CHEMISTRY

Q1.

Which of the following will first impart red colour to Bunsen flame?

(a) Ca
(b) Ba
(c) Sr
(d) Ra

Q2.

Which of the following does not have N-N bond?

(a) N_2O
(b) N_2O_3
(c) N_2O_4
(d) N_2O_5

Q3.

In Mond's process of nickel purification which of the following is used?

(a) $Ni(CO)_4$
(b) $Ni(PPh_3)_2$
(c) $Ni(CO)_2 (PPh_3)_2$
(d) $Ni(C_5H_5)(NO)$

Q4.

The quantum numbers listed below are of four different electrons in an atom

(a) $n = 4, l = 0, m_l = 0, m_s = 1/2$;
(b) $n = 3, l = 2, m_l = 1, m_s = 1/2$;
(c) $n = 3, l = 2, m_l = -2, m_s = 1/2$;
(d) $n = 3, l = 1, m_l = 0, m_s = 1/2$;

Q5.

The order observed in the boiling point of the following aqueous solutions (= 0.030 m glycerin ; b = 0.02 m KBr: c = 0.030 m benzoic acid) is

(a) $a < c < b$
(b) $c < a < b$
(c) $b < c < a$
(d) $c < b < a$

Q6.

How many seconds will be required to produce 1.0 g of silver (atomic weight = 108) metal by the electrolysis of a $AgNO_3$ solution using a current of 30 amps? (F = 96500 coul. Mol^{-1})

  (a) 2.7×10^4
  (b) 2.98×10^1
  (c) 3.2×10^3
  (d) 3.7×10^{-5}

Q7.

Which of the following sequence of bond orders is correct?

  (a) $O_2^- < O_2 > O_2^+$
  (b) $O_2^- > O_2 < O_0^+$
  (c) $O_2^- < O_2 < O_2^+$
  (d) $O_2^- > O_2 > O_2^+$

Q8.

The reaction of pentyl magnesium bromide with water would give

  (a) pent – 1 – ene
  (b) pentane
  (c) pent – 2 – ene
  (d) pentanol – 1

Q9.

At constant temperature and pressure 5 litres of a hydrocarbon require 15 litres of oxygen for complete combustion. The hydrocarbon is

  (a) ethane
  (b) ethyne
  (c) ethane
  (d) propane

Q10.

1-butyene may be prepared by the reaction of acetylene with

  (a) sodamide and ethyl bromide]
  (b) sodamide and propyl bromide
  (c) acetamide and ethyl bromide
  (d) benzamide and ethyl bromide

Q11.

10 mL of conc. H_2SO_4 (18M) is diluted to 10 L. the approximate strength of the acid would be:

    (a) 0.18 N
    (b) 0.36 N
    (c) 0.036 N
    (d) 0.09 N

Q12.

Which transformation could take place at the anode of an electrochemical cell?

    (a) Cr^{3+} to $Cr_2 O_7^{2-}$
    (b) O_2 to $H_2 O$
    (c) F_2 to F^-
    (d) $HAsO_2$ to As

Q13.

Which of the following statements is incorrect?

    (a) Ferrocene has Fe metal and is 18 e-species
    (b) All the ten carbons in ferrocene are equidistant from iron metal
    (c) Zeise's salt has Pt metal and is a 18 e- species.
    (d) In Zeise salt, ethylene is perpendicular to the $PtCI_3$ plane.

Q14.

The reaction of saturated solution of $Na_2Cr_2O_7$ with concentrated H_2SO_4

    (a) $Cr_2 (SO_4)_3$
    (b) CrO_4^-
    (c) CrO_3
    (d) $CrOSO_4$

Q15.

The basic building unit of all silicates is

    (a) SiO
    (b) $(SiO_3)^{3-}$
    (c) SiO_2
    (d) $(SiO_4)^{4-}$

Q16.

Use the table of data shown below to calculate the average rate of the reaction between 10s and 20s (A and B)

Time (s)	[A] mol. I^{-l}
0	0.2
5	0.14
10	0.10
15	0.071
20	0.050

(a) 6 x 10^{-3}
(b) 8 x 10^{-3}
(c) 5 x 10^{-3}
(d) 200

Q17.

When an insulator is heated, an electric charge is developed on the face of the isolator crystal. This phenomenon is known as

(a) ferroelectric effect
(b) paramagnetic effect
(c) pyroelectric effect
(d) piezoelectric effect

Q18.

