04/04/2025
Evening

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Memory Based
Answers & Solutions
for
JEE (Main)-2025 (Online) Phase-2

(Physics, Chemistry and Mathematics)

Time : 3 hrs. **M.M. : 300**

IMPORTANT INSTRUCTIONS:

(1) The test is of **3 hours** duration.

(2) This test paper consists of 75 questions. Each subject (PCM) has 25 questions. The maximum marks are 300.

(3) This question paper contains **Three Parts**. **Part-A** is Physics, **Part-B** is Chemistry and **Part-C** is **Mathematics**. Each part has only two sections: **Section-A** and **Section-B**.

(4) **Section - A :** Attempt all questions.

(5) **Section - B :** Attempt all questions.

(6) **Section - A (01 – 20)** contains 20 multiple choice questions which have **only one correct answer**. Each question carries **+4 marks** for correct answer and **–1 mark** for wrong answer.

(7) **Section - B (21 – 25) contains** 5 **Numerical value** based questions. The answer to each question should be rounded off to the **nearest integer**. Each question carries **+4 marks** for correct answer and **–1 mark** for wrong answer.

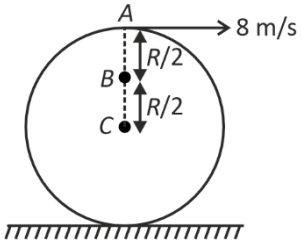
PHYSICS

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer:

1. A disc is performing pure rolling if speed of top point is 8 m/s. Find speed of point *B*.



(1) 2 m/s (2) 4 m/s

(3) 6 m/s (4) 8 m/s

Answer (3)

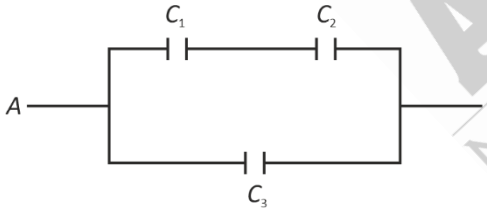
Sol. $2\omega_R = 8$

$V_C = \omega R = 4$ m/s

$V_B = V_C + = \omega\, R/2$

$= 4 + 2 = 6$ m/s

2. The equivalent capacitance between *A* and *B* is



(1) $\frac{C_1C_2 + C_2C_3 + C_1C_2}{C_2 + C_3}$ (2) $\frac{C_1C_2 + C_1C_3 + C_2C_3}{C_1 + C_2}$

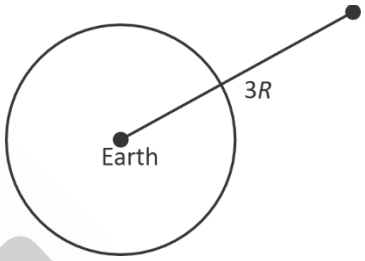
(3) $\frac{2C_1C_2 + C_2C_3}{C_2 + C_3}$ (4) $\frac{2C_2C_3 + C_1C_2}{C_1 + C_3}$

Answer (2)

Sol. $C_{eq} = \frac{C_1C_2}{C_1 + C_2} + C_3$

$= \frac{C_1C_2 + C_1C_3 + C_2C_3}{C_1 + C_2}$

3. A particle of mass *m* is at a distance 3*R* from the centre of Earth. Find minimum kinetic energy of particle to leave Earths field (*R* : Radius of Earth)



(1) $\frac{mgR}{3}$

(2) $3mgR$

(3) $\frac{2}{3}mgR$

(4) $\frac{mgR}{2}$

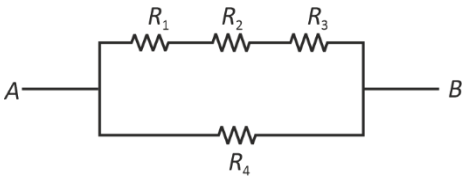
Answer (1)

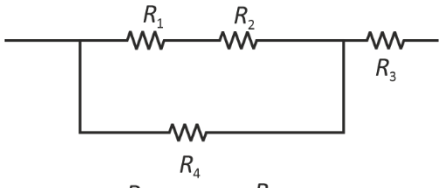
Sol. $k_i + u_i = 0$

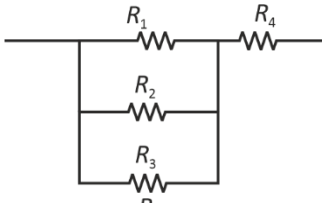
$k_i = +\frac{GMm}{3R}$

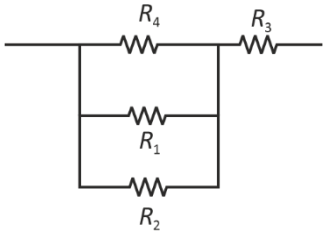
$= \frac{mgR}{3}$

4. If resistor $R_1 = R_2 = R_3 = 5\ \Omega$ and $R_4 = 10\ \Omega$ which circuit diagram is having equivalent (Across *A* and *B*) resistance = $6\ \Omega$

(1) 

(2) 

(3) 

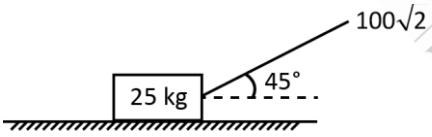
(4) 

Answer (1)

Sol. $R_1 + R_2 + R_3 = 15\ \Omega$

Request = $\frac{15.10}{25} = 6\Omega$

5. If the displacement of the block is 5 m, the work done by force applied is (coefficient of friction between block and surface is $\frac{1}{4}$)



(1) $500\sqrt{2}$ J (2) 250 J

(3) 100 J (4) 500 J

Answer (4)

Sol. $W = F \cdot S$

$= 100 \times 5$

$= 500$ J

6. The dimensional formula of the ratio of electrical dipole moment to the magnetic moment is $M^PL^QT^RA^S$. Then P, Q, R and S are

(1) 0, –1, 1, 0 (2) 0, 1, –1, 0

(3) 0, 1, 0, –1 (4) 0, 1, 0, 1

Answer (1)

Sol. $\left[\frac{P}{M}\right] = \left[\frac{B}{E}\right] = \left[\frac{1}{C}\right] = M^0L^{-1}T^1A^0$

7. Two polarises P_1 & P_2 are aligned in such a way that intensity is zero. P_3 polarises is inserted b/w P_1 and P_3 such that final transmitted ray will have the maximum intensity. Find angle between P_1 and P_3.

(1) $\frac{\pi}{4}$ (2) $\frac{\pi}{2}$

(3) $\frac{\pi}{3}$ (4) $\frac{\pi}{8}$

Answer (1)

Sol. $I = I_0 \cos^2\theta_1, \cos^2\theta_2$

$\theta_1 + \theta_2 = 90°$

I is max when $\theta_1 = \theta_2 = 45° = \frac{\pi}{4}$

8. A medium has relative permittivity $\frac{1}{0.085}$ and relative permeability is $\frac{10}{\pi}$. Find ratio of speed of light in vacuum to the medium.

(1) 6.12 (2) 3.14

(3) 2.28 (4) 1.27

Answer (1)

Sol. $\frac{c}{v} = \mu$

$\mu = \sqrt{\varepsilon_r \mu_r}$

$= \sqrt{\frac{1}{0.085} \times \frac{10}{\pi}}$

$= \sqrt{37.46}$

= 6.12

9. Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : Plank's constant and linear momentum have same dimensions.

Reason (R) : Bohr's angular momentum is integral multiple of $\frac{h}{2\pi}$.

