# JEE (Main)-2025 (Online) Session-2
# Memory Based Question with & Solutions
# (Physics, Chemistry and Mathematics)
# 3rd April 2025 (Shift-1)

**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.

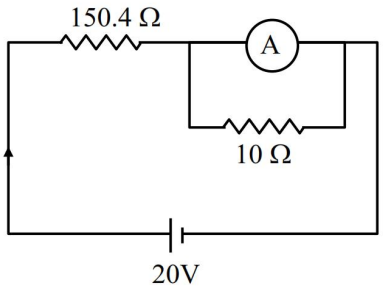
# MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – APRIL, 2025

**(Held On Thursday 3rd April, 2025)** **TIME : 9 : 00 AM to 12 : 00 PM**

## PHYSICS

### SECTION-A

**1.** An ammeter having resistance 240Ω is connected in the given circuit as shown. Find current through the ammeter.




(1) 2 mA (2) 5 mA

(3) 8 mA (4) 9 mA

**Ans.** **(2)**

**Sol.** $I_1 = I_0 \times \frac{10}{250}$

$= \frac{20}{150.4+9.6} \times \frac{10}{250}$

$= \frac{20}{160} \times \frac{10}{250} = 5\text{mA}$

**2.** A particle is released from height 'h' above the surface of the earth. At certain height it's K.E is 3 times of PE. The height from the surface of the earth and the speed of the Particle at the instant are respectively.

(1) $\frac{h}{2}, \sqrt{\frac{3gh}{2}}$ (2) $\frac{h}{4}, \sqrt{\frac{3gh}{2}}$

(3) $\frac{h}{2}, \sqrt{\frac{3gh}{4}}$ (4) $\frac{h}{4}, \sqrt{\frac{3gh}{4}}$

**Ans.** **(2)**

**Sol.** mgh = KE + PE

mgh = 4mgh'

$h' = \frac{h}{4}$

$\frac{1}{2}mv^2 = 3 \times mg\frac{h}{4}$

$v = \sqrt{\frac{3}{2}gh}$

**3.** The work function of a metal 3 eV. The colour of the visible light that is required to cause emission of photo electrons is :-

(1) Violet (2) Red

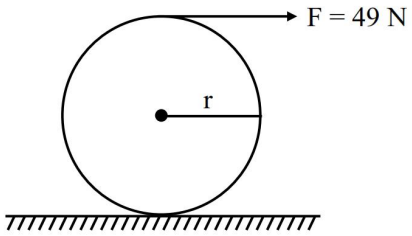
(3) Yellow (4) Green

**Ans.** **(1)**

**Sol.** $\phi_0 = E = \frac{hc}{\lambda} = \frac{1240}{\lambda}$

$\lambda = \frac{1240}{3} = 413.3\text{ nm}$

**4.** A force of 49 N acts tangentially at the highest point of a sphere (solid sphere of mass 20 kg) kept on a rough horizontal plane. If the sphere rolls without slipping, then the acceleration of the center of the sphere is :-




(1) 2.5 m/s² (2) 3.5 m/s²

(3) 0.35 m/s² (4) 0.45 m/s²

**Ans.** **(2)**

**Sol.** F + f = ma

$(F - f)R = \frac{2}{5}mR^2\frac{a}{R}$

$2F = \frac{7}{5}ma$

$a = \frac{10}{7} \times \frac{F}{m} = \frac{10}{7} \times \frac{49}{20} = 3.5\text{ m/s}^2$

**5.** The electrostatic potential on the surface of uniformly charged spherical shell of radius R = 10 cm is 120 V. The potential at the centre of shell, at a distance 5 cm from centre and a distance 15 cm from the centre of the shells are :-

(1) 0V, 120 V, 40 V (2) 40 V, 40 V, 80 V

(3) 120 V, 120 V, 80 V (4) 0 V, 0 V, 80 V

**Ans.** **(3)**

**Sol.** $v_{surface} = \frac{KQ}{R} = 120 = (V_{in})_{surface}$

$v_c = 120V$

$v_{5cm} = 120V$

$v_{15} = \frac{kQ}{r} = 120 \times \frac{10}{15} = 80$

**6.** In a biconvex lens $R_1$, $R_2$ and f are 15 cm, 10 cm and 12 cm respectively find refractive index of lens.

(1) 2 (2) $\frac{3}{4}$

(3) $\frac{4}{3}$ (4) $\frac{3}{2}$

**Ans.** **(4)**

**Sol.** $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\frac{1}{12} = (\mu - 1)\left(\frac{1}{15} + \frac{1}{10}\right)$

$\frac{1}{12} = (\mu - 1)\frac{1}{5}\left(\frac{5}{6}\right)$

$\frac{1}{2} + 1 = \mu$

**7.** Power of point source is 450 watt. Radiation pressure on a perfectly Reflecting surface at a distance of 2 m is

(1) $2 \times 10^{-8}$ (2) $4 \times 10^{-8}$

(3) $6 \times 10^{-8}$ (4) $8 \times 10^{-8}$

**Ans.** **(3)**

**Sol.** $\frac{2I}{C} = \frac{2}{C}\left(\frac{P}{4\pi r^2}\right)$

$= \frac{2 \times 450}{3 \times 10^8 \times 4\pi 2^2} = \frac{300}{16\pi} 10^{-8}$

**8.** When block of ice melts

(1) Internal energy decreases

(2) Internal energy constant

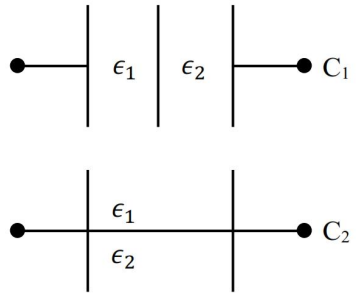
(3) Work done by atmosphere is positive

(4) Work done by atmosphere is negative

**Ans.** **(3)**

**Sol.** Work done by atmosphere is positive.

**9.** Two dielectric of dielectric constants $\epsilon_1$ & $\epsilon_2$ are inserted between the plates of two identical parallel plate capacitors as shown in the figure. The ratio of their capacitances $C_2/C_1$ is (Given $\frac{\epsilon_1}{\epsilon_2} = 2$) :-




(1) $\frac{9}{8}$ (2) $\frac{7}{8}$ (3) $\frac{8}{7}$ (4) $\frac{8}{9}$

**Ans.** **(1)**

**Sol.** $C_1^{**} = \frac{2k\frac{A}{2}\varepsilon_0}{d} = C_0 (Let)$

$C_2^{**} = \frac{2\frac{A}{2}\varepsilon_0}{d} = \frac{C_0}{2}$

$C_2 = \frac{3C_0}{2}$

$C_1^* = \frac{2KA\varepsilon_0}{\frac{d}{2}}$

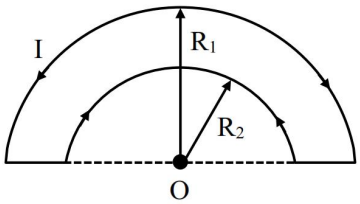
$C_1^* = 4C_0$

$C_2^* = \frac{KA\varepsilon_0}{\frac{d}{2}} = 2C_0$

$C_{effc} = \frac{4C_0 2C_0}{6C_0}$

$C_{effc} = \frac{4}{3}C_0$

**10.** A current carrying wire is bent as shown in the figure. Find magnetic field at centre O of the semi-circles. (Take $R_1 = 4\pi$ and $R_2 = 6\pi$) :-