X – ray diffraction studies indicated that the edge length of unit cell of fcc lattice of KF is 537.5 pm. The distance between K^+ and F^- ions is

(a) 385.3 pm   (b) 179.3 pm

(c) 268. 3 pm   (d) 136.3 pm

Q19.

Among the anions CI^-, SO_4^{-2}, PO_4^{-3}, the coagulating power follows the order

(a) $PO_4^{-3} > CI^- > SO_4^{-2}$
(b) $PO_4^{-3} > SO_4^{-2} > CI^-$
(c) $CI^- > SO_4^{-2} > CI^-$
(d) $SO_4^{-2} > CI^- > PO_4^{-3}$

Q20.

Which of the following statements is true of the critical micelle concentration?

(a) The surfactant molecules decompose
(b) The surfactant molecules become completely soluble.
(c) The surfactant molecules dissociate
(d) The surfactant molecules associate

Q21.

Elevation in boiling point for 13.44 g of $CuCI_2$ dissolved in 1 kg of water will be ($K_b = 0.52$ Km^{-1} ; molar mass of $CuCI_2 = 134.4$ gmol^{-1})

(a) 0.05
(b) 0.10
(c) 0.16
(d) 0.20

Q22.

3-Phenylpropee on reaction with HBrgoves (as a major prodect)

(a) $C_6H_5CH_2CH(Br)CH_3$
(b) $C_6H_5CH(Br)CH_2CH_3$
(c) $C_6H_5CH_2CH_2CH_2Br$
(d) $C_6H_5CH(Br)CH = CH_2$.

Q23.

$CH \equiv CH$ reacts with acetic acid in presence of Hg^{2+} to give

(a)
$$\underset{\underset{CH(OOC.CH_3)_2}{|}}{CH_3}$$

(b)
$$\underset{\underset{CH_3}{|}}{CH(OOC.CH_3)_2}$$

(c)
$$\underset{\underset{CH_2(OOC.CH_3)}{|}}{CH_3}$$

(d) None of these

Q24.

Which of the following reactions will not give propane?

(a) CH3CH2CH2CI $\xrightarrow[H_2O]{Mg/ether}$

(b) CH3COCI $\xrightarrow[H_2O]{CH_3MgX}$

(c) $CH3CH = CH$ $\xrightarrow[CH_3COOH]{B_2H_6}$

(d) $\underset{\underset{OH}{|}}{CH_3 CH-CH_3}$ $\xrightarrow{P/HI}$
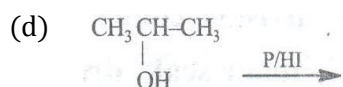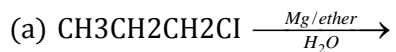
Q25.

What will be the product in the following reaction?

$\xrightarrow[\text{ii) H}_2/\text{Pt}]{\text{i) NBS}}$

(a)

(b)

(c)

(d)
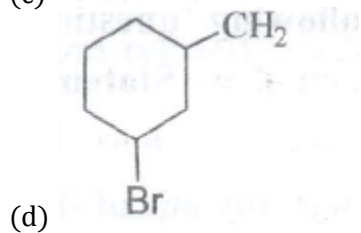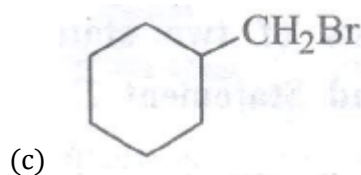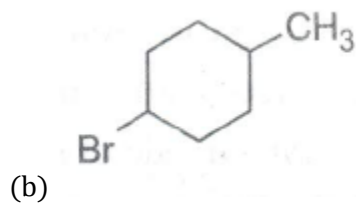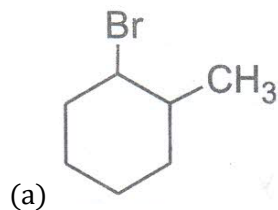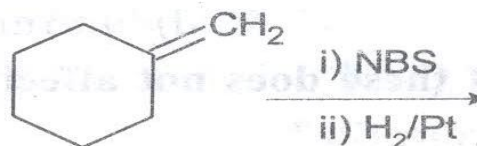
Q26.

Select the structural formula of catcehol.