In the light of the above statements, choose the correct answer from the options given below :

(1) (A) is false but (R) is true

(2) (A) is true but (R) is false

(3) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

(4) Both (A) and (R) are true but (R) is the correct explanation of (A)

Answer (1)

Sol. $L = \frac{nh}{2\pi}$

10. Match the column.

	Column-I		Column-II
a.	Adiabatic process	(i)	$W \alpha \Delta T$
b.	Isochoric process	(ii)	$W = 0$
c.	Isobaric process	(iii)	$\Delta U + W = 0$
d.	Isothermal process	(iv)	$\Delta U = 0$

(1) a(ii), b(iii), c(i), d(iv) (2) a(i), b(ii), c(iii), d(iv)

(3) a(iii), b(ii), c(i), d(iv) (4) a(iii), b(ii), c(iv), d(ii)

Answer (3)

Sol. Conceptual

11. n identical bulbs each takes power p when connected with main supply. If n bulbs are connected in series with main supply, then power will be

(1) np (2) $\frac{p}{n^2}$

(3) $\frac{p}{n}$ (4) n^2p

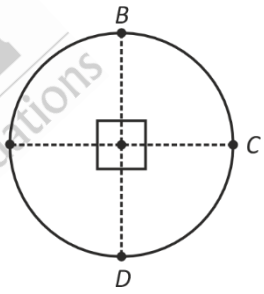
Answer (3)

Sol. $p = \frac{v^2}{R}$

$p' = \frac{v^2}{nR}$

$p' = \frac{p}{n}$

12. Four points on a uniformly charged ring are labelled as A, B, C, and D such that $AB = BC = CD = DA$. If the electric field due to the segment BC at the centre has a magnitude E, then the magnitude of electric field due to the segment ABC is



(1) $\sqrt{2}E$ (2) E

(3) 0 (4) $\frac{E}{\sqrt{2}}$

Answer (1)

Sol. $E_Q = \frac{2k\lambda}{R}\sin\frac{\theta}{2}$

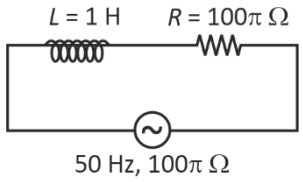
$E_{BC} = \frac{2k\lambda}{R}\sin\frac{\pi}{4} = E$

$E_{ABC} = \frac{2k\lambda}{R}\sin\frac{\pi}{2}$

$\Rightarrow E_{ABC} = \sqrt{2}E$

13. An ac source of 100π volt is connected to the given circuit.

Find maximum value of the current in the circuit.



(1) $\frac{1}{\sqrt{2}}$ A (2) 1 A

(3) $\sqrt{3}$ A (4) 0.5 A

Answer (2)

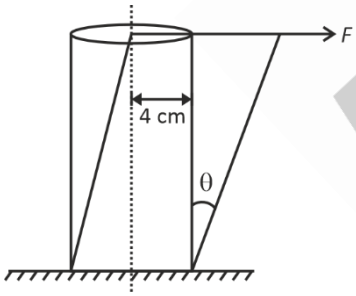
Sol. $Z = (100\pi)\sqrt{2}$

$$I_{rms} = \frac{100\pi}{100\pi\sqrt{2}} = \frac{1}{\sqrt{2}}$$

$$I_{max} = I_{rms}\sqrt{2}$$

$= 1$ A

14. A force $F = 10^5$ N is applied on the cylinder as shown. If the shear modulus of the cylinder is 10^{10} N/m^2 find θ



(1) $\frac{\pi}{160}$ (2) $\frac{1}{160\pi}$

(3) $\frac{1}{16\pi}$ (4) $\frac{\pi}{16}$

Answer (2)

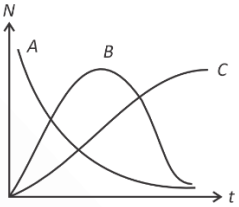
Sol. $C_1 = \frac{F}{A\theta}$

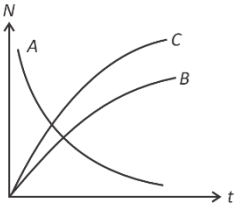
$$\theta = \frac{F}{AC_1}$$

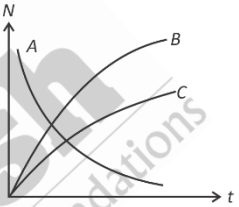
$$= \frac{10^5}{\pi \times 16 \times 10^{-4} \times 10^{10}}$$

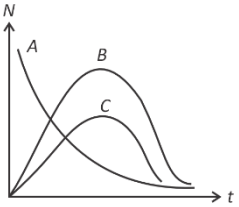
$$\theta = \frac{1}{160\pi}$$

15. In a successive nuclear decay, a sample of radioactive nuclei A decays into an unstable nuclei B which further disintegrates into a stable nuclei C. Which of the following graphs correctly represents the concentration of the nuclei as a function of time? (Assume concentration of B and C to be zero initially)

(1) 

(2) 

(3) 

(4) 

Answer (1)

Sol. At $t = \infty$

$N_A = 0, N_B = 0, N_C \neq 0$ (Entire sample contains C)

16. For n-type semi-conductor choose the correct option having correct statements

(i) $n_e \cdot n_n = n_i^2$

(ii) $n_e n_n \neq n_i^2$

(iii) Pentavalent impurity

(iv) Electrons are majority carriers

(v) Additional are not generated

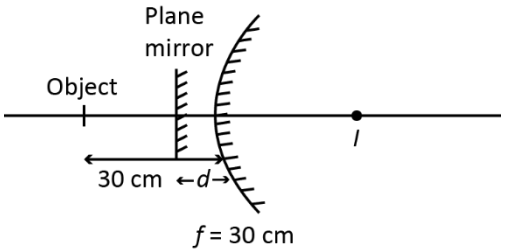
(1) (ii), (iii), (iv) (2) (i), (iii), (iv), (v)

(3) (i), (v) only (4) (i), (iii), (iv)

Answer (2)

Sol. Conceptual

17. A convex mirror with $f = 30$ cm is given an object is placed in front of this mirror at distance 30 cm from mirror. Find the position of plane mirror (with small aperture) with respect to convex mirror, such that images of the both mirrors coincide.



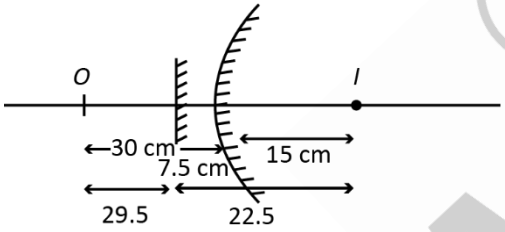
(1) 22.5 cm (2) 7.5 cm

(3) 20 cm (4) 30 cm

Answer (2)

Sol. $\frac{1}{v}=\frac{1}{f}-\frac{1}{4}=\frac{1}{30}-\frac{1}{-30}$

$v = 15$ cm



18. Two adiabatic containers A and B have volume in the ratio 1 : 2. The pressure and temperature for gas in A is 8 kPa and 1000 K, and the corresponding values for B is 7 kPa and 500 K. If the containers are connected by a thin pipe and gases are allowed to mix thoroughly, the final temperature of the mixture is 600 K. The final pressure in the vessel is

(1) 7.6 kPa (2) 7.8 kPa

(3) 7.4 kPa (4) 7.2 kPa

Answer (4)

Sol. $\frac{P_1V_1}{T_1}+\frac{P_2V_2}{T_2}=\frac{P}{T}(V_1+V_2)$ ... conserving moles.

$$\left(\frac{8\text{ kPa}}{1000\text{ K}}\right)(V)+\left(\frac{7\text{ kPa}}{500\text{ K}}\right)(2V)=\frac{P(3V)}{600\text{ K}}$$

$P = 7.2$ kPa

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. In a YDSE setup, the slits are separated by 1.5 mm and the distance between slits and screen is 2 m. On using light of wavelength 400 nm, it is observed that 20 maxima's of double slit experiment lie inside the control maxima of single slit diffraction. The width of each slits is ____ μm.