(1) $8.3\ I \times 10^{-9}$ T (2) $8.3\ I \times 10^{-6}$ T

(3) $6\ I \times 10^{-8}$ T (4) $4\ I \times 10^{-6}$ T

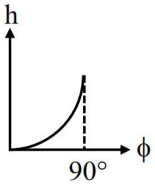
**Ans.** **(1)**

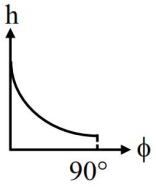
**Sol.** $B_{net} = B_1 - B_2$

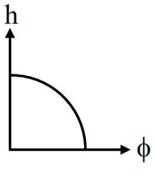
$$= \frac{\mu_0}{4} = \frac{I}{R} - \frac{\mu_0}{4}\frac{I}{r_2} \quad = \frac{\mu_0 I}{4}\left(\frac{1}{4\pi} - \frac{1}{6\pi}\right)$$

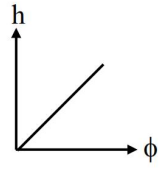
$$= \frac{\mu_0}{4\pi}\frac{I}{2}\left(\frac{1}{2} - \frac{1}{3}\right) = 8.3I \times 10^{(-9)}\,T$$

**11.** If a particle is thrown at an angle $\phi$ with vertical then mark the graph between h and $\phi$.

(1) 

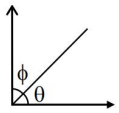

(2) 


(3) 


(4) 

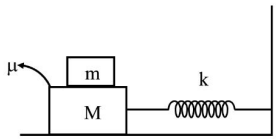

**Ans.** **(3)**

**Sol.**




$$H = \frac{u^2 \sin^2\theta}{2g} \Rightarrow H = \frac{u^2 \cos^2\theta}{2g}$$

**12.** The figure below shows an oscillating system of two blocks and a spring. The horizontal surface is smooth and the contact between the blocks is rough with coefficient of static friction $\mu$. Considering that the blocks of mass m is always stationary relative to M, choose the correct option regarding the statement below :




smooth

(A) Maximum frictional force between blocks is $\mu$ mg

(B) Time period of oscillation is $2\pi\sqrt{\frac{m+M}{k}}$

(C) Friction between the blocks at any instant is $\mu$Mg

(1) Only A & B are correct

(2) Only A is correct

(3) Only B is correct

(4) None of these

**Ans.** **(3)**

**Sol.** $f_{max.} = ma_{max.}$

$= m\omega^2 A$

$f = ma$

$= m\omega^2 x$

**13.** Choose the correct option.

| | |
|---|---|
| a. Gravitational potential | (i) $M^{-1}L^3T^{-2}$ |
| b. Gravitational constant | (ii) $ML^2T^{-2}$ |
| c. Acceleration due to gravity | (iii) $M^0L^2T^{-2}$ |
| d. Potential energy | (iv) $M^0LT^{-2}$ |

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

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

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

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

**Ans.** **(1)**

**Sol.** Gravitational potential

$$v = \frac{-GM}{R} = M^0L^2T^{-2}$$

Gravitational constant $F = \frac{GM_1M_2}{R^2} = M^{-1}L^3T^{-2}$

$$g = \frac{GM}{R^2} = M^0LT^{-2}$$

$$U = \frac{GM_1M_2}{R} = ML^2T^{-2}$$

**14.** A thin uniform wire of length 25 m and area of cross-section 5 $mm^2$ has resistivity $2 \times 10^{-6}$ $\Omega$-m. If the wire is bent to form a circle, the resistance across diametrically opposite points is

(1) 12.5 $\Omega$ (2) 5 $\Omega$

(3) 10 $\Omega$ (4) 2.5 $\Omega$

**Ans.** **(4)**

**Sol.** $R = \frac{\rho\ell}{A}$

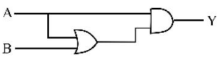
$$R_{net} = \frac{R}{4}$$

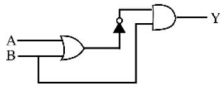
$$= \frac{\rho\ell}{A4}$$

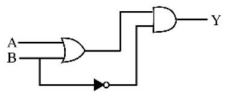
$$= \frac{\rho\ell}{A4} = \frac{2\times10^{-6}\times25}{5\times10^{-6}\times4} = \frac{10}{4} = 2.5\Omega$$

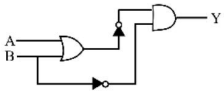
**15.** For given truth table, which option is correct

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

(1) 


(2) 


(3) 


(4) 


**Ans.** **(1)**

**Sol.** 


Option 1 is correct because its follow the given truth table

**16.** Which of the following is correct when deviation is minimum regarding an equilateral prism of angle A :

(1) $i = e$

(2) Ray inside prism becomes parallel to base of prism.

(3) More is 'A', smaller is deviation.

(4) All of these

**Ans.** **(4)**

**Sol.** From condition of minimum deviation

$i = e$

Ray inside prism becomes parallel to base of prism.

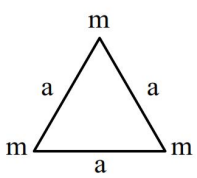
$\delta = (i + e) - A$

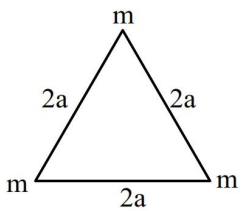
$\delta = 2i - A$

So, More is 'A', smaller is deviation.

## SECTION-B

**1.** Three particles in figure (a) collide at centroid in 4 sec. In how much time will they collide in figure (b)



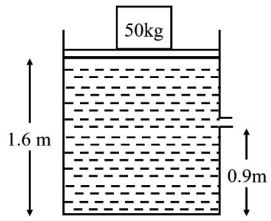




**Ans.** **(8)**

**Sol.** $v_{rel} = \frac{3v}{2}$ $\qquad t' = 8s$

$$t = \frac{2d}{3v} = 4$$

**2.** In the shown diagram a block of 50 kg is kept on a light plate of area 1 $m^2$ covering the surface of a water tank in which a hole is pierced at a height of 0.9 m from the bottom. Given the height of water is 1.6 m. If the velocity of efflux is v (in SI unit), then find $10v^2$ :




**Ans.** **(150)**

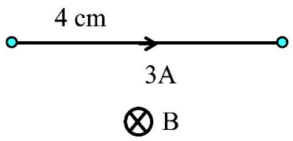
**Sol.** $P_0 + \frac{50 \times 10}{1} + 1000 \times 10 \times 0.7$

$= P_0 + \frac{1}{2}\rho v^2$

$2\left(\frac{500 \times 7000}{1000}\right) = V^2 = 15$

$10V^2 = 150$

**3.** If a rod of length 4 cm is placed in magnetic field 0.15 T perpendicularly having current 3 amp. The magnitude of force on Rod is $2x \times 10^{-3}$. Find x :-




