JEE Main – 2023 | Session - 1
Questions to be challenged

24 JAN - SHIFT 1

Chemistry | Question ID: 7155051482

NTA Response: 7155054458

VMC Response: 7155054455

Solution: $[Co(NH_3)_5Cl]_{Cl_2} \rightleftharpoons [Co(NH_3)_5Cl]^{2+} + 2Cl^-$

(secondary valency = 6) (Primary valency = 2)

24 JAN - SHIFT 2

Chemistry | Question ID: 7155051570

NTA Response: 7155054720

VMC Response: 7155054718

Solution:

Crystal field model sussessfully explains structure stability, magnetic property and colour of metal complex but could not explain the order of spectrochemical series.

Chemistry | Question ID: 7155051582

NTA Response: 2

VMC Response: 3

Solution:

(A) $T_1 > T_2 > T_3 > T_4$

(B) Planck's hypothesis implies that radiation of frequency ν can be generated only if an oscillator of that frequency has acquired the minimum energy required to start oscillation.
Thus, atoms in blackbody acts as SHM.

(C) As the temperature increases, the maximum intensity of emission moves to shorter wavelength.

(D) The wavelength corresponding to maximum intensity is inversely proportional to absolute temperature

$\because \quad \lambda \propto \frac{1}{T}$

$\lambda T =$ Constant

but $\nu \times \lambda = C$

$\because \quad \lambda = \frac{c}{\nu}$

$\because \quad \frac{T}{\nu} =$ Constant

(E) If the oscillating atom releases an energy E into the surroundings, then radiation of frequency $\nu = E/h$ will be detected.

25 JAN - SHIFT 1

Chemistry | Question ID: 3666941201
NTA Response: 3666943602
VMC Response: Bonus
Solution:

X at alternate corners $= 4 \times \frac{1}{8} = \frac{1}{2}$

X at body center = 1

Y at $\frac{1}{3}$ rd faces $= 6 \times \frac{1}{3} \times \frac{1}{2} = 1$

$X_{1.5}Y_1$

X_3Y_2

Chemistry | Question ID: 3666941224
NTA Response: 41500
VMC Response: Bonus
Solution:

$\pi = CRT$

$\frac{\pi}{C} = RT = \text{constant}$

25 JAN - SHIFT 2

Chemistry | Question ID: 7155051652
NTA Response: 7155054957
VMC Response: 7155054958
Solution:
In chemisty dipole moment is from '+' to '–'
Statement 1 : False
Statement 2 : True

Chemistry | Question ID: 7155051653
NTA Response: 7155054962
VMC Response: 7155054961
Solution:

If $[H^+]$ is $\uparrow$ by 1000 times

pH should decrease by 3 units.

Chemistry | Question ID: 7155051673
NTA Response: 925
VMC Response: 847
Solution:

$$C_2H_4(g) + 3O_2(g) \longrightarrow 2CO_2(g) + 2H_2O(\ell)$$

xL - 2xL -

$$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(\ell)]$$ Considering T, P constant

yL - yL -

$x + y = 16.8$

$2x + y = 28$

$\Rightarrow\ x = 11.2$

$y = 5.6$

Heat evolved $= (n_{C_2H_4} \times 1400 + n_{CH_4} \times 900)kJ$

$$= \left(\frac{1\times 11.2}{0.0821\times 298}\times 1400\right) + \left(\frac{1\times 5.6}{0.0821\times 298}\times 900\right)$$

= 640.894 + 206.001= 846.895 = 847

29 JAN - SHIFT 1

Mathematics | Question ID: 3666942082

NTA Response: 3666946442

VMC Response: No Options Matching (Bonus)

29 JAN - SHIFT 2

Chemistry | Question ID: 366694305

NTA Response: 366694917

VMC Response: 366694920

Solution:

Statement 1 says DECREASE in 1st IE from Al to Ga. But IE of Ga>Al.

Hence statement 1 is wrong.

