# VITEEE 2011 Question Paper

## PART - I (PHYSICS)

**1.** A glass rod rubbed with silk is used to change a gold leaf electroscope and the leaves are observed to diverge. The electroscope thus charged is exposed to X-rays for a short period. Then
(a) the divergence of leave will not affected
(b) the leaves will diverge further
(c) the leaves will collapse
(d) the leaves will melt

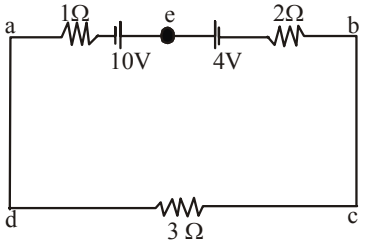
**2.** An infinite number of charge, each of charge 1 $\mu$C are placed on the x-axis with coordinates x=1, 2, 4, 8,.....$\infty$. If a charge of 1C is kept at the origin, then what is the net force acting on 1C charge?
(a) 9000 N (b) 12000 N
(c) 24000 N (d) 36000 N

**3.** A cube of side $\ell$ is placed in a uniform field E, where $E = E_i$ . The net electric flux through the cube is
(a) zero (b) $l^2E$
(c) $4l^2E$ (d) $6l^2E$

**4.** The capacity of a capacitor is $4\times10^{-6}$ F and its potential is 100 V. The energy released on discharging it fully will be
(a) 0.02 J (b) 0.04 J
(c) 0.025 J (d) 0.05 J

**5.** Dimensions of a block are 1cm×1cm×100cm. If specific resistance of its material is $3\times10^{-7}\ \Omega$ m, then the resistance between the opposite rectangular faces is
(a) $3\times10^{-7}\ \Omega$ (b) $3\times10^{-9}\ \Omega$
(c) $3\times10^{-5}\ \Omega$ (d) $3\times10^{-3}\ \Omega$

**6.** The magnitude and direction of the current in the circuit shown will be




(a) 7/3 A from a to b through e
(b) 7/3 A from b to a through e
(c) 1A from b to a through e
(d) 1A from a to b through e

**7.** An electric bulb of 100 W is connected to a supply of electricity of 220 V. Resistance of the filament is
(a) 484 $\Omega$ (b) 100 $\Omega$
(c) 22000 $\Omega$ (d) 242 $\Omega$

**8.** Pick out the wrong statement.
(a) In a simple battery circuit, the point of lowest potential is the negative terminal of the battery.
(b) The resistance of an incandescent lamp is greater when the lamp is switched off.
(c) An ordinary 100W lamp has less resistance than a 60 W lamp.
(d) At constant voltage, the heat developed in a uniform wire varies inversely as the length of the wire used.

**9.** The electrochemical equivalent of magnesium is 0.126 mg/C. A current of 5A is passed in a suitable solution for 1h. The mass of magnesium deposited will be
(a) 0.0378 g (b) 0.227 g
(c) 0.378 g (d) 2.27 g

**10.** In producing chlorine through electrolysis 100 W power at 125 V is being consumed. How much chlorine per minute is leberated? (ECE of chlorine is $0.367\times10^{-6}$ kg/C)
(a) 24.3 mg (b) 16.6 mg
(c) 17.6 mg (d) 21.3 mg

**11.** A particle carrying a charge to 100 times the charge on an electron is rotating per second in a circular path of radius 0.8 m. The value of the magnetic field produced at the centre will be ($\mu_0$= permeability for vacuum)
(a) $\dfrac{10^{-7}}{\mu_0}$ (b) $10^{-17}\ \mu_0$
(c) $10^{-6}\ \mu_0$ (d) $10^{-7}\ \mu_0$

**12.** A rectangular loop carrying a current i is placed in a uniform magnetic field B. The area enclosed by the loop is A. If there are n turns in the loop, the torque acting on the loop is given by

(a) $ni\mathbf{A}\times\mathbf{B}$ (b) $ni\mathbf{A}\cdot\mathbf{B}$

(c) $\frac{1}{n}(i\mathbf{A}\times\mathbf{B})$ (d) $\frac{1}{n}(i\mathbf{A}\cdot\mathbf{B})$

**13.** In a magnetic field of 0.05 T, area of a coil changes from 101 $cm^2$ to 100 $cm^2$ without changing the resistance which is 2 Ω. The amount of charge that flow during this period is

(a) $2.5\times10^{-6}$ C (b) $2\times10^{-6}$ C

(c) $10^{-6}$ C (d) $8\times10^{-6}$ C

**14.** A solenoid has 2000 turns wound over a length of 0.30 m . The area of its cross-section is $1.2\times10^{-3}$ $m^2$. Around its central section, a coil of 300 turn is wound. If an initial current of 2A in the solenoid is reversed in 0.25 s, then the emf induced in the coil is