**Ans.** **( x = 9 )**

**Sol.** $\vec{F} = i(\vec{\ell} \times \vec{B})$

$F = i \ell B$

$3 \times 4 \times 10^{-2} \times 0.15$

$= 12 \times 10^{-2} \times 0.15$

$F = 180 \times 10^{-4}\,N$

$= 18 \times 10^{-3}\,N$

$2x = 18$

$x = 9\,s$

## CHEMISTRY

### SECTION-A

**1.** Which of the following has highest atomic number

(1) Po (2) Pt

(3) Pr (4) Pb

**Ans.** **(1)**

**Sol.** $_{84}Po \rightarrow$ p-block

$_{78}Pt \rightarrow$ d-block

$_{59}Pr \rightarrow$ f-block

$_{82}Pb \rightarrow$ p-block

**2.** Which of the following ion shows spin only magnetic of 4.9 B.M.

(1) $Mn^{2+}$ (2) $Cr^{2+}$

(3) $Fe^{3+}$ (4) $Co^{2+}$

**Ans.** **(2)**

**Sol.** $\mu = \sqrt{n(n+2)}$ B.M., where n = no. of unpaired $e^{\ominus}$ if $\mu = 4.9$ B.M. then $n = 4$

$Cr^{2\oplus} \Rightarrow 3d^4$ | 1 | 1 | 1 | 1 | | n=4

**3.** An ideal gas with an adiabatic exponent 1.5, initially at 27°C is compressed adiabatically from 800 cc to 200 cc. The final temperature of the gas is

(1) 600 K (2) 300 K

(3) 450 K (4) 273 K

**Ans.** **(1)**

**Sol.** $PV^x$ = constant

$$\frac{T_1}{T_2} = \left(\frac{V_2}{V_1}\right)^{x-1}$$

$$\frac{300}{T_2} = \left(\frac{200}{800}\right)^{\frac{3}{2}-1}$$

$T_2 = 600K$

**4.** 2 moles each of ethylene glycol and glucose are mixed with 500 g of water. Find the boiling point of solution.

Given : $K_b = 0.52$ K kg $mol^{-1}$

(1) 377.16 K (2) 368.84 K

(3) 376.16 K (4) 369.84 K

**Ans.** **(1)**

**Sol.** $\Delta T_b = ik_b m$

$$\Delta T_b = k_b \times \frac{4\times1000}{500} \qquad (i = 1)$$

$= 0.52 \times 8$

$= 4.16$

$(T_b)_{solution} - T_b = 4.16$

$(T_b)_{solution} = 373 + 4.16$

$= 377.16$

**5.** Match the column.

| List-I | | List-II | |
|---|---|---|---|
| (a) | $PF_5$ | (i) | Tetrahedral and $sp^3$ |
| (b) | $SF_6$ | (ii) | Square planar and $dsp^2$ |
| (c) | $[Ni(CO)_4]$ | (iii) | Octahedral and $sp^3d^2$ |
| (d) | $[PtCl_4]^{2-}$ | (iv) | Trigonal bipyramidal and $sp^3d$ |

(1) a→(iv), b→(iii), c→(i), d→(ii)

(2) a→(ii), b→(i), c→(iv), d→(iii)

(3) a→(iii), b→(ii), c→(i), d→(iv)

(4) a→(ii), b→(iv), c→(i), d→(iii)

**Ans.** **(1)**

**Sol.** (a) $PF_5 \rightarrow sp^3d$ (Trigonal bipyramidal)

(b) $SF_6 \rightarrow sp^3d^2$ (Octahedral)

(c) $Ni(CO)_4 \rightarrow sp^3$ (Tetrahedral)

(d) $[PtCl_4]^{2-} \rightarrow dsp^2$ (Square Planar)

**6.** Arrange the following cations in increasing order of limiting molar conductivities of at 298 K

$H^+$, $Ca^{+2}$, $Na^+$, $K^+$, $Mg^{+2}$.

(1) $K^+ > Na^+ > H^+ > Ca^{+2} > Mg^{+2}$

(2) $H^+ > Ca^{+2} > Mg^{+2} > K^+ > Na^+$

(3) $H^+ > Ca^{+2} > K^+ > Mg^{+2} > Na^+$

(4) $H^+ > Ca^{+2} > Mg^{+2} > Na^+ > K^+$

**Ans.** **(2)**

**Sol.** Reference NCERT table

Limiting Molar Conductivity for some Ions in Water at 298 K

| Ion | $\lambda^0/(S\ cm^2 mol^{-1})$ |
|---|---|
| $H^+$ | 349.6 |
| $Na^+$ | 50.1 |
| $K^+$ | 73.5 |
| $Ca^{2+}$ | 119.0 |
| $Mg^{2+}$ | 106.0 |

Molar conductivity $\propto$ charge

$\propto$ Mobility

Limiting Molar Conductivity :

$H^+ > Ca^{+2} > Mg^{+2} > K^+ > Na^+$

**7.** Which is **correct :**

(1) $A + e^- \rightarrow A^- \rightarrow$ is always exothermic.

(2) $A \rightarrow A^+ + e^- \rightarrow$ is always endothermic.

(3) $IE_1$ of (Be) < $IE_1$ (B).

(4) Lithium is most electropositive in its group.

**Ans.** **(2)**

**Sol.** (1) $A + e^- \rightarrow A^-$

If A = inert gas, Be, Mg & N then it will be endothermic.

(2) $A \rightarrow A^+ + e^-$

Ionisation energy is always endothermic

(3) Be > B ionisation energy (due to $2s^2$ configuration)

(4) Li is not most electropositive in its group

Cs is more electropositive

**8.** Which of the following property shows irregular trend in group 16?

(1) Electronegativity (2) Atomic radius

(3) Electron affinity (4) Ionisation enthalpy

**Ans.** **(3)**

**Sol.** Electron affinity

S > Se > Te > Po > O

**9.** Consider the following statements

**Statement I:** N–N has less bond strength than P–P

**Statement II:** All group-15 elements in +3 oxidation state undergo disproportionation.

In the above statements, choose the correct option.

(1) Both Statement are correct.

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

(4) Both Statement are incorrect.

**Ans.** **(2)**

**Sol.** $\overset{..}{N}-\overset{..}{N} < \overset{..}{P}-\overset{..}{P}$

(due to Lone pair. – Lone pair repulsion)

