JEE MAIN

COURSE
NUCLEUS

TEST CODE				
1	1	2	6	7

MOCK TEST-2

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 **Physics**, **Chemistry** and **Mathematics** 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 : $\ell n\ 2 = 0.693$, $\ell n\ 1.1 = 0.095$, $\ell n\ 3 = 1.09$, $e = 1.6 \times 10^{-19}$, $m_e = 9.1 \times 10^{-31}$ kg]

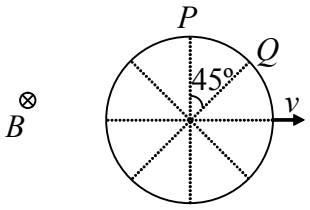
Take: $\epsilon_0 = 8.85 \times 10^{-12}\ C^2/Nm^2$, $g = 10\ m/s^2$, $S_{water} = 1$ cal/gm °C, $L_{ice} = 80$ cal/gm. , $g = 10\ m/s^2$ unless otherwise stated

PHYSICS

Q.1 The plates of a parallel plate capacitor are charged upto 100 volt. A 2 mm thick plate is inserted between the plates. To maintain the same potential difference, the distance between the capacitor plates is increased by 1.6 mm. The dielectric constant of the plate is

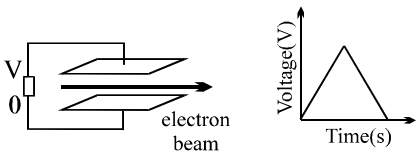
(1) 5 (2) 1.25 (3) 4 (4) 2.5

Q.2 A conducting ring of radius R is placed in uniform inward magnetic field $\vec{B}$ as shown. If ring is moving with velocity $\vec{v}$ in its plane, the induced emf across arc PQ will be



(1) vBR (2) $vBR\left(1-\frac{1}{\sqrt{2}}\right)$ (3) $vBR\frac{\pi}{4}$ (4) $2vBR\sin\frac{\pi}{8}$

Q.3 An electron beam passes between two parallel plate electrodes as shown in the diagram. The bottom plate is kept at zero potential, while a slowly varying positive voltage is applied to the upper plate, as shown in the graph. After passing between the plates, the beam hits a screen and makes spot. Ignoring gravity, as the potential varies the spot is

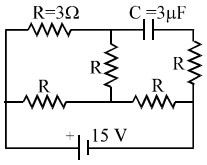


(1) deflected up (2) deflected down

(3) deflected up then down (4) deflected down then up

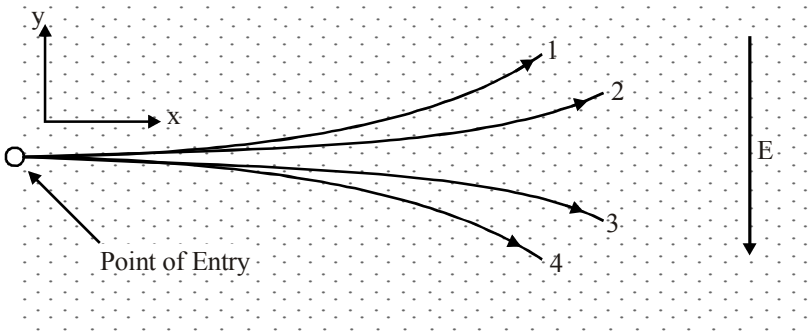
SPACE FOR ROUGH WORK

Q.4 In the circuit shown below, the cell is ideal, with emf = 15 V. Each resistance is of 3Ω. The potential difference across the capacitor is



(1) zero (2) 9 V (3) 12 V (4) 15 V

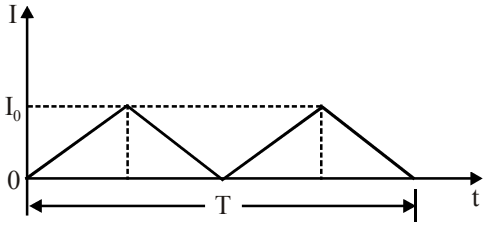
Q.5 Two particles of the same mass carry charges +3Q and –2Q respectively. They are shot into a region that contains a uniform electric field one after the other as shown. The particles have the same initial velocities in the positive x direction. The lines, numbered 1 through 4, indicate possible paths for the particles. If the electric field points in the negative y direction, what will be the resulting paths for these particles?



(1) path 1 for +3Q and path 3 for –2Q (2) path 3 for +3Q and path 3 for –2Q
(3) path 2 for +3Q and path 4 for –2Q (4) path 4 for +3Q and path 2 for –2Q

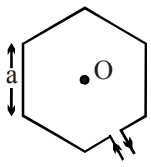
SPACE FOR ROUGH WORK

Q.6 A current flowing through the inductor of inductance L has a shape indicated in Fig. The highest value of current is I_0. What will be the maximum voltage drop across the inductor



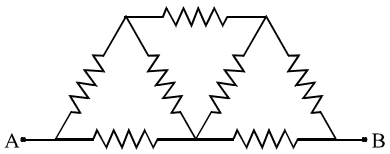
(1) zero (2) $\frac{LI_0}{2T}$ (3) $\frac{LI_0}{\sqrt{2}T}$ (4) $4L\frac{I_0}{T}$

Q.7 A current ' i ' is flowing in a hexagonal coil of side a. The magnetic field strength at the centre of the coil will be (the gap between the incoming and outgoing wire is negligible)



(1) $\frac{3\sqrt{3}\mu_0 i}{\pi a}$ (2) $\frac{\sqrt{3}\mu_0 i}{2\pi a}$ (3) $\frac{\mu_0 i}{3\sqrt{3}\pi a}$ (4) $\frac{\sqrt{3}\mu_0 i}{\pi a}$

Q.8 Seven resistors each of resistance R, are connected as shown in figure. The equivalent resistance between A and B is
(1) 4/3 R
(2) 3/2 R
(3) 7R
(4) 8/7 R

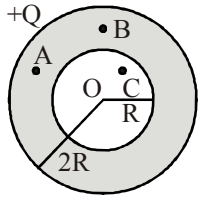


Q.9 Electric field at a distance r from an electric dipole on its axis is $\vec{E}_1$ and at distance 2r on its perpendicular bisector is $\vec{E}_2$ then:

(1) $|\vec{E}_2| = |\vec{E}_1|/2$ (2) $|\vec{E}_2| = |\vec{E}_1|/4$ (3) $|\vec{E}_2| = |\vec{E}_1|/8$ (4) $|\vec{E}_2| = |\vec{E}_1|/16$

SPACE FOR ROUGH WORK

Q.10 A hollow conducting sphere of inner radius R and outer radius 2R is given a charge Q as shown in the figure, then the



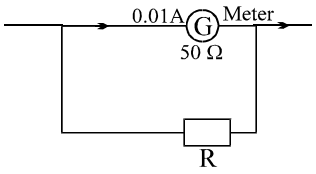
(1) potential at A and B is different (2) potential at O and B is different
(3) potential at O and C is different (4) potential at A, B, C and O is same

Q.11 Two parallel metal plates carry opposite electrical charges each with a magnitude of Q. The plates are separated by a distance d and each plate has an area A. Consider the following :
(I) increasing Q (II) increasing d (III) increasing A
Which of the following would have the effect of reducing the potential difference between the plates?
(1) I only (2) II only (3) III only (4) I and III

Q.12 A capacitor and a coil in series are connected to a 6 volt ac source. By varying the frequency of the source, maximum current of 600 mA is observed. If the same coil is now connected to a cell of emf 6 volt and internal resistance of 2 Ω, the current through it will be :
(1) 0.5A (2) 0.6A (3) 1.0A (4) 2.0A

Q.13 A sphere of radius R carries charge density proportional to the square of the distance from the center: $\rho = Ar^2$, where A is a positive constant. At a distance of R/2 from the center, the magnitude of the electric field is
(1) $A/(4\pi\varepsilon_0)$ (2) $AR^3/(40\varepsilon_0)$ (3) $AR^3/(24\varepsilon_0)$ (4) $AR^3/(5\varepsilon_0)$

Q.14 The figure is a galvanometer (current for maximum deflection is 0.01 A & coil resistance is 50 Ω) is to be converted into an ammeter of range 0 – 8 A. Calculate the value of resistor R.



(1) 39950 Ω (2) 15.98 Ω (3) 0.160 Ω (4) 0.062 Ω

SPACE FOR ROUGH WORK

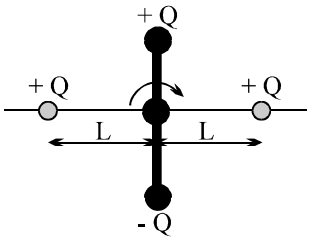
Q.15 A portable generator turning at 350 rad/s produces an EMF of 120 V rms. If an additional 500W light bulb is added to the circuit, what additional torque is required to keep the generator spinning at 350 rad/s ?