(a) $6\times10^{-4}$ V (b) $4.8\times10^{-3}$ V

(c) $6\times10^{-2}$ V (d) 48mV

**15.** An inductive circuit contains a resistance of 10 Ω and an inductance of 2.0 H. If an AC voltage of 120 V and frequency of 60 Hz is applied to this circuit, the current in the circuit would be nearly

(a) 0.32 A (b) 0.16 A

(c) 0.43 A (d) 0. 80 A

**16.** In a Millikan's oil drop experiment the charge on an oil drop is calculated to be $6.35\times10^{-19}$ C. The number of excess electrons on the drop is

(a) 3.2 (b) 4

(c) 4.2 (d) 6

**17.** The values $+\frac{1}{2}$ and $-\frac{1}{2}$ of spin quantum number show

(a) rotation of electron clockwise and anti-clockwise directions respectively

(b) rotation of electron anti-clockwise and clockwise directions respectively

(c) rotation in any direction according to convention

(d) None of the above

**18.** The frequency of incident light falling on a photosensitive metal plate is doubled, the kinetic energy of the emitted photoelectrons is

(a) double the earlier value

(b) unchanged

(c) more than doubled

(d) less than doubled

**19.** Light of two different frequencies whose photons have energies 1 eV and 2.5 eV, respectively, successively illuminate a metal whose work function is 0.5 eV. The ratio of the maximum speed of the emitted electrons will be

(a) 1:5 (b) 1:4

(c) 1:2 (d) 1:1

**20.** An electron accelerated under a potential difference V volt has a certain wavelength $\lambda$. Mass of proton is some 2000 times of the mass of the electron. If the proton has to have the same wavelength $\lambda$, then it will have to be accelerated under a potential difference of

(a) V volt (b) 2000 V volt

(c) $\frac{V}{2000}$ volt (d) $\sqrt{2000}$ V volt

**21.** The ratio of momentum of an electron and $\alpha$ -particle which are accelerated from rest by a potential difference of 100 V is

(a) 1 (b) $\sqrt{(2m_e/m_a)}$

(c) $\sqrt{(m_e/m_\alpha)}$ (d) $\sqrt{(m_e/2m_\alpha)}$

**22.** Sky wave propagation is used in

(a) radio communication

(b) satellite communication

(c) T V communication

(d) Both T V and satellite communication

**23.** The frequency of an FM transmitter without signal input is called

(a) the centre frequency

(b) modulation

(c) the frequency deviation

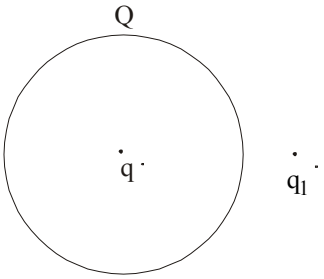
(d) the carrier sweing

**24.** What is the age of an ancient wooden piece if it is known that the specific activity of $C^{14}$ nuclide in its amounts is 3/5 of that in freshly grown trees? Given the half of C nuclide is 5570 yr.

(a) 1000 yr (b) 2000 yr

(c) 3000 yr (d) 4000 yr

**25.** A thin metallic spherical shell contains a charge Q on it. A point charge $q$ is placed with the centre of the shell and another charge $q_1$s placed outside it as shown in the figure. All the three charges are positive.

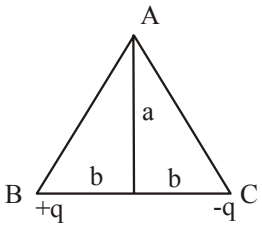



The force on the charge at the centre is

(a) towards left (b) towards right

(c) upward (d) zero

**26.** As shown in the figure, charges + q and – q are placed at the vertices B and C of an isosceles triangle. The potential at the vertex A is




(a) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{2a}{\sqrt{a^2+b^2}}$ (b) zero

(c) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{\sqrt{a^2+b^2}}$ (d) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{(-q)}{\sqrt{a^2+b^2}}$

**27.** On moving a charge of 20 C by 2 cm, 2 J of work is done, then the potential difference between the points is

(a) 0.1 V (b) 8 V

(c) 2 V (d) 0.5 V

**28.** The insulation property of air breaks down at $3 \times 10^6$ V/m. The maximum charge that can be given to a sphere of diameter 5 m is nearly

(a) $2\times10^{-2}$C (b) $2\times10^{-3}$C

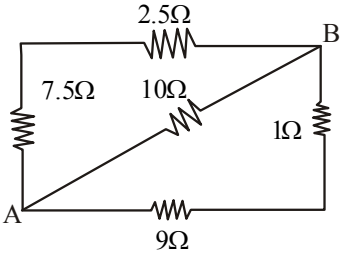
(c) $2\times10^{-4}$C (d) $2\times10^{-5}$C