**10.** Consider the following complex ions

(a) $[Co(NH_3)_6]^{3+}$ (b) $[Co(NH_3)_5Cl]^{2+}$

(c) $[Co(NH_3)_5(H_2O)]^{3+}$ (d) $[Co(CN)_6]^{3-}$

Choose the correct order of wavelength absorbed by complex ions

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

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

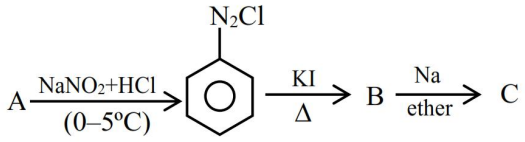
**Ans.** **(3)**

**Sol.** $\Delta \propto \frac{1}{\lambda_{obs}}$

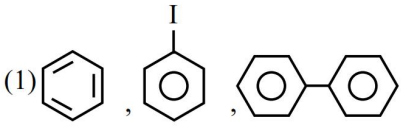
$\Delta$ : d > a > c > b

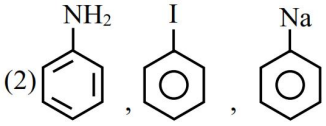
$\lambda_{obs}$ : b > c > a > d

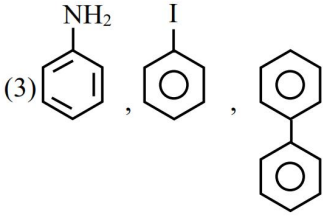
**11.**

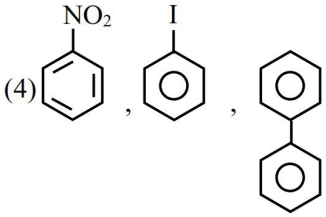



Identify A, B, C respectively

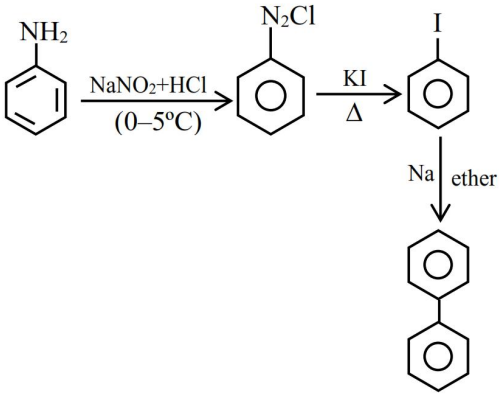
(1) 


(2) 

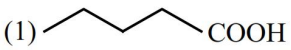

(3) 

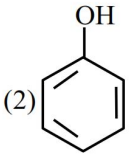

(4) 

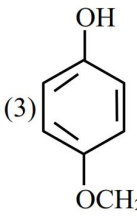

**Ans.** **(3)**

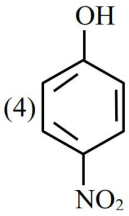
**Sol.** 

**12.** Which of the following is more acidic than others?

(1) 

(2) 

(3) 

(4) 

**Ans.** **(1)**

**Sol.** pKa(p-nitrophenol) is around 7.15

pKa(pentanoic acid) is around 4.82

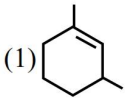
pKa(phenol) is around 10.00

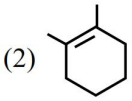
pKa(p-methoxy phenol) is around 10.2

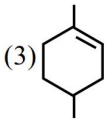
So, pentanoic acid has highest acidic nature among all

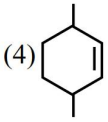
**13.** Identify reactant of following reaction

Reactant $\xrightarrow[Zn\text{-}H_2O]{O_3}$ 3-Methyl-6-ketoheptanal

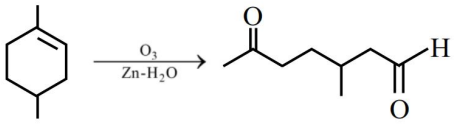
(1) 

(2) 

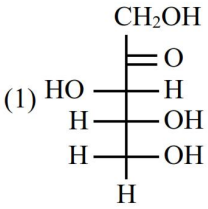
(3) 

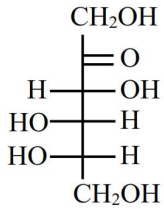
(4) 

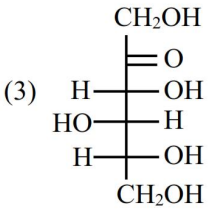
**Ans.** **(3)**

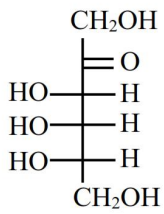
**Sol.** 

**14.** Identify structure of L-Fructose

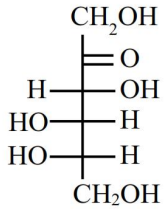
(1) 

(2) 

(3) 

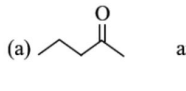
(4) 

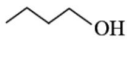
**Ans.** **(2)**

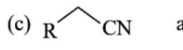
**Sol.** 

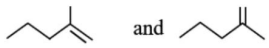
(L-Fructose)

**15.** Which of the following is/are correct

(a)  : are Metamers

(b)  : are Position isomers

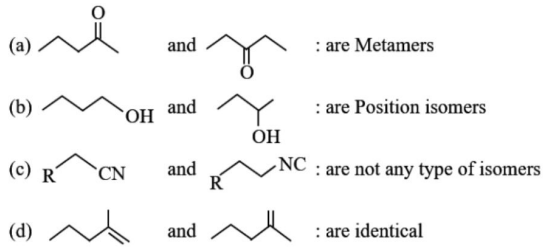
(c)  : are Functional isomers

(d)  : are Position isomers

(1) (a), (b), (c) (2) (a), (b), (d)

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

**Ans.** **(3)**

**Sol.** 

**16.** The given reaction is at equilibrium starting with only $PCl_5$

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$,

When addition of Xe gas takes place at constant pressure, then which of the following is correct?

(1) Conc. of $PCl_3$ will become more than $Cl_2$

(2) $PCl_3$ and $Cl_2$ will have same concentration at new equilibrium.

(3) Conc. of $Cl_2$ will become more than $PCl_3$.

(4) $PCl_3$ will be 30% and $Cl_2$ will be 70% at the new equilibrium

**Ans.** **(2)**

**Sol.** $PV = nRT$

$(V) \uparrow \propto (n) \uparrow$

Reaction will be shift at that direction where no. of gases mole more.

**17.** Which of the following statement(s) is/are **INCORRECT**

I. $NO_2$ dimerises easily

II. $NF_5$ does not exist but $PF_5$ exists

III. The oxides $N_2O_5$ and $P_2O_5$ are purely acidic but $As_2O_5$ and $Sb_2O_5$ are basic

IV. Nitrogen cannot form pπ-dπ bond as the heavier elements

(1) Only I, II and IV (2) Only III

(3) Only III and IV (4) Only I and II

**Ans.** **(3)**

**Sol.** I. $NO_2$ dimerises easily to form $N_2O_4$ due to presence of unpaired electron.

II. N does not have any d-orbital so it cannot increase its valancy to 5 to form $NF_5$

III. $N_2O_5$, $P_2O_5$ $As_2O_5$ $Sb_2O_5$ = Acidic oxides

IV. Nitrogen can form pπ-dπ bond

Eg. $\ddot{N}(SiH_3)_3$

**18.** Correct set of four Quantum numbers for last electron of $Cr^{3+}$ on is:

(1) $n = 4, l = 1, m = 0, s = +\frac{1}{2}$

(2) $n = 4, l = 2, m = 0, s = +\frac{1}{2}$

(3) $n = 3, l = 2, m = 0, s = +\frac{1}{2}$

(4) $n = 3, l = 2, m = -1, s = 0$

**Ans.** **(3)**

**Sol.** $Cr+3 = [Ar]3d^3$

$n = 3, l = 2, m = 0, s = +\frac{1}{2}$

**19.** Given below are two statements about X-ray spectra of elements:

**Statement I:** A plot of $\sqrt{\upsilon}$ ($\nu$ = frequency of X-rays emitted) vs atomic mass is a straight line.

**Statement II:** A plot of $\nu$ ($\nu$ = frequency of X-rays emitted) vs atomic number is a straight line.

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

(1) Both Statement are correct.

