# JEE MAIN

| COURSE |
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| NUCLEUS |

| TEST CODE | | | | |
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# MOCK TEST-1

***Class:*** **XII** ***Time:*** **3 Hours.** ***Max. Marks:*** **360**

## IMPORTANT INSTRUCTIONS

**1.** The question paper consists of **'90'** objective type questions. There are **'30'** questions each in **Mathematics**, **Physics** and **Chemistry** respectively. **Please fill the OMR answer Sheet accordingly and carefully.**

**2.** Each question has four choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

**3.** You will be **awarded 4 marks** for each question, if you have darkened only the bubble corresponding to the correct answer and zero mark if no bubble are darkened. In all other cases, **minus one (–1) mark** will be awarded.

**4.** There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 3 above.

**5.** Use **Black or Blue Ball Point Pen** only for filling particulars.

**6.** Use of **Calculator, Log Table, Slide Rule and Mobile** is not allowed.

**7.** Rough work is to be done on the space provided at the bottom and in end of the booklet for this purpose in the Test Booklet only.

**8.** On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator. However, the candidates are allowed to take away this Test Booklet with them.

**9.** Do not fold or make any stray marks on the Answer Sheet.

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***USEFUL DATA***

Atomic weights: Al = 27, Mg = 24, Cu = 63.5, Mn = 55, Cl = 35.5, O = 16, H = 1, P = 31, Ag = 108, N = 14, Li = 7, I = 127, Cr = 52, K=39, S = 32, Na = 23, C = 12, Br = 80, Fe = 56, Ca = 40, Zn = 65.5, Ti = 48, Ba = 137, U = 238, Co= 59, B =11, F = 19, He = 4, Ne = 20, Ar = 40 , Mo = 96

[Take : $l$n 2 = 0.693, $l$n 1.1 = 0.095, $l$n 3 = 1.09, e = $1.6 \times 10^{-19}$, $m_e = 9.1 \times 10^{-31}$ kg ]

**Take: $\epsilon_0 = 8.85 \times 10^{-12}$ $C^2/Nm^2$, g = 10 $m/s^2$, $S_{water}$ = 1 cal/gm $^oC$, $L_{ice}$ = 80 cal/gm. , g = 10 $m/s^2$ unless otherwise stated**

# MATHEMATICS

Q.1 Consider the plane $(x, y, z) = (0, 1, 1) + \lambda(1, -1, 1) + \mu(2, -1, 0)$. The distance of this plane from the origin is

(1) 1/3 (2) $\sqrt{3}/2$ (3) $\sqrt{3/2}$ (4) $2/\sqrt{3}$

Q.2 If $\vec{a}$ , $\vec{b}$ , $\vec{c}$ , $\vec{d}$ are non zero vectors satisfying $(\vec{a}\times\vec{b})\times(\vec{c}\times\vec{d}) - (\vec{b}\times\vec{c})\times(\vec{d}\times\vec{a}) = [\vec{a}\,\vec{c}\,\vec{d}]\,\vec{b}$ then

(1) no three out of $\vec{a}$ , $\vec{b}$ , $\vec{c}$ and $\vec{d}$ are coplanar

(2) $\vec{b}$ , $\vec{c}$ , $\vec{d}$ are coplanar

(3) $\vec{a}$ , $\vec{b}$ , $\vec{d}$ are coplanar

(4) $\vec{a}$ , $\vec{b}$ , $\vec{c}$ are coplanar

Q.3 Let P(a, b, c) be any point on the plane $3x + 2y + z = 7$, then the least value of $(a^2 + b^2 + c^2)$, is

(1) 7 (2) 14 (3) $\frac{7}{2}$ (4) 4

Q.4 Let $w = \frac{z^2 - 3z + 6}{z + 1}$ and $z = 1 + i$ (where $i = \sqrt{-1}$), then $|w|$ and amp w respectively are

(1) 2, $-\frac{\pi}{4}$ (2) $\sqrt{2}$ , $-\frac{\pi}{4}$ (3) 2, $\frac{3\pi}{4}$ (4) $\sqrt{2}$ , $\frac{3\pi}{4}$

Q.5 If $\omega$ is one of the imaginary cube root of unity then the value of the expression,

$(1 + 2\omega + 2\omega^2)^{10} + (2 + \omega + 2\omega^2)^{10} + (2 + 2\omega + \omega^2)^{10}$ is :

(1) 0 (2) 1 (3) $\omega$ (4) $\omega^2$

**SPACE FOR ROUGH WORK**

Q.6 Two tour guides are leading 6 tourist. The guides decide to split up. Each tourist must choose one of the guides, but with the stipulation that each guide must take at least one tourist. Number of possiible different groupings of guides and tourist is

(1) 56 (2) 82 (3) 60 (4) 62

Q.7 From 6 boys and 7 girls a committee of 5 is to be formed so as to include atleast one girl. The number of ways this can be done is

(1) $^{13}C_4$ (2) $(^7C_0 + {}^7C_1 + .... + {}^7C_5)\,(^6C_5 + {}^6C_4 + .... + {}^6C_0)$

(3) $7 \,.\, {}^6C_4$ (4) $^{13}C_5 - {}^6C_5$

Q.8 Urn A contains 9 red balls and 11 white balls. Urn B contains 12 red balls and 3 white balls. A person is to roll a single fair die. If the result is a one or a two, then he is to randomly select a ball from urn A. Otherwise he is to randomly select a ball form urn B. The probability of obtaining a red ball, is

(1) $\frac{41}{60}$ (2) $\frac{19}{60}$ (3) $\frac{21}{35}$ (4) $\frac{35}{60}$

Q.9 Two coins look similar, but have different probabilities of falling "head". One is a fair coin, with P (H) = 1/2, but the other is weighed so that P (H) = 4/5. One of the coin is chosen at random and is tossed 10 times, let X denotes the number of heads that of appear, and F is the event that the fair coin was drawn. If X = 7 is observed, the probability that the coin was fair, is

(1) $\frac{5^{10}}{5^8 + 8^{10}}$ (2) $\frac{5^8}{5^{10} + 4^{10}}$ (3) $\frac{5^{10}}{5^{10} + 8^7}$ (4) $\frac{5^{10}}{5^{10} + 8^8}$

Q.10 A taxi was involved in a hit and run accident at night. There are two taxi companies in the city, namely Black Taxis and White Taxis. It is known that 85% of the taxis in the city are Black and 15% are White. There was a witness to the accident and, according to the witness , the taxi involved in the accident was White. Further investigation of the reliability of the witness showed that, the witness was able to identify correctly the colour of a taxi, 80% of the time. The probability that the taxi involved was Black, is

(1) $\frac{17}{29}$ (2) $\frac{15}{29}$ (3) $\frac{12}{29}$ (4) $\frac{14}{29}$

**SPACE FOR ROUGH WORK**

Q.11 If a variable takes the discrete values

$p+4,\ p-\frac{7}{2},\ p-\frac{5}{2}, p-3,\ p-2,\ p+\frac{1}{2}, p-\frac{1}{2},\ p+5\ (p>0)$, then the median is

(1) $p-\frac{5}{4}$ (2) $p-\frac{1}{2}$ (3) $p-2$ (4) $p+\frac{5}{4}$

Q.12 Out of 800 boys in a school, 224 played cricket, 240 played hockey and 336 played basketball of the total , 64 played both basketball and hockey, 80 played cricket and basketball and 40 played cricket and hockey, 24 played all the three games. The number of boys who play only cricket is

(1) 128 (2) 216 (3) 240 (4) 160

Q.13 Let $x_1, x_2, \ldots\ldots, x_n$ be n observations such that $\sum x_i^2 = 400$ and $\sum x_i = 80$. Then a possible value of n among the following is

(1) 9 (2) 12 (3) 15 (4) 18

Q.14 The statement $p \to (q \to p)$ is equivalent to

(1) $p \to (p \wedge q)$ (2) $p \to (p \vee q)$ (3) $p \to (p \to q)$ (4) $p \to (p \leftrightarrow q)$

Q.15 A flagstaff 5m high is placed on a building 25 m high. If the flag and building both subtend equal angles on the observer at a height 30 m, the distance between the observer and the top of the flag is