(1) 0.70 Nm (2) 1.4 Nm (3) 2.9 Nm (4) 84 Nm

Q.16 A non conducting disc of radius R, having a concentric hole of radius R/2 carries a uniform positive surface charge of area density σ on one face. It is rotated with an angular velocity ω about a perpendicular axis passing through its center. Its magnetic moment is

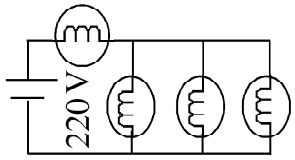
(1) $15\pi\sigma\omega R^4/64$ (2) $5\pi\sigma\omega R^4/32$ (3) $\pi\sigma\omega R^4/32$ (4) None

Q.17 In the diagram shown, the +Q and –Q charges are connected by a nonconducting rod, which can freely rotate about the fixed axis passing through the centre. The other two +Q charges are fixed at the positions shown. The dipole shown is in the state of



(1) Stable equilibrium (2) Unstable equilibrium
(3) Neutral equilibrium (4) Non-equilibrium

Q.18 Four identical bulbs each rated 100 watt , 220 volts are connected across a battery as shown . The total electric power consumed by the bulbs is :



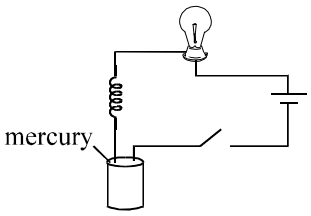
(1) 75 watt (2) 400 watt (3) 300 watt (4) 400/3 watt

Q.19 A proton sits at coordinates (x,y) = (0, 0) and an electron at (h,d), where d << h. At time t = 0, a uniform electric field E of unknown magnitude but pointing in the positive y direction is turned on. Assuming that h is large enough that the proton-electron interaction is negligible, the y coodinates of the two particles will be equal (at equal time)

(1) at about y = d/2000 (2) at an undetermined value since E is unknown
(3) at about y = d/43 (4) nowhere: they move in opposite directions

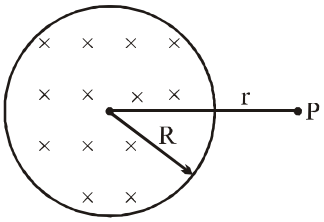
SPACE FOR ROUGH WORK

Q.20 The figure to the right shows a conducting wire wound in a helical shape so as to form a spring. The bottom end of the wire barely touches the mercury (a good electrical conductor). After the switch is closed, current in the circuit causes the light to glow. The bulb will



(1) glow continually with constant intensity
(2) glow briefly and then go out
(3) repeatedly turn on and off like a turn signal on a car
(4) glow continually with decreasing intensity

Q.21 For the situation described in figure, the magnetic field changes with time according to, $B = (2.00\,t^3 - 4.00\,t^2 + 0.8)$ T and $r = 2R = 5.0$ cm. Calculate the force on an electron located at P at $t = 2.00$ s.



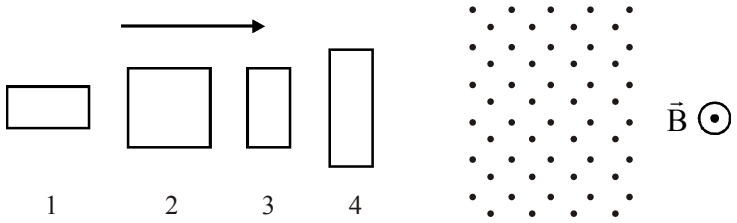
(1) 0 (2) 12×10^{-21} N (3) 8×10^{-19} N (4) 8×10^{-21} N

Q.22 n identical point charges are kept symmetrically on the periphery of the circle $x^2 + y^2 = R^2$ in xy-plane. The resultant electric field at (0, 0, R) is E_1 and at (0, 0, 2R) is E_2, the ratio of E_1/E_2 is :

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

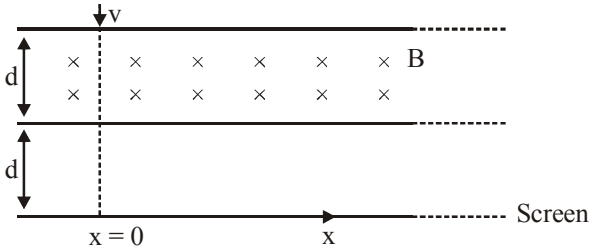
SPACE FOR ROUGH WORK

Q.23 The four wire loops shown have vertical edge lengths of either L, 2L or 3L. They will move with the same speed into a region of uniform magnetic field $\vec{B}$ directed out of the page. Rank them according to the maximum magnitude of the induced emf, greatest to least.



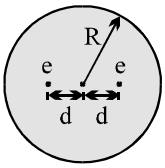
(1) 1 and 2 tie, then 3 and 4 tie
(2) 3 and 4 tie, then 1 and 2 tie
(3) 4, 2, 3, 1
(4) 4 then, 2 and 3 tie and then 1

Q.24 A non relativistic positive charge particle of charge q and mass m is projected perpendicular to uniform magnetic field B as shown. Neglecting gravity calculate X-coordinate of point on screen at which the charge particle will hit : $d = \frac{r\sqrt{3}}{2}$, where $r = \frac{mv}{qB}$



(1) $\sqrt{3}$ r
(2) 2r
(3) 2.5 r
(4) 0.5 r

Q.25 Using thomson's model of the atom, consider an atom consisting of two electrons, each of charge –e, embeded in a sphere of charge + 2e and radius R. In equilibrium each electron is at distance d from the centre of the atom. What is equilibrium separation between electrons?

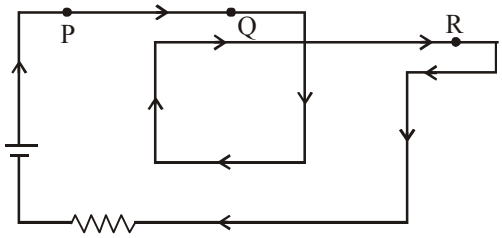


(1) R
(2) R/2
(3) R/3
(4) R/4

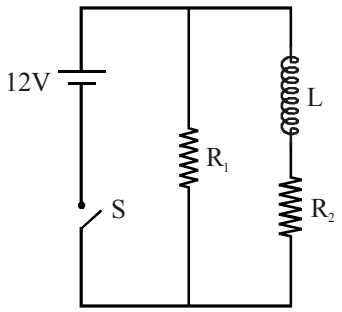
SPACE FOR ROUGH WORK

Q.26 A battery establishes a steady current around the circuit shown. A compass needle is placed successively at points P, Q, and R, just above the wire (slightly out of the plane of the page). The relative deflection of the needle, in descending order, is

(1) P, Q, R.
(2) Q, R, P.
(3) R, Q, P.
(4) Q, P, R.



Q.27 An inductor of inductance L = 400 mH and resistors of resistance $R_1 = 4\Omega$ and $R_2 = 2\Omega$ are connected to a battery of emf 12 V as shown in the figure. The intenal resistance of the battery is negligible. The switch S is closed at t = 0. The potential drop across L as a function of time is



(1) $6e^{-5t}$ V (2) $\frac{12}{t}e^{-3t}$V (3) $6(1 - e^{-t/0.2})$ (4) $12e^{-5t}$ V

Q.28 In separate experiments, four different particles each start from far away with the same speed and impinge directly on a gold nucleus. The masses and charges of the particles are
particle 1: mass m_0, charge q_0
particle 2: mass $2m_0$, charge $2q_0$
particle 3: mass $2m_0$, charge $q_0/2$
particle 4: mass $m_0/2$, charge $2q_0$
Rank the particles according to the distance of closest approach to the gold nucleus, from smallest to largest.

(1) 3, then 1 and 2 tie, then 4
(2) 4, then 1 and 2 tie, then 3
(3) 1 and 2 tie, then 3, 4
(4) 1 and 2 tie, then 4, 3

SPACE FOR ROUGH WORK

Q.29 The unit "henry" is equivalent to:

(1) volt-second/ampere (2) volt/second

(3) ampere-volt/second (4) ampere-second/volt

Q.30 An RLC series circuit is driven by a sinusoidal emf with angular frequency ω_d. If ω_d is increased without changing the amplitude of the emf, the current amplitude increases. If L is the inductance, C is the capacitance, and R is the resistance, this means that:

(1) $\omega_d L > 1/\omega_d C$ (2) $\omega_d L < 1/\omega_d C$

(3) $\omega_d L = 1/\omega_d C$ (4) $\omega_d L > R$

SPACE FOR ROUGH WORK

Q.31 Which of the following solution can not act as Buffer solution?
(1) $HCl + CH_3COONa$ (2) $HCl + NaOH$
(3) $HCOOH + NH_4OH$ (4) $NaOH + NH_4Cl$

Q.32 Which of the following represents Finkelstein reaction ?
(1) $R - I + NaCl \xrightarrow{\text{Acetone}} R - Cl + NaI$ (2) $R - Br + NaI \xrightarrow{\text{Acetone}} R - I + NaBr$
(3) $R - Br + AgF \longrightarrow R - F + AgBr$ (4) $R - OH + HI \longrightarrow RI + H_2O$