**29.** Two capacitors of capacities C and 2C are connected in parallel and then connected in series with a third capacitor of capacity 3C. The combination is charged with V volt. The charge on capacitor of capacity C is

(a) $\frac{1}{2}$CV (b) CV

(c) 2CV (d) $\frac{3}{2}$CV

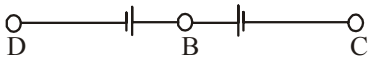
**30.** Five resistances are connected as shown in the figure. The effective resistance between points A and B is




(a) $\frac{10}{3}\Omega$ (b) $\frac{10}{17}\Omega$

(c) 40Ω (d) 45Ω

**31.** A potentiometer is connected across A and B and a balance is obtained at 64.0 cm. When potentiometer lead to B is moved to C, a balance is found at 8.0 cm. If the potentometer is now connected across B and C, a balance will be found at




(a) 8.0 cm (b) 56.0 cm

(c) 64.0 cm (d) 72.0 cm

**32.** In an electromagnetic wave, the average energy density associated with magnetic field is

(a) $L i_0^2/2$ (b) $B^2/2\mu_0$

(c) $\mu_0 B^2/2$ (d) $\mu_0/2B^2$

**33.** An electromagnetic wave going through vacuum is described by

$E=E_0 \sin(kx-\omega t)$

Which of the following is/are independent of the wavelength?

(a) k (b) $\omega^2$

(c) $k/\omega$ (d) $k\omega^2$

**34.** An ammeter reads upto 1A. Its internal resistance is 0.81 Ω . To increase the range to 10 A, the value of the required shunt is

(a) 0.09 Ω (b) 0.03 Ω

(c) 0.3 Ω (d) 0.9 Ω

**35.** A coil of resistance 10Ω and inductance 5 H is connected to a 100 V battery. Then the energy stored in the coil is

(a) 250 J (b) 250 erg

(c) 125 J (d) 125 erg

**36.** A nucleus $^{A}_{Z}X$ emits an $\alpha$ - particle. The resultant nucleus emits a $\beta^+$ – particle. The respective atomic and mass number of final nucleus will be

(a) Z–3, A–4 (b) Z–1, A–4

(c) Z–2, A–4 (d) Z, A–2

**37.** In Young's double slit experiment, the intensity of light at a point on the screen where the path difference is $\lambda = I$. The intensity of light at a point where the path difference becomes $\lambda/3$ is

(a) I / 4 (b) I / 3

(c) $\frac{I}{2}$ (d) I

**38.** Polarising angle for water is 53°4'. If light is incident at this angle on the surface of water and reflected the angle of refraction is

(a) 53°4' (b) 126°56'

(c) 36°56' (d) 30°4'

**39.** A 2V battery, a 15 $\Omega$ resistor and a potentiometer of 100 cm length, all are connected in series. If the resistance of potentiometer wire is 5 $\Omega$, then the potential gradient of the potentiometer wire is

(a) 0.005 V/cm (b) 0.05 V/cm

(c) 0.02 V/cm (d) 0.2 V/cm

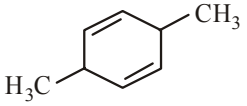
**40.** The output voltage of a transformer connected to 220 V line is 1100 V at 2 A current. Its efficiency is 100%. The current coming from the line is

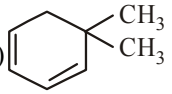
(a) 20A (b) 10A

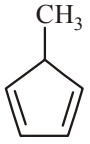
(c) 11A (d) 22A

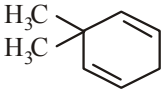
## PART - II (CHEMISTRY)

**41.** An alkene having molecular formula $C_8H_{12}$ on ozonolysis yields glyoxal and 2, 2-dimethyl butane-1, 4-dial. The structure of alkene is

(a) 

(b) 

(c) 

(d) 

**42.** Amongst $Ni(CO)_4$, $[Ni(CN)_4]^{2-}$ and $\left[NiCl_4^{2-}\right]$

(a) $Ni(CO)_4$ and $NiCl_4^{2-}$ are diamagnetic but $[Ni(CN)_4]^{2-}$ is paramagnetic

(b) $Ni(CO)_4$ and $[Ni(CN)_4]^{2-}$ are diamagnetic but $NiCl_4^{2-}$ is paramagnetic

(c) $NiCl_4^{2-}$ and $[Ni(CN)_4]^{2-}$ are diamagnetic but $Ni(CO)_4$ is paramagnetic