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

Q.16 A line 'L' passes through a point with position vector $\vec{a}$ and is perpendicular to the plane containing the two intersecting lines $\vec{r} = \vec{b} + \lambda\vec{p}$ and $\vec{r} = \vec{c} + \mu\vec{q}$. If L intersects a plane $\vec{r}\cdot\vec{n} = d$ at the point R then the position vector of the point R, is

(1) $(d - \vec{a}\cdot\vec{n})(\vec{p}\times\vec{q})$ (2) $\vec{a} + \frac{(d-\vec{a}\cdot\vec{n})}{[\vec{p}\ \vec{q}\ \vec{n}]}(\vec{p}\times\vec{q})$

(3) $\vec{a} + [\vec{p}\ \vec{q}\ \vec{n}]\vec{b} + [\vec{p}\ \vec{q}\ \vec{a}]\vec{c}$ (4) $\vec{a} + \frac{(d+\vec{a}\cdot\vec{n})}{[\vec{p}\ \vec{q}\ \vec{n}]}(\vec{p}\times\vec{q})$

**SPACE FOR ROUGH WORK**

Q.17 Equation of the line in the plane $x + 3y - z = 9$, which is perpendicular to the line $\vec{r} = \hat{i} + \hat{j} + \hat{k} + \lambda\left(2\hat{i} + \hat{j} - \hat{k}\right)$ and passing through a point where the plane P meets the given line, is

(1) $\frac{x-3}{2} = \frac{y-2}{1} = \frac{z}{5}$ (2) $\frac{x-3}{-2} = \frac{y-2}{-1} = \frac{z}{5}$

(3) $\frac{x-3}{-5} = \frac{y-2}{1} = \frac{z}{2}$ (4) $\frac{x-3}{1} = \frac{y-2}{5} = \frac{z}{2}$

Q.18 For any complex number $w = a + bi$, where $a, b \in R$.
If $w = \cos 40° + i \sin 40°$, then $|w + 2w^2 + 3w^3 + ..... + 9w^9|^{-1}$ equals

(1) $\frac{1}{9}\sin 40°$ (2) $\frac{2}{9}\sin 20°$ (3) $\frac{1}{9}\cos 40°$ (4) $\frac{9}{2}\text{cosec}\, 20°$

Q.19 The vector $z = -4 + 5i$ is turned counter clockwise through an angle of 180º & stretched 1.5 times. The complex number corresponding to the newly obtained vector is :

(1) $-6 + \frac{15}{2}i$ (2) $6 + \frac{15}{2}i$ (3) $6 - \frac{15}{2}i$ (4) none of these

Q.20 The total number of combinations 6 at a time which can be formed from 6 alike white, 6 alike blue, 6 alike green and 6 alike red balls is

(1) 90 (2) 84 (3) 78 (4) none

Q.21 A multiple choice exam has 20 questions, and each question has 5 possible answers. The same 5 answers for each question will appear on each examination paper, but they can appear in any order. The questions will appear in the same order on every examination paper. Number of different examination papers that can be printed are

(1) $5^{20}$ (2) P(20, 5) (3) $\frac{20!}{5!}$ (4) $(5!)^{20}$

Q.22 A person throws four standard six sided distinguishable dice. Number of ways in which he can throw if the product of the four number shown on the upper faces is 144, is

(1) 24 (2) 36 (3) 42 (4) 48

**SPACE FOR ROUGH WORK**

Q.23 A bag contains 2 white & 4 black balls. A ball is drawn 5 times, each being replaced before another is drawn. The probability that atleast 4 of the balls drawn are white is :
(1) 4/81 (2) 10/243 (3) 11/243 (4) none

Q.24 Two positive numbers x and y each of which does not exceed two, are taken at random. The probability that $x\,y \le 1$ and $y/x \le 2$ is

(1) $\frac{3}{2} l\text{n}2$ (2) $\frac{3l\text{n}2+1}{4}$ (3) $\frac{3l\text{n}2+1}{8}$ (4) none

Q.25 The number of reflexive relation in set A = {a, b, c} is equal to
(1) $2^9$ (2) $2^8$ (3) $2^7$ (4) $2^6$

Q.26 If p, q, r are statements, with truth values T, F, T respectively, then the truth value of $(\sim p \vee q) \wedge \sim r \Rightarrow p$ is
(1) true (2) false
(3) false if r is replace by a false statement. (4) false if q is replace by a true statement.

Q.27 Number of triangles with positive area whose vertices are points in the xy-plane with integer coordinates (x, y) satisfying $1 \le x \le 4$ and $1 \le y \le 4$, is
(1) 500 (2) 532 (3) 516 (4) 538

Q.28 The equation of the right bisector plane of the segment joining (2, 3, 4) and (6, 7, 8) is
(1) x + y + z + 15 = 0 (2) x + y + z – 15 = 0
(3) x – y + z – 15 = 0 (4) None of these

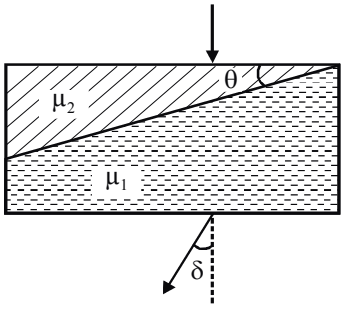
Q.29 $z_1$ & $z_2$ are complex numbers . The equation $\left|\frac{z_1+z_2}{2}+\sqrt{z_1 z_2}\right|+\left|\frac{z_1+z_2}{2}-\sqrt{z_1 z_2}\right| =$

(1) $2\left|\sqrt{z_1}+\sqrt{z_2}\right|$ (2) $2\left|\sqrt{z_1}-\sqrt{z_2}\right|$ (3) $2\left(\left|\sqrt{z_1}\right|^2+\left|\sqrt{z_2}\right|^2\right)$ (4) $\left|\sqrt{z_1}\right|^2+\left|\sqrt{z_2}\right|^2$

Q.30 If $x^4 – 2x^3 – 2x^2 + 4x + 3 = 0$ has four real roots $\alpha, \beta, \gamma, \delta$
then $(1 + \alpha^2)(1+ \beta^2)(1+ \gamma^2)(1+ \delta^2)$ is equal to
(1) 8 (2) 64 (3) 72 (4) 144

**SPACE FOR ROUGH WORK**

Q.31 A ray of light falls perpendicularly at the surface of composite glass slab, made of two transparent prism of small angle of refractive index $\mu_1$ and $\mu_2$ respectively, as shown in figure. The correct deviation $\delta$ is




(1) zero (2) $(\mu_1 + \mu_2 - 2)\theta$ (3) $(\mu_2 - \mu_1)\theta$ (4) $\left(1 - \frac{\mu_1}{\mu_2}\right)\theta$

Q.32 In the ideal double-slit experiment, when a glass-plate (refractive index 1.5) of thickness t is introduced in the path of one of the interfering beams (wavelength $\lambda$), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass-plate is

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

Q.33 Object distance from the pole of a concave mirror is equal to its radius of curvature . The image must be:
(1) real (2) inverted (3) same sized (4) erect

Q.34 When a certain metallic surface is irradiated with monochromatic light wavelength $\lambda$, the stopping potential for photoelectric current is $3\ V_0$. When the same surface is irradiated with light of wavelength $2\lambda$, the stopping potential is $V_0$. The threshold wavelength for the given surface is
(1) $4\lambda$ (2) $6\lambda$ (3) $8\lambda$ (4) $4\lambda / 3$

**SPACE FOR ROUGH WORK**

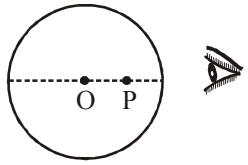
Q.35 Ram is looking at his face in a mirror kept 10 cm away & he finds that his image is erect and magnified (m = 1.8). If he holds the mirror 50cm away.
(1) He cannot see the image because reflected rays falling on his eyes are converging.
(2) He sees a magnified & erect image.
(3) He sees a diminished & inverted image
(4) He sees a magnified & inverted image.