Mathematics | Question ID: 366694350

NTA Response: 3666941068

VMC Response: 3666941070

Solution:

$B \to (\sim A \vee B)$, $(\sim A \vee B)$ is equivalent of $A \to B$

So, $B \to (\sim A \vee B)$ is equivalent to $B \to (A \to B)$

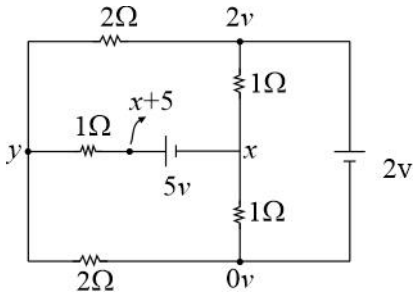
30 JAN - SHIFT 1

Physics | Question ID: 1755052021

NTA Response: 1

VMC Response: 2

Solution:



Net current at node 'x'

(A) $\dfrac{2-x}{1} + \dfrac{0-x}{1} + \dfrac{y-(x+5)}{1} = 0$

Net current at node 'y'

(B) $\dfrac{2-y}{2} + \dfrac{(x+5)-y}{1} + \dfrac{0-y}{2} = 0$

(A): $2-x+0-x+y-x-5=0$

$y-3x-3=0$ … (i)

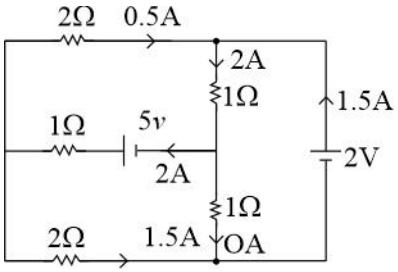
(B): $2-\bar{y}+2\bar{x}+10-2y+0-\bar{y}=0$

$2x-4y+12=0$

Or $x-2y+6=0$ … (ii)

Solving $x = 0; y = 3$

So current distribution will be like:



Physics | Question ID: 7155052025

NTA Response: 22

VMC Response: 220

Solution:

$$L.C. = \left(\frac{0.5}{100}\right) mm$$

$$V.S.R = (46-6)\left(\frac{0.5}{100}\right) mm$$

$$M.S.R = (4 \times 0.5)\, mm$$

$\therefore$ Measured value,

$$M = (2+0.2)\, mm$$

Or $M = 220 \times 10^{-2}\, mm$

Chemistry | Question ID: 7155052046

NTA Response: 221

VMC Response: 148

Solution:

$$\text{wt of DCM} = \text{M} \times \text{V} \times \text{M.wt}$$

$$= 2.6 \times 10^{-3} \times 671.14 \times 85 = 148.3\text{mg}$$

Mass of solution = wt of DCM + wt of $CHCl_3$

$$= 148.3 + (671.14 \times 1.49) \times 1000 = 148.3 + 1000 \times 1000 \simeq 10^6$$

$$\text{(conc.) in ppm} = \frac{\text{wt of DCM}}{\text{wt of solution}} \times 10^6 = \frac{148.3}{10^6} \times 10^6 = 148.3\text{ppm}$$

30 JAN - SHIFT 2

Physics | Question ID: 3666942395

NTA Response: 3666947558

VMC Response: Bonus

Solution:

Given options comes as answer if recoil velocity is calculated after one second but in question time is not mentioned.

Mathematics | Question ID: 3666942468

NTA Response: 3666947789

VMC Response: Bonus

Solution:

Both options (3666947792) & (3666947789) are same and hence both sould be correct.

$$\tan^{-1}\left\{\frac{a_2-a_1}{1+a_1a_2}\right\}+\tan^{-1}\left(\frac{a_3-a_2}{1+a_2a_3}\right)\ldots\ldots\ldots\ldots\ \tan^{-1}\left(\frac{a_{2022}-a_{2021}}{1+a_{2021}a_{2022}}\right)$$

$$\tan^{-1}a_2-\tan^{-1}a_1+\tan^{-1}a_3-\tan^{-1}a_2\ldots\ldots\ldots\ \tan^{-1}a_{2022}-\tan^{-1}a_{2021}$$

$$=\frac{-\pi}{4}+\tan^{-1}2022=\frac{\pi}{2}-\cot^{-1}2022-\frac{\pi}{4}=\frac{\pi}{4}-\cot^{-1}2022$$