(d) $Ni(CO)_4$ is diamagnetic but $NiCl_4^{2-}$ and $[Ni(CN)_4]^{2-}$ is paramagnetic

**43.** The equivalent conductances of two ions at infinite dilution in water at 25ºC are given below

$\Lambda^{o}_{Ba^{2+}} = 127.00\ Scm^2/equiv.$

$\Lambda^{o}_{Cl^-} = 76.00\ Scm^2/equiv.$

The equivalent conductance (in S $cm^2$/equiv) of $BaCl_2$ at infinite dilution will be

(a) 203 (b) 279

(c) 205.5 (d) 139.5

**44.** The product formed when phthalimide is treated with a mixture of $Br_2$ and strong NaOH solution is

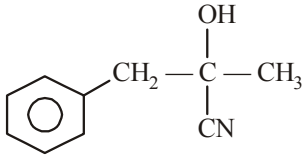
(a) aniline (b) phthalamide

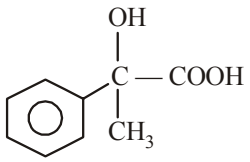
(c) phthalic acid (d) anthranilic acid

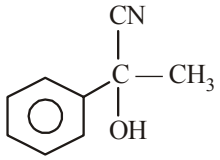
**45.** In a set of reactions acetic acid yielded a product D.

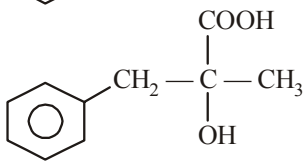
$$CH_3COOH \xrightarrow{SOCl_2} A \xrightarrow[\text{anhy. } AlCl_3]{\text{Benzene}} B \xrightarrow{HCN} C \xrightarrow{H_2O} D$$

The structure of D would be

(a) 

(b) 

(c) 

(d) 

**46.** The alcohol having molecular formula $C_4H_9OH$, when shaken with a mixture of anhydrous $ZnCl_2$ and conc. HCl gives an oily layer product after five minutes. The alcohol is

(a) $H_3C-(CH_2)_3-OH$

(b) $(CH_3)_2CH-CH_2OH$

(c) $(CH_3)_3C-OH$

(d) $H_3C-CH(OH)CH_2-CH_3$

**47.** *p*-toluidine and benzyl amine can be distinguished by

(a) Sandmeyer's reaction

(b) Dye test

(c) Molisch test

(d) Gattermann reaction

**48.** $CH_3CH_2Br$ undergoes Wurtz reaction. We may expect some of the following product

A : $CH_3CH_2CH_2CH_3$

B : $CH_2=CH_2$

C : $CH_3-CH_3$

Select correct product.

(a) Only A (b) A and B

(c) A, B and C (d) A and C

**49.** Sometimes explosion occurs while distilling ethers. It is due to the presence of

(a) peroxides (b) oxides

(c) ketones (d) aldehydes

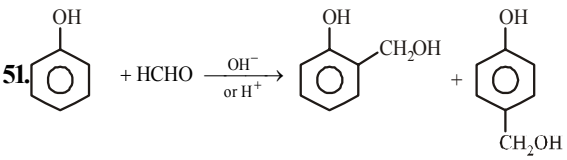
**50.** Glycerine is used as a preservative for fruits and eatables because

(a) it makes them sweet

(b) it acts as an insecticide

(c) it keeps the food moist

(d) all of the above

**51.** 

This reaction is called

(a) Reimer-Tiemann reaction

(b) Lederer-Manasse reaction

(c) Sandmeyer reaction

(d) Kolbe's reaction

**52.** $CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow{SeO_2} X + Se + H_2O : X$

(a) $CH_3-\overset{\overset{O}{\|}}{C}-\overset{\overset{O}{\|}}{C}-H$ (b) $CH_3-\overset{\overset{O}{\|}}{C}-OCH_3$