Q.33 Which ionic compound has the largest lattice energy ?
(1) NaF (2) AlF_3 (3) AlN (4) MgF_2

Q.34 At 30ºC, the solubility of Ag_2CO_3 ($K_{sp} = 8 \times 10^{-2}$) will be maximum in –
(1) 0.05 M Na_2CO_3 (2) 0.05 M $AgNO_3$
(3) Pure water (4) 0.05 M NH_3

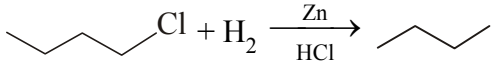
Q.35 Select the true statement:
(1) Boiling point order : RF > RCl > RBr > RI
(2) Haloalkanes are highly soluble in water.
(3) Melting point order : p-dichloro benzene > o-dichloro benzene
(4) Density order : RCl > RBr > RI

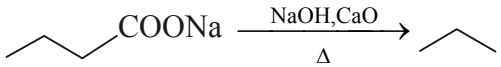
Q.36 Which of the following molecule is polar ?
(1) CO_2 (2) $BeCl_2$ (3) COS (4) BF_3

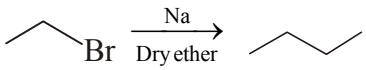
Q.37 For the following equilibrium :
$C(s) + O_2(g) \rightleftharpoons CO_2(g)$
concentration of $CO_2(g)$ can be decreased by
(1) Addition of graphite
(2) Addition of $O_2(g)$
(3) Addition of inert gas at constant pressure
(4) Decrease in temperature.

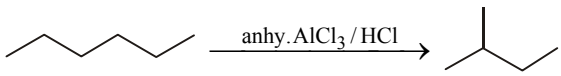
SPACE FOR ROUGH WORK

Q.38 Which reaction shows incorrect major product ?

(1) 

(2) 

(3) 

(4) 

Q.39 Order of bond energy of H_2^+, H_2, H_2^- is

(1) $H_2 < H_2^+ < H_2^-$ (2) $H_2^+ < H_2 < H_2^-$

(3) $H_2^- < H_2^+ < H_2$ (4) $H_2^+ < H_2^- < H_2$

Q.40 A 64 watt bulb emits monochromatic light of wavelength 310 nm, if emitted photons from bulb strikes on a metal surface with 25% efficiency, then magnitude of photocurrent **(in ampere)** will be -

(1) 0 (2) 4 (3) 16 (4) 64

Q.41 In electrophilic substitution reaction of chlorobenzene, the chloro group:

(1) Activates the ring by inductive effect.

(2) Acts as meta directing group.

(3) Increases electron density on benzene ring.

(4) Gives ortho/para substituted product.

Q.42 The number of $3c - 2e^-$ and $2c - 2e^-$ bonds in a molecule of diborane respectively are :

(1) 0, 4 (2) 2, 4 (3) 4, 2 (4) 3, 3

Q.43 The uncertainty in position of electron in first Bohr orbit is 10 % for the hydrogen atom, then uncertainty in velocity of electron **(in m/s)** in that orbit will be approximately.

(1) 10^{-4} (2) 10^7 (3) 10^{11} (4) 10^{-7}

Q.44 Acetaldehyde can be obtained from ethanol by reaction with :

(1) H_2 / Ni (2) Acidified $KMnO_4$

(3) CrO_3 in anhydrous medium (4) Jones Reagent

SPACE FOR ROUGH WORK

Q.45 In the solid state phosphorus pentachloride exists as :
(1) PCl_5 (2) $PCl_4^+ Cl^-$ (3) $PCl_4^+ PCl_6^-$ (4) $PCl_5 Cl_2$

Q.46 The Schrodinger wave equation for an atomic orbital of H-atom is -

$$\psi = \frac{1}{4\sqrt{2}\pi}\left(\frac{1}{a_0}\right)^{3/2}\left(4-\frac{r}{a_0}\right)e^{-r/2a_0}$$

Then number of radial and angular nodes for above mentioned orbital are respectively -
(1) 0, 1 (2) 1, 0 (3) 2, 1 (4) 1, 2

Q.47 What is the major product of the given reaction sequence ?

$$\text{Toluene} \xrightarrow[h\nu]{Cl_2} C_7H_7Cl \xrightarrow{\text{aq.KOH}} \text{product}$$

(1) p-cresol (2) m-cresol (3) o-cresol (4) benzyl alcohol

Q.48 Number of S – S bond in polythionic acid $H_2S_nO_6$ is
(1) n (2) (n – 1) (3) (n – 2) (4) (n + 1)

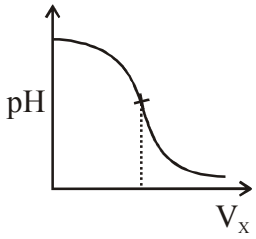
Q.49 pOH of a solution formed by mixing 60 ml of 0.2 M NaCN (aq) with 80 ml of 0.1 M HCl (aq) will be-
(**Given** : $K_a(HCN) = 5 \times 10^{-10}$; log 2 = 0.3; log 5 = 0.7)
(1) 9 (2) 7 (3) 5 (4) 3

Q.50 Which statement is **true** for Lucas test ?
(1) Reactivity order of alcohols : 1° > 2° > 3°
(2) 1° alcohol gives immediate turbidity in Lucas test
(3) 1° alcohol is insoluble in Lucas reagent
(4) 3° halide is insoluble in conc. HCl + $ZnCl_2$.

Q.51 The molecule having the largest bond angle is :
(1) H_2O (2) H_2Se (3) PH_3 (4) NH_3

SPACE FOR ROUGH WORK

Q.52 Aqueous solution of X is added slowly into aqueous solution of Y and the variation in pH is plotted on a graph -



X and Y solutions are respectively -

(1) HCl, NH_4OH (2) NaOH, CH_3COOH

(3) NaOH, H_2CO_3 (4) NH_4OH, CH_3COOH

Q.53 Select the incorrect combination of reaction name and product obtained.

(1) Kolbe's reaction – Salicylic acid (2) Riemer Tiemann – Salicylaldehyde

(3) Dow's process – Chlorobenzene (4) Williamson Synthesis – Diethyl ether

Q.54 Which is not correctly matched :

(1) NO_2^+ – Bent shape (2) CO_2 – Linear

(3) XeO_3 – Trigonal pyramidal (4) SO_3 – Trigonal planar

Q.55 Which of the following observation could be explained with help of electromagnetic theory given by Maxwell ?

(1) variation of heat capacity of solid as a function of temperature.

(2) the nature of emission of radiation from hot bodies.

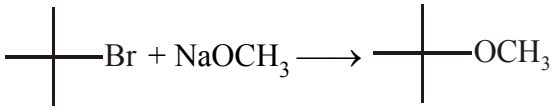
(3) line spectra of atoms with special reference to hydrogen.

(4) bending of wave around an obstacle.

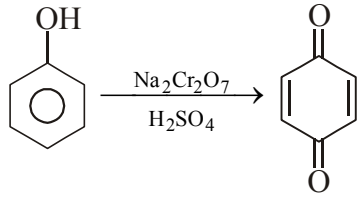
SPACE FOR ROUGH WORK

Q.56 Indicate the reaction in which correct major product is shown.

(1) $C_2H_5OH \xrightarrow[413\,K]{H_2SO_4} C_2H_5OC_2H_5$

(2) 

(3) Ethanol $\xrightarrow[443\,K]{H_2SO_4}$ Acetylene

(4) 

Q.57 What type of bonds are possible around a carbon atom with sp^2 hybridisation.

(1) 2π bonds and 1σ bond (2) 1π-bond and 2σ-bonds

(3) 4σ bonds (4) 1π-bond and 3σ-bonds

Q.58 At 298 K for the gas phase reaction -

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$; $K_P = 4 \times 10^{24}$ atm^{-1}

If $SO_2(g)$, $O_2(g)$ and $SO_3(g)$ at partial pressures of 2, 1 and 2 atm respectively, are mixed and allowed to attain equilibrium, the approximate partial pressure of $SO_2(g)$ at equilibrium is -

(1) 10^{-8} (2) 2×10^{-8} (3) 2×10^{-12} (4) 10^{-12}

Q.59 In which reaction is benzene not obtained as the major product ?

(1) n-hexane $\xrightarrow[\substack{773\,K \\ 10-20\,atm}]{Mo_2O_3}$ (2) Acetylene $\xrightarrow[873\,K]{\text{Red hot Fe tube}}$

(3) Aniline $\xrightarrow[273-278\,K]{NaNO_2+HCl}$ (4) Phenol $\xrightarrow[\Delta]{\text{Zn dust}}$

Q.60 Which gas should not be collected over water because of its high solubility in water ?

