

PRACTICE PAPER

CHEMISTRY

Q1

In the extraction of iron, the furnace charge consists of iron ore, coke and lime stone. The function of lime stone is to act as :

- (a) oxidising agent
- (b) reducing agent
- (c) flux
- (d) slag

Q2

Identify the bidentate ligand

- (a) Bipyridine
- (b) Ethylene diammine
- (c) Oxalate
- (d) All of these

Q3

Which of the following is an antibiotic?

- (a) Aspirin
- (b) Chloroquine
- (c) Chloromycetin
- (d) Paraetamol

Q4

Identify which is a protein based fibre

- (a) Rayon
- (b) Polyester
- (c) Silk
- (d) Cotton

Q5

Ascorbic Acid is

- (a) Vitamin A
- (b) Vitamin D
- (c) Vitamin B₁₂
- (d) Vitamin C

Q6

Which of the following is a polysaccharide?

- (a) Cellulose
- (b) Glycogen
- (c) Starch
- (d) All of these

Q7

To a solution of ammonium hydroxide some solid ammonium chloride is added. Then

- (a) $[NH_4^+]$ as well as $[OH^-]$ will increase
- (b) $[NH_4^+]$ as well as $[OH^-]$ will decrease
- (c) $[NH_4^+]$ will increase and $[OH^-]$ will decrease
- (d) $[NH_4^+]$ will decrease and $[OH^-]$ will increase

Q8

One litre of a 0.02 M solution of HCl is mixed with one litre of a 0.01 M solution of NaOH. The pH of the resulting solution will be

- (a) $-\log [0.01]$
- (b) $+\log [0.01]$
- (c) $-\log [0.005]$
- (d) $+\log [0.005]$

Q9

Crystalline barium chloride is not so soluble in water as crystalline sodium chloride is. On adding a saturated solution of barium chloride to a saturated solution of table salt (which is NaCl with negligible impurities of $NaHCO_3$ and Na_2SO_4), a dense crystalline white substance is deposited. The deposit will most probably be of

- (a) NaCl crystals
- (b) $BaCl_2 \cdot 2H_2O$ crystals
- (c) $Ba(HCO_3)_2$ crystals
- (d) $BaSO_4$ crystals

Q10

In a crystal of KCl, how many Cl⁻ ions surround K⁺ ions?

- (a) 8
- (b) 12
- (c) 6
- (d) 4

Q11

Amalgam is a solution of

- (a) gas in solid
- (b) liquid in solid
- (c) solid in liquid
- (d) liquid in liquid

Q12

Which of the following will not form a solution?

- (a) Salicylic acid and water
- (b) Methanol and water
- (c) Carbon tetrachloride and water
- (d) Acetic acid and water

Q13

Which type of saline water is used for intravenous injections?

- (a) Brine
- (b) Isotonic
- (c) Hypertonic
- (d) Hypotonic

Q14

What is the shape of XeF_6 molecule?

- (a) Trigonalbipyramidal
- (b) Octahedral
- (c) Distorted octahedral
- (d) Square planar

Q15

Which of the following transition metals displays maximum number of oxidation states?

- (a) Iron
- (b) Manganese
- (c) Vanadium
- (d) Chromium

Q16

Which of the following elements does not impart a color to the flame?

- (a) Calcium
- (b) Strontium
- (c) Barium
- (d) Beryllium

Q17

Which of the following has a higher reducing power?

- (a) H₂O
- (b) H₂S
- (c) H₂Se
- (d) H₂Te

Q18

The preferred method of separation of a mixture of benzoic acid and naphthalene is

- (a) Sublimation
- (b) Crystallization
- (c) Distillation
- (d) Chromatography

Q19

The biuret test is given by

- (a) Carbohydrates
- (b) Proteins
- (c) Nucleic acids
- (d) Lipids

Q20

When ethylcyanide is treated with KOH solution [i.e., C₂H₅CN (in the presence of KOH, H₂O) → ?], what are the products?

- (a) C₂H₅OH + CO₂ + NH₂
- (b) C₂H₅OH + HCOOH + NO
- (c) C₂H₅COOK + NH₃
- (d) C₂H₅COOK + NH₂

Q21

To which carbon of sugar in RNA a base molecule is attached.