(a)

(b)

(c)

(d)
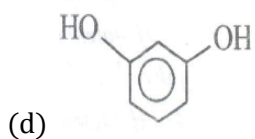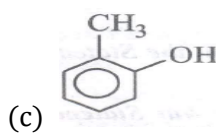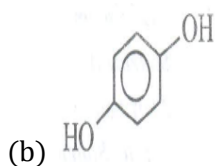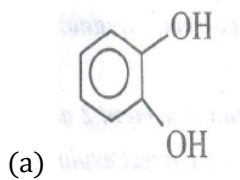
Q27.

Among the following the one that gives positive iodoform test upon reaction with 1_2 and NaOH is

(a) $CH_3CH_2CH(OH)CH_2CH_3$
(b) $C_6H_5CH_2CH_2OH$

(c)

(d) $PhCOHCH_3$
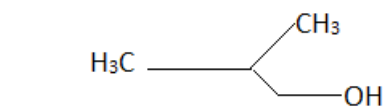
Q28.

Which of the following artificial sweetening agent is unstable at cooking temperature :

(a) Aspartame
(b) Sucralose
(c) Alitame
(d) All of these
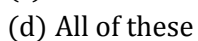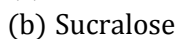
Q29.

When H_2S gas is passed in metal sulphate solution in the presence of NH_4OH, a white precipitate is produces the metal is

(a) Zn
(b) Fe
(c) Pb
(d) Hg

Q30.

Which of the following is peroxide :

(a) MnO_2
(b) SiO_2
(c) BaO_2
(d) None of these

<div align="center">PHYSICS</div>

Q1.

Least count of Vernier calipers is 1×10^{-4}m. The main scale reading before zero is 9 and the zeroth division of Verner scale division coincides with main scale division. Each main scale division is 1×10^{-3}m. then the measured value is

(a) 10mm
(b) 9mm
(c) 9.1mm
(d) 9.01mm

Q2.

Which out of these doest not affect the maximum height of a projectile?

(a) Mass of projectile
(b) Angle of projection
(c) Acceleration of projectile
(d) Magnitude of initial velocity

Following question 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

1. If both Statement 1 and Statement 2 are true and Statement 2 is a correct explanation of Statement 1.
2. If both Statement 1 and Statement 2 are true but the Statement 2 is not a correct explanation of Statement 1.
3. If statement 1 is true but the Statement 2 is false.
4. If statement 1 is false but Statement 2 is true.

Q3.

Statement 1: As per law of conservation of momentum, momentum can never change.

Statement 2: Momentum is quantity of motion possessed by a body so there is no question of its change

(a) 1   (b) 2

(c) 3   (d) 4

Q4.

If momentum of a body increases by 50% kinetic energy will increase by

(a) 50%
(b) 150%
(c) 125%
(d) 100%

Q5.

A flywheel rotating about a fixed axis has a kinetic energy of 360 J when the angular speed is 30 rads-1. The moment of inertia of wheel about the axis of rotation is

(a) 0.6 kgm²
(b) 0.75 kgm²
(c) 0.15 kgm²
(d) 0.8kgm²

Q6.

The speed of the planet orbiting the sun

(a) Increases in going from aphelion to perihelion
(b) Increases in going from perihelion to aphelion
(c) Remains same throughout
(d) Varies at random

Q7.

Water rises in a capillary tube through a height h. if the tube is inclined to the liquid surface at 30°C, the liquid will rise in the tube upto its length equation to

(a) h/2
(b) h
(c) 2h
(d) 4h

Q8.

Steam of 100°C is passed into a calorimeter of water equivalent 10 mg containing 94 cc of water and 10 g of ice at 0°C. If the temperature of the calorimeter and its contents rises to 5°C, the amount of the steam passed is

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

Q9.

At room temperature, the rms speed of the molecule of a certain diatomic gas is found to be 1930 ms^{-1}, The gas is

(a) H_2
(b) F_2
(c) O_2
(d) Cl_2

Q10.

The ratio of velocity of sound in hydrogen and oxygen at STP is

(a) 16 : 1
(b) 8 : 1
(c) 4 : 1
(d) 2 : 1

Q11.

When we hear a sound, we can identify its source from

(a) The wavelength of sound
(b) The overtones present in the sound
(c) The intensity of sound
(d) The amplitude of sound

Q12.

Four equal charges, each of charge Q are placed at the four corners of a body of side 'a' each. Work done to remove a charge –Q from the centre of the body to infinity is

(a) 0
(b) $\sqrt{2}Q^2 / 4\pi\epsilon_0 a$
(c) $\sqrt{2}Q^2/\pi \epsilon_0 a$
(d) $Q^2/2\pi \epsilon_0 a$

Q13.

