \quad \left[\sin\frac{\alpha}{2}-\sin\left(-\frac{\alpha}{2}\right)\right]-\left[0-\sin(-\alpha)\right]=\sin\left(\frac{\pi}{2}\right)-\sin(\pi-\alpha)$$

$$\Rightarrow \quad 2\sin\frac{\alpha}{2}-\sin\alpha=1-\sin\alpha \qquad \text{Hence, } 2\sin\frac{\alpha}{2}=1 \Rightarrow \alpha=\frac{\pi}{3}$$

4.(2) $$\int_0^{\pi/6}\left((1+\cos x)-\left(1+\cos\left(x-\frac{\pi}{3}\right)\right)\right)dx+\int_{\pi/6}^{\pi}\left(\left(1+\cos\left(x-\frac{\pi}{3}\right)\right)-(1+\cos x)\right)dx$$

$$=\left[\sin x-\sin\left(x-\frac{\pi}{3}\right)\right]_0^{\pi/6}+\left[\sin\left(x-\frac{\pi}{3}\right)-\sin x\right]_{\pi/6}^{\pi}$$

$$=\left[\left(\frac{1}{2}+\frac{1}{2}\right)-\frac{\sqrt{3}}{2}\right]+\left[\frac{\sqrt{3}}{2}-\left(-\frac{1}{2}-\frac{1}{2}\right)\right]= 2 \text{ sq. units}$$

SECTION-4

5.(65) $$2\tan^{-1}\left(\frac{1}{5}\right)-\sin^{-1}\left(\frac{3}{5}\right)$$

$$\tan^{-1}\left(\frac{5}{12}\right)-\sin^{-1}\left(\frac{3}{5}\right)$$

$$\tan^{-1}\left(\frac{5}{12}\right)-\tan^{-1}\left(\frac{3}{4}\right)=-\left(\tan^{-1}\left(\frac{3}{4}\right)-\tan^{-1}\left(\frac{5}{12}\right)\right)$$

$$=-\tan^{-1}\left(\frac{16}{63}\right)=-\cos^{-1}\left(\frac{63}{65}\right)$$

$$\Rightarrow \quad \lambda=65$$

6.(4) Let $8x-16=t^2 \Rightarrow \sqrt{\dfrac{t^2+16+8|t|}{8}}+\sqrt{\dfrac{t^2+16-8|t|}{8}}=\dfrac{|t|+4+\big||t|-4\big|}{2\sqrt{2}}$

7.(3) $f'(x)=2e^{2x}-(\lambda+1)e^x+2\ge 0 \ \forall x\in R$

i.e., $\quad 2e^{2x}+2-(\lambda+1)e^x\ge 0$

$$\lambda+1\le 2\left(e^x+e^{-x}\right)$$

$$\frac{\lambda+1}{2}\le\left(e^x+e^{-x}\right)\forall x\in R \Rightarrow \frac{\lambda+1}{2}\le\left(e^x+e^{-x}\right)_{min}\forall x\in R$$

So $\quad \dfrac{\lambda+1}{2}\le 2 \ ; \ \lambda+1\le 4 \ ; \ \lambda\le 3$

$$\lambda\in(-\infty,3]$$

$\therefore \quad k=3$

8.(9) $\frac{3+5+7+\alpha+\beta}{5}=5 \quad\Rightarrow\quad \alpha+\beta=10$ **. . . .(i)**

$$\frac{3^2+5^2+7^2+\alpha^2+\beta^2}{5}-(5)^2=4$$

$\alpha^2+\beta^2=62$ **. . . .(ii)**

From (i) and (ii) $\alpha\beta=19$

Here equation is $x^2-10x+19=0$

$a+b=9$

9.(3) $\int \frac{\tan x}{\tan^2 x+\tan x+1}dx$

Let $\tan x=t,\ \sec^2 x\,dx=dt,\ dx=\frac{dt}{1+t^2}$

$$\int \frac{t}{\left(1+t+t^2\right)}\cdot\frac{dt}{1+t^2}=\int\left(\frac{1}{1+t^2}-\frac{1}{1+t+t^2}\right)dt=\int\frac{dt}{1+t^2}-\int\frac{dt}{\left(t+\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}$$

$$=\tan^{-1}(t)-\frac{1}{\left(\frac{\sqrt{3}}{2}\right)}\tan^{-1}\left(\frac{2t+1}{\sqrt{3}}\right)+C=\tan^{-1}(\tan x)-\frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{2\tan x+1}{\sqrt{3}}\right)+C$$

10.(8) $\int\frac{dx}{(\cos x-\sin x)(1+\sin x\cos x)}=2\int\frac{(\cos x-\sin x)dx}{(\cos x-\sin x)^2\left(2+(\sin x+\cos x)^2-1\right)}$

$$=2\int\frac{(\cos x-\sin x)dx}{\left(\left(\sin^2 x+\cos^2 x\right)-2\sin x\cos x\right)\left(1+(\sin x+\cos x)^2\right)}$$

$$=2\int\frac{(\cos x-\sin x)dx}{\left(2-(\sin x+\cos x)^2\right)\left(1+(\sin x+\cos x)^2\right)}$$

$$=2\int\frac{dt}{\left(2-t^2\right)\left(1+t^2\right)}\text{ where } t=\sin x+\cos x$$

$$=\frac{2}{3}\left[\tan^{-1}(t)+\frac{1}{2\sqrt{2}}\ell n\left(\frac{\sqrt{2}+t}{\sqrt{2}-t}\right)\right]+C$$

$\therefore\quad A=\frac{2}{3},\ B=\frac{1}{3\sqrt{2}}$

$\therefore\quad 12A+9\sqrt{2}B-3=12\cdot\frac{2}{3}+9\sqrt{2}\,\frac{1}{3\sqrt{2}}-3=8$