

MODEL TEST PAPER XI
CHEMISTRY

Q.1

An aqueous solution of glucose is 10% in strength. The volume in which 1 g mole of it is dissolved will be

- (a) 18 lit
- (b) 9 lit
- (c) 0.9 lit
- (d) 1.8 lit

Q.2

Which of the following involve sp^3d hybridisation ?

- (a) I_3^-
- (b) IBr_2^-
- (c) I_5^-
- (d) ICl_4^-

Q.3

Phospholipids are esters of glycerol with

- (a) Three carboxylic acid residues
- (b) Two carboxylic acid residues and one phosphate group
- (c) One carboxylic acid residues and two phosphate groups
- (d) Three phosphate groups

Q.4

Which of the following molecules will not have a dipole moment ?

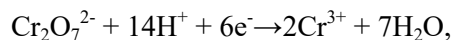
- (a) CH_3Cl
- (b) CH_3OCH_3
- (c) CH_2Cl_2
- (d) CCl_4

Q.5

The pair of radiation with lowest frequency, lowest wavelength respectively is represented by

- (a) X-rays, microwaves
- (b) X-rays, visible radiation
- (c) γ -rays, microwaves
- (d) Microwaves, γ -rays

If the formula mass of $\text{Cr}_2\text{O}_7^{2-}$ ion is M , then in the reaction



The equivalent mass of $\text{Cr}_2\text{O}_7^{2-}$ is

- (a) M
- (b) $\frac{M}{2}$
- (c) $\frac{M}{6}$
- (d) $\frac{M}{14}$

Q.7

The formula of potassium dicyanobis(oxalate) nickelate (II) is

- (a) $\text{K}_4[\text{Ni}(\text{CN})(\text{Ox})_2]$
- (b) $\text{K}_3[\text{Ni}_2(\text{CN})_2(\text{Ox})_2]$
- (c) $\text{K}_4[\text{Ni}(\text{CN})_2(\text{Ox})_2]$
- (d) $\text{K}_2[\text{Ni}(\text{CN})_2(\text{Ox})_2]$

Q.8

The solubility product of BaCrO_4 is 2.4×10^{-10} .

The maximum concentration of $\text{Ba}(\text{NO}_3)_2$ possible without precipitation in a 6×10^{-10} M K_2CrO_4 solution is

- (a) 4×10^{-7} M
- (b) 1.2×10^{-10} M
- (c) 6×10^{-4} M
- (d) 3×10^{-4} M

Q.9

How many electrons are delivered at the cathode during electrolysis by a current of 1 amp. In 60 seconds?

- (a) 6.0×10^{23}
- (b) 6.0×10^{20}
- (c) 3.74×10^{20}
- (d) 7.48×10^{21}

In the extraction of Cu, the reaction

$\text{Cu}_2\text{O} + \text{FeS} \rightarrow \text{FeO} + \text{Cu}_2\text{S}$ takes place during the

- (a) Concentration
- (b) Smelting
- (c) Roasting
- (d) Bassemmerisation

Q.11

A buffer solution contains 0.1 M of acetic acid and 0.1 M of sodium acetate. What will be its pH ?

(pK_a of acetic acid is 4.75)

- (a) 4.00
- (b) 4.75
- (c) 5.00
- (d) 5.25

Q.12

Which of the following gases react with oxygen to form a brown coloured gas?

- (a) CO
- (b) N_2
- (c) NO
- (d) Br_2

Q.13

Which of the following compounds will be formed when addition of HBr takes place with acetylene?

- (a) Ethylidene bromide
- (b) Ethylene bromide
- (c) Ethyl bromide
- (d) Vinyl bromide

Q.14

Which of the following species has the same number of electrons in the outermost and penultimate shells?

- (a) Fluoride ion
- (b) Sodium ion
- (c) Magnesium ion
- (d) Chloride ion

Electrolysis of the sodium salt of which of the following acids will give ethylene ?

- (a) Acetic acid
- (b) Succinic acid
- (c) Formic acid
- (d) Fumaric acid

Q.16

Which of the following statements is not correct regarding lanthanides and actinides ?

- (a) Oxidation state of + 3 is predominant in both the series
- (b) In both the series, *f*-orbitals are being progressively filled.
- (c) All the elements of both the series are radioactive.
- (d) Both the series show contraction as lanthanide contraction and actinide contraction

Q.17

Natural gas

- (a) Is a mixture of gaseous paraffins
- (b) Is a mixture of unsaturated compounds
- (c) Is manufactured by the cracking of a fuel oil
- (d) Is a mixture of aromatic compounds

Q.18

Action of heat on mixture of anhydrous sodium propanoate and soda lime produces

- (a) Butane
- (b) Ethane
- (c) Methane
- (d) Propane

Q.19

Which is the strongest carboxylic acid among the following ?