(c) $CH_3-\overset{\overset{O}{\|}}{C}-CH_2OH$ (d) None of the above

**53.** Which of the following will give Cannizzaro reaction?

(a) $CH_3CHO$ (b) $CH_3COCH_3$

(c) $(CH_3)_3C-CHO$ (d) $CH_3CH_2CHO$

**54.** The secondary structure of a protein refers to

(a) $\alpha$-helical backbone

(b) hydrophobic interactions

(c) sequence of $\alpha$-amino acids

(d) fixed configuration of the polypeptide backbone

**55.** Self condensation of two moles of ethyl acetate in the presence of sodiumethoxide after acidification yields

(a) acetic acid (b) acetoacetic ester

(c) ethyl propionate (d) ethyl butyrate

**56.** Which one of the following will be most basic?

(a) Aniline (b) *p*-methoxyaniline

(c) *p*-methyl aniline (d) Benzylamine

**57.** $Mn_2O_7$ dissolves in water to give an acid. The colour of the acid is

(a) green (b) blue

(c) purple (d) red

**58.** "925 fine silver" means an alloy of

(a) 7.5% Ag and 92.5% Cu

(b) 92.5% Ag and 7.5% Cu

(c) 80% Ag and 20% Cu

(d) 90% Ag and 10% Cu

**59.** In which of the following octahedral complexes of Co (At. no. 27), will the magnitude of $\Delta_0$ be the highest?
(a) $[Co(CN)_6]^{3-}$ (b) $[Co(C_2O_4)_3]^{3-}$
(c) $[Co(H_2O)_6]^{3+}$ (d) $[Co(NH_3)_6]^{3+}$

**60.** **Assertion (A)** $Cu^{2+}$ and $Cd^{2+}$ are separated by first adding KCN solution and then passing $H_2S$ gas.
**Reason (R)** KCN reduces $Cu^{2+}$ to $Cu^{+}$ and forms a complex with it.
The correct answer is
(a) Both (A) and (R) are true and (R) is the correct explanation of (A)
(c) Both (A) and (R) are true but (R) is not the correct explanation of (A)
(c) (A) is true but (R) is not true
(d) (A) is not true but (R) is true

**61.** The effective atomic number of cobalt in the complex $[Co(NH_3)_6]^{3+}$ is
(a) 36 (b) 24
(c) 33 (d) 30

**62.** The IUPAC name for the complex $[Co(NO_2)(NH_3)_5]Cl_2$ is
(a) nitrito-N-pentammine cobalt (III) chloride
(b) nitrito-N-pentammine cobalt (II) chloride
(c) pentaminenitrito-N-cobalt (II) chloride
(d) pentaminenitrito-N-cobalt (III) chloride

**63.** The radio-isotope used for treatment of thyroid disorders is
(a) Na-24 (b) P-32
(c) Co-60 (d) I-131

**64.** Tetragonal crystal system has the following unit cell dimensions
(a) $a = b = c, \alpha = \beta = \gamma = 90^\circ$
(b) $a = b \neq c, \alpha = \beta = \gamma = 90^\circ$
(c) $a \neq b \neq c, \alpha = \beta = \gamma = 120^\circ$
(d) $a = b \neq c, \alpha = \beta = 90^\circ, \gamma = 120^\circ$

**65.** A crystalline solid
(a) changes rapidly from solid to liquid
(b) has no definite melting point
(c) undergoes deformation of its geometry easily
(d) soften easily

**66.** Two glass bulbs A and B are connected by a very small tube having a stop-cock. Bulb A has a volume of 100 $cm^3$ and contained the gas while bulb B was empty. On opening stop-clock, the pressure fell down to 40%. The volume of the bulb B must be
(a) 75 $cm^3$ (b) 125 $cm^3$
(c) 150 $cm^3$ (d) 250 $cm^3$

**67.** 20 mL of 0.2 M NaOH is added to 50 mL of 0.2 M acetic acid. The pH of this solution after mixing is $(K_a = 1.8 \times 10^{-5})$
(a) 4.5 (b) 2.3
(c) 3.8 (d) 4

**68.** Consider the following equation, which represents a reaction in the extraction of chromium from its ore

$$2Fe_2O_3 \cdot Cr_2O_3 + 4Na_2CO_3 + 3O_2 \longrightarrow 2Fe_2O_3 + 4Na_2CrO_4 + 4CO_2$$

Which one of the following statements about the oxidation states of the substances is correct?
(a) The iron has been reduced from +3 to +2 state.
(b) The chromium has been oxidised from +3 to +6 state.
(c) The carbon has been oxidised from +2 to +4 state.
(d) There is no change in the oxidation state of the substances in the reaction.

**69.** The freezing point of a solution composed of 10.0 g of KCl in 100 g of water is 4.5°C. Calculate the van't Hoff factor, i for this solution.
(a) 2.50 (b) 1.8
(c) 1.2 (d) 1.3

**70.** In the reversible reaction,

$$2NO_2 \underset{k_2}{\overset{k_1}{\rightleftharpoons}} N_2O_4$$

the rate of disappearance of $NO_2$ is equal to
(a) $\frac{2k_1}{k_2}[NO_2]^2$
(b) $2k_1[NO_2]^2 - 2k_2[N_2O_4]$
(c) $2k_1[NO_2]^2 - k_2[N_2O_4]$
(d) $(2k_1 - k_2)[NO_2]$