- (a) 2
- (b) 3
- (c) 5
- (d) 1

Q22

Rubber is a natural polymer containing

- (a) all trans 1, 4 - polyisopropene
- (b) all cis 1, 4- polyisopropene
- (c) only cis-trans, 1, 4 - polyisopropene
- (d) only cis trans 1, 2 - polyisopropene

Q23

Cell membrane is a

- (a) bilayer of lipids interspersed proteins
- (b) bilayer of lipids and proteins interspersed with polysaccharides
- (c) bilayer of polysaccharides of proteins intersperse with lipids
- (d) bilayer of protein and RNA interspersed with lipids.

Q24

On heating ammonium dichromate the gas evolved is

- (a) O_2
- (b) NH_3
- (c) N_2O
- (d) N_2

Q25

The green house effect is caused by

- (a) NO_2
- (b) CO_2
- (c) CO
- (d) O

Q26

Which of the following undergoes Friedel Craft reaction?

- (a) C_6H_5COOH
- (b) $C_6H_5NH_2$
- (c) $C_6H_5NO_2$
- (d) None of these

Q27

Acetic acid when reacted with thionyl chloride yields which of the following?

- (a) Acetylchloride + SO_2 + HCl
- (b) Chloroacetic acid + SO_2
- (c) $ClCH_2COCl$ + SO_2
- (d) Acetyldichloride + SO_2 + HCl

Q28

Butyl methyl ether [$(CH_3)_3C-O-CH_3$] may be easily prepared by the reaction of

- (a) $(CH_3)_3C-Cl$ with $NaOCH_3$
- (b) $(CH_3)_3C-Cl$ with CH_2OH
- (c) $(CH_3)_3C-O^-$ with CH_3Cl
- (d) $(CH_3)_3C-OH$ with CH_3Cl

Q29

A colourless water soluble organic compound decomposes sodium carbonate and liberates carbon dioxide. It produces a silver mirror with Tollen's reagent. The liquid is

- (a) Acetaldehyde
- (b) Benzoic acid
- (c) Formic acid
- (d) Salicylic acid

Q30

Bromobenzene may be obtained by reaction of benzene with

- (a) Bromine water
- (b) Bromine in CCl_4
- (c) Bromine
- (d) Bromine and $FeBr_3$

PHYSICS

Q1

A student makes an error of 1% in measuring length of pendulum and negative error of 3% in value of time periods. The percentage error in measurement of value of g will be

- (a) 5%
- (b) 1%
- (c) 7%
- (d) 2%

Q2

A ball is dropped vertically and another ball is thrown horizontally with the same velocities from same height and at the same time. If the resistance is neglected, then

- (a) Ball P reaches the ground first
- (b) Ball Q reaches the ground first
- (c) Both reach the ground at same time
- (d) The time is decided by the masses of two balls

Q3

A β kg block at rest requires a force of $(\alpha - \gamma)$ N is required to keep block in uniform motion. The coefficient of friction is

- (a) $\frac{\beta}{\alpha}$
- (b) $\frac{9.8\beta}{\alpha - \gamma}$
- (c) $\frac{\alpha - \gamma}{9.8\beta}$
- (d) $\frac{\alpha}{9.8\beta}$

Q4

Two springs have their force constants k_1 and k_2 stretched through same distance. The ratio of their potential energies is

- (a) $\sqrt{k_1} : \sqrt{k_2}$
- (b) $K_2 : k_1$
- (c) $K_1 : k_2$
- (d) $K_2 : k_1$

Q5

Which of the following is a correct statement?

- (a) Centre of gravity of solid body always lies within the body
- (b) Centre of gravity of a planet-satellite lies closer to the satellite
- (c) A high jumper can pass a bar while his centre of gravity passes below the bar
- (d) A high jumper can pass a bar with his centre of gravity above the bar only

Q6

The acceleration on the surface of the earth varies

- (a) Inversely with latitude
- (b) Directly with latitude
- (c) Directly with longitude
- (d) Inversely with longitude

Q7

The upper end of a wire 1 metre long and 2 mm radius is fixed and the lower end is twisted through angle 45° . The angle of twist is

- (a) 0.009°
- (b) 0.09°
- (c) 0.9°
- (d) 9°

Q8

Two stars radiate maximum energy at wavelength 3.6×10^{-7} m and 4.8×10^{-7} m respectively. Their temperatures are in ratio of

- (a) $2/3$
- (b) $1/2$
- (c) $3/5$
- (d) $4/3$

Q9

If one mole of a monoatomic gas ($\gamma = 5/3$) is mixed with one mole of a diatomic gas ($\gamma = 7/5$), the value of γ for the mixture is