- (a) $\text{C}_1_3\text{C.COOH}$
- (b) $\text{Br}_3\text{C.COOH}$
- (a) $\text{F}_3\text{C.COOH}$
- (b) $\text{C}_1_2\text{CH.COOH}$

Which of the following compounds will have most hindered rotation about C – C bond?

- (a) 1,1,2,2-tetrabromo ethylene
- (b) Hexabromoethane
- (c) Hexachloroethane
- (d) Ethane

Q.21

The olefin which on ozonolysis gives $\text{CH}_3\text{CH}_2\text{CHO}$ and CH_3CHO is

- (a) 1- butane
- (b) 2- butane
- (c) 1- pentene
- (d) 2-pentene

Q.22

To prepare a pure sample of *n*-hexane using sodium metal as one reactant, the other reactant will be

- (a) Ethyl chloride and *n*-butyl chloride
- (b) Methyl bromide and *n*-pentyl bromide
- (c) *n*-propyl bromide
- (d) ethyl bromide and *n*-butyl bromide

Q.23

Fog is a colloidal system of

- (a) Gas in liquid
- (b) Liquid in gas
- (a) (c) Gas in gas
- (c) Gas in solid

Q.24

A flask containing air (open to atmosphere) is heated from 300 K to 500 K. The percentage of air escaped to the atmosphere is

- (a) 66.6%
- (b) 16.6%
- (c) 33.3%
- (d) 40%

Q.25

3 g of a hydrocarbon on combustion in excess of oxygen produce 8.8 g of CO_2 and 5.4 g of H_2O . the data illustrate the law of

- (a) Conservation of mass
- (b) Multiple proportions
- (c) Constant proportions
- (d) Reciprocal proportions

Q.26

Which of the following statements is not true about noble gases ?

- (a) Their ionization energies are very high
- (b) Their electron affinities are nearly zero
- (c) They don't form any chemical compounds
- (d) They are not easily liquefied

Q.27

Which of the following is an example of a covalent solid?

- (a) CaF_2
- (b) H_2O
- (c) Cl_2
- (d) SiC

Q.28

Electrolysis of an aqueous solution of sodium salt of mono-carboxylic acid gives an

- (a) Alkane
- (b) Alkyne
- (c) Ether
- (d) Alkene

Q.29

Which one of the following theory can best explain the paramagnetic behaviour of oxygen ?

- (a) VSEPR
- (b) Valence bond theory
- (c) Both VSEPR theory and
- (d) Molecular orbital theory

What of the following compounds is expected to be colored ?

- (a) Ag_2SO_4
- (b) MgF_2
- (c) CuF_2
- (d) CuCl

PHYSICS

Q.1

The time period T of small drop of liquid due to surface tension depends upon density ρ , radius r and surface tension S . The relation is

- (a) $T \propto \rho r^3/S$
- (b) $T \propto (\rho S/r^3)^{1/2}$
- (c) $T \propto (Sr^3/\rho)^{1/2}$
- (d) $T \propto (\rho r^3/S)^{1/2}$

Q.2

A ball is thrown from the ground to clear a wall 3 m high at a distance of 6m and fall 18 m away from the wall. The angle of projection of ball is

- (a) $\tan^{-1}3/2$
- (b) $\tan^{-1}2/3$
- (c) $\tan^{-1}1/2$
- (d) $\tan^{-1}3/4$

Q.3

A machine gun fires a bullet of mass 40 g with a velocity of 1200 m/s. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can be fired per second at the most

- (a) 1
- (b) 4
- (c) 2
- (d) 3

A spring of force constant k is cut into two pieces such that one piece is double the length of the other. The long piece will be proportional to

- (a) $2k/3$
- (b) $3k/2$
- (c) $3k$
- (d) $6k$

Q.5

A man is standing at the centre of a rotating turn table with his arms stretched. If he draws his arms inwards and thereby reduces his moment of inertia by a factor of k , the angular speed of turn table will

- (a) Remain constant
- (b) Increases by a factor of k
- (c) Decreases by a factor of k
- (d) Decreases of a factor of k^2

Q.6

Work done to bring four particles each having a mass of 0.1 kg from infinity to the vertices of square of side 0.2 m is