Q.36 An electromagnetic wave has an electric field given by the expression (in Cartesian co-ordinates) :

$$\vec{E}(x,t) = 6.0\cos(1.14\times10^{7}x - 3.43\times10^{15}t)\hat{z}$$

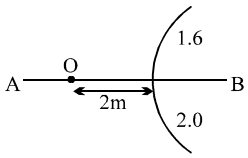
What is the direction of the magnetic field at time t = 0 and position x = 0 ?
(1) –x (2) +x (3) –y (4) +y

Q.37 In the figure shown, O is the centre of the glass sphere. Spot P on the sphere when viewed almost normally appears :
(1) At point O
(2) Towards left of point O
(3) Towards right of point O, shifted towards the observer
(4) Towards right of point O, shifted away from the observer




Q.38 A beam of light of wavelength 400nm and power 1.55mW is directed at the cathode of a photoelectric cell. If only 10% of the incident photons effectively produce photoelectrons, find the current due to these electrons.
(1) 20 μA (2) 50 μA (3) 200 μA (4) 500 μA

Q.39 In the figure shown a point object O is placed in air. A spherical boundary separates various media of radius of curvature 1.0 m. AB is principal axis. The refractive index above AB is 1.6 and below AB is 2.0. The separation between the images formed due to refraction at spherical surface is:



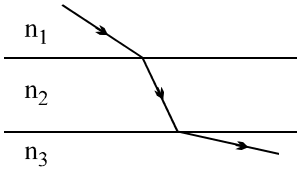

(1) 12 m (2) 20 m (3) 14 m (4) 10 m

**SPACE FOR ROUGH WORK**

Q.40 A parallel beam of monochromatic light is incident normally on a narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of the incident beam. At the first minimum of the diffraction pattern, the phase difference between the rays coming from the two edges of the slit is

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

Q.41 A beam of light passes from medium 1 to medium 2 to medium 3 as shown in the diagram. What may be concluded about the three indexes of refraction, $n_1$, $n_2$ and $n_3$?




(1) $n_1 > n_2 > n_3$ (2) $n_1 > n_3 > n_2$
(3) $n_2 > n_3 > n_1$ (4) $n_2 > n_1 > n_3$

Q.42 A hydrogen atom in its ground state absorbs a photon of energy 10.2eV and gets excited. The change in angular momentum of the electrons in this process is (in $kgm^2/s$) nearly :

(1) $1 \times 10^{-34}$ (2) $2 \times 10^{-34}$ (3) $0.5 \times 10^{-34}$ (4) cannot be determined

Q.43 A ray of light is incident at an angle of 75° from air into a medium having refractive index $\mu$. The reflected and the refracted rays are found to suffer equal deviations in opposite direction $\mu$ equals

(1) $\frac{\sqrt{3}+1}{\sqrt{3}-1}$ (2) $\frac{\sqrt{3}+1}{2}$ (3) $\frac{2\sqrt{2}}{\sqrt{3}+1}$ (4) None of these

Q.44 In a YDSE experiment $\lambda = 540$ nm, D = 1m, d = 1mm. A thin film is pasted on upper slit and the central maxima shifts to the point just in front of the upper slit. What is the path difference at the centre of the screen ?

(1) 540 nm (2) 270 nm (3) 500 nm (4) 810 nm

Q.45 Light from denser medium 1 passes to a rarer medium 2. When the angle of incidence is $\theta$ the partially reflected and refracted rays are mutually perpendicular. The critical angle will be

(1) $\sin^{-1}(\cot\theta)$ (2) $\sin^{-1}(\tan\theta)$ (3) $\sin^{-1}(\cos\theta)$ (4) $\sin^{-1}(\sec\theta)$

Q.46 The ratio of magnetic moment to the angular momentum is a universal constant for hydrogen like atoms and ions. The value of this constant is

(1) $\frac{e^2}{8\varepsilon_0 m}$ (2) $\frac{e}{2m}$ (3) $\frac{\pi m}{2e}$ (4) $\frac{m^2}{2e\varepsilon_0}$

**SPACE FOR ROUGH WORK**

Q.47 Three polaroids are kept coaxially. Angle between the first and third polaroid is 90°. Angle between the first and second polaroid is 60°. If unpolarized light energy incident on the first polaroid is $I_0$. Light energy that emerges from the system is

(1) zero (2) $\frac{3I_0}{32}$ (3) $\frac{3I_0}{16}$ (4) $\frac{\sqrt{3}\,I_0}{8}$

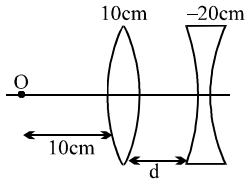
Q.48 The image of an illuminated square is obtained on a screen with the help of a converging lens. The distance of the square from the lens is 40 cm. The area of the image is 9 times that of the square. The focal length of the lens is

(1) 30 cm (2) 36 cm (3) 27 cm (4) None

Q.49 The radius of the shortest orbit in a one electron system is 18pm. It may be :

(1) hydrogen (2) deuterium (3) $He^+$ (4) $Li^{+2}$

Q.50 What should be the value of distance d so that final image is formed on the object itself. (focal lengths of the lenses are written on the lenses.)

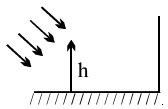



(1) 10 cm (2) 20 cm
(3) 5 cm (4) none of these

Q.51 On a heavy atom electrons are fired with kinetic energy E. If binding energy of electrons in this atom corresponding to K, L and M shells are 40.2 keV, 21.8 keV and 11.5 keV respectively, what should be the minimum value of E to produced $L_\alpha$ X–ray from the atom :

(1) 11.5 keV (2) 21.8 keV (3) 40.2 keV (4) 10.3 keV

Q.52 Sun rays are reflected from a horizontal mirror and fall on a vertical screen. A vertical object is placed perpendicular to mirror at large distance from the screen. If object is of length h then length of the shadow on the screen will be




(1) of height h (2) of height 2h (3) inverted (4) erect

Q.53 In a coolidge tube experiment, the minimum wavelength of the continuous X-ray spectrum equal to 66.3 pm.

(1) electrons accelerate through a potential difference of 12.75 kV in the coolidge tube
(2) electrons accelerate through a potential difference of 18.75 kV in the coolidge tube
(3) de-Broglie wavelength of the electrons reaching the anticathode is of the order of 10 μm
(4) de-Broglie wavelength of the electrons reaching the anticathode is 0.01 Å.

**SPACE FOR ROUGH WORK**

Q.54 A prism of refractive index $\sqrt{2}$ has refracting angle 60º. In order that a ray suffers minimum deviation it should be incident at an angle
(1) 45° (2) 90° (3) 30° (4) none

Q.55 A nucleus at rest disintegrates into two nuclear fragments with velocities in the ratio 8 : 27. The ratio of their nuclear radii will be
(1) 3 : 2 (2) 9 : 4 (3) 27 : 8 (4) 8 : 27

Q.56 A myopic person cannot see objects clearly if they are farther than 5 m from his eye. The power of the lens of his specs so that he can see distant objects also should be
(1) +0.2 D (2) –0.2 D (3) –0.5 D (4) None

Q.57 The electric potential at the surface of an imaginary atomic nucleus of $^{64}_{32}X$ [Take $R_0 = 1.2$ fm]
(1) 8000V (2) $9.6 \times 10^{10}$ V (3) $8 \times 10^{8}$V (4) $9.6 \times 10^{6}$V

Q.58 In a compound microscope, maximum magnification is obtained when the final image
(1) is formed at infinity (2) is formed at the least distance of distinct vision
(3) coincides with the object (4) coincides with the objective lens

Q.59 The counting rate observed from a radioactive source at t = 0 second was $N_0$ counts per second and at 4t second $\frac{N_0}{16}$ counts per second. The counting rate observed, as counts per second, at 5t second will be
(1) $\frac{N_0}{128}$ (2) $\frac{N_0}{64}$ (3) $\frac{N_0}{32}$ (4) $\frac{N_0}{256}$

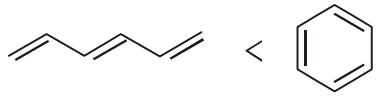
Q.60 10gm of a radioactive element is kept in a container. The element is β-active. Then after one half-life: (molar mass of the substance is 100 gm, Avogadro's number = $6 \times 10^{23}$ per mole).
(1) The weight of the substance left in the container will be 5 gm.
(2) The weight of the active substance in the container will be nearly l0 gm.
(3) If all β particles leave the container then the charge of the substance left is 4800C.
(4) If all β particles leave the container then the charge of the substance left is 9600C.