Answer (150)

Sol. $20\frac{\lambda D}{d}=2\frac{\lambda D}{a}$

or $a=\frac{d}{10}$

$a = \frac{1.5\text{ mm}}{10}=150\ \mu\text{m}$

22.

23.

24.

25.

CHEMISTRY

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

1. Elements of group 13 having maximum and minimum first ionisation energy respectively are

(1) B, In (2) Al, B

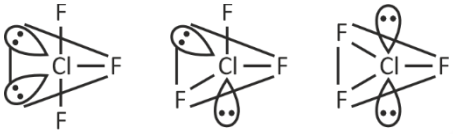
(3) Ga, B (4) Tl, B

Answer (1)

Sol.

	B	Al	Ga	In	Tl	
(IE_1)	801	577	579	558	589	(in kJ/mol)

2. **Statement-I:** ClF_3 has 3 possible structures



(I) (II) (III)

Statement-II: III is most stable structure due to least lp-bp repulsion.

(1) Statement-I is correct and statement-II is incorrect

(2) Statement-I is incorrect and statement-II is correct

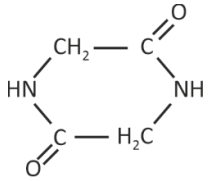
(3) Both statement-I and II are correct

(4) Both statement-I and II are incorrect

Answer (1)

Sol. lp is placed at equatorial position in stable structure.

3. x is a dipeptide which is hydrolysed to 2 amino acids y and z. y when treated with HNO_2 gives lactic acid. z when heated gives cyclic structure as below:



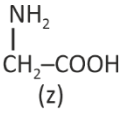
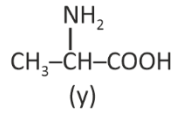
y and z respectively are

(1) Alanine and Lysine (2) Alanine and Glycine

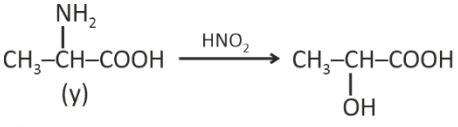
(3) Glycine and Alanine (4) Valine and Glycine

Answer (2)

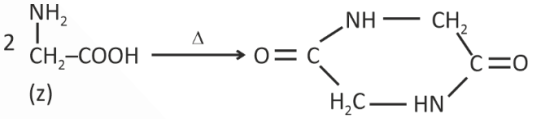
Sol.

x gives  (z) and  (y)

upon hydrolysis



(Lactic acid)

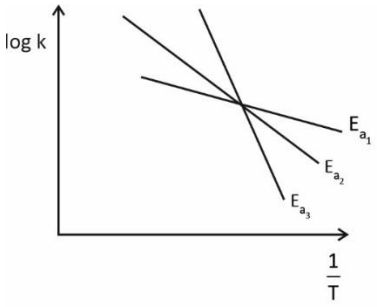


(Cyclic structure)

y = Alanine

z = Glycine

4. Consider the following graph between Rate Constant (k) and $\frac{1}{T}$.



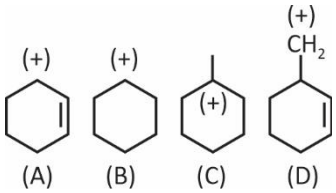
(1) $E_{a_1} > E_{a_2} > E_{a_3}$ (2) $E_{a_3} > E_{a_2} > E_{a_1}$

(3) $E_{a_3} > E_{a_1} > E_{a_2}$ (4) $E_{a_1} > E_{a_3} > E_{a_2}$

Answer (2)

Sol. $|\text{slope}| \propto E_a$

5. Arrange the following carbocation in decreasing order of their stability

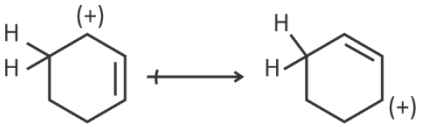


(1) (A) > (B) > (C) > (D) (2) (A) > (C) > (B) > (D)

(3) (C) > (A) > (B) > (D) (4) (B) > (C) > (A) > (D)

Answer (2)

Sol. (A) is most stable as it is stabilised by resonance as well hyperconjugation due to two α-hydrogen atoms.



(C), (B), (D) are 3°, 2° and 1° alkyl carbocations having 7,4 and 1 α-hydrogen atom. Number of hyperconjugation structure is same as the number of α-hydrogen atoms.

$\therefore$ Correct stability order is

(A) > (C) > (B) > (D)

6. Consider the following complex species

(a) $Ni(CO)_4$ (b) $[Ni(CN)_6]^{2-}$

(c) $[FeF_6]^{3-}$ (d) $[CoF_6]^{3-}$

Which of the following order is correct for their number of unpaired electrons

(1) c > d > a = b (2) c > d > a > b

(3) a > b > c > d (4) c > a > d > b

Answer (1)

Sol. (a) $Ni(CO)_4 \Rightarrow Ni^0 \Rightarrow 3d^{10}\,4s^0$ in presence of CO ligand

No. of unpaired electron = 0

(b) $[Ni(CN)_6]^{2-}$

$Ni^{4+} \Rightarrow t_{2g}^6 e_g^0$

No. of unpaired electron = 0

(c) $[FeF_6]^{3-}$

$Fe^{3+} \Rightarrow t_{2g}^3 e_g^2$

No. of unpaired electron = 5

(d) $[CoF_6]^{3-}$

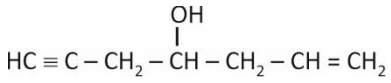
$Co^{3+} \Rightarrow t_{2g}^4 e_g^2$

No. of unpaired electron = 4

Order of no. of unpaired electron

c > d > a = b

7. The correct IUPAC name of the following compound is



(1) 4-Hydroxyhept-1-en-6-yne

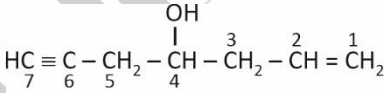
(2) 4-Hydroxyhept-6-en-1-yne

(3) 4-Hydroxyhept-1-yn-6-ene

(4) 4-Hydroxyhept-6-yn-1-ene

Answer (1)

Sol.



4-Hydroxy-hept-1-en-6-yne

8. Given below are two statements:

Statement-I: Aqueous KOH gives elimination reaction as major product always.

Statement-II: Alcoholic KOH eliminates H^+ from β-carbon atom

In the light of the above statements, choose the correct answer from the options given below:

(1) Statement-I is correct and statement-II is incorrect

(2) Statement-I is incorrect and statement-II is correct

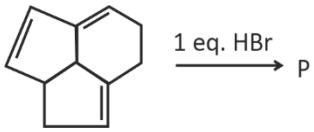
(3) Both statement-I and statement-II are correct

(4) Both statement-I and statement-II are incorrect

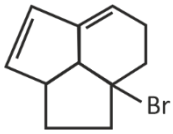
Answer (2)

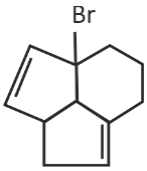
Sol. Aqueous KOH can give substitution product as major product.

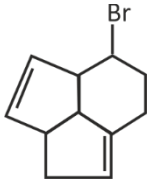
9. Consider the following reaction

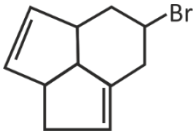


Identify the major product 'P'

(1) 

(2) 

(3) 

(4) 

Answer (2)

Sol. Product is obtained by carbocation formation which is 3° and allylic.

10. Given below are two statements.

Statement I: The formula of cryoscopy constant is given as $K_f = \frac{MRT_f^2}{1000 \times \Delta S_{fusion}}$

Statement II: K_f of water is greater than benzene.

In light of the above statements choose the most appropriate option.