- (a) 1.8×10^{-11} J
- (b) 8.1×10^{-11} J
- (c) -1.8×10^{-11} J
- (d) -8.1×10^{-11} J

Q.7

The maximum average velocity of water in a tube of diameter 2 cm so that flow becomes laminar is (given the viscosity of water = 10^{-3} Nm⁻²s⁻¹)

- (a) 1 m/s
- (b) 0.1 m/s
- (c) 10 m/s
- (d) 100 m/s

Q.8

A gas mixture consists of two moles of oxygen and four moles of argon at temperature T . Neglecting all vibrational modes, the total internal energy of the system is

- (a) $4 RT$
- (b) $15 RT$
- (c) $9 RT$
- (d) $11 RT$

Q.9

A closed compartment containing gas is moving with some acceleration in horizontal direction. Neglecting the effect of gravity, the pressure in the compartment is

- (a) Same everywhere
- (b) Lower in the front side
- (c) Lower in the rear side
- (d) Lower in the upper side

Following questions consists of two statements printed as Statement 1 and Statement 2. While answering these questions you are required to select any one of the responses indicated as

- (a) If both Statement 1 and Statement 2 are true and Statement 2 is a correct explanation of Statement 1.
- (b) If both Statement 1 and Statement 2 are true but the Statement 2 is not a correct explanation of Statement 1.
- (c) If statement 1 is true but the Statement 2 is false.
- (d) If Statement 1 is false but Statement 2 is true.

Q.10

Statement 1: Damped vibrations are due to air resistance or frictional forces

- (a) 1
- (b) 2
- (c) 3
- (d) 4

Q.11

A tube of diameter d and of length l unit is open at both ends. Its fundamental frequency of resonance is found to be n_1 . The velocity of sound in air is 330m/s . The lowest frequency of resonance of tube is n_2 , if one end of the tube is closed. Considering the end correction, the value of n_1/n_2 is

- (a) $\frac{(l+0.6d)}{(l+0.3d)}$
- (b) $\frac{(l+0.3d)}{2(l+0.6d)}$
- (c) $\frac{(l+0.6d)}{2(l+0.3d)}$
- (d) $\frac{(d+0.3l)}{2(d+0.6l)}$

Q.12

The kinetic energy gained by an alpha particle is going from a point at 70V to another point at 50V is

- (a) 40 eV
- (b) 40 KeV
- (c) 40 meV
- (d) 0 eV

Three resistors of $4\ \Omega$, $6\ \Omega$ and $10\ \Omega$ are connected in series with battery of $15\ \text{V}$. When a current of $0.6\ \text{A}$ passes through $6\ \Omega$ resistor, the internal resistance of the battery is

- (a) $3.82\ \Omega$
- (b) $2.35\ \Omega$
- (c) $5.29\ \Omega$
- (d) $5\ \Omega$

Q.14

A solenoid of length $0.4\ \text{m}$ and 500 turns of wire carries of current of $0.3\ \text{A}$. A thin coil having 10 turns of wire and of radius $0.01\ \text{m}$ carries a current of $0.4\ \text{A}$. The torque required to hold the coil in the middle of solenoid with its axis perpendicular to the axis of the solenoid will be

- (a) $6 \times 10^6\ \text{N}$
- (b) $5.94 \times 10^{-6}\ \text{N}$
- (c) $9.54 \times 10^6\ \text{Nm}$
- (d) $5.9 \times 10^{-8}\ \text{Nm}$

Q.15

A proton moving with a constant velocity passes through region of space without any change in its velocity. If E and B represent the electric and magnetic fields respectively, this region of space may have

- (a) $E = 0, B = 0$
- (b) $E = 0, B \neq 0$
- (c) $E \neq 0, B = 0$
- (d) $E \neq 0, B \neq 0$

Q.16

In a transformer with efficiency of 100% , the input power is $60\ \text{watt}$. The number of secondary coils is 300 . The output power will be

- (a) 60
- (b) 120
- (c) 180
- (d) 240

Q.17

In a circular conducting coil, when current increases from $2\ \text{A}$ to $18\ \text{A}$ in 0.5 seconds, the induced emf is $20\ \text{V}$. The self inductance of the coil will be

- (a) $62.5\ \text{mH}$
- (b) $6.25\ \text{mH}$
- (c) $50\ \text{mH}$
- (d) $5\ \text{mH}$

In a plane electromagnetic wave electric field oscillates sinusoidally with frequency 2×10^{10} Hz and amplitude 48 V/m, the wavelength of the waves will be