The resistance of an incandescent lamp is

(a) Greater when switched off
(b) Smaller when switched off
(c) Greater when Switched on
(d) The same whether it is switched off or switched on

Q14.

A paramagnetic gas consists of atoms with dipole moment M. The temperature of gas is T_1 and its volume density ρ. The thermal energy of each dipole compared magnetic potential energy in a magnetic field B is given by

(a) $3kT_1/2MB$
(b) $2kT_1/3MB$
(c) $2kT_1/MB$
(d) $kT_1/3MB$

Q15.

With a resistance R connected in series with a galvanometer of resistance 100Ω, it acts as a voltmeter of range 0 – V. To double the range a resistance of 1000Ω is to be connected in series with R. The value of R is

(a) 1000Ω
(b) 1100Ω
(c) 800Ω
(d) 900Ω

Q16.

A pure resistive circuit element X when connected to an a.c. supply of peak voltage 200V gives a peak current of 5A. A second current element Y when connected to same a.c. supply gives the same value of peak current but the current lags behind by 90°. If series combination of X and Y is connected to the same supply, the impedance of the circuit is

(a) $40\sqrt{2}\ \Omega$
(b) $40\ \Omega$
(c) $80\ \Omega$
(d) $2\sqrt{40}\ \Omega$

Q17.

Magnetic flux through a circuit of resistance R changes by an amount $\Delta\varphi$ in time Δt. The total quantity of charge Q passing through any point in the circuit during Δt is represented by

(a) $Q = \dfrac{1}{R}\dfrac{\Delta\varphi}{\Delta t}$
(b) $Q = \dfrac{\Delta\varphi}{R}$
(c) $Q = \dfrac{\Delta\varphi}{\Delta t}$
(d) $Q = R\dfrac{\Delta\varphi}{\Delta t}$

Q18.

The part of the electromagnetic spectrum to which 2.7K belongs is

(a) Radio
(b) Microwave
(c) X-ray
(d) γ-rays

Q19.

A glass slab of thickness t and refractive index μ is introduced between a projector and a screen. In order to get a sharp image, the screen may

(a) Not be moved at all
(b) Be moved away through a distance $\dfrac{t}{\mu}$ (μ - 1)
(c) Be moved towards the projector through a distance $\dfrac{t}{\mu}$ (μ + 1)
(d) Be moved through a distance μ

Q20.

Foucalt'smethod in optics is popularly used to find the

(a) Phase of light
(b) Velocity of light
(c) Frequency of light
(d) Colour or wavelength of light

Q21.

If a thin prism of glass is dipped into water then minimum deviation of light w.r.t. air, produced by prism will be ($_a\mu^g = 3/2$ and $_a\mu^w = 4/3$)

(a) 1/2
(b) 1/4
(c) 2
(d) 1/5

Q22.

When a monochromatic point source of light is at a distance of 0.2 m from a photoelectric current are respectively 0.6 V and 18 mA. If the same source is placed 0.6 m away from the photoelectric cell, then

(a) The stopping potential will be 0.2 V
(b) The stopping potential will be 0.6 V
(c) The saturation current will be 6 mA
(d) The saturation current will be 2 mA

Q23.

Three fourths of the active nuclei present in a radioactive sample decay in ¾ s. The half life of the sample is

(a) 1s
(b) ½ s
(c) 3/8 s
(d) 3/4s

Q24.

A photon is emitted as a result of transition of electron from nth orbit to one less than nth orbit when n is greater than 1. The frequency of this photon depends on n as

(a) $V \alpha 1/n$

(b) $V \alpha 1/n^2$

(c) $V \alpha 1/n^3$

(d) $V \alpha 1/n^4$

Q25.

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

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

Q26.

On a particular day, the maximum frequency reflected from ionosphere is 10 MHz. One another day it was 8 MHz. The ratio of the maximum electron densities of the ionosphere on the days is

(a) 16/25
(b) 21/28
(c) 28/21
(d) 25/16

Q27.

A siren placed at a railway platform is emitted sound of frequency 5 kHz. A passenger sitting in a moving train A records a frequency of 5.5 kHz, while the train approaches the siren. The passenger in train B records a frequency of 6.0 kHz while approaching the same siren. The ratio of the velocity of train B to that of train A is

(a) 242/252
(b) 2
(c) 5/6
(d) 11/6

Q28.