(1) Statement I is correct, Statement II is incorrect

(2) Statement I is incorrect, Statement II is correct

(3) Statement I and II both are correct

(4) Statement I and II are incorrect

Answer (4)

Sol. $K_f = \frac{MRT_f^2}{1000 \times \Delta H_{fusion}}$

K_f (H_2O) = 1.86 K kg mol^{-1}

K_f (benzene) = 5.12 K mol^{-1}

11. Match the column

	List-I (Process)		List-II (Thermodynamic parameter)
(A)	Adiabatic	(1)	w = 0
(B)	Isobaric	(2)	q = –w
(C)	Isochoric	(3)	q = 0
(D)	Isothermal	(4)	q = $\Delta U + P\Delta V$

(1) A-4, B-1, C-3, D-2 (2) A-2, B-1, C-3, D-4

(3) A-3, B-4, C-1, D-2 (4) A-4, B-1, C-2, D-3

Answer (3)

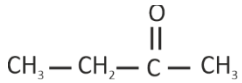
Sol. Adiabatic q = 0

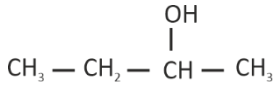
Isobaric ($\Delta P = 0$) $\Delta U + P\Delta V = q$

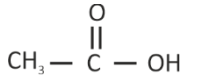
Isochoric ($\Delta V = 0$) w = 0

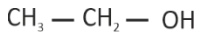
Isothermal ($\Delta T = 0$) q = w

12. Which of the following compound gives yellow precipitate with NaOI?

(A) 

(B) 

(C) 

(D) 

(1) (A) and (D) only (2) (B), (C) and (D) only

(3) (A), (B) and (D) only (4) (A) and (C) only

Answer (3)

Sol. Compounds of the type $CH_3-\overset{\overset{O}{\|}}{C}-R$ and $CH_3-\overset{\overset{OH}{|}}{CH}-R$ where R is H, alkyl or aryl group give yellow precipitate of CHI_3 with NaOI.

(A) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow{NaOI} \underset{\text{Yellow}}{CHI_3\downarrow} + CH_3-CH_2-\overset{\overset{O}{\|}}{C}-ONa$

(B) $CH_3-CH_2-\overset{\overset{OH}{|}}{CH}-CH_3 \xrightarrow{NaOI} \underset{\text{Yellow}}{CHI_3\downarrow} + CH_3-CH_2-\overset{\overset{O}{\|}}{C}-ONa$

(D) $CH_3-CH_2-OH \xrightarrow{NaOI} \underset{\text{Yellow}}{CHI_3\downarrow} + HCOONa$

13. Among the following complexes of iron, the most stable complex having x number of electron in t_{2g} set of orbitals

$[Fe(NH_3)_6]^{3+}$, $[Fe(CN)_6]^{3-}$, $[FeF_6]^{3-}$

What is the nature of oxide V_2O_x?

(1) Acidic (2) Basic

(3) Neutral (4) Amphoteric

Answer (4)

Sol. $[Fe(CN)_6]^{3-}$ is most stable complex given among given

$Fe^{3+} \Rightarrow 3d^5 \Rightarrow t_{2g}^5 e_g^0$

$x = 5$

V_2O_5 is amphoteric.

14. Given below are two statements:

Statement-I: Group-13 has more ionisation energy than group-14 along the same period.

Statement-II: Silicon has higher boiling point than lead.

In the light of the above two statements, choose the most appropriate option.

(1) Statement-I is correct and statement-II is incorrect

(2) Statement-I is incorrect and statement-II is correct

(3) Both statement-I and II are correct

(4) Both statement-I and II are incorrect

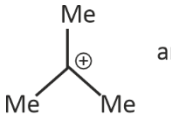
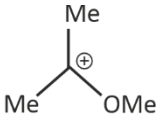
Answer (2)

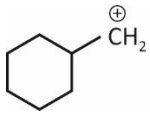
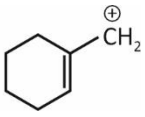
Sol.

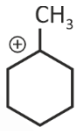
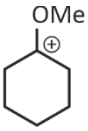
	Si	Pb
BP $\rightarrow$	3550 K	2024 K

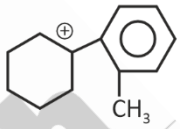
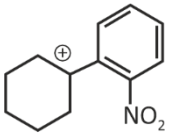
$\therefore$ On moving from left to right in periodic table, ionisation energy generally increases.

15. In which of the following pair of ions, first ion is more stable than second ion

(1)  and 

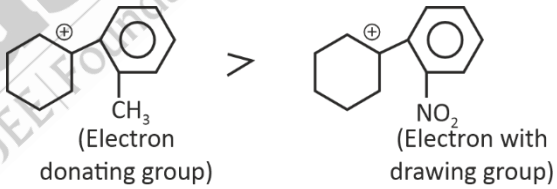
(2)  and 

(3)  and 

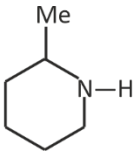
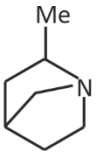
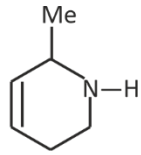
(4)  and 

Answer (4)

Sol.



16. The correct order of basic strength of following amines in non-aqueous medium.

(a)  (b)  (c) 

(1) b > a > c (2) b > c > a

(3) a > b > c (4) c > b > a

Answer (1)

Sol. Basic strength depends an availability of lone pair on nitrogen or donation ability of lone pair of nitrogen.

17. Which of the following order is incorrectly matched with respect to ionisation energy

(1) $Mn^{3+} > Mn^{2+}$ (2) $Fe^{2+} > Fe^{3+}$

(3) $Cr^{3+} > Cr^{+}$ (4) $Co^{3+} > Co^{2+}$

Answer (2)

Sol. Successive $I \cdot \varepsilon$ always increases $I\varepsilon$ of $M^{3+} > M^{2+} > M^{+}$

18.

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. Total number of electrons in chromium (Z = 24) for which the value of azimuthal quantum number (l) is 1 and 2

Answer (17)

Sol. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$

$l = 1 \Rightarrow$ p-subshell $\Rightarrow 6 + 6 = 12e^-$

$l = 2 \Rightarrow$ d-subshell $\Rightarrow 5e^-$

Total electrons = $5 + 12 = 17e^- = 17$

22. Consider the following zero order reaction :

$A \rightarrow$ Products

Half-life of the reaction is 1 hr if initial concentration of the reactant is 2 mol/L. Find the half-life of the reaction in minutes if the initial concentration of the reaction is 0.5 mol/L.

Answer (15)

Sol. $[A]_o$: 2 M 0.5 M

$T^{1/2}$: 1 hr t

If n is the order of reaction, then

$T^{1/2} \propto ([A]^o)^{1-n}$

$\propto [A]_o$ if n = 0

$$\frac{t}{1} = \left(\frac{0.5}{2}\right)^1 = \left(\frac{1}{4}\right)^1$$

t = 0.25 hr = 15 min

23. If x mg of $Mg(OH)_2$ is added in 1 L of solution to make a solution with pH = 10, then find the value of x.

[Given : MW of $Mg(OH)_2$ = 58 g/mol]

Assume $Mg(OH)_2$ dissociates completely in water.

Answer (3)

Sol. Given, pH = 10

pOH = 4

$[OH^-] = 10^{-4}$ M

$Mg(OH)_2 \rightarrow Mg^{2+} + 2OH^-$

$[Mg(OH)_2] = 0.5 \times 10^{-4}$ M

Mol of $Mg(OH)_2$ in 1 L of solution = 5×10^{-5} mol

Mass of $Mg(OH)_2 = 5 \times 10^{-5}$

$= 5 \times 10^{-5} \times 58$

$= 290 \times 10^{-5}$ g

= 2.9 mg

≈ 3

24. An octahedral complex ion is formed using metal (M^{4+}) with ligands NH_3 and Cl^- 1 mol complex gives 'n' mol of AgCl with $AgNO_3$ solution. The value of n is same as number of lone pairs of electron present on central atom in BrF_3. Find the total number of isomers of complex ion.