- (a) 2.2×10^{-4} m
- (b) 1.5×10^{-2} m
- (c) 5.1×10^{-3} m
- (d) 5.1×10^{-2} m

Q.19

White light is used to illuminate the two slits in a Young's double slit experiment. The separation between the slits is b and the screen is at a distance $d \gg b$ from the slits. At a point on the screen directly in front of one of the slits, certain wavelengths are missing. Some of these are

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

Q.20

The refractive index of water is $4/3$ and that of glass is $5/3$. The critical angle of ray entering water from glass is

- (a) $\sin^{-1}(4/5)$
- (b) $\sin^{-1}(5/4)$
- (c) $\sin^{-1}(1/2)$
- (d) $\sin^{-1}(2/1)$

Q.21

A terrestrial telescope is made by introducing an erecting lens of focal length f between the objective and the eyepiece lenses of an astronomical telescope. This causes the length of the telescope tube to increase by an amount equal to

- (a) f
- (b) $2f$
- (c) $3f$
- (d) $4f$

The X-ray beam coming from the X ray tube will be

- (a) Monochromatic
- (b) Having all wavelengths smaller than a certain maximum
- (c) Having all wavelengths larger than a certain minimum wavelength
- (d) Having all wavelengths lying between a minimum and maximum wavelength

Q.23

Magnetic moment due to orbital motion of an electron in an atom when orbital angular momentum is equal to one quantum unit is

- (a) $2.9 \times 10^{-2} \text{ A m}^2$
- (b) $9.2 \times 10^{-20} \text{ A m}^2$
- (c) $9.2 \times 10^{-24} \text{ A m}^2$
- (d) $2.9 \times 10^{-26} \text{ A m}^2$

Q.24

Consider alpha particle, beta particle and gamma rays, each having energy 0.5 MeV. The penetrating power of the radiations in increasing order will be

- (a) α, β, γ
- (b) α, γ, β
- (c) β, γ, α
- (d) γ, β, α

Q.25

The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than 2480 nm is incident on it. The band gap for semiconductor in eV is

- (a) 0.9
- (b) 0.7
- (c) 0.5
- (d) 1.1

Read the following paragraph

In an npn transistor 10^{10} electrons enter the emitter in 10^{-6} s. 2% of electrons are lost in the base. Now answer the following questions

Power gain is

- (a) 9.63
- (b) 6.93
- (c) 3.96
- (d) 3.69

Q.27

Emitter current is

- (a) 1.6 mA
- (b) 6.1 mA
- (c) 3 mA
- (d) 4.2 mA

Q.28

In the formula $X = 3YZ^2$, X and Z have dimension of capacitance and magnetic inductions respectively. What are the dimension of Y in MKSQ system ?

- (a) $[M^{-3}L^{-1}T^3Q^4]$
- (b) $[M^{-3}L^{-2}T^4Q^4]$
- (c) $[M^{-2}L^{-2}T^4Q^4]$
- (d) $[M^{-3}L^{-2}T^3Q]$

Q.29

A river is flowing from west to east at a speed of 5m/min. A man on the south bank of the river, capable of swimming at 10m/min in still water, wants to swim across the river in the shortest time. He should swim in a direction

- (a) Due north
- (b) 30° east of north
- (c) 30° west of north
- (d) 60° east of north

Q.30

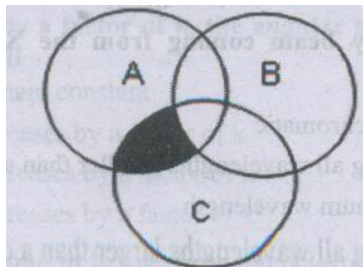
A particle of mass m is projected with a velocity v making an angle of 45° with the horizontal. The magnitude of the angular momentum of the projection about the point of projection when the particle is at its maximum height h is

- (a) Zero
- (b) $mv^3/(4\sqrt{2}g)$
- (c) $mv^3(\sqrt{2}g)$
- (d) $m(2gh^3)^{1/2}$

MATHEMATICS

Q.1

The shaded area in this diagram represents



- (a) $A \cap C$
- (b) $(A \cap B) - C$
- (c) $(A \cap C) - (A \cap B)$
- (d) $(A \cap C) - B$