- (a) 1.40
- (b) 1.50
- (c) 1.53
- (d) 3.07

Q10

Two simple pendulums A and B of same lengths have bobs of same diameter but of masses m and M ($M > m$) respectively and have been set into motion in a real medium. The pendulum having greater logarithmic decrement is

- (a) Pendulum A
- (b) Pendulum B
- (c) Both will have same logarithmic decrement
- (d) Any of the pendulums A or B depending upon the nature of medium

Q11

Four wires of identical lengths, diameters and of the same material are stretched on a sonometer wire. The ratio of their tensions is 1 : 4 : 9 : 16. Their fundamental frequencies will be in the ratio of

- (a) 1: 4: 9: 16
- (b) 4: 3: 2: 1
- (c) 1: 2: 3: 4
- (d) 16: 9: 4: 1

Q12

Ratio of electric fields due to cylindrical charge of infinite length at a distance equal to its radius from its surface to that from its surface to that from its axis is

- (a) 3
- (b) $1/3$
- (c) 2
- (d) $1/2$

Q13

In an electric circuit of complex nature when a current gets divided in accordance with Kirchoff's law into a number of branches, the heating effect is

- (a) Maximum
- (b) Minimum
- (c) Infinite
- (d) Zero

Q14

Relative permeability of iron is 5500. Its magnetic susceptibility will be

- (a) 5499
- (b) 5500×10^7
- (c) 5500×10^{-7}
- (d) 5501

Q15

A magnet of length 12 cm has pole strength 10 units. The magnet is placed at an angle of 30° with the direction of a uniform field of strength 0.5 Oersted. The torque acting on the magnet is

- (a) 30 dyne cm
- (b) 20 dyne cm
- (c) 40 dyne cm
- (d) 36 dyne cm

Q16

In an a.c. circuit the reactance of coil is $\sqrt{3}$ times its resistance. The phase difference between the voltage across the coil to the current through coil is

- (a) $\pi/4$
- (b) $\pi/6$
- (c) $\pi/2$
- (d) $\pi/3$

Q17

The time taken by a.c. of 50 Hz in reaching from zero to maximum value is

- (a) 1×10^{-2}
- (b) 2×10^{-2} s
- (c) 50×10^{-3}
- (d) 5×10^{-3} s

Q18

If V_γ , V_x and V_M are the speed of γ rays, X rays and microwaves respectively in vacuum, then

- (a) $V_\gamma < V_x < V_M$
- (b) $V_\gamma > V_x > V_M$
- (c) $V_\gamma > V_x < V_M$
- (d) $V_\gamma = V_x = V_M$

Read the following paragraph :

A beam of plane polarized light is incident normally on a polarizer having X sectional area of 3×10^{-4} m², which rotates about the axis of the ray with an angular velocity of 31.4 rads⁻¹

Now answer the following questions:

Q19

Intensity of emergent beam of light passing through the polarizer per revolution, If flux of energy of incident ray is 10^{-3} W , is

- (a) $\frac{3}{5} \text{ Wm}^{-2}$
- (b) $\frac{5}{3} \text{ Wm}^{-2}$
- (c) $\frac{2}{5} \text{ Wm}^{-2}$
- (d) $\frac{1}{5} \text{ Wm}^{-2}$

Q20

Energy of light passing through polarizer is

- (a) 10^{-1} J
- (b) 10^{-2} J
- (c) 10^{-3} J
- (d) 10^{-4} J

Q21

Two points separated by a distance of 0.1 mm can just be seen with a microscope with a light of wavelength 6000 \AA . If the light of wavelength 4800 \AA is used, the limit of resolution will be

- (a) 7 cm
- (b) 9 cm
- (c) 0.08 mm
- (d) 8 mm

Q22

Which of the following is correct?

- (a) Only a charged particle in motion is accompanied by matter waves
- (b) Only subatomic particles in motion are accompanied by matter waves
- (c) Any particle in motion, whether charged or uncharged, is accompanied by matter waves
- (d) No particle, whether at rest or in motion, is ever accompanied by matter waves

Q23

In a nuclear reactor 0.01 mg of a fissile material is totally converted into energy in one second. The power of reactor in MW is

- (a) 1000
- (b) 900
- (c) 0.01
- (d) 100

Q28

A convex lens of focal length 40 cm is in contact with a concave lens of focal length 25 cm. The power of the combination is

- (a) -1.5D
- (b) -6.5 D
- (c) +6.5 D
- (d) +6.67 D

Q29

Two equal negative charges $-q$ are fixed at points $(0, -a)$ and $(0, a)$ on y -axis. A positive charge Q is released from rest at the point $(2a, 0)$ on the x , axis, The charge Q will