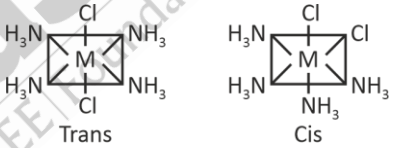
Answer (2)

Sol. 

$AgNO_3$ + Complex $\rightarrow$ 2 mol AgCl

Complex ion should be $[M(NH_3)_4Cl_2]Cl_2$

Total number of isomers = 2



25. Find the mass of CaO formed in kg when 150 kg sample of 75% pure $CaCO_3$ is heated strongly.

Answer (63)

Sol. Mass of impure $CaCO_3$ = 150 kg

Mass of pure $CaCO_3 = \frac{75 \times 150}{100} = 112.5$ kg

NO. of moles of pure $CaCO_3 = \frac{112.5 \times 10^3}{100}$

= 1125

$CaCO_3 \xrightarrow{\Delta} CaO + CO_2(g)$

No. of moles of CaO formed = 1125

Mass of $CaO = \frac{1125 \times 56}{1000} = 63$ kg

MATHEMATICS

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

1. $\cot^{-1}\left(\frac{7}{4}\right)+\cot^{-1}\left(\frac{19}{4}\right)+\cot^{-1}\left(\frac{39}{4}\right)+...\infty$

(1) $\cot^{-1}(2)$ (2) $\cot^{-1}\left(\frac{1}{2}\right)$

(3) $\cot^{-1}\left(\frac{1}{3}\right)$ (4) $\cot^{-1}(3)$

Answer (2)

Sol. $T_r=\cot^{-1}\left(\frac{4r^2+3}{4}\right)$

$T_r=\tan^{-1}\left(\frac{1}{r^2+\frac{3}{4}}\right)$

$T_r=\tan^{-1}\left(\frac{\left(r+\frac{1}{2}\right)-\left(r-\frac{1}{2}\right)}{1+r^2-\frac{1}{4}}\right)$

$T_r=\tan^{-1}\left(\frac{\left(r+\frac{1}{2}\right)-\left(r-\frac{1}{2}\right)}{1+\left(r+\frac{1}{2}\right)\left(r-\frac{1}{2}\right)}\right)$

$T_r=\tan^{-1}\left(r+\frac{1}{2}\right)-\tan^{-1}\left(r-\frac{1}{2}\right)$

$T_1=\tan^{-1}\left(\frac{3}{2}\right)-\tan^{-1}\left(\frac{1}{2}\right)$

$T_2=\tan^{-1}\left(\frac{5}{2}\right)-\tan^{-1}\left(\frac{3}{2}\right)$

$T_n=\tan^{-1}\left(\frac{2n+1}{2}\right)-\tan^{-1}\left(\frac{1}{2}\right)$

$\sum T_r=\tan^{-1}\left(\frac{2n+1}{2}\right)-\tan^{-1}\left(\frac{1}{2}\right)$

$\sum T_r=\frac{\pi}{2}-\tan^{-1}\left(\frac{1}{2}\right)$

$\sum T_r=\cot^{-1}\left(\frac{1}{2}\right)$

2. $\int\frac{\left(\sqrt{1+x^2}+x\right)^{19}}{\sqrt{1+x^2}-x}dx$ is equal to

(1) $\frac{1}{21}\left(\sqrt{1+x^2}+x\right)^{20}+\frac{1}{19}\left(\sqrt{1+x^2}+x\right)^{19}+c$

(2) $\frac{1}{36}\left(\sqrt{1+x^2}+x\right)^{18}+\frac{1}{38}\left(\sqrt{1+x^2}+x\right)^{19}+c$

(3) $\frac{1}{42}\left(\sqrt{1+x^2}+x\right)^{21}+\frac{1}{38}\left(\sqrt{1+x^2}+x\right)^{19}+c$

(4) $\frac{1}{21}\left(\sqrt{1+x^2}+x\right)^{21}+\frac{1}{19}\left(\sqrt{1+x^2}+x\right)^{20}+c$

Answer (3)

Sol. $I=\int\left(\sqrt{1+x^2}+x\right)^{20}dx$

Let $x=\tan\theta$

$\therefore\quad dx=\sec^2\theta d\theta$

$I=\int(\sec+\tan\theta)^{20}\cdot\sec^2\theta d\theta$

$=\int\sec\theta(\sec\theta+\tan\theta)^{20}\cdot\frac{(\sec\theta+\tan\theta)+(\sec\theta-\tan\theta)}{2}d\theta$

$=\frac{1}{2}\int\sec\theta(\sec\theta+\tan\theta)(\sec\theta+\tan)^{20}d\theta$

$+\frac{1}{2}\int\sec\theta(\sec+\tan\theta)^{20}(\sec\theta-\tan\theta)d\theta$

$=\frac{1}{2}\int\sec\theta(\sec\theta+\tan\theta)(\sec\theta+\tan\theta)^{20}d\theta$

$$+\frac{1}{2}\int \sec\theta\cdot(\sec\theta+\tan\theta)\cdot(\sec\theta+\tan\theta)^{18}d\theta$$

Let $\sec\theta + \tan\theta = u$

$$\Rightarrow \quad \sec\theta(\sec\theta + \tan\theta) = \frac{du}{d\theta}$$

$$=\frac{1}{2}\int u^{20}du+\frac{1}{2}\int u^{18}d\theta$$

$$=\frac{u^2}{42}+\frac{u^{19}}{38}+c$$

$$=\frac{1}{42}(\sec\theta+\tan\theta)^{21}+\frac{1}{38}(\sec\theta+\tan\theta)^{19}+c$$

$$=\frac{1}{42}\left(\sqrt{1+x^2}+x\right)^{21}+\frac{1}{38}\left(\sqrt{1+x^2}+x\right)^{19}+c$$

3. Let $L_1:\frac{x-1}{3}=\frac{y}{4}=\frac{z}{5}$ and $L_2:\frac{x-p}{2}=\frac{y}{3}=\frac{2}{4}$. If the shortest distance between L_1 and L_2 is $\frac{1}{\sqrt{6}}$. Then possible value of p is

(1) 3

(2) 2

(3) 5

(4) 7

Answer (2)

Sol. S.D. between two given lines L_1 and L_2

$$=\frac{\begin{vmatrix} p-1 & 0 & 0 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{vmatrix}}{|(2\hat{i}+3\hat{j}+4\hat{k})\times(3\hat{i}+4\hat{j}+5\hat{k})|}$$

$$=\left|\frac{(p-1)(-1)}{\sqrt{6}}\right|$$

$$\because \quad \left|\frac{p-1}{\sqrt{6}}\right|=\frac{1}{\sqrt{6}}$$

$$\therefore \quad P-1=\pm 1$$

$$\therefore \quad P=0 \text{ or } 2$$

4. Let $f(x)$ and $g(x)$ satisfies the functional equation $2g(x)+3g\left(\frac{1}{x}\right)=x$ and $2f(x)+3f\left(\frac{1}{x}\right)=x^2+5$.