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

(4) Both Statement are incorrect.

**Ans.** **(4)**

**Sol.** $\sqrt{\upsilon} = a(z-b)$

$\sqrt{\upsilon} \propto Z$

$\sqrt{\upsilon}$ vs $Z$ graph is a straight line

## SECTION-B

**20.** There are two solutions of compounds A & B. The initial concentration of B is 8 times initial concentration of A. If half life of A & B are 40 and 10 min. then find the time when concentration of both A & B are same.

(Assume first order reaction)

**Ans.** **(40)**

**Sol.**

| | $A \longrightarrow P$ | $B \longrightarrow P$ |
|---|---|---|
| t=0 | a | 8a |
| t=t | $C_A$ | $C_B$ |

$C_A = a.e^{-k_A t}$ $\quad$ $C_B = 8a \times e^{-K_B t}$

$k_A = \frac{\ln 2}{40}$ $\quad$ $k_B = \frac{\ln 2}{10}$

$a \times e^{-\frac{\ln 2}{40} \times t} = 8a \times e^{-\frac{\ln 2}{10} \times t}$

$\frac{t}{10} - \frac{t}{40} = 3$

t = 40 min

**21.** $K_2Cr_2O_7 + H_2SO_4 + 4H_2O_2 \rightarrow A + K_2SO_4 + 5H_2SO_4$.

Find the number of oxygen atom in product A.

**Ans.** **(5)**

**Sol.** $K_2Cr_2O_7 + H_2SO_4 + 4H_2O_2 \rightarrow CrO_5 + K_2SO_4 + 5H_2SO_4$.

Number of 'O' atom in A = 5

**22.** $FeCl_3 + KOH + H_2C_2O_4 \longrightarrow A$

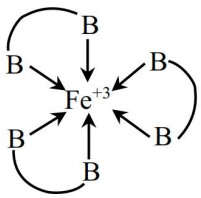
'A' is a complex, find the number of optical isomer of product A.

**Ans.** **(2)**

**Sol.** $K_3[Fe(C_2O_4)_3] = A$

$C_2O_4^{2-} \rightarrow$ Symmetrical bidentate ligand

$[Fe(BB)_3]^{3-}$




POS ×

Optically active

**23.** 0.5 g of a hydrocarbon gives 1.46 g $CO_2$ and 0.9 g $H_2O$ on combustion. What is the percentage of carbon in hydrocarbon. (Nearest integer)

**Ans.** **(80)**

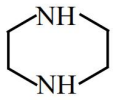
**Sol.** $C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$

$$\%C = \frac{12}{44} \times \frac{\text{wt. of } CO_2}{\text{wt. of Hydrocarbon}} \times 100$$

$$\%C = \frac{12}{44} \times \frac{1.46}{0.5} \times 100$$

$\%C = 79.63 \approx 80\%$

**24.** Calculate the mass of nitrogen present in 1.6 g of following compound




**Ans.** **(0.52)**

**Sol.** $C_4H_{10}N_2 \rightarrow$ Molar mass $= 12 \times 4 + 1 \times 10 + 14 \times 2$

$= 48 + 10 + 28$

$= 86$

86 g m o.c $\rightarrow$ 28g nitrogen

1.6 gm o.c $\rightarrow \frac{28}{86} \times 1.6$

$= 0.52$ g

## MATHEMATICS

**1.** Let A be 3×3 matrix such that $\det(A) = 5$. If $\det\left(3adj\left(2Aadj(2A)\right)\right) = 2^{\alpha}.3^{\beta}.5^{\gamma}$, then $(\alpha+\beta+\gamma)$ is equal to

(1) 25 (2)26 (3) 27 (4) 28

**Ans.** **(4)**

**Sol.** $\left|3adj\left(2Aadj(2A)\right)\right| = 3^3\left|adj\left(2A.adj(2A)\right)\right|$

$= 3^3\left|2A.adj(2A)\right|^2$

$= 3^3\left|\left|2A\right|I_3\right|^2$

$= 3^3\left(\left|2A\right|^3\right)^2$

$= 3^3\times\left(2^9.\left|A\right|^3\right)^2$

$= 3^3\times 2^{18}\times 5^6$

**2.** The sum of all rational terms in $\left(2+\sqrt{3}\right)^8$ is

(1) 18117 (2) 18817

(3) 17280 (4)1800

**Ans.** **(2)**

**Sol.** $T_{r+1} = {}^8C_r\times 2^{8-r}\times\left(\sqrt{3}\right)^r$

Sum of all rational terms

$= {}^8C_0\times 2^8 + {}^8C_2\times 2^6\times 3 + {}^8C_4\times 2^4\times 3^2$

$+ {}^8C_6\times 2^2\times 3^3 + 3^4$

$= 256 + 28\times 64\times 3 + 70\times 16\times 9 + 28\times 4\times 27 + 81$

$= 256 + 5376 + 10080 + 3024 + 81$

$= 18817$

**3.** If the sum $\sum_{r=1}^{9}\left(\frac{r+3}{2^r}\right)\cdot {}^9C_r = \alpha\cdot\left(\frac{3}{2}\right)^9 - \beta$, then the value of $(\alpha+\beta)^2$ is equal to

(1) 9 (2) 81

(3) 27 (4) 36

**Ans.** **(2)**

**Sol.** $\sum_{r=1}^{9} r.\frac{9}{r}.{}^8C_{r-1}.\frac{1}{2^r} + \sum_{r=1}^{9}\frac{3}{2^r}.{}^9C_r$

$= \frac{9}{2}\left(1+\frac{1}{2}\right)^8 + 3\left\{\left(1+\frac{1}{2}\right)^9 - 1\right\}$

$= \frac{9}{2}.\left(\frac{3}{2}\right)^8 + 3.\left(\frac{3}{2}\right)^9 - 3$

$= 6.\left(\frac{3}{2}\right)^9 - 3 = \alpha\left(\frac{3}{2}\right)^9 - \beta$

$\therefore\ \alpha = 6, \beta = 3$

$\therefore\ (\alpha+\beta)^2 = 81.$

**4.** Let $S_n = 1 + 3 + 11 + 25 + 45 + \cdots$ Then sum upto 20th term equals to

(1) 6200 (2) 7200

(3) 7240 (4) 6240

**Ans.** **(3)**

**Sol.** Using method of difference

$S_n = 1 + 3 + 11 + 25 + 45 + \ldots..$

2 8 14 20

$T_1 = 1$

$T_2 = 1 + 2$

$T_3 = 1 + 2 + 8$

$T_4 = 1 + 2 + 8 + 14$

$T_n = \underbrace{1+2+8+14+20+\ldots}_{\text{upto n terms}}$

$T_n = 1 + \frac{n-1}{2}\left[2\times 2 + (n-2)\times 6\right] = 3n^2 - 7n + 5$

$S_{20} = \sum_{n=1}^{20} T_n = 3\sum_{1}^{20} n^2 - 7\sum_{1}^{20} n + 5\sum_{1}^{20} 1$