Q.2

The range of the function $f(x) = X - [x]$ is

- (a) $[0, 1]$
- (b) $[0, 2]$
- (c) $[0, 1]$
- (d) None of these

Q.3

Domain of $(2,3), (4,5), (6,7)$ is

- (a) $(3, 4, 7)$
- (b) $(2, 4, 6)$
- (c) $(2, 5, 7)$
- (d) None of these

Q.4

If α and β are the roots of $ax^2 + bx + c$, the equation whose roots are $\frac{1}{a\alpha+b}, \frac{1}{a\beta+b}$ is

- (a) $acx^2 + bx + 1 = 0$
- (b) $acx^2 - bx + 1 = 0$
- (c) $acx^2 + bx - 1 = 0$
- (d) $acx^2 - bx - 1 = 0$

Q.5

If $a > 0$ and $x = \sqrt{a + \sqrt{a + \sqrt{a + \sqrt{a + \dots}}}}$, the value of x is

- (a) $\frac{\sqrt{4a}-1}{4}$
- (b) $\frac{1+\sqrt{4a}+1}{4}$
- (c) $1 + \frac{\sqrt{4a}-1}{4}$
- (d) $\frac{1+\sqrt{4a}+1}{2}$

The values of θ lying between 0 and $(\pi/2)$ and satisfying the equation

$$\begin{vmatrix} 1 + \sin^2 \theta & \cos^2 \theta & 4\sin 4\theta \\ \sin^2 \theta & 1 + \cos^2 \theta & 4\sin 4\theta \\ \sin^2 \theta & \cos^2 \theta & 1 + 4\sin 4\theta \end{vmatrix} = 0$$
 are

- (a) $\frac{\pi}{4}, \frac{3\pi}{4}$
- (b) $\frac{5\pi}{4}, \frac{7\pi}{4}$
- (c) $\frac{7\pi}{24}, \frac{11\pi}{24}$
- (d) $\frac{5\pi}{24}, \frac{11\pi}{24}$

Q.7

If the system of equation $x - Ky - z = 0, Kx - y - z = 0, x + y - z = 0$ has a non-zero solution, then the possible values of K are

- (a) -1, 2
- (b) 1, 2
- (c) 0, 1
- (d) 1, 1

Q.8

In how many ways 3 girls and 9 boys can be seated in two vans, each having numbered seats, 3 in the front and 4 at the back, if 3 girls sit together in a back row on adjacent seats ?

- (a) ${}^{11}C_9 \times 4! \times 3!$
- (b) ${}^{11}P_9 \times 4!$
- (c) ${}^{11}P_9 \times 3!$
- (d) None of these

Q.9

The number of ways in which 5 beads of different colours form a necklace is

- (a) 12
- (b) 24
- (c) 120
- (d) 60

$$\left(\frac{a}{a+x}\right)^{\frac{1}{2}} + \left(\frac{a}{a-x}\right)^{\frac{1}{2}} =$$

- (a) $2 + \frac{3x^2}{4a^2} + \dots$
- (b) $2 + \frac{5x^2}{4a^2} + \dots$
- (c) $1 + \frac{3x^2}{4a^2} + \dots$
- (d) None of these

Q.11

If the sum of the coefficients in the expansion of $(1 - 3x + 10x^2)^n$ is a sum of the coefficients in

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

Q.12

The n^{th} term of the two series $3 + 10 + 17 + \dots$ and $60 + 65 + 67 + \dots$ are equal. Then the value of n is

- (a) 9
- (b) 13
- (c) 19
- (d) None of these

Q.13

If a, b, c , are in A. P, and $(b-a), (c-b), a$ are in G.P, then $a : b : c$ is

- (a) $1 : 2 : 3$
- (b) $3 : 2 : 1$
- (c) $2 : 3 : 4$
- (d) None of these

Q.14

$\lim_{x \rightarrow 0} \frac{(1-x)^n - 1}{x}$ is equal to

- (a) $n!$
- (b) $\sqrt{(n-1)!}$
- (c) $-n$
- (d) n

if $f(x) = |x|$, then $f'(2) =$

- (a) 2
- (b) 1
- (c) Does not exist
- (d) None of these

Q.16

The curve $y - e^{xy} + x = 0$ has a vertical tangent at the point

- (a) (1, 1)
- (b) At no point
- (c) (0, 1)
- (d) (1, 0)