If $\alpha=\int_1^2 f(x)dx$ and $\beta=\int_1^2 g(x)dx$ then $(9\alpha + \beta)$ is equal to

(1) $\frac{27+6\ln_2}{10}$

(2) $\frac{27-6\ln_2}{10}$

(3) $\frac{3}{5}\ln_2$

(4) $\frac{3}{5}\ln_2+\frac{7}{30}$

Answer (1)

Sol. $2g(x)+3g\left(\frac{1}{x}\right)=x \quad \Rightarrow \quad 6g(x)+9g\left(\frac{1}{x}\right)=3x$

$$2g\left(\frac{1}{x}\right)+3g(x)=\frac{1}{x} \quad \Rightarrow \quad 6g(x)+4g\left(\frac{1}{x}\right)=\frac{2}{x}$$

$$\Rightarrow \quad 5g\left(\frac{1}{x}\right)=3x-\frac{2}{x}$$

$$\Rightarrow \quad g(x)=\frac{1}{5}\left(\frac{3}{x}-2x\right)$$

Similarly,

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

$$3f(x)+2f\left(\frac{1}{x}\right)=5+\frac{1}{x^2} \quad 9f(x)+6f\left(\frac{1}{x}\right)=\frac{15+3}{x^2}$$

$$\Rightarrow 5f(x)=\frac{15+3}{x^2}-2x^2-10$$

$$\Rightarrow f(x)=\frac{1}{5}\left[\frac{5+3}{x^2}-2x^2\right]$$

$$\alpha=\int_1^2 f(x)dx=\frac{11}{30^2} \text{ and } \beta=\int_1^2 g(x)dx=\frac{3}{5}\ln x-\frac{x^2}{5}\Big|_1^2$$

$$=\left(\frac{3}{5}\ln_2-\frac{4}{5}\right)-\left(\frac{-1}{5}\right)=\frac{3}{5}(\ln_2-1)$$

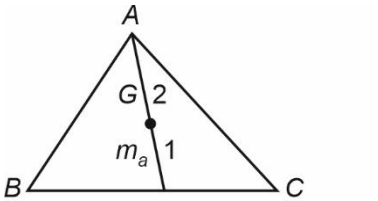
5. In ΔABC if A is (2, –3, 1), B is (3, –1, –5) and C is (1, –4, –4). If G is the centroid of ΔABC, then $6((AG)^2 + (BG)^2 + (CG)^2)$ is equal to

(1) 164 (2) 265

(3) 625 (4) 628

Answer (1)

Sol.



$$m_a = \frac{1}{2}\sqrt{2b^2 + 2c^2 - a^2}$$

$$AB = \sqrt{1^2 + 2^2 + 6^2} = \sqrt{41}$$

$$BC = \sqrt{2^2 + 3^2 + 1^2} = \sqrt{14}$$

$$AC = \sqrt{1^2 + 1^2 + 5^2} = \sqrt{27}$$

$$AG^2 + BG^2 + CG^2 = \frac{1}{3}\left(AB^2 + BC^2 + AC^2\right)$$

$$= \frac{1}{3}(41 + 14 + 27)$$

$$6\left(AG^2 + BG^2 + CG^2\right) = 2(82)$$

$$= 164$$

6. If m and n are two digits numbers such that $m > n$ and $gcd\ (m, n) = 6$. Find the number of such pairs.

(1) 60 (2) 65

(3) 55 (4) 35

Answer (2)

Sol. m, n two digit number

$m > n$

$\gcd(m, n) = 6$

$\Rightarrow m = 6a$

$n = 6b$ such that $\gcd(a, b) = 1, a > b$

Now, since $n \geq 10 \Rightarrow b \geq 2$

$m \leq 99 \Rightarrow a \leq 16$

We need to find a, b such that

$\gcd(a, b) = 1, a > b$ and $a, b \in \{2, 3, \ldots 16\}$

Let $b = 2$, a will be all odd numbers

$a \in \{3, 5, 7, 9, 11, 13, 15\} \Rightarrow 7$ pairs

Let $b = 3$, $a \in \{4, 5, 7, 8, 10, 11, 13, 14, 16\} \Rightarrow 9$ pairs

Let $b = 4$, $a \in \{5, 7, 9, 11, 13, 15\} \Rightarrow 6$ pairs

Let $b = 5$, $a \in \{6, 7, 8, 9, 11, 12, 13, 14, 16\} \Rightarrow 9$ pairs

Let $b = 6$, $a \in \{7, 11, 13\} \Rightarrow 3$ pairs

Let $b = 7$, $a \in \{8, 9, 10, 11, 12, 13, 14, 15, 16\} \Rightarrow 9$ pairs

Let $b = 8$, $a \in \{9, 11, 13, 15\} \Rightarrow 4$ pairs

Let $b = 9$, $a \in \{10, 11, 13, 14, 16\} \Rightarrow 5$ pairs

Let $b = 10$, $a \in \{11, 13\} \Rightarrow 2$ pairs

Let $b = 11$, $a \in \{12, 13, 14, 15, 16\} \Rightarrow 5$ pairs

Let $b = 12$, $a \in \{13\} \Rightarrow 1$ pair

Let $b = 13$, $a \in \{14, 15, 16\} \Rightarrow 3$ pairs

Let $b = 14$, $a \in \{15\} \Rightarrow 1$ pair

Let $b = 15$, $a \in \{16\} \Rightarrow 1$ pair

Total $\Rightarrow 65$ numbers

7. The sum of three terms in A.P. "A" is 36 and product is p and for A.P. "B" sum is 36 and product is q of three terms and $\frac{p+q}{p-q} = \frac{19}{5}$, given $D = d + 3$. Then the value of $p–q$. (where d and D are common difference of A.P. "A" and "B", respectively)

(1) 620 (2) 540

(3) 510 (4) 720

Answer (1)

Sol. Let the terms to $a_1 - d$, a_1, $a_1 - d$, and

$a_2 - D$, , a_2, $a_2 + D$

$a_1 - d + a_1$, $a_1 + d = 36 \Rightarrow a_1 - 12$

$a_1 = a_2 = 12$

$(a_1 - d)\ (a_1)\ (a_1 + d) = p$

$$\frac{p+q}{p-q} = \frac{19}{5} \Rightarrow 5p + 5q = 19p - 19q$$

$\Rightarrow \quad 24q = 14p \quad \Rightarrow 12q = 7p$

$12(12 - D)\ (12)\ (12 + D) = 7(12 - d)\ 12\ (12 + d)$

$\Rightarrow \quad 12(9 - d)\ (15 + d) = 7(12 - d)\ (12 + d)$

$= \quad 12(135 - 6d - d^2) = 7(144 - d^2)$

$= \quad 5d^2 + 72d - 612 = 0 \quad \Rightarrow \quad (5d - 102)(d - 6) = 0$

$\Rightarrow \quad d = 6, D = 9$

$P = (12 - 6)(12)(12 + 6) = 6 \times 12 \times 18$

$q = (12 - 9)(12)(12 + 9) = 3 \times 12 \times 21$

$p - q = 12 \times 9 (12 - 7) = 108 \times 5 = 540$

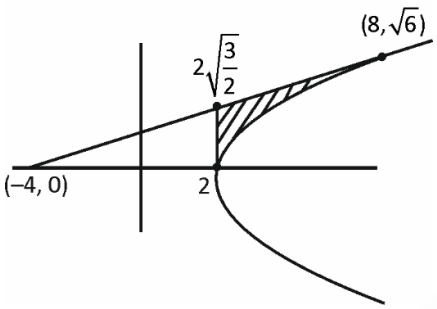
8. The area bounded between the tangent of a parabola $y^2 = x - 2$ which passes through $(-4, 0)$ with positive slope, x-axis, and the parabola is (in square units)

(1) $\frac{7\sqrt{6}}{2}$ (2) $\sqrt{6}$

(3) $\frac{3\sqrt{6}}{2}$ (4) $\frac{9}{2}\sqrt{6}$

Answer (4)

Sol.