$= 3\times\frac{20\times 21\times 41}{6} - \frac{7\times 20\times 21}{2} + 5\times 20$

$= 7240$

**5.** Let $f(x)=\int x^3\sqrt{3-x^2}\,dx$. If $5f(\sqrt{2})=-4$, then $f(1)$ is equal to

(1) $-\frac{2\sqrt{2}}{5}$ (2) $-\frac{6\sqrt{2}}{5}$

(3) $-\frac{4\sqrt{3}}{5}$ (4) $-\frac{8\sqrt{2}}{5}$

**Ans.** **(2)**

**Sol.** Let $3 - x^2 = y^2$

$\therefore -x\,dx = y\,dy$

$\therefore x\,dx = -y\,dy$

$$\int(3-y^2)(-y\,dy).y=\int-(3y^2-y^4)\,dy$$

$$=-3\left(y^3-\frac{y^5}{5}\right)+c$$

$$=-\frac{y^3}{5}(5-y^2)+c$$

$$=-\frac{(3-x^2)^{3/2}}{5}(5-3+x^2)+c$$

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

$$f(\sqrt{2})=-\frac{4}{5}\ \therefore\ -\frac{4}{5}=-\frac{1}{5}(2+2)+c\ \therefore c=0$$

$$\therefore\ f(1)=-\frac{(2)^{3/2}}{5}(3)=-\frac{6\sqrt{2}}{5}$$

**6.** A relation

$R=\{(x,y):x,y\epsilon A=\{-3,-2,-1,0,1,2,3\}\}$ such that $x^2+2y\le 4$. Then, the number of ordered pairs in relation R be r and number of ordered pairs required to add in R so that it becomes reflexive relations is m, then $r+m$ is equal to

(1) 26 (2) 28

(3) 24 (4) 23

**Ans.** **(2)**

**Sol.** $A=\{-3,-2,-1,0,1,2,3\}$

No of ordered pairs in relation R

$2y \le 4 - x^2$ $\quad\therefore\ y\le\frac{4-x^2}{2}$

Now put:

(1) $x = \pm3,\ y\le\frac{4-9}{2}\Rightarrow y\le\frac{-5}{2}\Rightarrow y=-3$

$(\pm3, -3) \to 2$ pairs

(2) $x = \pm2,\ y\le\frac{4-4}{2}\Rightarrow y\le 0$

$\Rightarrow y = -3, -2, -1, 0$

$(\pm2, -3), (\pm2, -2), (\pm2, -1), (\pm2, 0)$

8 pairs.

(3) $x \pm1,\ y\le\frac{3}{2}\Rightarrow y = -3, -2, -1, 0, 1$

No of ordered pairs = 10

(4) $x = 0, y \le 2$

$\Rightarrow y = -3, -2, -1, 0, 1, 2$

6 pairs.

$\therefore$ total order pair

$\therefore$ r = 26

For reflexive m = 2

$\therefore$ r + m = 28.

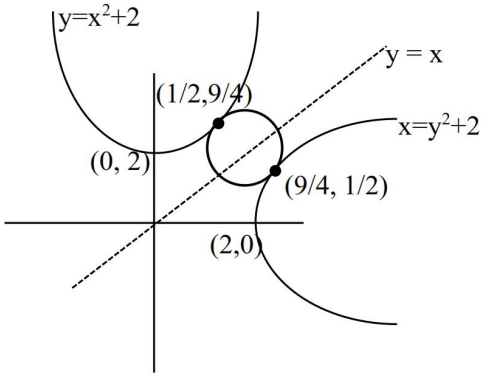
**7.** The radius of circle touching both parabolas $y = x^2 + 2$ and $x = y^2 + 2$ is

(1) $\frac{7\sqrt{2}}{8}$ (2) $\frac{7\sqrt{2}}{2}$

(3) $\frac{7\sqrt{2}}{4}$ (4) $\frac{7\sqrt{2}}{6}$

**Ans.** **(1)**

**Sol.**




For $y = x^2 + 2$

$$\frac{dy}{dx}=2x=1$$

at $x=\frac{1}{2}$ and $y=\frac{9}{4}$

For $x = y^2 + 2$

$$1=2y\frac{dy}{dx}\Rightarrow\frac{1}{2y}=1$$

at $y=\frac{1}{2}$ and $x=\frac{9}{4}$

$$\Rightarrow 2R = \sqrt{2\times\left(\frac{9}{4}-\frac{1}{2}\right)^2} = \sqrt{2\times\left(\frac{7}{4}\right)^2} = \sqrt{2}\times\frac{7}{4}$$

$$\Rightarrow R = \frac{7\sqrt{2}}{8}$$

**8.** If $3x + 2\tan x = \pi,\ x\epsilon[-2\pi, 2\pi] - \left\{\pm\frac{\pi}{2}, \pm\frac{3\pi}{2}\right\}$. Then number of values of $x$ that satisfies the above equation is

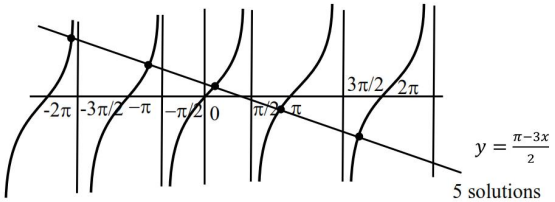
(1) 7 (2) 5

(3) 4 (4) 6

**Ans.** **(2)**

**Sol.** $3x + 2\tan x = \pi,\ x \in [-2\pi, 2\pi] - \{\pm\pi/2, \pm 3\pi/2\}$

$$\tan x = \frac{\pi - 3x}{2}$$




5 solutions

**9.** Let $\int_0^x g(t)\,dt = x - \int_0^x tg(t)\,dt, x \geq 0$ and $\frac{dy}{dx} - y\tan x = 2(x+1)\sec x\, g(x)$ satisfying the condition $y(0) = 0$. Then $y\left(\frac{\pi}{3}\right)$ is

(1) $\pi$ (2) $2\pi$

(3) $\frac{2\pi}{3}$ (4) $\frac{4\pi}{3}$

**Ans.** **(4)**

**Sol.** $\int_0^x g(t)dt = x - \int_0^x tg(t)dt \qquad x \geq 0$

$g(x) = 1 - xg(x)$

$$\Rightarrow g(x) = \frac{1}{1+x}$$

$$\frac{dy}{dx} - y\tan x = 2(x+1)\sec x g(x)$$

$$\frac{dy}{dx} - y\tan x = 2\sec x$$

$\cos x.y = 2x + c$

$$y = \frac{2x}{\cos x}$$

$$y\left(\frac{\pi}{3}\right) = \frac{\frac{2\pi}{3}}{\frac{1}{2}} = \frac{4\pi}{3}$$

**10.** If $f(x) = \begin{vmatrix} \sin x & \cos x & \sin x + \cos x + 1 \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$, then the value of $f''(x) + f(x)$ is