- (a) Execute simple harmonic motion about the origin
- (b) Move to the origin and remain at rest
- (c) Move to infinity
- (d) Execute oscillatory but not simple harmonic motion

Q30

A particle of charge q and mass m moves in a circular orbit of radius r with angular speed ω . The ratio of the magnitude of its magnetic moment to that of angular momentum depends on

- (a) ω and q
- (b) ω , q and m
- (c) q and m
- (d) ω and m

MATHEMATICS

Q1

If a, b, c , be three cube roots of unity then $\begin{vmatrix} e^a & e^{2a} & e^{3a} - 1 \\ e^b & e^{2b} & e^{3b} - 1 \\ e^c & e^{2c} & e^{3c} - 1 \end{vmatrix}$ is

- (a) 0
- (b) $a + 2b + 3c$
- (c) $1 + a + b + c$
- (d) None of these

Q2

If one root of this equation $x^2 - \lambda x + 12 = 0$ is even prime and $x^2 + \lambda x + \mu = 0$ has equal roots, then λ is

- (a) 32
- (b) 16
- (c) 8
- (d) None of these

Q3

The sum of the series $30 + 28 + 26 \dots\dots\dots$

- (a) 120
- (b) 30
- (c) 40
- (d) 50

Q4

The number of arrangements of the letters of word BANANA in which two N's do not appear adjacently is

- (a) 20
- (b) 30
- (c) 40
- (d) 50

Q5

If number of terms is $\left(x + \frac{1}{x}\right)^n$ is not then n is

- (a) 50
- (b) 52
- (c) 48
- (d) None of these

Q6

The equations $\lambda x - y = 2$, $2x - 3y = -\lambda$, $3x - 2y + 1 = 0$ are consistent for

- (a) $\lambda = 1$
- (b) $\lambda = -4$
- (c) $\lambda = -1, 4$
- (d) $\lambda = 1, -4$

Q7

If A is skew symmetric matrix, then trace of A is

- (a) 1 (b) 3
(c) 9 (d) 0

Q8

If $\log_{10} 2 = 0.301$, the number of digits in 2^3 is

- (a) 20
(b) 19
(c) 21
(d) None of these

Q9

A man is throwing stones at a target. The probability of hitting the target at any trial is $\frac{1}{3}$. The probability of hitting the target 4th time at the 8th throw is

- (a) $\frac{35(4)^2}{(3)^3}$
(b) $\frac{35(4)^4}{(3)^8}$
(c) $\frac{(4)^4}{(3)^8}$
(d) None of these

Q10

Range of the function f defined by $f(x) = \left[\frac{1}{\tan(x)} \right]$, where $[.]$ and $(.)$ respectively denoted the greatest integer and the fractional part function is

- (a) I, the set of integers
(b) Q, the set of rationals
(c) N, the set of natural numbers
(d) R, the set of real numbers.

Q11

$\lim_{x \rightarrow 0} \frac{1 - \cos x \cos 4x \cos 5x}{\sin^2 x}$ is

- (a) 15
(b) 21
(c) 26
(d) None of these

Q12

If $f(x) = \frac{1}{(x-3)(x-5)}$ and $g(x) = \frac{1}{x}$ then the points of discontinuity of $f(g(x))$ are

- (a) $\{0, 1\}$ (b) $\{3, 5\}$
 (c) $\left\{\frac{1}{3}, \frac{1}{5}\right\}$ (d) None of these

Q13

If $x^y = e^{x+y}$ then $\frac{dy}{dx}$ is

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

Q14

The equation of tangent at the origin to the curve $y = \cos x$ is

- (a) $y = 0$ (b) $y = x$
 (c) $x = 0$ (d) None of these

Q15

If $[0, 1]$, lagrange mean value theorem is not applicable to

- (a) $f(x) = \begin{cases} \cos xx & \neq 0 \\ 1 & x = 0 \end{cases}$
 (b) $f(x) = |x|$
 (c) $f(x) = x|x|$
 (d) $f(x) = \begin{cases} \frac{1}{3} - x, & x < \frac{1}{3} \\ \left(\frac{1}{3} - x\right)^2, & x \geq \frac{1}{3} \end{cases}$

Q16

The difference between the greater and the least value of the function $f(x) = \int_0^x (x + 1 + \cos t) dt$ for $x \in [1, 2]$ is