**71.** A chemical reaction was carried out at 300 K and 280 K. The rate constants were found to be $k_1$ and $k_2$ respectively. Then
(a) $k_2 = 4k_1$ (b) $k_2 = 2k_1$
(c) $k_2 = 0.25\, k_1$ (d) $k_2 = 0.5\, k_1$

**72.** The rate constant of a reaction at temperature 200 K is 10 times less than the rate constant at 400 K. What is the activation energy of the reaction?
(a) 1842.4 R (b) 460.6 R
(c) 230.3 R (d) 921.2 R

**73.** A vessel at 1000 K contains $CO_2$ with a pressure of 0.5 atm. Some of the $CO_2$ is converted into CO on the addition of graphite. The value of K if the total pressure at equilibrium is 0.8 atm, is

(a) 1.8 atm (b) 3 atm
(c) 0.3 atm (d) 0.18 atm

**74.** For the reaction $2A + B \rightleftharpoons C$, $\Delta H = x$ cal, which one of the following conditions-would favour the yield of C on the basis of Le-Chatelier principle?
(a) High pressure, high temperature
(b) Only low temperature
(c) High pressure, low temperature
(d) Only low pressure

**75.** The EMF of the cell,
$Mg|Mg^{2+}(0.0IM) \parallel Sn^{2+}(0.1\ M)|Sn$ at 298K is

$\left(E^{o}_{Mg^{2+}/Mg} = -2.34V, E^{o}_{Sn^{2+}/Sn} = -0.14V\right)$

(a) 2.17V (b) 2.23V
(c) 2.51V (d) 2.45V

**76.** Heat of formation, $\Delta H^{o}_{f}$ of an explosive compound like $NCl_3$ is
(a) positive (b) negative
(c) zero
(d) positive or negative

**77.** For the reaction,

$$C_3H_8(g) + 5O_2(g) \longrightarrow 3CO_2(g) + 4H_2O(l)$$

at constant temperature, $\Delta H - \Delta E$ is
(a) RT (b) $-3RT$
(c) 3RT (d) $-RT$

**78.** The favourable conditions for a spontaneous reaction are
(a) $T\Delta S > \Delta H$, $\Delta H = +$ ve, $\Delta S = +$ve
(b) $T\Delta S > \Delta H$, $\Delta H = +$ ve, $\Delta S = -$ve
(c) $T\Delta S = \Delta H$, $\Delta H = -$ve, $\Delta S = -$ve
(d) $T\Delta H = \Delta H$, $\Delta H = +$ ve, $\Delta S = +$ve

**79.** Compound A and B are treated with dil. HCl separately. The gases liberated are Y and Z respectively. Y turns acidified dichromate paper green while Z turns lead acetate paper black. The compound A and B are respectively.
(a) $Na_2CO_3$ and NaCl
(b) $Na_2SO_3$ and $Na_2S$
(c) $Na_2S$ and $Na_2SO_3$
(d) $Na_2SO_3$ and $Na_2SO_4$

**80.** Which of the following is correct comparison of the stability of the molecules?
(a) $CN < O_2^+$ (b) $CN = N_2$
(c) $N_2 < O_2$ (d) $H_2^+ > He_2^+$

## PART - III (MATHEMATICS)

**81.** To the lines $ax^2 + 2hxy + by^2 = 0$, the line $a^2x^2 + 2h(a+b)xy + b^2y^2 = 0$ are
(a) equally inclined
(b) perpendicular
(c) bisector of the angle
(d) None of the above

**82.** If R be a relation from $A=\{1, 2, 3, 4\}$ to $B=\{1, 3, 5\}$ such that $(a, b) \in R \Leftrightarrow a < b$, then $ROR^{-1}$ is
(a) $\{(1,3), (1, 5), (2, 3), (2, 5), (3, 5), (4, 5)\}$
(b) $\{(3, 1), (5, 1), (3, 2), (5, 2), (5, 3), (5, 4)\}$
(c) $\{(3, 3), (3, 5), (5, 3), (5, 5)$
(d) $\{(3, 3), (3, 4), (4, 5)\}$

**83.** If $x + iy = (1 - i\sqrt{3})^{100}$, then find $(x, y)$.
(a) $\left(2^{99}, 2^{99}\sqrt{3}\right)$ (b) $\left(2^{99}, -2^{99}\sqrt{3}\right)$
(c) $\left(-2^{99}, 2^{99}\sqrt{3}\right)$ (d) None of these

**84.** For a GP, $a_n = 3\left(2^n\right)$, $\forall\ n \in N$. Find the common ratio.
(a) 2 (b) 1/2
(c) 3 (d) 1/3

**85.** If $a, b, c$ are in HP, then $\frac{a}{b+c}, \frac{b}{c+a}, \frac{c}{a+b}$ will be in
(a) AP (b) GP
(c) HP (d) None of these