(1) H_2 (2) N_2 (3) CH_4 (4) HCl

SPACE FOR ROUGH WORK

Q.61 Let p, q and r be three logical statements with truth values F, T and F respectively, then the truth value of $(\sim p \Rightarrow \sim q) \vee r$ is

(1) T (2) F, if r had truth value T

(3) F (4) F, if q had truth value F

Q.62 A house of height 100 m subtends a right angle at the window of an opposite house. If the height of the window is 64 m, then the distance between the two houses is

(1) 48 m (2) 36 m (3) 54 m (4) 72 m

Q.63 Let R = {(3, 3), (6, 6), (9, 9), (12, 12), (6, 12), (3, 9), (3, 12), (3, 6)} be a relation on the set A = {3, 6, 9, 12}, then the relation R is

(1) Reflexive and transitive only (2) Reflexive only

(3) An equivalence relation (4) Reflexive and symmetric

Q.64 The parabola $y = x^2 - 9$ and $y = kx^2$ intersect each other at the points A and B. If the length AB is equal to 10 units then the value of k is equal to

(1) 75 (2) $\frac{9}{25}$ (3) $\frac{16}{25}$ (4) $\frac{16}{9}$

Q.65 An ellipse in the first quadrant is tangent to co-ordinate axes. If one focus is F_1 (3, 7), and the other focus is F_2(d, 7), then the value of $\sqrt{3d}$ is equal to

(1) 5 (2) 7 (3) 14 (4) 49

Q.66 If A is a square matrix such that $A^2 + A + 2I = \mathbf{O}$, then which of the following is INCORRECT ?

(1) A is non-singular (2) $A \neq \mathbf{O}$ (3) $A^{-1} = \frac{1}{2}(A^2 + I)$ (4) $A^{-1} = \frac{1}{2}(A + I)$

(Where I is unit matrix of order 2 and $\mathbf{O}$ is null matrix of order 2)

Q.67 The system of equations :

$2x \cos^2\theta + y \sin 2\theta - 2 \sin\theta = 0$

$x \sin 2\theta + 2y \sin^2\theta = -2 \cos\theta$

$x \sin\theta - y \cos\theta = 0$, for all values of θ, can

(1) have a unique non - trivial solution (2) not have a solution

(3) have infinite solutions (4) have a trivial solution

SPACE FOR ROUGH WORK

Q.68 One circle has a radius of 5 and its center at (0, 5). A second circle has a radius of 12 and its centre at (12, 0). The length of a radius of a third circle which passes through the center of the second circle and both points of intersection of the first 2 circles, is equal to
(1) 13/2 (2) 15/2 (3) 17/2 (4) none

Q.69 Locus of a point P(x, y) satisfying the equation

$$\sqrt{x^2+y^2+24y+144} = 13 - \sqrt{x^2+y^2-10x+25}, \text{ is}$$

(1) a finite line segment (2) an infinite ray
(3) part of a circle with finite radius (4) pair of straight lines

Q.70 P and Q are two points on the base AB of a triangle ABC whose vertices are (–2, 3), (4, – 6) and (1, 1) respectively. If the join of CP and CQ divides the triangle ABC into three triangles of equal areas, then the equation of line pair through the origin and parallel to CP and CQ is equal to
(1) $y^2 + 4xy - 3x^2 = 0$ (2) $3y^2 + 4xy + x^2 = 0$
(3) $y^2 + 3xy - 4x^2 = 0$ (4) $y^2 - 5xy + 4x^2 = 0$

Q.71 The line $4x - 7y + 10 = 0$ intersects the parabola, $y^2 = 4x$ at the points A and B. The sum of the co-ordinates of the point of intersection of the tangents drawn at the points A and B is
(1) 4 (2) 5 (3) 6 (4) 7

Q.72 The tangent at a point whose eccentric angle 60° on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ (a > b) meet the auxiliary circle at L and M. If LM subtends a right angle at the centre, then eccentricity of the ellipse is
(1) $\frac{1}{\sqrt{7}}$ (2) $\frac{2}{\sqrt{7}}$ (3) $\frac{3}{\sqrt{7}}$ (4) $\frac{1}{2}$

Q.73 If the curves $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ and $x^2 = cy$ touch each other at the point $\left(2\sqrt{2}, 4\right)$ then the value of $(a^2 + b^2 + c)$ is equal to
(1) 38 (2) 26 (3) 22 (4) 18

Q.74 If the lines $x + y + 1 = 0$; $4x + 3y + 4 = 0$ and $x + \alpha y + \beta = 0$, where $\alpha^2 + \beta^2 = 2$, are concurrent then
(1) $\alpha = 1, \beta = -1$ (2) $\alpha = 1, \beta = \pm 1$ (3) $\alpha = -1, \beta = \pm 1$ (4) $\alpha = \pm 1, \beta = 1$

SPACE FOR ROUGH WORK

Q.75 The distance from the centre of the circle $x^2+y^2=2x$ to the straight line passing through the points of intersection of the two circles $x^2+y^2+5x-8y+1=0$, $x^2+y^2-3x+7y-25=0$ is :

(1) 1 (2) 2 (3) 3 (4) none

Q.76 If $\alpha+\beta+\gamma=\pi$, then the value of $\begin{vmatrix} \sin(\alpha+\beta+\gamma) & \sin\beta & \cos\gamma \\ -\sin\beta & 0 & \tan\alpha \\ \cos(\alpha+\beta) & -\tan\alpha & 0 \end{vmatrix}$ is :

(1) 0 (2) 1 (3) 2 (4) $2\cdot\sin\beta\cdot\cos\gamma\cdot\tan\alpha$

Q.77 Number of skew-symmetric matrices of order 3 whose elements are $0, 0, 0, 1, -1, 2, -2, 3, -3$ is

(1) 8 (2) 12 (3) 24 (4) 48

Q.78 In a class of 100 students few are in science stream and rest are in arts stream. 30 students took physics, 20 took chemistry, 25 took maths, 2 students took physics, chemistry and maths, 5 in physics and Chemistry, 6 in Physics and Maths and 3 in chemistry and Maths. How many took Arts if no students is common in Science & Arts

(1) 33 (2) 35 (3) 37 (4) 39

Q.79 If the mean of the numbers $27+x$, $31+x$, $89+x$, $107+x$, $156+x$ is 82, then the mean of $130+x$, $126+x$, $68+x$, $50+x$, $1+x$ is

(1) 75 (2) 157 (3) 82 (4) 80

Q.80 Let p and q be two statements. Then, $(\sim p\vee q)\wedge(\sim p\wedge\sim q)$ is a

(1) tautology (2) contradiction

(3) neither tautology nor contradiction (4) either tautology or contradiction

Q.81 The locus of the middle points of the focal chords of parabola, $y^2=8x$ is another parabola whose length of latus rectum is

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

SPACE FOR ROUGH WORK

Q.82 P is any point on the ellipse $\frac{x^2}{8}+\frac{y^2}{4}=1$ and $Q(0,2)$ and $R(0,-2)$ are two points. If p_1 and p_2 are the lengths of the perpendicular from Q and R on the tangent at P then $\left(p_1^2+p_2^2\right)$ is equal to

(1) 32 (2) 16 (3) 4 (4) 8

Q.83 The reflection of hyperbola $\frac{x^2}{9}-\frac{y^2}{4}=1$ in the line $y=x$ will be a conic. The eccentricity of that conic will be

(1) $\frac{\sqrt{13}}{2}$ (2) $\frac{\sqrt{13}}{3}$ (3) $\frac{\sqrt{5}}{2}$ (4) $\frac{\sqrt{5}}{3}$

Q.84 The line $x+3y-2=0$ bisects the angle between a pair of straight lines of which one has equation $x-7y+5=0$. The equation of the other line is

(1) $3x+3y-1=0$ (2) $x-3y+2=0$ (3) $5x+5y-3=0$ (4) none

Q.85 The line segment joining A (5, 0) and B ($10\cos\theta$, $10\sin\theta$) is divided internally in the ratio 2 : 3 at P. If θ varies then the locus of P is

(1) $(x+3)^2+y^2=16$ (2) $x^2+(y-3)^2=16$

(3) $(x-3)^2+y^2=16$ (4) $x^2+(y+3)^2=16$

Q.86 If the system of equations

$x+2y+2z=1$

$x-y+3z=3$

$x+11y-z=b$

has solutions, then the value of b lies in the interval

(1) $(-7,-4)$ (2) $(-4,0)$ (3) $(0,3)$ (4) $(3,6)$

SPACE FOR ROUGH WORK

Q.87 If the chords of contact of tangents from two points $(-4, 2)$ and $(2, 1)$ to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ are at right angle, then the eccentricity of the hyperbola, is

(1) $\frac{\sqrt{7}}{2}$ (2) $\sqrt{\frac{5}{3}}$ (3) $\sqrt{\frac{3}{2}}$ (4) $\sqrt{2}$

Q.88 If the trace of matrix $A = \begin{pmatrix} x-2 & e^x & -\sin x \\ \cos(x^2) & x^2-x+3 & \ln|x| \\ 0 & \tan^{-1}x & x-7 \end{pmatrix}$ is zero, then x is equal to

(1) -2 or 3 (2) -3 or -2 (3) -3 or 2 (4) 2 or 3

Q.89 P is a point on the line $y + 2x = 1$ and Q and R are two points on the line $3y + 6x = 6$ such that the triangle PQR is an equilateral triangle. Area of this triangle is equal to