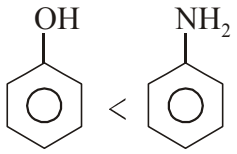
**SPACE FOR ROUGH WORK**

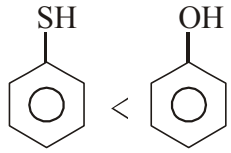
Q.61 There is 34 g $H_2O_2$ in its 2L aqueous solution. The volume strength of the solution is :
(1) 33.6 V (2) 5.6 V (3) 22.4 V (4) 11.2 V

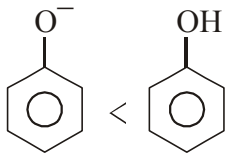
Q.62 Syn gas is a mixture of :
(1) $CO_2 + H_2$ (2) $CO + H_2$ (3) $CO + CO_2$ (4) $CO + N_2$

Q.63 Which order is incorrect according to their resonance energy :

(1) 

(2) 

(3) 

(4) 

Q.64 The ratio of mass percent of C and H of an organic compound $C_xH_yO_z$ is 7.5 : 1. If the percentage of oxygen in the compound is 32%. Then, the empirical formula of the compound is :
(1) $C_2H_4O$ (2) $C_5H_4O$ (3) $C_3H_3O_2$ (4) $C_5H_8O_2$

Q.65 The correct order in which the O–O bond length increases in the following is :
(1) $O_3 < H_2O_2 < O_2$ (2) $O_2 < O_3 < H_2O_2$
(3) $O_2 < H_2O_2 < O_3$ (4) $H_2O_2 < O_2 < O_3$

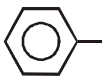
Q.66 Which of the following group has the maximum hyperconjugation effect when attached to benzene ring?
(1) $(CH_3)_3C–$ (2) $CH_3–CH_3–$ (3) $(CH_3)_2CH–$ (4) $CH_3–$

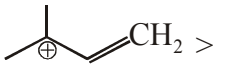
Q.67 3L mixture of $O_2(g)$ and $N_2(g)$ is passed through ozonizer. The gas mixture obtained contains $O_2$, $O_3$ and $N_2$ gases only. This obtained mixture is passed through alkaline pyrogallol and then through turpentine oil, there were 1100 mL and 600 mL volume contractions respectively. The volume of $O_2(g)$ and $N_2(g)$ in the original mixture respectively is -
(1) 1.5 L, 1.5 L (2) 2.5 L, 0.5 L (3) 1L, 2 L (4) 2 L, 1 L

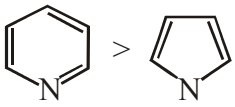
**SPACE FOR ROUGH WORK**

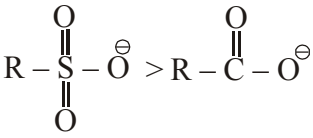
Q.68 In the solvay process of manufacturing of Sodium Bicarbonate, the final by-product is :
(1) $NH_4Cl$ (2) $NaHCO_3$ (3) $CaCl_2$ (4) $CO_2$

Q.69 Which comparison is not correct as indicated ?

(1)  > $CH_3OH$ (Acidic nature)

(2)  (Stability)

(3)  (Basic nature)

(4)  (Stability)

Q.70 15 g of a gas present in 5L vessel exerts a pressure of 0.1 bar. What is the root mean square speed of the gas molecules?
(1) 50 m/s (2) $10^2$ cm/s (3) 100 m/s (4) 75 m/s

Q.71 In which of the following pair both the chlorides do not impart colour to the flame?
(1) $BeCl_2$ and $SrCl_2$ (2) $BeCl_2$ and $MgCl_2$
(3) $CaCl_2$ and $BaCl_2$ (4) $MgCl_2$ and $CaCl_2$

Q.72 Which species has dipole moment?
(1) Chair form of Cyclohexane-1,4-dione (2) p-chloro phenol
(3) Staggered form of 1,2-dichloro ethane (4) Trans-2-butene

Q.73 An open container of volume 5L contains air at 27°C and 1 atm. The container is heated to T K. The amount of air expelled from the container is found to be 1.5L at – 33°C and 1atm. What is the value of temperature T K ?
(1) 400 K (2) 720 K (3) 450 K (4) 480 K

Q.74 The stability of +1 oxidation state increases in the sequence.
(1) Ga < In < A*l* < T*l* (2) A*l* < Ga < In < T*l*
(3) T*l* <In < Ga < A*l* (4) In < T*l* < Ga < A*l*

**SPACE FOR ROUGH WORK**

Q.75 The most stable conformational isomer of cis 1-Bromo-2-chloro cyclohexane is
(1) Both chlorine and Bromine atoms at axial position.
(2) Bromine atom at axial position and chlorine atom at equatorial position
(3) Both chlorine and Bromine atoms at equatorial position
(4) Bromine atom at equatorial position and chlorine atom at axial position.

Q.76 Which of the following forms a positively charged sol ?
(1) haemoglobin (2) clay (3) eosin (4) charcoal

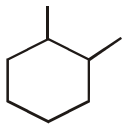
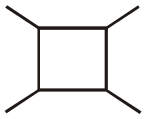
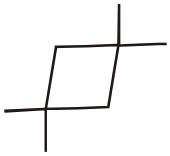
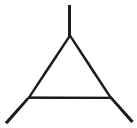
Q.77 Phosphine is prepared by the action of :
(1) White Phosphorus and $H_2SO_4$ (2) White Phosphorus and NaOH
(3) White Phosphorus and $H_2S$ (4) White Phosphorus and $HNO_3$

Q.78 Structural isomers of the compound with molecular formula $C_4H_{10}O$ are -
(1) 6 (2) 7 (3) 8 (4) 9

Q.79 Which of the following is **NOT** correct?
(1) Fertile soils are colloidal in nature in which humus acts as a protective colloid.
(2) Latex is negatively charged colloidal solution.
(3) The formation of micelles takes place only below critical micelle concentration.
(4) In chemisorption unimolecular layer forms.

Q.80 $2SO_2(g) + O_2(g) \xrightarrow{'X'} 2SO_3(g)$
In above reaction 'X' will be :
(1) $CuCl_2$ (2) $V_2O_5$ (3) Pt + Rh (4) 'C'

Q.81 Which of the following compounds can not show geometrical isomerism?

(1)  (2)  (3)  (4) 

**SPACE FOR ROUGH WORK**

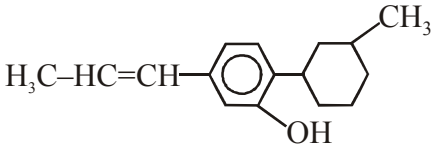
Q.82 A sample of hard water containing $Ca^{2+}$(aq) ions, having concentration 400 ppm is passed through cation exchange resin (RH) which exchanges $Ca^{2+}$ (aq) ions for $H^{+}$(aq). What is the volume of 1M NaOH required to neutralise 1L of water obtained from cation exchange resin after exchange of $Ca^{2+}$ of hard water?

(1) 20 mL (2) 10 mL (3) 40 mL (4) 80 mL

Q.83 What will be the product when ammonia react with excess chlorine:

(1) $NH_4Cl$ (2) $N_2$ (3) $NCl_3$ (4) $NaClO_3$

Q.84 How many sterogenic centers and stereoisomers are present in given compound respectively ?




(1) 3, 8 (2) 4, 8 (3) 4, 16 (4) 3, 6

Q.85 For a vander Waal's gas the volume of gas molecules are negligible. The molar volume of gas is 20L/mol at 300K. The compressibility factor of the gas is -

[**Given :** a = 96 $L^2$.atm.$mol^{-2}$ and R = 0.08 L.atm.$mol^{-1}K^{-1}$]

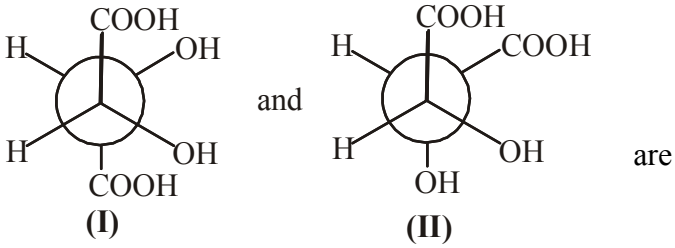
(1) 0.8 (2) 0.75 (3) 1.2 (4) 1

Q.86 Geometry around 'Xe' in $XeF_6$ is :

(1) Square bipyramidal (2) Distorted octahedral

(3) Pentagonal pyramidal (4) Square Antiprismatic

Q.87 The structure :