31 JAN - SHIFT 1

Physics | Question ID: 366694554

NTA Response: 3666941673

VMC Response: 3666941674

Solution:

$$n=\frac{N}{L};\ B=\mu_r\mu_0 ni$$

$$\text{Total flux }=N.B.A=N.\mu_r\mu_0 ni.A=\left(\frac{N^2}{L}\right)\mu_r\mu_0 Ai\ =\frac{400^2}{0.4}\times\mu_r\times4\pi\times10^{-7}\times2\times10^{-4}\times0.4=4\pi\times10^{-6}$$

$$16\times10^4\times10^{-11}\times2\mu_r=10^{-6}\quad\Rightarrow\mu_r=\frac{10^{-6}}{32\times10^{-7}}=\frac{10}{32}=\frac{5}{16}$$

Mathematics | Question ID: 366694620

NTA Response: 3666941879

VMC Response: 3666941877

Solution:

$(p\to q)\vee(p\wedge(\sim q))$

$(\sim p\vee q)\vee(p\wedge(\sim q))\qquad\because\ p\to q\equiv\sim p\vee q$

$(\sim p\vee q\vee p)\wedge(\sim p\vee q\vee\sim q)$

$(\sim p\vee p\vee q)\wedge(\sim p\vee q\vee\sim q)$

$(T\vee q)\wedge(\sim p\vee T)$

$T\wedge T\equiv T$ (Tautology)

$S2:(\sim p\to\sim q)\wedge((\sim p)\vee q)$

$(\sim(\sim p)\vee\sim q)\wedge((\sim p)\vee q)$

$(p\vee\sim q)\wedge((\sim p)\vee q)$

$(\sim q\vee p)\wedge(\sim p\vee q)$

$(q\to p)\wedge(p\to q)$

$p\Leftrightarrow q$ (Not a contradiction)

So S1 is correct and S2 is false.

31 JAN - SHIFT 2

Chemistry | Question ID: 7155051744

NTA Response: 7155055233

VMC Response: 7155055234

Solution:

As per NCERT data,

Element		$(I.E.)_1$ (in kJ/mole)
Ca	–	590
Sc	–	631
Ti	–	656

And $(I.E.)_1$ values increase from left to right in 3d-series.

Hence, Assertion (A) and Reason (R) both are correct. And reason is not the correct explanation of assertion.

Mathematics | Question ID: 7155051792

NTA Response: 196

VMC Response: 204

Solution:

1st Solution

$a+b+c+d = \text{Prime} = \{3,5,7,11\}$

$a,b,c,d \in \{0,2,3,4\}$

a, b, c d are entries of matrix A

Using multinomial theorem

$$(1+x+x^2+x^3+x^4)^4 = \left(\frac{1-x^5}{1-x}\right)^4 = (1-x^5)^4(1-x)^{-4} = (1-4x^5+6x^{10})(1-x)^{-4}$$

$\because$ Coefficient of x^r in $(1-x)^{-n}$ is ${}^{n+r-1}C_r$

Coefficient of x^3 $\Rightarrow$ $1\times {}^{4+3-1}C_3x^3 = {}^6C_3 = 20$

Coefficient of x^5 $\Rightarrow$ $1\times {}^{4+5-1}C_5x^4 = {}^8C_5x^5 = 56x^5$

$-4x^5\times 1 = -4x^5$

$\therefore$ Coefficient of $x^5 = 52$

Coefficient of x^7 $\Rightarrow$ $1\times {}^{4+7-1}C_7x^7 = {}^{10}C_3x^7 = 120x^7$

$-4x^5\times {}^{4+2-1}C_2x^2 = 40x^7$

$\therefore$ Coefficient of $x^7 = 80$

Coefficient of x^{11} $\Rightarrow$ $1\times {}^{4+11-1}C_{11}x^{11} = {}^{14}C_3x^{11} = 364x^{11}$