(1) $\frac{1}{15}$ (2) $\frac{1}{5\sqrt{3}}$ (3) $\frac{1}{3\sqrt{5}}$ (4) $\frac{1}{2\sqrt{15}}$

Q.90 If the S.D. of a set of observations is 4 and if each observation is divided by 4, the S.D. of the new set of observations will be

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

SPACE FOR ROUGH WORK

COURSE
NUCLEUS

JEE-MAIN MOCK TEST-2
XII

TEST CODE
1 1 2 6 7

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

HINTS & SOLUTIONS

PHYSICS

Q.1 Potential difference between plates remains same. Decrease in potential difference is counteracted by potential difference due to the extra distance.

$$t\left(E-\frac{E}{k}\right)=Ed$$

$$\Rightarrow \quad t\left(1-\frac{1}{k}\right)=d \quad \Rightarrow \quad k=\frac{t}{t-d}$$

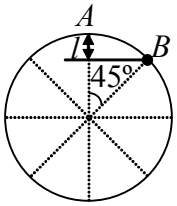
E is original electric field, k dielectric constant of plate, t thickness of plate & d extra distance

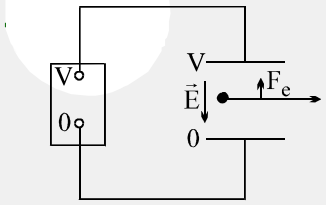
Q.2 $emf = vBl$

ℓ is length of component perpendicular to velocity

$l = R - R\cos 45^\circ$

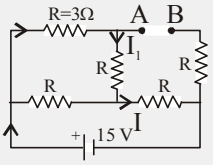
$$emf = vBR\left(1-\frac{1}{\sqrt{2}}\right)$$





electrostatic force on electrons is opposite to direction of electric field

Q.4 In steady state, capacitor acts as an open circuit.



$I_1 = 1A;$

$V_A - I_1R - IR = V_B$

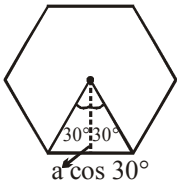
$\Rightarrow V_A - V_B = 12$

Q.5 Acceleration of $+3Q = \frac{3QE}{m}$ $(\downarrow)$

Acceleration of $-2Q = \frac{2QE}{m}$ $(\uparrow)$

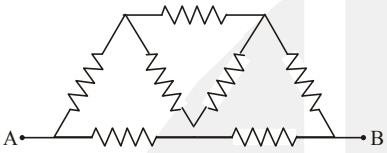
Q.6 $V = \dfrac{LdI}{dt}$

Q.7 $B_1 = \dfrac{\mu_0 i}{4\pi \times a\cos 30°}$



$B = 6B_1 = \dfrac{\mu_0 i}{2\pi a} \times \dfrac{1}{\sqrt{3}} \times 6^3 = \dfrac{\sqrt{3}\mu_0 i}{\pi a}$

Q.8 Due to symmetry,



$R_{eq} = \dfrac{8R}{7}$

Q.9 $E_1 = \dfrac{2kp}{r^3}$, $E_2 = \dfrac{kp}{(2r)^3}$

$E_1 = 16E_2$

Q.10 $V_A = V_{\text{at surface}} = V_B = V_C = V_O$
charge is on the outer surface hence V_{inside} remains constant.

Q.11 $V = \dfrac{Qd}{\epsilon_0 A}$, If A increases, V decreases.

Q.12 The maximum current is obtained at resonance where the net impedance is only resistive which is the resistance of the coil only. This gives the resistance of the coil as 10 ohm. Now, this coil along with the internal resistance of the cell gives a current of 0.5 A.

Q.13 $\rho(r) = A(r)^2$
Charge enclosed for sphere of radius R/2

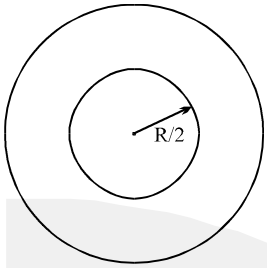
$$Q = \int (4\pi r^2) dr\, \rho(r) = 4\pi A \int_0^{R/2} r^4\, dr$$

$$= 4\pi A \left[\frac{v^5}{5}\right]_0^{R/2}$$

$$= \frac{4\pi A}{5\times 32}(R^5) = \frac{\pi A}{40}R^5$$

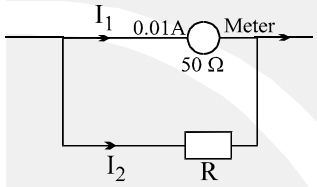
Applying Gauss's law for this sphere

$4\pi(R/2)^2 E = Q/\varepsilon_0 = \dfrac{\pi A}{40}R^5$



$\Rightarrow \quad E = \dfrac{AR^3}{40\varepsilon_0}$

Q.14



$I_2 = 8A$ (app) as I_1 is very-very small
$r_g I_1 = I_2 R$

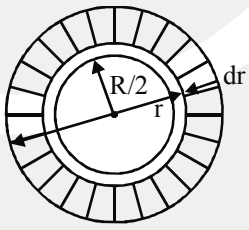
$R = \dfrac{r_g I_1}{I_2} = \dfrac{0.01 \times 80}{8} = 0.062\ \Omega$

Q.15 $P = \bar{\tau}\omega$

$\Delta P = \Delta\bar{\tau}\ \omega$

$\Delta\bar{\tau} = \dfrac{500}{350} = 10/7 = 1.4$ Nm

Q.16



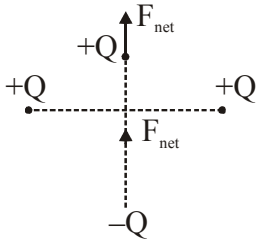
$dq = \sigma\,(2\pi r)\,dr$

$dM = \dfrac{dq}{T}\pi r^2$

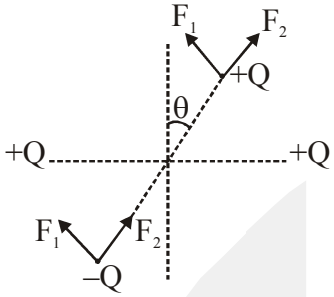
$M = \displaystyle\int_{R/2}^{R} \frac{\sigma \cdot 2\pi r \cdot dr \cdot \pi r^2}{2\pi/\omega}$

$M = \dfrac{15\pi\sigma\omega R^4}{64}$

Q.17 In eq. position, no torque acts.



After displacing by angle θ, no torque acts. So, it is a position of neutral equilibrium.



Q.18 $P_{total} = \frac{V^2}{R_{eq}} = \frac{3V^2}{4R} = \frac{3}{4}\times 100 = 75\ W$

Q.19 $S = \frac{1}{2}at^2$

$\Rightarrow S = \frac{1}{2}\ \frac{qE}{m}t^2 \qquad \Rightarrow \frac{Se}{Sp} = \frac{mp}{Se}$

$\Rightarrow Sp \simeq \frac{d}{2000}$

Q.20 When switch is closed, the circular turns of spring attract each other. Due to this, bottom end of wire looses contact with mercury and turns off. Afterwards, due to gravity, it falls down and turns on. This process repeats.

Q.21 $\varepsilon = -\frac{d\phi}{dt} = -A\frac{d_B}{dt} = -\pi R^2 (6t^2 - 8t)$

$\varepsilon = -\int \vec{E}.\vec{d\ell}$

$\pi R^2 (6\times 4 - 8\times 2) = E \times 2\pi r$

$E = \frac{R^2}{2r}(24-16) = \frac{R^2}{2\times 2R}(8)$

$E = 2R = \frac{2\times 5}{2\times 100} = \frac{1}{20}\ N/C$

$F = qE = -1.6\times 10^{-19}\times \frac{1}{20}$

$= -8\times 10^{-21}\ N$

Q.22 $E = \frac{nkQz}{(R^2+z^2)^{3/2}} \Rightarrow E_1 = \frac{nkQz}{(R^2+R^2)^{3/2}}$

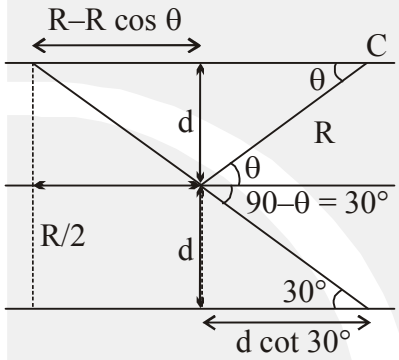
$\Rightarrow E_2 = \frac{nkQ(2R)}{[R^2+(2R)^2]^{3/2}}$

$\frac{E_1}{E_2} = \frac{1}{2\sqrt{2}} \cdot \frac{5\sqrt{5}}{2} = \frac{5\sqrt{5}}{4\sqrt{2}}$

Q.23 Perpendicular length is more so induced emf is more

Q.24 $\sin\theta = \frac{d}{R} = \frac{\sqrt{3}}{2}$

$\theta = 60°$



$x = \frac{R}{2} + \frac{R\sqrt{3}}{2}\times\sqrt{3} = 2R$

Q.25 Field due to +2e charge sphere at distance d from the centre $E = \frac{2ked}{R^3}$

Force on electron $F = eE = \frac{2ke^2d}{R^3}$

$F_c = \frac{ke^2}{4d^2}$

$\frac{2ke^2d}{R^3} = \frac{ke^2}{4d^2} \qquad \Rightarrow \qquad R^3 = 8d^3$

$\Rightarrow \qquad R = 2d$

Q.26 B_P is only because of single current.
B_Q is because of two currents in same direction.
B_R is because of two currents in opposite direction.