(1) Structural isomers (2) Enantiomer (3) Diastereomers (4) Identical

**SPACE FOR ROUGH WORK**

Q.88 How many grams of $FeC_2O_4(s)$ is required to react with 50 mL, 0.1 M $KMnO_4(aq)$ in acidic medium?
(1) 1.2g (2) 1.8 g (3) 3.6 g (4) 2.4 g

Q.89 Which of the them is an amphoteric oxides?
(1) CaO (2) $CO_2$ (3) $SiO_2$ (4) $SnO_2$

Q.90 Choose the correct statement among the given :
(1) Gauche form of ethane-1,2-diol is most stable
(2) Enol form of Ethanamide can show geometrical
(3) In methyl cyclohexane, methyl group lies at equatorial position than axial position.
(4) All are correct

**SPACE FOR ROUGH WORK**

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**ANSWER KEY**

| COURSE |
|---|
| NUCLEUS |

# JEE-MAIN MOCK TEST-1
## XII

| TEST CODE |
|---|
| 1 1 2 5 8 |

| Q.No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans | 3 | 4 | 3 | 2 | 1 | 4 | 4 | 1 | 4 | 1 | 1 | 1 | 4 | 2 | 2 |
| Q.No. | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Ans | 2 | 1 | 2 | 3 | 2 | 4 | 4 | 3 | 3 | 4 | 1 | 3 | 2 | 4 | 2 |
| Q.No. | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| Ans | 3 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 1 | 4 | 4 | 1 | 2 | 3 | 2 |
| Q.No. | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| Ans | 2 | 2 | 1 | 4 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 4 | 2 | 3 | 3 |
| | PC | IOC | OC | PC | IOC | OC | PC | IOC | OC | PC | IOC | OC | PC | IOC | OC |
| Q.No. | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 |
| Ans | 2 | 2 | 4 | 4 | 2 | 4 | 4 | 3 | 2 | 3 | 2 | 2 | 4 | 2 | 2 |
| | PC | IOC | OC | PC | IOC | OC | PC | IOC | OC | PC | IOC | OC | PC | IOC | OC |
| Q.No. | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| Ans | 1 | 2 | 2 | 3 | 2 | 3 | 1 | 3 | 2 | 1 | 2 | 3 | 1 | 4 | 4 |

# HINTS & SOLUTIONS

## MATHEMATICS

Q.1 $\vec{r} = \vec{a} + \lambda\vec{b} + \mu\vec{c}$

taking dot with $\vec{b} \times \vec{c}$

$[\vec{r}\ \vec{b}\ \vec{c}] = [\vec{a}\ \vec{b}\ \vec{c}]$ where $\vec{a} = (0,1,1)$;

$\vec{b} = (1,-1,1)$ and $\vec{c} = (2,-1,0)$

$$[\vec{a}\ \vec{b}\ \vec{c}] = \begin{vmatrix} 0 & 1 & 1 \\ 1 & -1 & 1 \\ 2 & -1 & 0 \end{vmatrix} = 0 - (0-2) + 1(-1+2) = 3$$

and $$[\vec{r}\ \vec{b}\ \vec{c}] = \begin{vmatrix} x & y & z \\ 1 & -1 & 1 \\ 2 & -1 & 0 \end{vmatrix} =$$

$x(0+1) - y(0-2) + z(-1+2) = x + 2y + z$

hence equation of plane is

$x + 2y + z = 3;$

$$\therefore \quad p = \left|\frac{-3}{\sqrt{6}}\right| = \sqrt{\frac{3}{2}} \quad \text{Ans. ]}$$

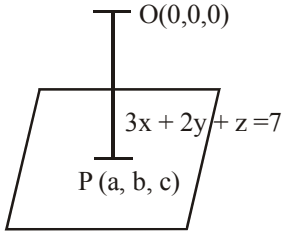
Q.2 $(\vec{a}\times\vec{b})\times\vec{V} - \vec{u}\times(\vec{d}\times\vec{a}) = [\vec{a}\,\vec{c}\,\vec{d}]\vec{b}$

$(\vec{a}.\vec{V})\vec{b} - (\vec{b}.\vec{V})\vec{a} - (\vec{u}.\vec{a})\vec{d} + (\vec{u}.\vec{d})\vec{a} = [\vec{a}\,\vec{c}\,\vec{d}]\vec{b}$

$[\vec{a}\,\vec{c}\,\vec{d}]\vec{b} - [\vec{b}\,\vec{c}\,\vec{d}]\vec{a} - [\vec{b}\,\vec{c}\,\vec{a}]\vec{d} + [\vec{b}\,\vec{c}\,\vec{d}]\vec{a} = [\vec{a}\,\vec{c}\,\vec{d}]\vec{b}$

$[\vec{b}\,\vec{c}\,\vec{a}]\vec{d} = 0 \quad \Rightarrow \vec{a}, \vec{b}, \vec{c}$ are coplanar ]

Q.3 Clearly minimum value of $a^2 + b^2 + c^2$




$$= \left(\frac{|(3(0)+2(0)+(0)-7|}{\sqrt{(3)^2+(2)^2+(1)^2}}\right)^2 = \frac{49}{14} = \frac{7}{2} \text{ units.}$$

(This is possible when P(a, b, c) is foot of perpendicular from O(0, 0, 0) on the plane.)

**Alternatively:**

Let $\vec{V}_1 = 3\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{V}_2 = a\hat{i} + b\hat{j} + c\hat{k}$

Now $\vec{V}_1 \cdot \vec{V}_2 = 3a + 2b + c = 7 \le |\vec{V}_1|\,|\vec{V}_2|$

$\Rightarrow 7 \le \sqrt{14} \times \sqrt{a^2 + b^2 + c^2}$

$\Rightarrow (a^2 + b^2 + c^2) \ge \frac{49}{14}$

Hence $a^2 + b^2 + c^2|_{least} = \frac{7}{2}$ **Ans.**]

Q.4 $w = \frac{(1+i)^2 - 3(1+i) + 6}{2+i} = \frac{3-i}{2+i}$

$= \frac{(3-i)(2-i)}{5} = \frac{5-5i}{5} = 1 - i$

Hence $|w| = \sqrt{2}$ and amp. $w = -\frac{\pi}{4}$.]

Q.5 Answer is 0 ]

Q.6 $\frac{6!}{1!\cdot 5!}\cdot 2! + \frac{6!}{2!\cdot 4!}\cdot 2! + \frac{6!}{3!\cdot 3!\cdot 2!}\cdot 2!$

(concept of grouping)

| $G_1$ | $G_2$ |
|---|---|
| 1 | 5 |
| 2 | 4 |
| 3 | 3 |

12 + 30 + 20 = 62

**Alternatively:** 1st tourist can go $G_1$ or $G_2$ in 2 ways ||||ly all others. Hence required number of ways $= 2^6 - 2 = 62$ Ans. ]

Q.7 $^{13}C_5 - {}^6C_5$; $13 \begin{matrix} / \\ \backslash \end{matrix} \begin{matrix} 6B \\ 7G \end{matrix}$ ]

Q.8 Urn A $\begin{matrix} 9R \\ 11W \end{matrix}$ ; Urn B $\begin{matrix} 12R \\ 3W \end{matrix}$

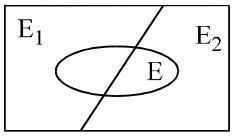
E : event of drawing a red ball;

$E_1$ = 1 or 2 on die $\Rightarrow$ $P(E_1) = \frac{1}{3}$

$E_2$ = 3, 4, 5, 6 on die $\Rightarrow$ $P(E_2) = \frac{2}{3}$

$E = (E \cap E_1) + (E \cap E_2)$

$P(E) = P(E_1) \cdot P(E/E_1) + P(E_2)\, P(E/E_2)$




Using the law of total probabilities,

P (red ball) $= \frac{2}{6}\cdot\frac{9}{20} + \frac{4}{6}\cdot\frac{12}{15} = \frac{41}{60}$ Ans. ]

Q.9 A : Coin randomly selected tossed 10 times, fell head wise 7 times

$B_1$ : coin was a fair coin $P(B_1) = 1/2$

$B_2$ : Coin was a weighted coin $P(B_2) = 1/2$

$P(A/B_1) = {}^{10}C_7 \cdot \left(\frac{1}{2}\right)^7 \cdot \left(\frac{1}{2}\right)^3 = {}^{10}C_3 \cdot \frac{1}{2^{10}}$

$P(A/B_2) = {}^{10}C_7 \cdot \left(\frac{4}{5}\right)^7 \cdot \left(\frac{1}{5}\right)^3 = {}^{10}C_3 \cdot \frac{4^7}{5^{10}}$

$P(B_1/A) = \frac{\frac{1}{2^{10}}}{\frac{1}{2^{10}} + \frac{4^7}{5^{10}}} = \frac{1}{1 + \frac{4^7 \cdot 2^{10}}{5^{10}}}$

$= \frac{5^{10}}{5^{10} + 8^8}$ Ans. ]

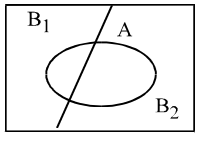
Q.10 Let $B_1$ : Taxi is black 0.85

$B_2$ : Taxi is white 0.15

A: witness says that taxi involved in the hit and run accident was White.