Q.17

$\int e^{-\log x} dx =$

- (a) $e^{-\log x}$
- (b) $xe^{\log x}$
- (c) $\log|x|$
- (d) None of these

Q.18

$\int_0^{\pi/2} \sin^2 x dx =$

- (a) $\pi/4$
- (b) $\pi/3$
- (c) $\pi/2$
- (d) None of these

Q.19

If $\frac{dr}{dt} = -rt$ and $r(0) = r_0$, then

- (a) $r = r_0 e^{\frac{t^2}{2}}$
- (b) $r = e^{\frac{-t^2}{2}}$
- (c) $r = r_0 e^{\frac{-t^2}{4}}$
- (d) $r = r_0 e^{\frac{-t^2}{2}}$

If $\frac{dy}{dx} + \left(\frac{1-y^2}{1-x^2}\right)^{1/2} = 0$, then which of the following

- (a) $\sqrt{1-x^2} + \sqrt{1-y^2} = c$
- (b) $y\sqrt{1-y^2} + x\sqrt{1-x^2} = c$
- (c) $y\sqrt{1-x^2} + x\sqrt{1-y^2} = c$
- (d) $y\sqrt{1-y} + \sqrt{1-x^2} = c$

Q.21

The solution of the equation $(x\sqrt{1+y^2}) dx + (y\sqrt{1+x^2}) dy = 0$ is

- (a) $(\sqrt{1+y^2}) + (\sqrt{1+x^2}) = 0$
- (b) $(x\sqrt{1+y^2}) + (y\sqrt{1+x^2}) = 0$
- (c) $\log(\sqrt{1+y^2}) + \log(\sqrt{1+x^2}) = 0$
- (d) $(\sqrt{1+y^2}) + (\sqrt{1+x^2}) = 0$

Q.22

The line $y = 2x + c$ is a tangent to the parabola $y^2 = 16x$ if c equals

- (a) 2
- (b) $\frac{1}{2}$
- (c) 0
- (d) None of these

Q.23

If α, β, γ are the directional angles that a line makes with x-axis, y-axis and z-axis respectively, then $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma =$

- (a) 1
- (b) 2
- (c) 0
- (d) -2

Q.24

The ratio in which the plane $\vec{r} \cdot (\hat{i} + 2\hat{j} + 2\hat{k}) = 17$ divides the line joining the points with position vectors $(-2\hat{i} + 4\hat{j} + 7\hat{k})$ and $(3\hat{i} - 5\hat{j} + 8\hat{k})$, is

- (a) 1 : 5
- (b) 1 : 10
- (c) 3 : 5
- (d) 3 : 10

Three forces \vec{P} , \vec{Q} , and \vec{R} acting along IA, IB and IC, where I is the incentre of ΔABC , are in equilibrium then \vec{P} , \vec{Q} , \vec{R} is

- (a) $\cos \frac{A}{2} : \cos \frac{B}{2} : \cos \frac{C}{2}$
- (b) $\cot \frac{A}{2} : \cot \frac{B}{2} : \cot \frac{C}{2}$
- (c) $\sin \frac{A}{2} : \sin \frac{B}{2} : \sin \frac{C}{2}$
- (d) $\operatorname{cosec} \frac{A}{2} : \operatorname{cosec} \frac{B}{2} : \operatorname{cosec} \frac{C}{2}$

Q.26

Two numbers a and b are chosen at random from the set of first 30 natural numbers. The probability that $a^2 - b^2$ is divisible by 3 is

- (a) 9/87
- (b) 12/87
- (c) 38/87
- (d) 47/87

Q.27

The principal value of $\sin^{-1}\left(-\frac{\sqrt{2}}{2}\right)$ is

- (a) $-2\pi/3$
- (b) $-\pi/3$
- (c) $-\pi/6$
- (d) π

Q.28

The equation $\frac{x^2}{1-r} + \frac{y^2}{r-3} + 1 = 0$ represents an ellipse only if

- (a) $r > 1$
- (b) $r < 3$
- (c) $1 < r < 3$
- (d) None of these

If e_1 and e_2 are eccentricities of the two hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{x^2}{b^2} - \frac{y^2}{a^2} = 1$, then

- (a) $e_1 = e_2$
- (b) $e_1 e_2 = 1$
- (c) $e_1^2 e_2^2 = 1$
- (d) $\frac{1}{e_1^2} + \frac{1}{e_2^2} = 1$

Q.30

The point(s) on the curve $y^3 + 3x^2 = 12y$ where the tangent is vertical, is (are)

- (a) $\left(\mp \frac{7}{\sqrt{3}}, 2\right)$
- (b) $(0, 1)$
- (c) $\left(\frac{4}{\sqrt{2}}, 2\right)$
- (d) $\left(\mp \frac{4}{\sqrt{3}}, 2\right)$