**86.** If $\frac{x^2 + 2x + 7}{2x + 3} < 6, x \in R$, then
(a) $x > 11$ or $x < -\frac{3}{2}$
(b) $x > 11$ or $x < -1$
(c) $-\frac{3}{2} < x < -1$
(d) $-1 < x < 11$ or $x < -\frac{3}{2}$

**87.** The number of ways of painting the faces of a cube of six different colours is
(a) 1 (b) 6
(c) 6! (d) 36

**88.** A line passes through (2, 2) and is perpendicular to the line 3x+y=3. What is its y-intercept?
(a) 1/3 (b) 2/3
(c) 1 (d) 4/3

**89.** The number of common tangents to the circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 6x - 8y = 24$ is
(a) 0 (b) 1
(c) 3 (d) 4

**90.** If D is the set of all real x such that $1 - e^{(1/x)-1}$ is positive, then D is equal to
(a) $(-\infty, 1]$ (b) $(-\infty, 0)$
(c) $(1, \infty)$ (d) $(-\infty, 0) \cup (1, \infty)$

**91.** Find the value of the limit $\lim_{x \to 0} \frac{\sqrt{1-\cos x}}{x}$
(a) 0 (b) 1
(c) $\sqrt{2}$ (d) does not exist

**92.** Evaluate $\int \frac{x^2+4}{x^4+16}$ dx.
(a) $\frac{1}{2\sqrt{2}} \tan^{-1}\left(\frac{x^2-4}{2x\sqrt{2}}\right) + c$
(b) $\frac{1}{2\sqrt{2}} \tan^{-1}\left(\frac{x^2-4}{2\sqrt{2}}\right) + c$
(c) $\frac{1}{2\sqrt{2}} \tan^{-1}\left(\frac{x^2-4}{x\sqrt{2}}\right) + c$
(d) None of the above

**93.** Evaluate $\int_{\pi/4}^{3\pi/4} \frac{1}{1+\cos x} dx$
(a) 2 (b) –2
(c) 1/2 (d) –1/2

**94.** If one AM 'A' and two GM p and q are inserted between two given numbers, then find the value of $\frac{p^2}{q} + \frac{q^2}{p}$
(a) A (b) 2A
(c) 3A (d) 4A

**95.** If the roots of the equation $x^2 + ax + b = 0$ are c and d, then one of the roots of the equation $x^2 + (2c + a)x + c^2 + ac + b = 0$ is
(a) $c$ (b) $d - c$
(c) $2d$ (d) $2c$

**96.** The sum of the coefficients of $(6a-5b)^n$, where $n$ is a positive integer, is
(a) 1 (b) –1
(c) $2^n$ (d) $2^{n-1}$

**97.** Find the value of $(7.995)^{1/3}$ correct to four decimal places.
(a) 1.9995 (b) 1.9996
(c) 1.9990 (d) 1.9991

**98.** The values of constants a and b, so that $\lim_{x \to \infty} \left(\frac{x^2+1}{x+1} - ax - b\right) = 0$ are
(a) $a = 0, b = 0$ (b) $a = 1, b = -1$
(c) $a = -1, b = 1$ (d) $a = 2, b = -1$

**99.** The projection of the vector $\boldsymbol{i} - 2\boldsymbol{j} + \boldsymbol{k}$ on the vector $4\boldsymbol{i} - 4\boldsymbol{j} + 7\boldsymbol{k}$ is
(a) $\frac{5\sqrt{6}}{10}$ (b) $\frac{19}{9}$
(c) $\frac{9}{19}$ (d) $\frac{\sqrt{6}}{19}$

**100.** If $\boldsymbol{a}, \boldsymbol{b}, \boldsymbol{c}$ are three non-zero vectors such that $\boldsymbol{a} + \boldsymbol{b} + \boldsymbol{c} = 0$ and $m = \boldsymbol{a}.\boldsymbol{b} + \boldsymbol{b}.\boldsymbol{c} + \boldsymbol{c}.\boldsymbol{a}$, then
(a) $m < 0$ (b) $m > 0$
(c) $m = 0$ (d) $m = 3$

**101.** A line making angles $45°$ and $60°$ with the positive directions of the axes of $x$ and $y$ makes with the positive direction of $z$-axis, an angle of
(a) $60°$ (b) $120°$
(c) $60°$ or $120°$ (d) None of these

**102.** If $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, $J = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then B is equal to
(a) $I\cos\theta + J\sin\theta$ (b) $I\sin\theta + J\cos\theta$
(c) $I\cos\theta - J\sin\theta$ (d) $-I\cos\theta + J\sin\theta$