$P(A/B_1) = 0.2$

$P(A/B_2) = 0.8$




$P(B_1/A) = \frac{(0.85)(0.2)}{(0.85)(0.2) + (0.15)(0.8)}$

$= \frac{0.170}{0.170 + 0.120} = \frac{17}{17+12} = \frac{17}{29}$ **Ans.**]

Q.11 Arrange the data in increasing order as,

$p-\frac{7}{2},\ p-3,\ p-\frac{5}{2}, p-2,\ p-\frac{1}{2}, p+\frac{1}{2},$

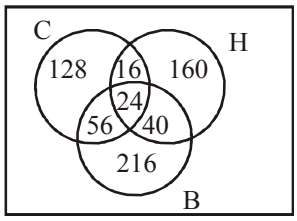
$p+4\ ,\ p+5.$

As, number of observations = 8

So, median =

$$\frac{(4^{th}\text{ observation})+(5^{th}\text{ observation})}{2}=\left(p-\frac{5}{4}\right)$$ **Ans.**

Q.12




V = 800

Total playing game = 640

800 – 640 = 160 ]

Q.13 Since, root mean square ≥ arithmetic mean

$$\therefore\ \sqrt{\frac{\sum_{i=1}^{n}x_i^2}{n}}\geq\frac{\sum_{i=1}^{n}x_i}{n}=\sqrt{\frac{400}{n}}\geq\frac{80}{n}\ \Rightarrow\ n\geq 16$$

Hence, possible value of n = 18. ]

Q.14

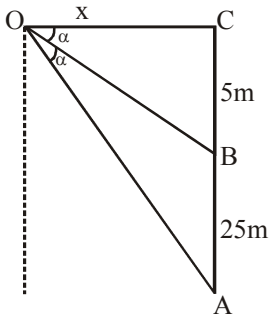
| p | q | $q\to p$ | $p\to(q\to p)$ | $p\vee q$ | $p\to(p\vee q)$ |
|---|---|---|---|---|---|
| T | T | T | T | T | T |
| T | F | T | T | T | T |
| F | T | F | T | T | T |
| F | F | T | T | F | T |

Q.15 In ΔOBC, we have

$$\tan\alpha=\frac{5}{x}\qquad\text{(i)}$$

Also, $\tan2\alpha=\frac{30}{x}$ (ii)

Dividing (ii) by (i), we have




$$\tan2\alpha=\frac{30}{5}\tan\alpha$$

$$\Rightarrow\frac{2\tan\alpha}{1-\tan^2\alpha}=6\tan\alpha\Rightarrow\tan^2\alpha=\frac{2}{3}$$

$$\Rightarrow\ \tan\alpha=\sqrt{\frac{2}{3}}$$

$$\therefore\ x=5\cot\alpha=5.\sqrt{\frac{3}{2}}.$$ ]

Q.16 Equation of the line is

$$\vec{r}=\vec{a}+t(\vec{p}\times\vec{q})\ \text{....(1)}$$

now (1) intersects $\vec{r}\cdot\vec{n}=d$ ....(2)

substituting $\vec{r}$ from (1) in (2)

$$(\vec{a}+t(\vec{p}\times\vec{q}))\cdot\vec{n}=d$$

$$\vec{a}\cdot\vec{n}+t[\vec{p}\ \vec{q}\ \vec{n}]=d$$

$$\Rightarrow\qquad t=\frac{(d-\vec{a}\cdot\vec{n})}{[\vec{p}\ \vec{q}\ \vec{n}]}$$

hence the position vector of R is

$$\vec{r}=\vec{a}+\frac{(d-\vec{a}\cdot\vec{n})}{[\vec{p}\ \vec{q}\ \vec{n}]}(\vec{p}\times\vec{q})$$ Ans. ]

Q.17 Vector perpendicular to $2\hat{i}+\hat{j}-\hat{k}$ and $\hat{i}+3\hat{j}-\hat{k}$ is

$$\begin{vmatrix}\hat{i}&\hat{j}&\hat{k}\\2&1&-1\\1&3&-1\end{vmatrix}=2\hat{i}+\hat{j}+5\hat{k}$$

Any general point on the line is

$(1 + 2\lambda, 1 + \lambda, 1 - \lambda)$ at their point of intersection. This point satisfies equation of plane

$(1+2\lambda)+3(1+\lambda)-(1-\lambda) = 9 \Rightarrow \lambda = 1$

$\therefore$ Point of intersection is (3, 2, 0).

Hence required line is

$\vec{r} = (3\hat{i}+2\hat{j}) + k(2\hat{i}+\hat{j}+5\hat{k})$

$\Rightarrow \frac{x-3}{2} = \frac{y-2}{1} = \frac{z}{5}$ **Ans.**]

Q.18

$S = w + 2w^2 + 3w^3 + ..... + 9w^9$

$Sw = \quad + w^2 + 2w^3 + .....+ 8w^9 + 9w^{10}$

where $w^9 = (\cos 40° + \sin 40°)^9 = 1$

and $|w| = 1$

---

$S(1-w) = w + w^2 + w^3 + ..... + w^9 - 9w^{10}$

$= \frac{w(1-w^9)}{1-w} - 9w = 0 - 9w$

$S = -\frac{9w}{1-w}$ (using $w^9 = 1$) ; $\left|\frac{1}{S}\right| = \left|\frac{w-1}{9w}\right|$

$= \frac{1}{9}|\cos 40° + i \sin 40° - 1|$

$= \frac{1}{9}|-2\sin^2 20° + 2i \sin 20° \cos 20°|$

$= \frac{1}{9}|2\sin 20° \, i(\cos 20° + i \sin 20°)| = \frac{2}{9}\sin 20°$

Q.19 Answer is $6 - \frac{15}{2}i$

Q.20 Treat W, B, G, R as beggar

0 0 0 0 0 0 Ø Ø Ø = $^9C_3 = 84$

or co-eff. of $x^6$ in

$(1 + x + x^2 + x^3 + x^4 + x^5 + x^6)^4$

Q.21 Q1 → a, b, c, d, e ; Question No. 1 can be printed in 5! ways

|||ly Question No.2 can be printed 5! ways and so on

$\therefore$ Total ways $(5!)^{20}$ Ans. ]

Q.22 Possible cases if the product of four numbers $a \cdot b \cdot c \cdot d = 144$ $(1 \le a, b, c, d \le 6)$

6, 6, 2, 2, ; 6, 6, 4, 1 ; 6, 4, 3, 2

and 4, 4, 3, 3

$= \frac{4!}{2!\cdot 2!} + \frac{4!}{2!} + 4! + \frac{4!}{2!\cdot 2!} = 48$ Ans. ]

Q.23 $P(W) = 1/3$ ; $P(B) = 2/3 \Rightarrow p = 1/3$ ;

$q = 2/3$ and $r = 4$ or 5 and $n = 5$

Use $P(r) = {}^nC_r \, p^r \, q^{n-r}$ ]

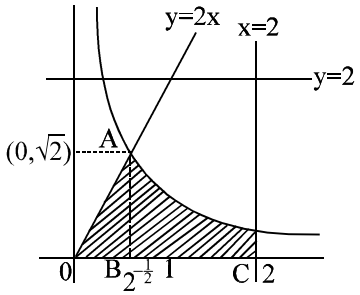
Q.24 $x \ge 0$ ; $y \ge 0$ ; $x \le 2$ ; $y \le 2$

A : $xy \le 1$

B : $y \le 2x$ ; n (S) = 4

n (A) = Area of shaded region.