$-4x^5\times {}^{4+6-1}C_6x^6 = -4\cdot {}^9C_3x^6 = -336x^{11}$

$6x^{10}\times {}^{4+1-1}C_1x^1 = 24x^{11}$

$\therefore$ Coefficient of $x^{11} = 52$

Answer = 20 + 52 + 80 + 52 = 204

2nd Solution

Let the matrix be $\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$

Now, $a_{11}, a_{12}, a_{21}, a_{22} \in \{0, 1, 2, 4\}$ such that … (A)

$a_{11} + a_{12} + a_{21} + a_{22} = p$ where $p \in \{3,5,7,11\}$ … (B)

We are looking for total number non-negative solutions of (B) under the constraint (A).

Total number of solutions

$= {}^{p+3}C_3 - {}^4C_1({}^{p-2}C_3) + {}^4C_2({}^{p-7}C_3)$

$= ({}^6C_3) + ({}^8C_3 - {}^4C_1 \cdot 1) + ({}^{10}C_3 - {}^4C_1 \cdot {}^5C_3) + ({}^{14}C_3 - {}^4C_1 \cdot {}^9C_3 + {}^4C_2 \cdot {}^4C_1) = 204$

1 FEB - SHIFT 1

Chemistry | Question ID: 3666942528

NTA Response: 3666947971

VMC Response: None Options Correct (Bonus)

Solution:

Statements A and B are correct and C and D are incorrect.

1 FEB - SHIFT 2

Physics | Question ID: 7155051195

NTA Response: 50

VMC Response: 67

Solution:

$$\frac{1}{2}kA^2 = \frac{1}{2}k\left(\frac{A}{2}\right)^2 + 0.25$$

$$\frac{3}{8}kA^2 = 0.25$$

$$\frac{3}{8}k\frac{1}{100} = 0.25$$

$$k = \frac{200}{3} = 67$$

Chemistry | Question ID: 7155051203

NTA Response: 7155053611

VMC Response: Bonus

Solution: Proper condition not given, incomplete question.

Chemistry | Question ID: 7155051225

NTA Response: 14

VMC Response: 13039

Solution:

$$\kappa = \kappa_{Ag^+} + \kappa_{Br^-} + \kappa_{NO_3^-}$$

$$\kappa_{sp} \text{ of } AgBr = \left[Ag^+\right]\left[Br^-\right]$$

$4.9\times10^{-13}=\left[s+10^{-5}\right][s]$

$\frac{4.9\times10^{-13}}{10^{-5}}=[s]$

$4.9\times10^{-8}=[s]$

$\left[Ag^{+}\right]=4.9\times10^{-8}+10^{-5}\approx10^{-5}\text{mole/litre}=10^{-2}\text{mole m}^{-3}$

$\left[Br^{-}\right]=4.9\times10^{-8}\text{mole/litre}=4.9\times10^{-5}\text{mole m}^{-3}$

$\left[NO_3^{-}\right]=10^{-5}\text{mole/litre}=10^{-2}\text{mole m}^{-3}$

$\kappa_{Ag^{+}}=10^{-2}\times6\times10^{-3}=6\times10^{-5}=6000\times10^{-8}$

$\kappa_{Br^{-}}=4.9\times8\times10^{-3}\times10^{-5}=39.2\times10^{-8}=39.2\times10^{-8}$

$\kappa_{NO_3^{-}}=7\times10^{-3}\times10^{-2}=7\times10^{-5}=7000\times10^{-8}$

$\kappa=6000\times10^{-8}+39.2\times10^{-8}+7000\times10^{-8}\ =10^{-8}\times13039.2\ sm^{-1}$

Mathematics | Question ID: 7155051248

NTA Response: 7155053761

VMC Response: Bonus

Solution:

Projection of $\vec{a}$ on $\vec{b}$ is $\vec{a}.\hat{b}$

$=\left(5\hat{i}-\hat{j}-3\hat{k}\right).\frac{(\hat{i}+3\hat{j}+5\hat{k})}{\sqrt{35}}$

$=\frac{5-3-15}{\sqrt{35}}=\frac{-13}{\sqrt{35}}$

Since proejction is -ve,

$\therefore$ projection of $\vec{a}$ on $\vec{b}$ is in direction opposite to that of $\vec{b}$.