**103.** Which of the following is correct?
(a) Determinant is a square matrix
(b) Determinant is a number associated to a matrix
(c) Determinant is a number associated to a square matrix
(d) All of the above

**104.** If $\alpha, \beta$ and $\gamma$ are the roots of $x^3 + ax^2 + b = 0$, then the value of $\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$ is

(a) $-a^3$ (b) $a^3 - 3b$
(c) $a^3$ (d) $a^2 - 3b$

**105.** If the axes are shifted to the point $(1, -2)$ without solution, then the equation $2x^2 + y^2 - 4x + 4y = 0$ becomes

(a) $2X^2 + 3Y^2 = 6$ (b) $2X^2 + Y^2 = 6$
(c) $X^2 + 2Y^2 = 6$ (d) None of these

**106.** If $f(x) = \begin{cases} x^2, & x \le 0 \\ 2\sin x, & x > 0 \end{cases}$, then $x = 0$ is

(a) point of minima
(b) point of maxima
(c) point of discontinuity
(d) None of the above

**107.** In a group $(G, *)$, then equation $x * a = b$ has a

(a) unique solution $b * a^{-1}$
(b) unique solution $a^{-1} * b$
(c) unique solution $a^{-1} * b^{-1}$
(d) many solutions

**108.** A die is rolled twice and the sum of the numbers appearing on them is observed to be 7. What is the conditional probability that the number 2 has appeared at least once?

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{2}{5}$

**109.** The locus of the mid-points of the focal chord of the parabola $y^2 = 4ax$ is

(a) $y^2 = a(x - a)$ (b) $y^2 = 2a(x - a)$
(c) $y^2 = 4a(x - a)$ (d) None of these

**110.** Find the value of $\sin 12° \sin 48° \sin 54°$.

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$
(c) $\frac{1}{6}$ (d) $\frac{1}{8}$

**111.** In an equilateral triangle, the inradius, circumradius and one of the exradii are in the ratio

(a) 2 : 3 : 5 (b) 1 : 2 : 3
(c) 1 : 3 : 7 (d) 3 : 7 : 9

**112.** Let $p$ and $q$ be two statements. Then, $p \vee q$ is false, if

(a) $p$ is false and $q$ is true
(b) both $p$ and $q$ are false
(c) both $p$ and $q$ are true
(d) None of the above

**113.** In how many ways 6 letters be posted in 5 different letter boxes?

(a) $5^6$ (b) $6^5$
(c) 5! (d) 6!

**114.** If A and B be two sets such that A×B consists of 6 elements. If three elements A × B are (1, 4), (2, 6) and (3, 6), find B×A.

(a) {(1, 4), (1, 6), (2, 4), (2, 6),(3, 4), (3, 6)}
(b) {(4, 1), (4, 2), (4, 3), (6, 1),(6, 2), (6, 3)}
(c) {(4, 4), (6, 6)}
(d) {(4, 1), (6, 2), (6, 3)}

**115.** Let $f: R \to R$ be defined as $f(x) = x^2 + 1$, find $f^{-1}(-5)$.

(a) $\{\phi\}$ (b) $\phi$
(c) {5} (d) {–5, 5}

**116.** If $X$ is a poisson variate such that $P(X = 1) = P(X = 2)$, then $P(X = 4)$ is equal to

(a) $\frac{1}{2e^2}$ (b) $\frac{1}{3e^2}$
(c) $\frac{2}{3e^2}$ (d) $\frac{1}{e^2}$

**117.** The area enclosed by $y = 3x - 5$, $y = 0$, $x = 3$ and $x = 5$ is

(a) 12 sq units (b) 13 sq units
(c) $13\frac{1}{2}$ sq units (d) 14 sq units

**118.** The order and degree of the differential equation $\left(1 + 4\frac{dy}{dx}\right)^{2/3} = 4\frac{d^2y}{dx^2}$ are respectively

(a) $1, \frac{2}{3}$ (b) $3, 2$
(c) $2, 3$ (d) $2, \frac{2}{3}$

**119.** The solution of the differential equation $\frac{dy}{dx} = (4x + y + 1)^2$, is

(a) $(4x + y + 1) = \tan(2x + C)$
(b) $(4x + y + 1)^2 = 2\tan(2x + C)$
(c) $(4x + y + 1)^3 = 3\tan(2x + C)$
(d) $(4x + y + 1) = 2\tan(2x + C)$

**120.** The system of equations $2x + y - 5 = 0$, $x - 2y + 1 = 9$, $2x - 14y - a = 0$, is consistent. Then, $a$ is equal to

(a) 1 (b) 2
(c) 5 (d) None of these