Shaded area OAB $= \sqrt{2} \cdot \frac{1}{\sqrt{2}} \cdot \frac{1}{2} = \frac{1}{2}$




Shaded area ABC $= \int_{\frac{1}{\sqrt{2}}}^{2} \frac{1}{x}\,dx = \ln x \Big]_{\frac{1}{\sqrt{2}}}^{2}$

$= \ln 2 + \ln \sqrt{2} + 3/2 \ln 2$

Total area $= \frac{3\ln 2}{2} + \frac{1}{2} = \frac{3\ln 2 + 1}{2}$

$\therefore$ $p = \frac{3\ln 2 + 1}{8}$ Ans. ]

Q.25 n(A) = 3

$\therefore$ Total number of relation in set

$A = 2^{3\times 3} = 2^9$

and maximum number of cartesian product = 9 out of which 3 ordered pair is necessary for reflexive .

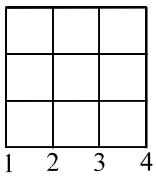
So, for remaining 6 ordered pair

Number of ordered pair required

$= {}^6C_0 + {}^6C_1 + {}^6C_2 + \ldots\ldots {}^6C_6 = 2^6$ ]

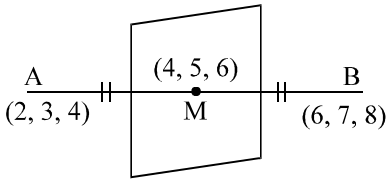
Q.26 $\because$ p = T
$\therefore \sim p = F$
$\therefore (\sim p \vee q) = F$
$\sim r = F$
$\therefore (\sim p \vee q) \wedge \sim r = F$ and p = T
$\therefore (\sim p \vee q) \wedge \sim r \Rightarrow p = T$ ]

Q.27 ${}^{16}C_3 - 2[2 \cdot {}^3C_3 + {}^4C_3] - 8 \cdot {}^4C_3$
$= {}^{16}C_3 - 12 - 32$




560 – 44 = 516 **Ans.** ]

Q.28 M ≡ (4, 5, 6)
plane passes through 4, 5, 6
$\therefore$ A(x – 4) + B(y – 5) + C(z – 5) = 0




A, B, C are 4, 4, 4
$\therefore$ equation is x – 4 + y – 5 + z – 6 = 0
$\Rightarrow$ x + y + z = 15 ]

Q.29 Answer is $\left|\sqrt{z_1}\right|^2 + \left|\sqrt{z_2}\right|^2$ ]

Q.30 $x^4 - 2x^3 - 2x^2 + 4x + 3 \equiv$
$(x - \alpha)(x - \beta)(x - \gamma)(x - \delta)$
substituting x = i
$1 - 2i - 3 + 2i + 4 = (i - \alpha)(i - \beta)(i - \gamma)(i - \delta) = 2$ ....(1)
substituting x = – i
$1 + 2i - 3 - 2i + 4$
$= (-i - \alpha)(-i - \beta)(-i - \gamma)(-i - \delta) = 2$ ....(2)
Multiplying (1) and (2)
$(1+\alpha^2)(1+\beta^2)(1+\gamma^2)(1+\delta^2) = 4.$

# PHYSICS

Q.31 $\delta_1 = (\mu_2 - 1)\theta$
$\delta_2 = -(\mu_1 - 1)\theta$
$\delta = (\mu_2 - \mu_1)\theta$

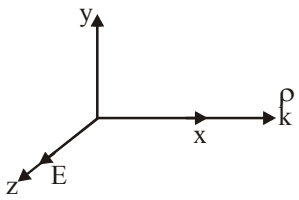
Q.34 $\frac{hc}{\lambda} = \phi + c\,.\,(3v_0)$ in case I

$\frac{hc}{2\lambda} = \phi + c.\,v_0$ in case II

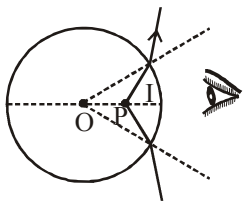
where $\frac{hc}{\lambda_0} = \phi$ ($\lambda_0$ – threshold wavelength)

Q.35 $1.8 = \frac{f}{f+10}$
1.8 f + 18 = f
18 = – 0.8 f
f = – 22.5 cm
in second case, u = – 50
$\Rightarrow$ Obj. is beyond C.
$\Rightarrow$ Image is invereted and diminished.

Q.36 $\vec{E} \times \vec{B} \to \hat{k}$



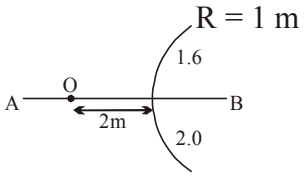

Q.37




Q.38 $P = \frac{nhc}{\lambda t}$

$i = \left(\frac{n}{t}\right) ex\% = \frac{p\lambda_e}{hc} x\%$

$= \frac{1.55 \times 10^{-3} \times 4 \times 10^{-7}}{6.63 \times 10^{-34} \times 3 \times 10^8}$

Q.39 


$I_1 \Rightarrow \frac{1.6}{v} - \frac{1}{-2} = \frac{1.6-1}{+1} \Rightarrow v_1 = 16$

$I_2 \Rightarrow \frac{2.0}{v} - \frac{1}{-2} = \frac{2-1}{1} \Rightarrow v_2 = 4$

$|v_1 - v_2| = 12$ m

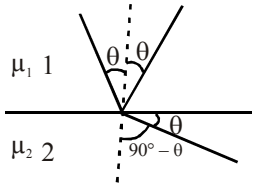
Q.44 Infront of upper slint

On screen $= \Delta x = d\left(\frac{d/2}{D}\right) - (\mu - 1)t = 0$

$\Delta x = d\frac{(d/2)}{D} - (\mu - 1)\, t = 0$

at centre on the screen

$\Delta x = (\mu - 1)t = \frac{d^2}{2D}$

Q.45 


$\mu_1 \sin\theta = \mu_1 \times \sin(90° - \theta)$

$\Rightarrow \quad \frac{\mu_2}{\mu_1} = \tan\theta$

for $\theta_C \Rightarrow \mu_1 \times \sin\theta_C = \mu_2 \times \sin(90°)$

$\sin\theta_C = \frac{\mu_2}{\mu_1} = \tan\theta$

$\Rightarrow \theta_C = \sin^{-1}(\tan\theta)$

Q.47 Accordin to Malus law, $I = I_0 \cos^2\theta$

After 2nd Polaroid, $I = \frac{I_0}{2}\cos^2 60° = \frac{I_0}{8}$

After 3rd Polaroid, $I = \frac{I_0}{8}\cos^2 30° = \frac{3I_0}{32}$

Q.53 $eV = \frac{hc}{\lambda} \Rightarrow V = \frac{12400}{\lambda(\text{in Å})}$

Q.57 $V = \frac{kQ}{R} = \frac{k \times 32 \times 1.6 \times 10^{-19}}{R_0 (40)^{1/3}}$

$= \frac{9 \times 10^9 \times 32 \times 1.6 \times 10^{-19}}{1.2 \times 10^{-15} \times (64)^{1/3}} = 96 \times 10^5 \text{V}$

Q.59 $\Delta t = 4t$

$\frac{N_0}{16} = \frac{dN}{dt} = N_0 e^{-\lambda \times 4t}$

$\frac{1}{16} = e^{-4\lambda t}$

$4\ln 2 = 4\lambda t$

$\lambda = \frac{\ell n 2}{t}$

Q.60 1. Due to emission of β-particles mass will almost remain unchanged.
2. No. of β-particles decayed $= 3 \times 10^{22}$, so charge $= 3 \times 10^{22} \times 1.6 \times 10^{-19} = 4800$C

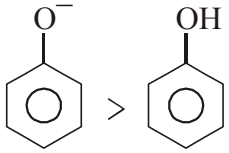
# CHEMISTRY

Q.61 Molarity $= \left(\frac{34/34}{2}\right)M = \frac{1}{2}M$

$\therefore$ Volume strength of the solution $= \frac{1}{2} \times 11.2\text{V} = 5.6\text{V}$

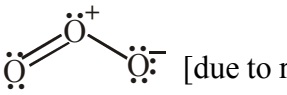
Q.62 Syn gas or water gas $\Rightarrow CO + H_2$

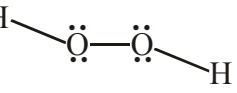
Q.63 Negative charged O-atom has more electron donating power than neutral O-atom therefore resonance energy.