$$y = (x-2)m + \frac{1}{4m}$$

using $y = mx + \frac{a}{m}$ for $y^2 = x - 2$

$$\Rightarrow \quad m = \pm\frac{1}{\sqrt{24}}$$

$$\Rightarrow \quad \text{line is } \sqrt{24}y = x + 4$$

$$\text{Area of triangle} = \frac{1}{2}\times 6 \times \sqrt{\frac{3}{2}} = 3\sqrt{\frac{3}{2}} = \sqrt{\frac{27}{2}} = 3\sqrt{\frac{3}{2}}$$

$$= \frac{3}{2}\sqrt{6}$$

$$\text{Other area} = \int_2^8 \frac{x+4}{\sqrt{24}} - \sqrt{x-2}$$

$$\left.\frac{x^2}{\sqrt{24}} + \frac{4x}{\sqrt{24}} - \frac{(x-2)^{3/2}}{\frac{3}{2}}\right|_2^8 = \left(\frac{64+32}{\sqrt{24}} - \frac{6\sqrt{6}}{\frac{3}{2}}\right) - \left(\frac{4+8}{\sqrt{24}} - 0\right)$$

$$= \frac{96 - 4\sqrt{6}}{\sqrt{24}} - \frac{12}{\sqrt{24}} = \frac{84 - 4\sqrt{6}}{2\sqrt{6}}$$

$$= \frac{84 - 48}{2\sqrt{6}} = \frac{36}{2\sqrt{6}} = 3\sqrt{6}$$

9. Let $f(x) = \log_2(\log_3(\log_7)(8 - \log_2(x^2 + 5x + 6)))$ where $(x < -3)$ has domain (α, β) and $g(x) = \sin^{-1}\left(\frac{2x^2 + x + 1}{3x + 5}\right)$ has domain $[\gamma, \delta]$. Then the value of $\alpha^2 + \beta^2 + \gamma^2 + \delta^2$ equals to

(1) 20 (2) 19

(3) 18 (4) 22

Answer (4)

Sol. $\log_2(\log_3(\log_7(8 - \log_2(x^2 + 5x + 6))))$

$\log_3(\log_7(8 - \log_2(x^2 + 5x + 6))) > 0$

$\log_2(8 - \log_2(x^2 + 5x + 6)) > 1$

$8 - \log_2(x^2 + 5x + 6) > 7$

$-\log_2(x^2 + 5x + 6) > -1$

$\log_2(x^2 + 5x + 6) < 1$

$x^2 + 5x + 6 < 2$

$x^2 + 5x + 4 < 0$

$(x + 4)(x + 1) < 0 \qquad \ldots(1)$

$\text{Log}_7(8 - \log_2(x^2 + 5x + 6)) > 0$

$8 - \log_2(x^2 + 5x + 6) > 1$

$7 > \log_2(x^2 + 5x + 6)$

$2^7 > x^2 + 5x + 6$

$-\log_2(x^2 + 5x + 6) > -1$

$\Rightarrow \quad x^2 + 5x + 6) < 128$

$$\Rightarrow \quad x = \frac{-5 \pm \sqrt{25 + 513}}{2}$$

$$x = \frac{-5 \pm \sqrt{513}}{2} \qquad \ldots(2)$$

$8 - \log_2(x^2 + 5x + 6) > 0$

$\log_2(x^2 + 5x + 6) < 8$

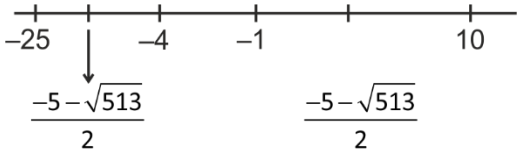
$x^2 + 5x + 6 < 2^8$

$x^2 + 5x + 6 < 256$

$\Rightarrow x^2 + 5x - 250 < 0$

$\Rightarrow x^2 + 25x - 10x - 250 < 0$ ...(3)

Intersection of (1) and (2) and (3) is



$x \in (-4, 3)$

Also $1 \le \frac{2x^2 + x + 1}{3x + 5} \le 1$

$\Rightarrow x \in [-1, 2]$

$\Rightarrow \alpha^2 + \beta^2 + \gamma^2 + \delta^2 = 16 + 9 + 1 + 4 \Rightarrow 30$

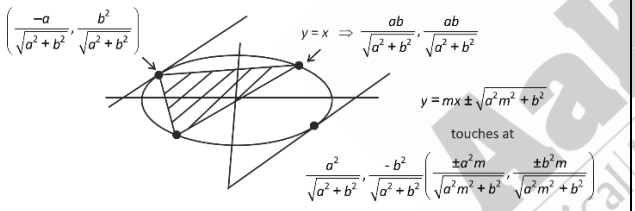
10. Ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ the line $y = x + p$ is a tangent on it and touches at points P and Q. Also if the line $y = x$ intersects ellipse at R and S. Then area of quadrilateral $PQRS$ is (Where $a = 3$ and $b = 4$)

(1) 12 (2) 10

(3) 24 (4) 20

Answer (3)

Sol.



$\Rightarrow$ For $m = 1$

$$A_1 = \frac{1}{2}\begin{vmatrix} \frac{ab}{\sqrt{a^2+b^2}} & \frac{ab}{\sqrt{a^2+b^2}} & 1 \\ \frac{-ab}{\sqrt{a^2+b^2}} & \frac{-ab}{\sqrt{a^2+b^2}} & 1 \\ \frac{-a^2}{\sqrt{a^2+b^2}} & \frac{b^2}{\sqrt{a^2+b^2}} & 1 \end{vmatrix}$$

$C_1 \to C_1 + C_2$

$$A_1 = \frac{1}{2}\begin{vmatrix} 0 & 0 & 2 \\ \frac{-ab}{\sqrt{a^2+b^2}} & \frac{-ab}{\sqrt{a^2+b^2}} & 1 \\ \frac{-a^2}{\sqrt{a^2+b^2}} & \frac{b^2}{\sqrt{a^2+b^2}} & 1 \end{vmatrix}$$

$$A_1 = \frac{1}{2}\left(2 \cdot \frac{ab^3 + a^3b}{\left(a^2+b^2\right)}\right) = \frac{ab\left(a^2+b^2\right)}{\left(a^2+b^2\right)} = ab$$

Similarly, $A_2 = ab$

Total area of quadrilateral is $2ab$ for $a = 4$, $b = 3$

Area $= 2(4)(3) = 24$

11. Given data 2, 3, 3, 4, 7, 5, a, b where mean is 4 and S.D is 1.5. Find the mean deviation about mode.

(1) $\frac{19}{8}$ (2) $\frac{9}{8}$

(3) $\frac{11}{8}$ (4) $\frac{5}{8}$

Answer (2)

Sol. $\frac{2+3+3+4+7+5+9}{8} = 4$

$\Rightarrow a + b = 8$

$$(1.5)^2 = \frac{2+3+3+4+7+5+9^2+6^2}{8} - (4)^2$$

$\Rightarrow a^2 + b^2 = 34$

$\therefore a = 3, b = 5$

$\therefore$ Mode = 3

Mean deviation about mode $= \frac{1+1+3+2+2}{8}$

$= \frac{9}{8}$

12.

13.

14.

15.

16.

17.

18.

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. If α be the non real root of the equation $1 + x + x^2 = 0$.

Find n if $\sum_{k=1}^{n}\left(\alpha^k + \frac{1}{\alpha^k}\right)^2 = 20$.