A steady current flows in a metallic conductor of non uniform cross section. The quantity (quantities) constant along the length of the conductor is (are)

(a) Current, electric field and drift speed
(b) Drift speed only
(c) Current and drift speed
(d) Current only

Q29.

A uniform electric field pointing in positive x, direction exists in a region. Let A be the origin, b be the point on x-axis at x = +1 cm and C be the point on the y-axis at y = +1 cm. then the potentials at the points A,B and C satisfy

(a) $V_A < V_B$
(b) $V_A > V_B$
(c) $V_A < V_C$
(d) $V_A > V_C$

Q30.

Yellow light is used in a single slit diffraction experiment with slit width of 0.6 mm. If yellow light is replaced by X-rays, then the observed pattern will reveal

(a) That the central maximum is narrower
(b) More number of fringes
(c) Les number of fringes
(d) No diffraction pattern

<div align="center">

MATHEMATICS

</div>

Q1

The period of the function $f(\theta = \sin^4 \theta + \cos^4 \theta$ is

(a) 2π
(b) π
(c) $\frac{\pi}{2}$
(d) $\frac{\pi}{4}$

Q2

Let R = {(1, 3) , (4, 2), (2, 4) (3, 1) } be a relation on that set A = {1, 2, 3, 4}. The relation R is

(a) Reflexive
(b) Symmetric
(c) Transitive
(d) Antisymmetric

Q3

If the roots of the equation $x^2 + bx + c = 0$ be two consecutive integers, then $b^2 - 4c$ equals

(a) 2   (b) 1

(c) -1   (d) -2

Q4

The conjugate of a complex number $\frac{i}{i+1}$ is

(a) $\frac{1-i}{2}$

(b) $\frac{1+i}{2}$

(c) $\frac{1}{i-1}$

(d) $\frac{2}{i+1}$

Q5

Let $A = \begin{bmatrix} 2 & 2\alpha & \alpha \\ 0 & \alpha & 2\alpha \\ 0 & 0 & 2 \end{bmatrix}$ and $[A^2] = 16$ than $|\alpha|$ equals

(a) 4   (b) 2

(c) 1   (d) 8

Q6

If $A^2 + A - I = 0$, then inverse of A is

(a) I – A   (b) A – I

(c) A   (d) A + I

Q7

The number of ways in which 3 men and 4 women can dine at a round table, if no two men are to sit together, is given by

(a) 3! X 4
(b) 3 x 4!
(c) 3! X 4!
(d) 3 x 4

Q8

Two event A and B have probabilities 0.20 and 0.30 respectively. The probability that both A and B occurs simultaneously is 0.10. Then the probability that neither A nor B occurs is

(a) 0.60
(b) 0.40
(c) 0.20
(d) 0.80

Q9

For all n∈ N, $(2^{3n} - 1)$ is divisible by

- (a) 2
- (b) 3
- (c) 6
- (d) 7

Q10

The fourth term is in the expansion of $\left(x^2 + \frac{1}{x}\right)^8$ is

- (a) $28x^5$
- (b) $56x^5$
- (c) X^8
- (d) X^4

Q11

The term independent of x in the expansion of $\left(x^3 - \frac{1}{x^2}\right)^{10}$ is

- (a) 210
- (b) $^{10}c_3$
- (c) $^{10}c_2$
- (d) $^{10}c_4$

Q12

The sum of the series $\frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + \cdots\cdots$ is

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

Q13

If $\frac{x^m}{y^m} = (x - y)^{(m-n)}$ then $\frac{dy}{dx}$ is

- (a) xy
- (b) $\frac{x}{y}$

- (c) $\frac{y}{x}$
- (d) x - y

Q14

A value of e for which mean value theorem holds for function $f(x) = x^2 + 3x$ on internal $[2, 4]$ is

(a) 3
(b) 3.5
(c) 2.5
(d) None of these

Q15

The area bounded by the curve $y = x^2$ and the straight line $y = x$ is given by

(a) $\frac{1}{2}$
(b) $\frac{1}{3}$
(c) $\frac{1}{4}$
(d) $\frac{1}{6}$

Q16

$\int \frac{dx}{x(x^n - 1)}$ is equal to

(a) $\frac{1}{n}\log\left[\frac{x^n-1}{x_n}\right] + c$
(b) $\frac{1}{n}\log\left[\frac{x^n+1}{x^n}\right] + c$
(c) $\frac{1}{n}\log\left[\frac{x^n}{x^n-1}\right] + c$
(d) $\frac{1}{n}\log\left[\frac{x^n}{x^n+1}\right] + c$