Q.27 As, $l_0 = \frac{E}{R_1} = 6A$

$\Rightarrow E = L\frac{dl_2}{dt} + R_2 l_2 \Rightarrow l_2 = l_0[1 - e^{-t/\tau^2}]$

Hence, $V_L = E - R_2 l_2 = 12e^{-5t}$ V

Q.28 $\frac{1}{2}mv_0^2 = \frac{(ze)(q)}{4\pi \in_0 r} \quad \Rightarrow \quad r \propto \frac{q}{m}$

Q.29 $V = L\left(\frac{di}{dt}\right)$

Q.30 $I_0 = \frac{V_0}{\sqrt{R^2 + \left(\frac{1}{\omega c} - \omega L\right)^2}}$

$I_0 \uparrow \omega\uparrow$ only possible if $\frac{1}{\omega C} > \omega L$.

CHEMISTRY

Q.31 Theory based

Q.32 Finkelstein reaction

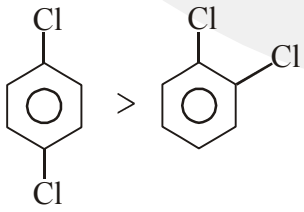
$R - Cl \xrightarrow[\text{Acetone}]{NaI} R - I + NaBr$

It is a halide exchange reaction, generally I^- (Nu) is used here.

Q.33 Lattice energy $\propto \frac{\text{charge}}{\text{size}}$

(1) $NaF \rightarrow Na^+F^-$
(2) $AlF_3 \rightarrow Al^{+3}3F^-$
(3) $AlN \rightarrow Al^{+3}N^{-3}$
(4) $MgF_2 \rightarrow Mg^{+2}2F^-$

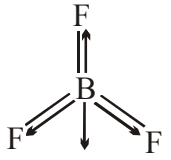
Q.34 Solubility of Ag_2CO_3 will decrease in Na_2CO_3 and $AgNO_3$ due to common ion effect and will increase in NH_3 solution due to complex $[Ag(NH_3)_2]^+$ formation.

Q.35 Melting point :  (Due to Packing)

Q.36 (1) $CO_2 \rightarrow \overleftrightarrow{O} = C = \overleftrightarrow{O}$ $\mu = 0$

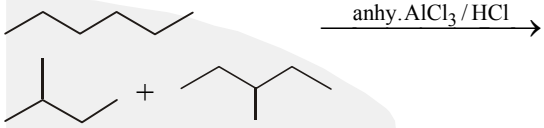
(2) $BeCl_2 \rightarrow \overleftrightarrow{Cl}–Be–\overleftrightarrow{Cl}$ $\mu = 0$

(3) $COS \rightarrow \overleftrightarrow{S}=C=\overleftrightarrow{O}$ $\mu \neq 0$

(4) $BF_3 \rightarrow$ 

$\mu = 0$(Trigonal planar

Q.37 Theory based

Q.38 

Q.39 Bond energy $\propto$ Bond order and if Bond order is same the

Bond energy $\propto \frac{1}{\text{No. of AB e}^-\text{s}}$

$H_2^+ \rightarrow$ Bond order = 0.5 (AB e^- s = 0)
$H_2 \rightarrow$ Bond order = 1 (AB e^- s = 0)
$H_2^- \rightarrow$ Bond order = 0.5 (AB e^- s = 1)
So, order of bond energy is
$H_2^- < H_2^+ < H_2$

Q.40 Power of bulb = 64 watt = 64 J/sec

$E_{photon} = \frac{1240}{310}eV = 4$ eV

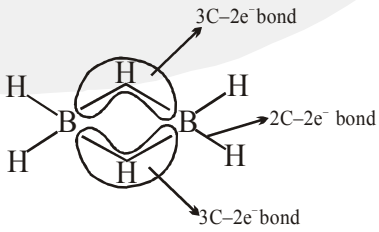
Number of photons emitted in 1 sec

$= \frac{64}{4 \times 1.6 \times 10^{-19}} = 10^{20}$

Current = $10^{20} \times 1.6 \times 10^{-19} \times \frac{25}{100} = 4$ amp

Q.41 In Chlorobenzene chlorine acts as activating group and electrophile substitution occurs at ortho or para position.

Q.42 Diborane.



$3C - 2e^- = 2$
$2C - 2e^- = 4$

Q.43 $\Delta x = 0.529 \times 10^{-10} \times \frac{10}{100}$

$= 0.529 \times 10^{-11}$ m

$\Delta x.\ \Delta V = \frac{h}{4\pi m}$

$\Delta V = \frac{6.63\times10^{-34}}{4\times3.14\times9.1\times10^{-31}\times0.529\times10^{-11}}$

$\Delta V \approx 10^7$ m/s

Q.44 Acidified $KMnO_4$ and Jones reagent oxidised ethanol into ethanoic acid while CrO_3 in anhydrous medium convert into ethanol (acetaldehyde)

$CH_3–CH_2–OH \xrightarrow[\text{anhydrous medium}]{CrO_3} CH_3-\overset{\overset{O}{\|}}{C}-H$ Acetaldehyde

Q.45 (1) PCl_5 exists as $PCl_4^+ PCl_6^-$

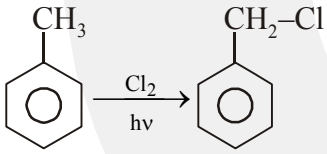
Q.46 Since ψ is not a function of angle therefore it must be a 's' orbital and for s-orbital, angular node = 0

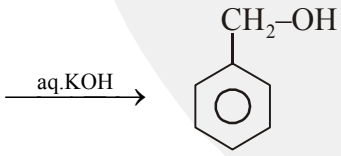
For radial node

$\psi(r, \theta, \phi) = 0$

$4 - \frac{r}{a_0}$; $r = 4a_0$

Radial node = 1

Q.47 



Benzyl alcohol

Q.49 $NaCN(aq) + HCl \longrightarrow NaCl(aq) + HCN(aq)$

m moles	60×0.2	80×0.1
	12	8
	4	–
	–	8

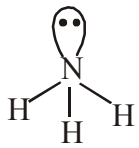
acidic buffer solution

$pH = pK_a(HCN) + \log \frac{[NaCN]}{[HCN]}$

$pH = 10 - \log 5 + \log\left(\frac{4}{8}\right)$

$= 10 - \log 5 - \log 2$

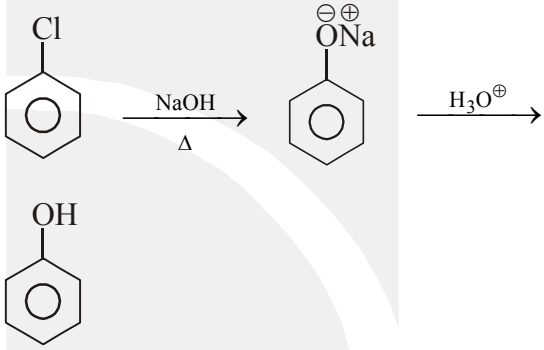
pH = 9; pOH = 5

Q.51 

Pyramidal, Bond angle = 107°

Q.52 Theory based.

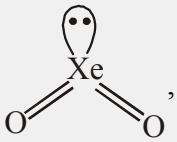
Q.53 Dow process



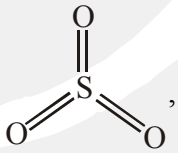
Product is phenol

Q.54 (1) NO_2^+ $O = \overset{+}{N} = O$ Linear shape

(2) CO_2 $O = C = O$, Linear

(3) XeO_3 

, Pyramidal

(4) SO_3 

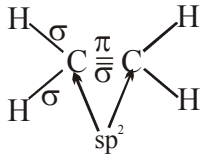
, Trigonal planar

Q.55 Theory based.