- (a) $\cos 2 - \cos 1$ (b) $\sin 2 - \sin 1$
 (c) 1 (d) $\frac{5}{2} + (\sin 2 - \sin 1)$

Q17

If $x \in (1, \infty)$ then $\int |\ln x| dx$ is

- (a) $x|\ln x| + c$
- (b) $x |\ln x| - x + c$
- (c) $x \ln x - x + c$
- (d) None of these

Q18

$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{e^x \sec^2 x}{e^x - 1} dx$ is equal to

- (a) $2e$
- (b) 0
- (c) E
- (d) None of these

Q19

Area enclosed by the curve $|x + y - 1| + |2y - 1| = 1$ is

- (a) 2 sq. units
- (b) 3 sq. units
- (c) 4 sq. units
- (d) None of these

Q20

The order and degree of the differential equation $\frac{d^4 y}{dx^4} + \left(\frac{dy}{dx}\right)^3 + y = 3$ is

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

Q21

If the distance of any point (x, y) from origin is defined as $d(x, y) = |x| + |y|$ then the locus of $d(x, y) = 2$ is

- (a) square of area 2 sq. units
- (b) square of area 4 sq. units
- (c) square of area 8 sq. units
- (d) None of these

Q22

The equation of pairs of lines passing through origin and having slope m for which equation $(x - 2)(x + m) + 1 = 0$ has integral roots is

- (a) $y^2 + 4xy + x^2 = 0$
- (b) $y^2 + 2xy + x^2 = 0$
- (c) $y^2 + xy = 0$
- (d) None of these

Q23

Two distinct chords drawn from the point (p, q) on the circle $x^2 + y^2 = px + qy$ where $pq \neq 0$ are bisected by the x axis, then

- (a) $P^2 = 8q^2$
- (b) $P^2 > 8q^2$
- (c) $Q^2 > 8p^2$
- (d) $P^2 = q^2$

Q24

A parabola is drawn with focus at $(3, 3)$ and vertex at the focus of the parabola $y^2 - 12x - 4y + 4 = 0$. The equation of parabola is

- (a) $x^2 + 6x + y = 0$
- (b) $x^2 - 6x - 4y + 21 = 0$
- (c) $x^2 + 6x - 4y - 21 = 0$
- (d) None of these

Q25

If $\frac{x^2}{f(3a)} + \frac{y^2}{f(a^2 - 4)}$ represents an ellipse with major axis as y axis and f is a decreasing function, then

- (a) $a \in (1, 4)$
- (b) $a \in (-1, 4)$
- (c) $a \in (1, 3)$
- (d) $a \in (-1, 3)$

Q26

If the eccentricity of the hyperbola $x^2 - y^2 \operatorname{cosec}^2 \alpha = 5\sqrt{3}$ times the eccentricity of ellipse $x^2 \operatorname{cosec}^2 \alpha + y^2 = 25$, then the value of α is

- (a) $\frac{\pi}{2}$
- (b) $\frac{5\pi}{4}$
- (c) $\frac{\pi}{3}$
- (d) $\frac{9\pi}{4}$

Q27

Let P be any point on the plane $lx + my + nz = p$ and Q be a point on line OP such that OP, OQ, p^2 . The focus of the point Q is

- (a) $x^2 + y^2 + z^2 = p^2$
- (b) $lx + my + nz = p(x^2 + y^2 + z^2)$
- (c) $p(lx + my + nz) = x^2 + y^2 + z^2$
- (d) $lx + my + nz = x^2 + y^2 + z^2 - p$

Q28

If $x = \sin\theta$, $y = \cos\theta$, $\frac{\pi}{2} \leq \theta \leq \pi$ then

- (a) $x - y = 1$
- (b) $y - x = 1$
- (c) $x + y = 1$
- (d) $x + y = -1$

Q29

$|\cot x + \operatorname{cosec} x| = |\cot x| + |\operatorname{cosec} x|$, $x \in [0, 2\pi]$ if and only if x belongs to the interval

- (a) $\left[0, \frac{\pi}{2}\right]$
- (b) $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$
- (c) $\left[-\frac{\pi}{2}, 0\right) \cup \left(0, \frac{\pi}{2}\right]$
- (d) None of these

Q30

If $x \in \left(\frac{3\pi}{2}, 2\pi\right)$, then the value of the expression $\cos^{-1}[\sin\{\cos^{-1}(\cos x) + \sin^{-1}(\sin x)\}]$, is

- (a) $\frac{\pi}{2}$
- (b) 0
- (c) $-\frac{\pi}{2}$
- (d) π