(1) –1 (2) 28

(3) 27 (4) 1

**Ans.** **(1)**

**Sol.** $$f(x) = \begin{vmatrix} \sin x & \cos x & \sin x + \cos x + 1 \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$$

$$f'(x) = \begin{vmatrix} \cos x & -\sin x & \cos x - \sin x \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$$

$$f''(x) = \begin{vmatrix} -\sin x & -\cos x & -\sin x - \cos x \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$$

$$f''(x) + f(x) = \begin{vmatrix} 0 & 0 & 1 \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$$

$= 27 - 28$

$= -1$

**11.** The number of seven digit numbers whose sum of digits is 7, is___.

**Ans.** **(924)**

**Sol.** Let the seven digit number be $a_0,a_1,a_2,a_3,a_4,a_5,a_6$ where $a_0$, $a_1$, $a_2$, $a_3$, $a_4$, $a_5$, $a_6$ are digits from 0 to 7 & $a_0 \neq 0$

$\therefore$ When $a_0 = 1$, $a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = 6$

$\therefore$ No. of ways $= {}^{6+6-1}C_{6-1} = {}^{11}C_5$

$\therefore$ When $a_0 = 2$, $a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = 5$

$\therefore$ No. of ways $= {}^{5+6-1}C_{6-1} = {}^{10}C_5$

$\vdots$

$\therefore$ When $a_0 = 7$, $a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = 0$

$\therefore$ No. of ways $= {}^{0+6-1}C_{6-1} = {}^{5}C_5$

$\therefore$ Total number of nos.

$= {}^5C_5 + {}^6C_5 + {}^7C_5 + \ldots + {}^{11}C_5$

$$= {}^{12}C_6 = \frac{12.11.10.9.8.7}{6.5.4.3.2.1} = 924$$

**12.** Let $\alpha, \beta$ are the roots of the equation $x^2 + \sqrt{3}x - 16 = 0$ and $\gamma, \delta$ are the roots of the equation $x^2 + 3x - 1 = 0$.

If $Q_n = \alpha^n + \beta^n \; \forall \; n \epsilon N$ then the value of $\frac{Q_{25}+\sqrt{3}Q_{24}}{2Q_{23}} + \left(\frac{P_{25}-P_{23}}{P_{24}}\right)$ is

(1) 5 (2) 6

(3) 7 (4) 8

**Ans.** **(1)**

**Sol.**

$$x^2 + \sqrt{3}x - 16 = 0 \begin{cases} \alpha \\ \beta \end{cases}, Q_n = \alpha^n + \beta^n$$

so, it will satisfy $Q_{n+2} + \sqrt{3}Q_{n+1} - 16Q_n = 0$

$$x^2 + 3x - 1 = 0 \begin{cases} \gamma \\ \delta \end{cases}, P_n = \gamma^n + \delta^n$$

so, it will satisfy $P_{n+2} + 3P_{n+1} - P_n = 0$

So, the value of $\left(\frac{Q_{25}+\sqrt{3}Q_{24}}{2Q_{23}}\right) + \left(\frac{P_{25}-P_{23}}{P_{24}}\right)$

$\because \frac{Q_{25}+\sqrt{3}Q_{24}}{2Q_3} = 8$ and $\frac{P_{25}-P_{23}}{P_{24}} = -3$

$\Rightarrow$ the required value = 8 – 3 = 5

**13.** If $y = \max\{|x|, x, |x-2|\}$, then the area under the curve from $x = -2$ to $x = 4$ is (in square units)

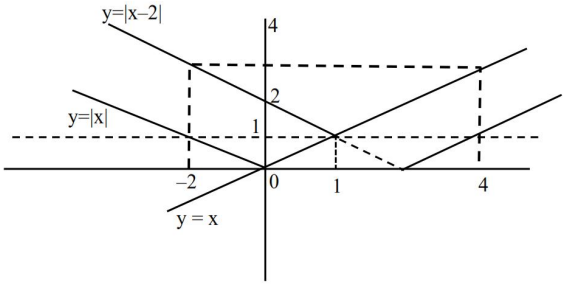
(1) 15 (2) 20

(3) 12 (4) 8

**Ans.** **(1)**

**Sol.** $\therefore$ Area $= \frac{1}{2} \times 3 \times 3 + 3 \times 1 + 3 \times 1 + \frac{1}{2} \times 3 \times 3$

= 15



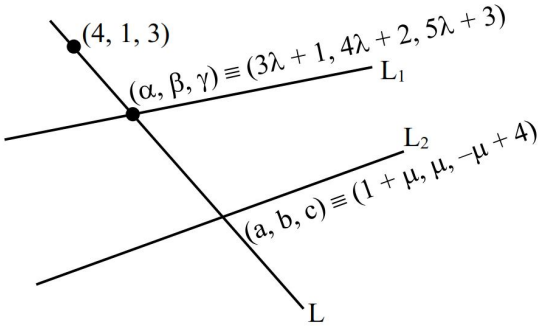

**14.** Let a line passing through (4,1,3) intersects the lines $l_1: \frac{x-1}{3} - \frac{y-2}{4} = \frac{z-3}{5}$ at $(\alpha, \beta, \gamma)$ and $l_2: x - 1 = y = -z + 4$ at (a,b,c), then find $\begin{vmatrix} 63 & 21 & -21 \\ \alpha & \beta & \gamma \\ a & b & c \end{vmatrix}$ is equal to

(1) 102 (2) 204

(3) 63 (4) 21

**Ans.** **(2)**

**Sol.**




$$\frac{3\lambda+1-4}{1+\mu-4} = \frac{4\lambda+2-1}{\mu-1} = \frac{5\lambda+3-3}{-\mu+4-3}$$

$$\frac{3\lambda-3}{\mu-3} = \frac{4\lambda+1}{\mu-1} = \frac{5\lambda}{-\mu+1} = \frac{9\lambda+1}{0}$$

$$\Rightarrow \lambda = \frac{-1}{9}, \; \mu = \frac{9}{7}$$

$$\begin{vmatrix} 63 & 21 & -21 \\ 3\lambda+1 & 4\lambda+2 & 5\lambda+3 \\ \mu+1 & \mu & -\mu+4 \end{vmatrix}$$

Using $C_2 \to C_2 + C_3$

$$= \begin{vmatrix} 63 & 0 & -21 \\ 3\lambda+1 & 9\lambda+5(=4) & 5\lambda+3 \\ \mu+1 & 4 & -\mu+4 \end{vmatrix}$$

Using $R_2 \to R_2 - R_3$

$$= \begin{vmatrix} 63 & 0 & -21 \\ 3\lambda-\mu & 0 & 5\lambda+\mu-1 \\ \mu+1 & 4 & -\mu+4 \end{vmatrix}$$

$= -4[63(5\lambda + \mu - 1) + 21(3\lambda - \mu)]$

$= -4 \times 21[15\lambda + 3\mu - 3 + 3\lambda - \mu]$

$= -84[18\lambda + 2\mu - 3]$

$$= -84\left[-2 + \frac{18}{7} - 3\right]$$

$$= -84\left[-5 + \frac{18}{7}\right] = -12[-35 + 18]$$

$= 12 \times 17$

$= 204$

**15.** Let $a_1, a_2, a_3, \ldots$ be the terms of an increasing G.P. such that $a_3 \cdot a_5 = 729$ and $a_2 + a_4 = \frac{111}{4}$, then $24(a_1 + a_2 + a_3)$ is equal to