Q.56 At 413 K (140°C) product is diethyl ether

$C_2H_5OH \xrightarrow[413\,K]{H_2SO_4} C_2H_5 - O - C_2H_5$

Q.57 For example : Ethene



MATHEMATICS

Q.58 $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$; $K_P = 4 \times 10^{24}\ atm^{-1}$

Initial pressure	2	1	2
Pressure at eq^m	2–2x $\simeq$ 2y	1–x $\simeq$ y	2 + 2x $\simeq$ 4

$\because$ K_P is ver large that means at eq^m almost reactants converted in product

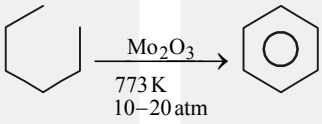
$$K_P = \frac{(4)^2}{(2y)^2(y)^1}$$

$$4 \times 10^{24} = \frac{4^2}{2y^2 \times y^1}$$

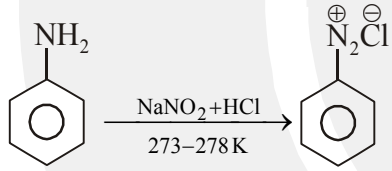
$$y \simeq 10^{-8}$$

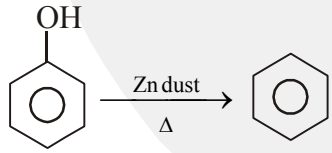
$P_{SO_2(g)}$ at eq^m = 2y

$= 2 \times 10^{-8}$

Q.59 (1) n-hexane 

(2) $HC \equiv CH \xrightarrow[873\,K]{\text{Red hot Fe tube}}$ 

(3) 

(4) 

Q.60 HCl is polar covalent gas so its solubility in water is high.
So, it should not be collected over water.

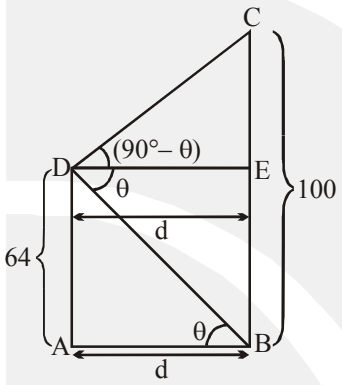
Q.61

p	q	r	~ p	~ q	(~ p ⇒ ~ q)	(~ p ⇒ ~ q) ∨ r
F	T	F	T	F	F	F

Q.62 In ΔDAB, $\tan\theta = \frac{64}{d} \Rightarrow d = 64\cot\theta$ .....(1)

In ΔCDE, $\tan(90° - \theta) = \frac{36}{d}$

.....(2)



$\therefore$ (1) × (2)

$\Rightarrow$ $64 \times 36 = d^2$

$\Rightarrow$ d = 48. **Ans.**]

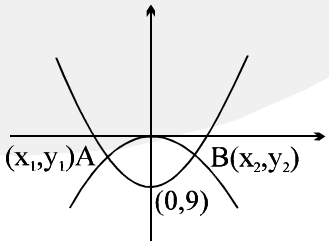
Q.63 Satisfied condition of reflexive and transitive

Q.64 solving $x^2 - 9 = kx^2$

$x^2(k-1) + 0.x + 9 = 0$

$x_1 + x_2 = 0$ & $x_1 x_2 = \frac{9}{k-1}$

now, $|x_1 - x_2| = 10 = \sqrt{(x_1+x_2)^2 - 4x_1x_2}$



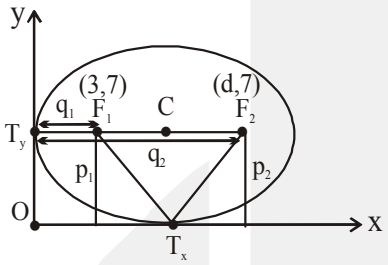
$$100 = \frac{36}{1-k}$$

$100 - 100k = 36 \Rightarrow k = \frac{64}{100} = \frac{16}{25}$ Ans]

Q.65 We have $q_1q_2 = 3d = b^2$

and $p_1p_2 = 49 = b^2$

Hence $3d = 49 \Rightarrow \sqrt{3d} = \sqrt{49} = 7$ **Ans.**



]

Q.66 We have $A(A + I) = -2I$

$\Rightarrow$ $|A(A + I)| = |-2I|$

$\Rightarrow$ $|A||A + I| = 4 \neq 0$

Thus, $|A| \neq 0$

$\Rightarrow$ A is non singular

$\Rightarrow$ A is correct

Also, $A\left(-\frac{1}{2}(A + I)\right) = I$

$\Rightarrow$ $A^{-1} = -\frac{1}{2}(A + I)$

$\Rightarrow$ D is correct

Also $A = 0$ does not satisfy the given eqaution $\Rightarrow$ $A \neq 0$

again $\left.\begin{matrix} A^2 + A + 2I = 0 \\ (A^T)^2 + A^T + 2I = 0 \end{matrix}\right]$ subtract again

will $A^T = B$

$(A^2 - B^2) + (A - B) = 0$

$(A - B)(A + B + I) = 0$

$\Rightarrow$ $A - B = 0$ or $A + B + I = 0$

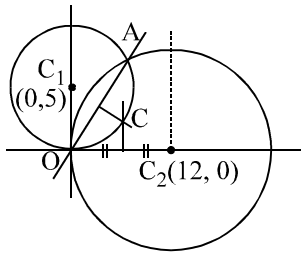
Q.67 slope of (1) and (2) is $\cot\theta \Rightarrow$ (1) and (2) are parallel and slope of (3) is $\tan\theta$

$\Rightarrow$ no solution.

Using $R_2 \to R_2 - (2\cos\theta)R_3$

and $R_1 \to R_1 + (2\sin\theta)R_3$, the value of determinat is 4 .]

Q.68

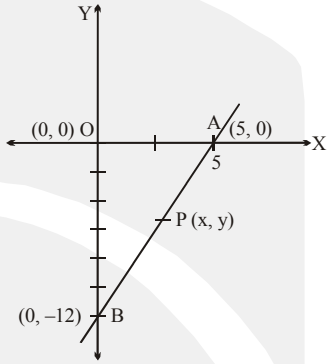


]

Q.69 The given equation denotes that

PA + PB = 13

$$\sqrt{x^2 + (y+12)^2} + \sqrt{(x-5)^2 + y^2} = 13$$

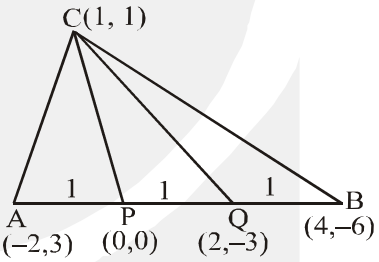


$\therefore$ Point P lies on line segment AB

Q.70 As length of all the 3 triangles is same line

AP = PQ = QB

Hence equation of CP is $y - x = 0$



slope of $CQ = \frac{4}{-1}$

equation of line through origin and parallel to QC, is

$y - 0 = -4(x - 0)$

$y + 4x = 0$

Equation of the line pair

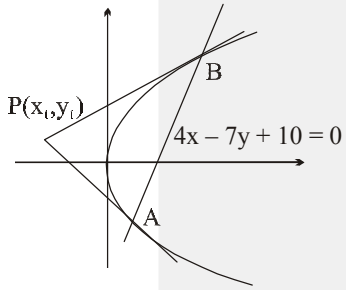
$(y - x)(y + 4x) = 0$

$\Rightarrow$ $y^2 + 3xy - 4x^2 = 0$ **Ans.**]

Q.71 C.O.C. of $P(x_1,y_1)$ w.r.t. $y^2 = 4ax$ is

$yy_1 = 2(x + x_1)$ ....(1)

compare with



$4x - 7y + 10 = 0$ ....(2)

to get $(x_1, y_1) = \left(\frac{5}{2}, \frac{7}{2}\right)$.]

Q.72 The equation of the tangent is

$$\frac{x}{a}\cdot\left(\frac{1}{2}\right)+\frac{y}{b}\left(\frac{\sqrt{3}}{2}\right)=1 \text{.....(i)}$$

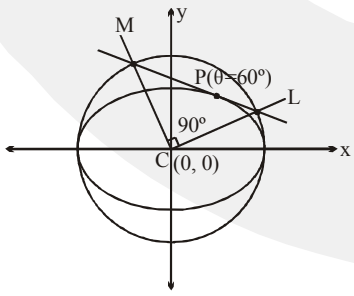
Auxiliary circle is $x^2 + y^2 = a^2$.....(ii)

C is the centre.
Combined equation of CL, CM is obtained by homgenising (ii) with (i), i.e.,

$$x^2 + y^2 - a^2\left(\frac{x}{2a}+\frac{\sqrt{3}y}{2b}\right)^2 = 0$$

Since $\angle LCM = 90°$

$$\Rightarrow 1 - \frac{1}{4} + 1 - \frac{3a^2}{4b^2} = 0 \Rightarrow \frac{3a^2}{4b^2} = \frac{7}{4}$$



$\Rightarrow 7b^2 = 3a^2 \Rightarrow 7a^2(1-e^2) = 3a^2$

Hence $e = \frac{2}{\sqrt{7}}$ Ans.]