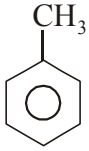

Q.64 Let, % of C be 7.5 x % and H be x %
$\therefore$ 7.5 x + x + 32 = 100
$\therefore$ x = 8
$\therefore$ % of C = 60%, H = 8 % and O = 32 %
$\therefore$ E.F. $= C_{\frac{60}{12}} H_{\frac{8}{1}} O_{\frac{32}{16}} = C_5H_8O_2$

Q.65 $O_2 \rightarrow$ B.O. $\Rightarrow$ [O = O] = 2

$O_3 \rightarrow$  [due to resonance] B.O. = 1.5

$H_2O_2 \rightarrow$  B.O. = 1

Bond length $\propto \frac{1}{\text{B.O.}}$ $\quad H_2O_2 > O_3 > O_2$

Q.66  More number of $\alpha$ – H, more will be hyperconjugation

Q.67 Let, $V_{O_2}$ = x mL, and

$V_{N_2}$ = y mL $\therefore$ x + y = 3000 ....(i)

$3.O_2(g) \xrightarrow{\text{Ozonizer}} 2.O_3(g)$

| | | |
|---|---|---|
| t = 0 | x = mL | 0 |
| $t = t_f$ | (x–3u)mL | (2u)mL= 600mL |
| | | $\therefore$ u = 300 |

$\Rightarrow$ x – 3 × 300 = 1100

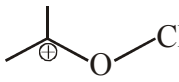
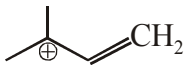
$\therefore$ x = 2000 $\therefore$ Eqn (1) $\Rightarrow$ y = 1000

$V_{O_2}$ = 2 L and $V_{N_2}$ = 1 L **Ans.**

Q.68 In solvay process manufacture of sodium bicarbonate, the final biproduct is :

$NH_4HCO_3 + NaCl \longrightarrow NaHCO_3\downarrow + NH_4Cl$

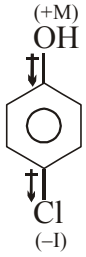
$NH_4Cl + CaO \longrightarrow NH_3\uparrow + CaCl_2 + H_2O$

Q.69  is more stable than  due to back-bonding.

Q.70 $d = \frac{15}{5L} = 3$ g/L = 3 kg/m$^3$

$\therefore v_{rms} = \sqrt{\frac{3P}{d}} = \sqrt{\frac{3\times10^4}{3}}$ m/s = 100 m/s

Q.71 Be and Mg does not impart colour to the flame due to their high Ionisation energy

Q.72 

Q.73 $\frac{5L}{300K} = \frac{(5+\Delta V)L}{(T)K}$ ....(i)

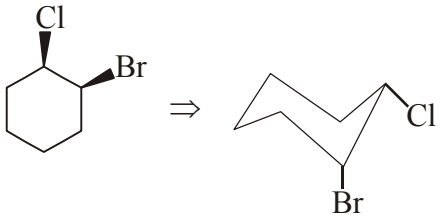
and $\frac{1.5L}{240K} = \frac{(\Delta V)L}{(T)K}$ ....(ii)

(i) / (ii) $\Rightarrow \frac{5/300}{1.5/240} = \left(\frac{5+\Delta V}{\Delta V}\right)$

$\therefore \Delta V = 3$

$\therefore$ eq$^n$. (ii) $\Rightarrow$ T = 480

Q.74 Due to inert pair effect as we more down the group stability of (+1) oxidation state increases.

Q.75 

Chlorine atom lies at equatorial position because of its smaller size, bond length is shorter than Bromine to avoid 1,3 diaxial repulsion.

Q.76 Theory based

Q.77 $P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3NaH_2PO_2$

White Phosphorus

Q.78 **4 isomers with alcohol functional group**

(1) $CH_3 - CH_2 - CH_2 - CH_2 - OH$

(2) $CH_3 - CH_2 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_3$

(3) $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}} - OH$

(4) $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - OH$

**3 isomers with ether functional group**

(1) $CH_3 - O - CH_2 - CH_2 - CH_3$

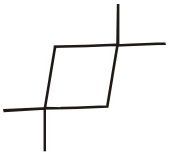
(2) $CH_3 - O - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$

(3) $CH_3 - CH_2 - O - CH_2 - CH_3$

Q.79 Theory based.

Q.80 $2SO_2(g) + O_2(g) \xrightarrow{V_2O_5} 2SO_3(g)$

* Manufacture of $H_2SO_4$ by "Contact process"

Q.81 

At both position same groups are present

Q.82 $[Ca^{2+}] = 400 \text{ ppm} = 400 \text{ mg/L}$

$= 10 \times 10^{-3} \text{ mol/L}$

$\therefore [H^+] = 20 \times 10^{-3} \text{ mol/L}$

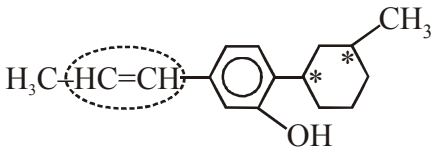
$\therefore n_{H^+} = 20 \text{ mmol}$

$H^+ + NaOH \rightarrow Na^+ + H_2O$

20 mmol 1M

$\therefore V_{NaOH} = \left(\frac{20}{1}\right) \text{mL} = 20 \text{ mL}$ **Ans.**

Q.83 $NH_3 + 3Cl_2 \text{ (excess)} \longrightarrow NCl_3 + 3HCl$

Q.84 

4-stereogeneic centres

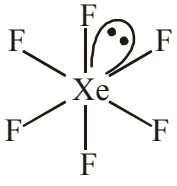
stereoisomers $= 2^n \Rightarrow n = 3$

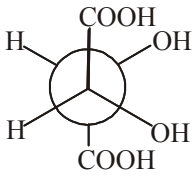
$2^3 = 8$

Q.85 $\left(P + \frac{a}{V_m^2}\right) V_m = RT \Rightarrow Z = 1 - \frac{a}{V_m RT}$

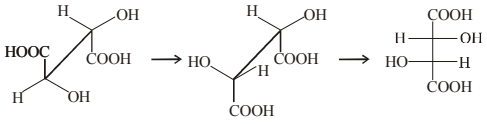
$\Rightarrow Z = 1 - \frac{96}{20 \times 0.08 \times 300} = 0.8$ **Ans.**

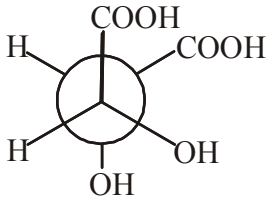
Q.86 $XeF_6$ ($sp^3d^3$) Distorted octahedral →



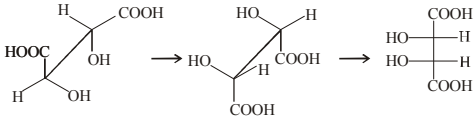
Q.87  ⇒

**(I)**



 ⇒

**(II)**



I and II are diastereomers

Q.88 $3 \times n_{FeC_2O_4} = 5 \times 50 \times 0.1$

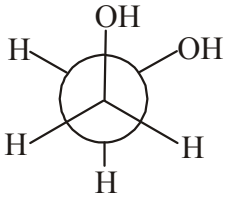
$\therefore n_{FeC_2O_4} = \frac{25}{3} \text{ mmol.}$

$\therefore m_{FeC_2O_4} = \frac{25}{3} \times \frac{144}{1000} \text{ g} = 1.2 \text{ g}$ **Ans.**

Q.89 $CaO \rightarrow$ Basic oxide

$CO_2, SiO_2 \rightarrow$ Acidic oxide

$SnO_2 \rightarrow$ Amphoteric oxide

Q.90 (1) Gauche form of ethane-1,2-diol is most stable due to H-bonding 

(2) $CH_3 - \underset{\displaystyle O}{\underset{\|}{C}} - NH_2 \rightleftharpoons CH_3 - \underset{\displaystyle OH}{\underset{|}{C}} = NH$

Shows G.I.

(3) In methyl cyclohexane, methyl group lies at equatorial position than axial position to avoid 1,3-diaxial repulsion.