(1) 139 (2) 129

(3) 125 (4) 119

**Ans.** **(2)**

**Sol.** Let the first term of the increasing G.P. be a and common ratio be r then as per the question

$a_3 \cdot a_5 = ar^2 \cdot ar^4 = 729 \Rightarrow ar^3 = 27$

$$a_2 + a_4 = \frac{111}{4} \Rightarrow ar + ar^3 = \frac{111}{4}$$

$$\Rightarrow ar = \frac{111}{4} - 27 = \frac{3}{4}$$

So, $r^2 = \frac{27}{3/4} = 36 \Rightarrow r = 6$

So, $a = \frac{3}{4 \times 6} = \frac{1}{8}$

Hence, $24(a_1 + a_2 + a_3) = 24(a + ar + ar^2)$

$= 24 \times a(1 + r + r^2)$

$$= 24 \times \frac{1}{8}(1 + 6 + 6^2) = 129$$

**16.** Let $z \in C$ such that $\frac{z^2+3i}{z-2+i} = 2 + 3i$ then sum of all possible values of $z^2$ is

(1) $-19 - 2i$ (2) $19 + 2i$

(3) $-19 + 2i$ (4) $19 - 2i$

**Ans.** **(1)**

**Sol.** $$\frac{z^2 + 3i}{z - 2 + i} = 2 + 3i$$

$$\Rightarrow z^2 + 3i = (2 + 3i)(z - 2 + i)$$

$$\Rightarrow z^2 + 3i = 2z - 4 + 2i + 3iz - 6i - 3$$

$$\Rightarrow z^2 + 3i = 2z - 4i - 7 + 3iz$$

$$\Rightarrow z^2 - z(2 + 3i) + 7(1 + i) = 0$$

Which has roots as $\alpha$ and $\beta$ sum of whose squares will be given as

$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$$

$$= (2 + 3i)^2 - 2 \times 7(1 + i)$$

$$= (4 - 9 + 12i) - 14 - 14i$$

$$= -19 - 2i$$

**17.** Let $f(x) = \begin{cases} (1 + ax)^{\frac{1}{x}} & , \quad x < 0 \\ 1 + b & , \quad x = 0 \\ \frac{(x+4)^{\frac{1}{2}} - 2}{(x+c)^{\frac{1}{3}} - 2} & , \quad x > 0 \end{cases}$ be continuous at $x = 0$ then $e^a bc$ is equal to

(1) 64 (2) 48

(3) 72 (4) 36

**Ans.** **(2)**

**Sol.** $$f(x) = \begin{cases} (a + ax)^{\frac{1}{x}}, & x < 0 \\ (1 + b), & x = 0 \\ \frac{(x+4)^{\frac{1}{2}} - 2}{(x+c)^{\frac{1}{3}} - 2}, & x > 0 \end{cases}$$

$$\Rightarrow \frac{2 - 2}{c^{\frac{1}{3}} - 2} \Rightarrow \text{finite}$$

$$c^{\frac{1}{3}} = 2$$

$c = 8$

$$\frac{1}{e^x} \times ax = 1 + b \Rightarrow e^a = b + 1$$

$$\frac{\frac{1}{2}(x+4)^{\left(\frac{-1}{2}\right)}}{\frac{1}{3}(x+c)^{\frac{-2}{3}}} \Rightarrow \frac{\frac{1}{2} \times \frac{1}{2}}{\frac{1}{3} \times c^{\frac{-2}{3}}}$$

$$= \frac{3}{4} c^{\frac{2}{3}} = \frac{3}{4} \times 4 = 3$$

$b + 1 = 3 \Rightarrow b = 2$

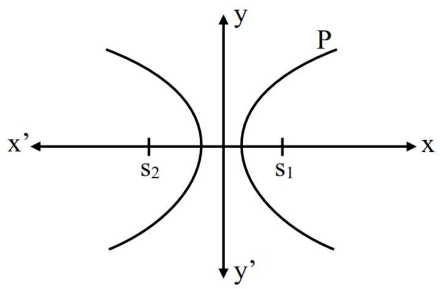
$e^a \times bc = (b + 1)bc$

$= 3 \times 2 \times 8 = 48$

**18.** Let the product of the focal distances of the point $P(4, 2\sqrt{3})$ on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ be 32. The length of conjugate axis be p and the length of it's latus rectum be q. Then $p^2 + q^2$ is equal to___.

**Ans.** **(120)**

**Sol.** $P\ 4,2\sqrt{3}\ \equiv P(x_1,y_1)$




$$PS_1 = e\left|x_1 - \frac{a}{e}\right| = ex_1 - a$$

$$PS_2 = e\left|x_1 + \frac{a}{e}\right| = ex_1 + a$$

$PS_1 \times PS_2 = 32$

$$\Rightarrow e^2x_1^2 - a^2 = 32$$

$$\Rightarrow \left(1+\frac{b^2}{a^2}\right)\times 16 - a^2 = 32$$

$$\Rightarrow 16\frac{b^2}{a^2} - a^2 = 16 \qquad \ldots(i)$$

$$\frac{16}{a^2} - \frac{12}{b^2} = 1 \qquad \ldots(ii)$$

$$\Rightarrow 16\frac{b^2}{a^2} - 12 = b^2$$

$\Rightarrow 16 + a^2 - 12 = b^2$

$\Rightarrow b^2 = a^2 + 4 \qquad \ldots(iii)$

Solving (ii) & (iii)

$$\frac{16}{a^2} - \frac{12}{a^2+4} = 1$$

$\Rightarrow 16a^2 + 64 - 12a^2 = a^4 + 4a^2$

$\Rightarrow a^4 = 64$

$\therefore\ a^2 = 8$

$b^2 = 12$

$p = 2b\ \&\ q = \dfrac{2b^2}{a}$

$$p^2 + q^2 = 4b^2 + \frac{4b^4}{a^2}$$

$$= 4\times 12 + 4\times\frac{144}{8}$$

$= 48 + 72 = 120$

**19.** $\frac{2x-3}{5+4x}$ $-1$ $\frac{3x+4}{2-x}$ If domain of $f(x)$ is $[\alpha,\beta)$, then find the value of $\alpha^2 + 4\beta$.

**Ans.** **(4)**

**Sol.** $$\frac{2x-3}{5+4x} > 0 \Rightarrow x \in \left(-\infty, \frac{-5}{4}\right) \cup \left(\frac{3}{2}, \infty\right)$$

$$-1 \le \frac{3x+4}{2-x} \le 1 \Rightarrow -1 \le \frac{3x+4}{2-x} \text{ and } \frac{3x+4}{2-x} < 1$$

$$\frac{3x+4}{2-x} + 1 \ge 0 \text{ and } \frac{3x+4}{2-x} - 1 < 0$$

$\Rightarrow$ x $\in$ [–3, 2) and $x \in \left(-\infty, \dfrac{-1}{2}\right] \cup (2,\infty)$

So, Domain is $x \in \left[-3, \dfrac{-5}{4}\right)$

$\alpha = -3\ \&\ \beta = -\dfrac{5}{4}$

So, $\alpha^2 + 4\beta$

$= 9 - 5 = 4.$