Q.73 $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $x^2 = cy$

$\left(2\sqrt{2}, 4\right)$ satisfy both curves

$$\frac{8}{a^2} - \frac{16}{b^2} = 1, \quad 8 = c.4 \Rightarrow c = 2$$

$$\frac{2x}{a^2} - \frac{2yy'}{b^2} = 0$$

$$y'\big|_{(2\sqrt{2},4)} = \frac{b^2}{a^2}\cdot\frac{2\sqrt{2}}{4} = \frac{b^2}{\sqrt{2}a^2}$$

$$\left.\begin{array}{l}\\\\\end{array}\right\} \Rightarrow \frac{b^2}{\sqrt{2}a^2} = 2\sqrt{2} \Rightarrow b^2 = 4a^2$$

$$2x = 2y' \Rightarrow \left.\frac{dy}{dx}\right|_{(2\sqrt{2},4)} = 2\sqrt{2}$$

$$\therefore \frac{8}{a^2} - \frac{16}{4a^2} = 1 \Rightarrow a^2 = 4, \quad b^2 = 16$$

$a^2 + b^2 + c = 16 + 14 + 2 = 22$. **Ans.**]

Q.74 Lines are $x + y + 1 = 0$; $4x + 3y + 4 = 0$ and $x + \alpha y + \beta = 0$, where $\alpha^2 + \beta^2 = 2$

$$\begin{vmatrix} 1 & 1 & 1 \\ 4 & 3 & 4 \\ 1 & \alpha & \beta \end{vmatrix} = 0$$

$1(3\beta - 4\alpha) - 1(4\beta - 4) + 1(4\alpha - 3)$
$= 3\beta - 4\alpha - 4\beta + 4 + 4\alpha - 3$
$= -\beta + 1 = 0 \Rightarrow \beta = 1$
$\therefore \alpha = \pm 1$]

Q.75 Compute perpendicular distance from (1, 0) to the Radical axis of two circles]

Q.76 as $\alpha + \beta + \gamma = \pi$ so

$$D = \begin{vmatrix} 0 & \sin\beta & \cos\gamma \\ -\sin\beta & 0 & \tan\alpha \\ -\cos\gamma & -\tan\alpha & 0 \end{vmatrix}$$

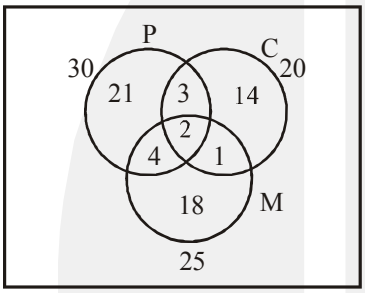
open through $R_1 = -\sin\beta(\cos\gamma\tan\alpha) + \cos\gamma(\sin\beta\tan\alpha) = 0$

Q.77 $A = \begin{pmatrix} 0 & \times & \times \\ \times & 0 & \times \\ \times & \times & 0 \end{pmatrix}$

Number of skew symmetric matrices
$= 3! \times 8 = 48$. **Ans.**
[As, diagonal element must be 0 and conjugate pair elements are additive inverse of each other in skew-symmetric matrix.]

Aliter: 1 can be put by 6 ways
– 1 can be put by 1 way
2 can be put by 4 ways
– 2 can be put by 1 way
3 can be put by 2 ways
– 3 can be put by 1 way
$\therefore$ Number of skew symmetric matrices
$= 6 \times 1 \times 4 \times 1 \times 2 \times 1 = 48$. **Ans.**]

Q.78



$n(A \cup B \cup C)$
$\therefore (A \cup B \cup C)^C = 37$]

Q.79 Given,

$$82 = \frac{(27+x)+(31+x)+(89+x)+(107+x)+(156+x)}{5}$$

$\Rightarrow 82 \times 5 = 410 + 5x \Rightarrow 410 - 410 = 5x \Rightarrow x = 0$

$\therefore$ Required mean is ,

$$\bar{x} = \frac{130+x+126+x+68+x+50+x+1+x}{5}$$

$$\bar{x} = \frac{375+5x}{5} = \frac{375+0}{5} = \frac{375}{5} = 75 \quad]$$

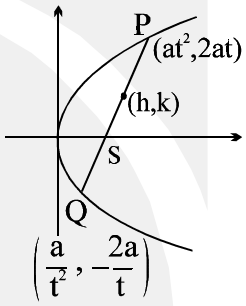
Q.80

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

$\because$ neither tautology nor contradiction.]

Q.81 $2h = a\left(t_1^2 + t_2^2\right)$ ....(1)
and $2k = 2a(t_1 + t_2)$ ....(2)
and $t_1 t_2 = -1$
from (2)

$$k^2 = a^2\left[\frac{2h}{a} - 2\right]$$

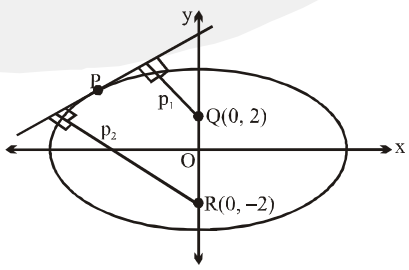


$y^2 = 2a(x - 2a)$
Put $a = 2$
Hence, $y^2 = 4(x - 4)$.]

Q.82 Let the tangent be $mx - y + \sqrt{8m^2 + 4} = 0$

$$p_1 = \left|\frac{\sqrt{8m^2+4} - 2}{\sqrt{1+m^2}}\right|;$$

$$p_2 = \left|\frac{\sqrt{8m^2+4} + 2}{\sqrt{1+m^2}}\right|$$



$$\Rightarrow \left(p_1^2 + p_2^2\right) = \frac{2(8m^2+4)+8}{(1+m^2)}$$

$$= \frac{16(1+m^2)}{(1+m^2)} = 16 \textbf{ Ans.}]$$

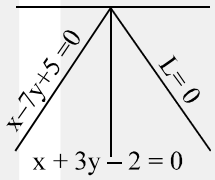
Q.83 Any point on hyperbola can be taken as $(3\sec\theta, 2\tan\theta)$ reflection of point $(3\sec\theta, 2\tan\theta)$ in line $y = x$ will be $(2\tan\theta, 3\sec\theta)$

$\therefore$ locus is $\frac{x^2}{4} - \frac{y^2}{9} = -1$

$\therefore$ eccentricity $= \sqrt{1+\frac{4}{9}} = \frac{\sqrt{13}}{3}$]

Q.84 $L \equiv x - 7y + 5 + \lambda(x + 3y - 2) = 0$

now equate perpendicular

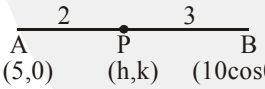


distance to get λ.]

Q.85 Let dividing point is P (h, k), then

$$h = \frac{2(10\cos\theta)+3(5)}{2+3} = 4\cos\theta + 3$$

and $k = \frac{2(10\sin\theta)+3(0)}{2+3} = 4\sin\theta$



$\therefore$ $(h-3)^2 + k^2 = 16$

$\Rightarrow$ Locus of P (h, k) is $(x-3)^2 + y^2 = 16$, which is a circle. **Ans.**]

Q.86 $x + 2y + 2z = 1$ ....(1)

$x - y + 3z = 3$ ....(2)

$x + 11y - z = b$ ....(3)

From (1) and (2)

$z = 2 + 3y$ and $x = -8y - 3$

Put in equation (3)

$\Rightarrow$ $b = -5$. **Ans.**]

Q.87 Equation of chord of contact with respect to point $(-4, 2)$ is

$\frac{-4x}{a^2} - \frac{2y}{b^2} = 1$ and with respect to point $(2, 1)$ is $\frac{2x}{a^2} - \frac{y}{b^2} = 1$.

Now, according to given condition,

$$\left(\frac{\frac{4}{a^2}}{\frac{-2}{b^2}}\right) \times \left(\frac{\frac{-2}{a^2}}{\frac{-1}{b^2}}\right) = -1 \Rightarrow \frac{b^4}{a^4} = \frac{1}{4}$$

$$\Rightarrow \frac{b^2}{a^2} = \frac{1}{2}1$$

Now, $e = \sqrt{1+\frac{b^2}{a^2}} = \sqrt{1+\frac{1}{2}} = \sqrt{\frac{3}{2}}$

Ans.]

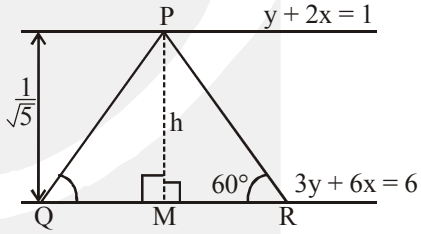
Q.88 As, trace $A = (x-2) + (x^2 - x + 3) + (x - 7)$
$= x^2 + x - 6$

Given, trace $A = 0 \Rightarrow x^2 + x - 6 = 0 =$
$(x + 3)(x - 2)$

$\therefore$ $x = -3$ or 2. **Ans.**]

Q.89 The distance between the given parallel lines (h) is $\frac{2-1}{\sqrt{5}} = \frac{1}{\sqrt{5}}$

$\therefore$ Length of the side of the triangle is $= \frac{2h}{\sqrt{3}}$



Area of triangle $= \frac{\sqrt{3}}{4} \cdot \frac{4h^2}{3} = \frac{h^2}{\sqrt{3}} = \frac{1}{5\sqrt{3}}$.

Q.90 We know that if $y = \frac{x}{h}$ when $\sigma y = \frac{\sigma_x}{|h|}$

Therefore, the S.D. of new set of observations will be $\frac{4}{4} = 1$.]