Q17

$\int_0^{\pi/2} \frac{sinx}{sinx + cosx}\, dx$ is

(a) $\frac{\pi}{2}$
(b) $\frac{\pi}{4}$
(c) Π
(d) 0

Q18

The solution of the equation $\frac{d^2y}{dx^2} = e^2$ is

(a) $\frac{e^2x}{4}$

(b) $\frac{e^{2x}}{4} + c$

(c) $\frac{c^{2x}}{4} + cx + d$

(d) *None of these*

Q19

The order and degree of the differential equation $\left(1 + \frac{dy}{dx}\right)^{\frac{4}{5}} = \frac{d^4y}{dx^4}$ *are*

(a) $(4, 5)$

(b) $(5,4)$

(c) $(4,4)$

(d) $(5,5)$

Q20

The equation of the ellipse whose foci are $(\pm\, 3, 0)$ and eccentricity is $1/3$ is

(a) $\frac{x^2}{81} + \frac{y^2}{72} = 1$

(b) $\frac{x^2}{9} + \frac{y^2}{72} = 1$

(c) $\frac{x^2}{81} + \frac{y^2}{9} = 1$

(d) None of these

Q21

The equation of the tangent to the circle $x^2 + y^2 + 4x - 4y + 2 = 0$ which make equal intercepts on the positive coordinate axes, is

(a) $x + y = 12$

(b) $x + y = 4$

(c) $x + y = \sqrt{3}$

(d) $x + y = 2\sqrt{3}$

Q22

The least distance of the point P(5,6) from the circle $x^2 + y^2 - 4x - 4y + 4 = 0$ is

   (a) 3
   (b) 7
   (c) 5
   (d) 4

Q23

A parallelepiped is formed by planes drawn through the points (1, 2, 3) and (5, 7, 9) parallel to the coordinate planes. The length of a diagonal of the parallelpiped is

   (a) $\sqrt{80}$
   (b) $\sqrt{88}$
   (c) $\sqrt{77}$
   (d) $\sqrt{84}$

Q24

The length of perpendicular from the centre of the sphere $x^2 + y^2 + z^2 + 4x - 2y + 6z + 5 = 0$ to the plane $x + 2y + 3z - 4 = 0$ is

   (a) $\sqrt{13}$
   (b) $\frac{13}{14}$
   (c) $\frac{13}{\sqrt{14}}$
   (d) None of these

Q25

If $\vec{a} = \hat{\imath}$ and $\vec{b} = x\hat{\imath} - y\hat{\jmath} + z\hat{k}$ are such that $\vec{a}, \vec{c}$ and $\vec{b}$ from a right handed system then $\vec{c}$ is

   (a) $x\hat{\imath} - y\hat{\jmath}$
   (b) $x\hat{\imath} + z\hat{k}$
   (c) $z\hat{\jmath} + y\hat{k}$
   (d) None of these

Q26

If the vectors $\vec{a}, \vec{b}$ and $\vec{c}$ from the sides BC, CA and BA respectively of a triangle ABC, Then

   (a) $\vec{a}.\vec{b} + \vec{b}.\vec{c} = 0$
   (b) $\vec{a} \ x \ \vec{c} + \vec{b} \ x \ \vec{c} = 0$
   (c) $\vec{a} \ x \ \vec{a} + \vec{a} \ x \ \vec{b} + \vec{a} \ x \ \vec{c} = 0$
   (d) None of these

Q27

A pair of fair die is thrown. The probability of getting a total of 8 is

(a) $\frac{1}{38}$

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

(c) $\frac{5}{36}$

(d) $\frac{1}{3}$

Q28

Pair of fair die the thrown. Independently four times. The probability of getting a score of 6 twice is

(a) $\frac{25}{216}$

(b) $\frac{20}{216}$

(c) $\frac{4}{216}$

(d) None of these

Q29

$\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right)$ is equal to

(a) π

(b) $\frac{\pi}{2}$

(c) $\frac{\pi}{4}$

(d) None of these

Q30

If α is root of $25 \sin^2\theta + 5 \sin\theta - 12 = 0$ and α lies in 1st quadrant, The $\cos \alpha$ is equal to

(a) $\frac{4}{5}$

(b) $\frac{-4}{5}$

(c) $\frac{3}{5}$

(d) $\frac{-3}{5}$