Answer (11)

Sol. α is root of equation $1 + x + x^2 = 0$, $\alpha = \omega$ or ω^2

$$\left(\alpha^k + \frac{1}{\alpha^k}\right)^2 = \alpha^{2k} + \frac{1}{\alpha^{2k}} + 2 = \left(\omega^k\right) = \left(\frac{1}{\omega^k}\right) + 2$$

$$\Rightarrow \omega^k + \frac{1}{\omega^k} + 2 = \begin{cases} 4 & , \text{ 3 divides k} \\ 1 & , \text{ 3 doesn't divide k} \end{cases}$$

$$\Rightarrow \sum_{K=1}^{n}\left(\alpha^k + \frac{1}{\alpha^k}\right)^2 = 20$$

$(1 + 1 + 4) + (1 + 1 + 4) + (1 + 1 + 4) + (1 + 1) = 20$

$\Rightarrow n = 11$

22. Let $A = \{-3, -2, -1, 0, 1, 2, 3\}$ and $xRy \Rightarrow 2x - y \in \{0,1\}$.

If l is number of elements in given relation, m and n are minimum number of elements to be added to make it reflexive and symmetric respectively. Then $l + m + n$ equals to

Answer (17)

Sol. $2x - y = 0$

$\Rightarrow 2x = y$

$\{(-1, -2), (0, 0), (1, 2)\}$

$2x - y = 1$

$\Rightarrow 2x = 1 + y$

$\{(-1, -3), (0, -1), (1, 1), (2, 4)\}$

$\therefore R = \{(-1, -2), (-1, -3), (0, 0), (1, 2), (0, -1), (1, 1), (2, 4)\}$

$\therefore l = 7$

$m = 7 - 2 = 5 \equiv \{(-3, -3), (-2, -2), (-1, -1), (2, 2), (3, 3\}$

$n = 5 \equiv \{(-2, -1), (-3, -1), (2, 1), (-1, 0), (4, 2\}$

$\therefore l + m + n = 17$

23. If $1^{2.15}C_1 + 2^{2.15}C_2 + \ldots\ldots + 15^{2.15}C_{15}$ is equal to $2^n \cdot 3^m \cdot 5^k$, then $m + n + k$ is equal to

Answer (19)

Sol. $\sum_{r=1}^{15} r^{215}C_r \qquad \left(r^nC_r = n^{n-1}C_{r-1}\right)$

$$= 15\sum_{r=1}^{15} r.^{14}C_{r-1}$$

$$= 15\sum_{r=1}^{15}(r-1+1)^{14}C_{r-1}$$

$$= 15\sum_{r=1}^{15}(r-1)^{14}C_{r-1} + 15\sum_{r=1}^{15}{}^{14}C_{r-1}$$

$$15\cdot\sum_{r=0}^{14} r^{14}C_r + 15\cdot(2^{14})$$

$$= 15\times 14\sum_{r=0}^{14}{}^{13}C_{r-1} + 15\cdot 2^{14}$$

$= 15 \times 14 \cdot 2^{13} + 15 \cdot 2^{14}$

$= 2^{14}(15 \times 7 + 15)$

$= 2^{14} \times 15(8)$

$= 2^{17} \cdot 3 \cdot 5$

$\therefore n + m + k = 19$

24. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ and $A^n = A^{n-1} + A^2 - I \; \forall \; n \geq 3$, then sum of all elements of A^{50} is

Answer (53.00)

Sol. If $A=\begin{bmatrix}1&0&0\\1&0&1\\0&1&0\end{bmatrix}$

$\Rightarrow A^2=\begin{bmatrix}1&0&0\\1&1&0\\1&0&1\end{bmatrix}, A^3=\begin{bmatrix}1&0&0\\2&0&1\\1&1&0\end{bmatrix}, A^4=\begin{bmatrix}1&0&0\\2&1&0\\2&0&1\end{bmatrix}$

$\Rightarrow A^5=\begin{bmatrix}1&0&0\\3&0&1\\2&1&0\end{bmatrix}, A^6=\begin{bmatrix}1&0&0\\3&1&0\\3&0&1\end{bmatrix}$, similarly

$A^5=\begin{bmatrix}1&0&0\\25&1&0\\25&0&1\end{bmatrix}$

$\Rightarrow$ Sum of elements = 53

25.

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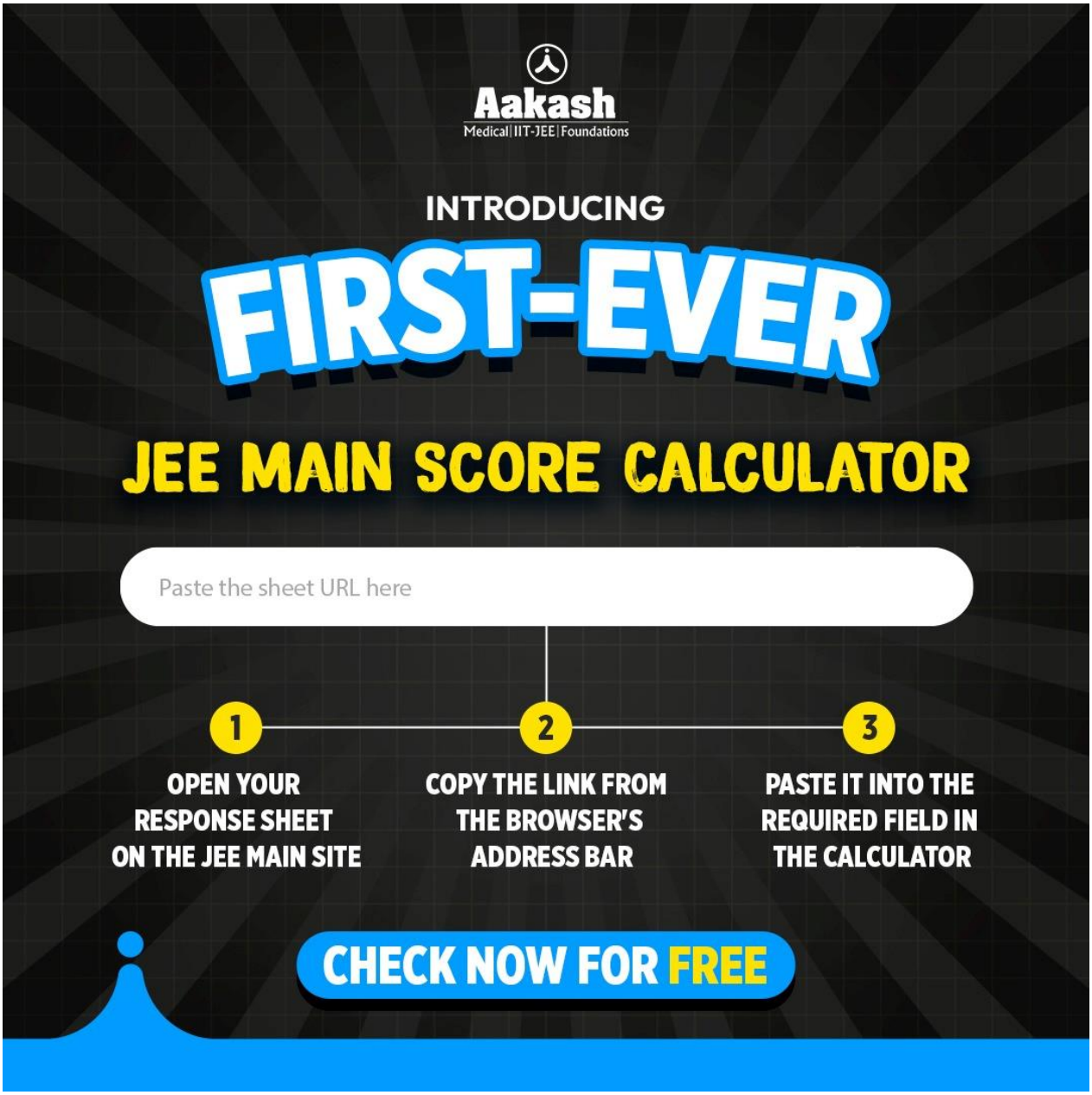

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