As no option matches, therefore it should be Bonus.

Mathematics | Question ID: 7155051232

NTA Response: 7155053695

VMC Response: Bonus

Solution:

$\left|\frac{1+ai}{b+i}\right|=1\Rightarrow|1+ai|^2=|b+i|^2$

$(1+ai)(1-ai)=(b+i)(b-i)$

$1+a^2=b^2+1\Rightarrow a=\pm b$

Since $ab<0,\therefore a=-b$ ...(1)

Using

$|z-1|=|2z|$

$\Rightarrow |z-1|^2=(2|z|)^2$

$\Rightarrow (z-1)(\bar{z}-1)=4z\bar{z}$

$\Rightarrow z\bar{z}-z-\bar{z}+1=4z\bar{z}$

$3z\bar{z}+z+\bar{z}-1=0$

$3|z|^2+z+\bar{z}-1=0$ ....(2)

Since $z=a+ib$ satisfies (2)

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

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

Solving (1) and (3)

we get $3(a^2+b^2)+2a-1=0$

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

$6a^2+2a-1=0$

$a=\dfrac{-2\pm\sqrt{28}}{12}=\dfrac{-2\pm 2\sqrt{7}}{12}$

Case-I	*Case-2*
$a=\dfrac{-1+\sqrt{7}}{6}$	$a=\dfrac{-1-\sqrt{7}}{6}$
$[a]=0$	$[a]=-1$
$b=-a=\dfrac{1-\sqrt{7}}{6}$	$b=-a=\dfrac{1+\sqrt{7}}{6}$
$\therefore \dfrac{1+[a]}{4b}=\dfrac{1+0}{4\left(\dfrac{1-\sqrt{7}}{6}\right)}=\dfrac{3}{2(1-\sqrt{7})}$	$\therefore \dfrac{1+[a]}{4b}=\dfrac{1-1}{4\left(\dfrac{1+\sqrt{7}}{6}\right)}=0$

As no option matches, therefore it should be Bonus.

Mathematics | Question ID: 7155051257

NTA Response: 6

VMC Response: Question Incorrect

Solution:

$\alpha x+\beta y+yz=1$ is not an equation of plane.

Correct equation of plane should be $\alpha x+\beta y+\gamma z=1.$

There is printing mistake in question. Instead of *yz*, it should be γz .

Mathematics | Question ID: 7155051256

NTA Response: 26

VMC Response: 13

Solution:

$$I=\int_0^{\pi}\frac{5^{\cos x}\left(1+\cos x\cos 3x+\cos^2 x+\cos^3 x\cos 3x\right)}{1+5^{\cos x}}dx$$

$$I=\int_0^{\pi/2}\left(\begin{array}{l}\dfrac{5^{\cos x}(1+\cos x\cos 3x+\cos^2 x+\cos^3 x\cos 3x}{1+5^{\cos x}}+\\ \dfrac{5^{\cos(\pi-x)}(1+\cos(\pi-x)\cos(3(\pi-x))+\cos^2(\pi-x)+\cos^3(\pi-x)\cos 3(\pi-x)}{1+5^{\cos(\pi-x)}}\end{array}\right)dx$$

$$I=\int_0^{\pi/2}(1+\cos x\cos 3x+\cos^2 x+\cos^3 x\cos 3x)\,dx$$

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

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

$$=4\times\left(\frac{5\times3\times1}{6\times5\times2}\times\frac{\pi}{2}\right)+\left(\frac{3\times1}{4\times2}\times\frac{\pi}{2}\right)-2\left(\frac{\pi}{4}\right)+\frac{\pi}{2}=\frac{13\pi}{16}$$

$\therefore\ k=13$