

CAREERS 360

PREPARATION **Series**

SRMJEEE 2025

Question Paper
Phase II

Question 1:

The collector of a transistor is _____ doped.

1. Zero percent
2. Infinitely
3. Moderately
4. Heavily

Solution:

In a transistor (BJT - Bipolar Junction Transistor), the doping levels of the three regions are as follows:

- **Emitter: Heavily doped** (to inject a large number of charge carriers into the base).
- **Base: Lightly doped** (to allow most carriers to pass through to the collector).
- **Collector: Moderately doped** (less than the emitter but more than the base, to efficiently collect charge carriers).

The collector is not as heavily doped as the emitter because its primary role is to gather carriers rather than emit them.

Correct Answer: Moderately

Question 2:

Which of the following quantities have the same S.I. unit as that of modulus of elasticity?

1. Energy per unit volume
2. Force per unit length
3. Energy
4. Change in length

Solution:

The correct answer is: **1. Energy per unit volume**

Explanation:

The modulus of elasticity (also known as Young's Modulus) has the S.I. unit of Pascal (Pa), which is equivalent to Newton per square meter (N/m^2). Among the given options, **energy per unit volume** also has the same unit of Joules per cubic meter (J/m^3), which simplifies to N/m^2 , thus matching the unit of modulus of elasticity.

Question 4:

For laminar flow, Reynolds number should be _____.

1. Equal to 2300
2. Less than 4300
3. Greater than 2300
4. Less than 2300

Solution:

The correct answer is: **4. Less than 2300**

Explanation:

The **Reynolds number (Re)** determines whether a flow is **laminar** or **turbulent**.

- **Laminar flow:** Smooth, orderly motion ($Re < 2300$)
- **Transitional flow:** Between laminar and turbulent ($2300 < Re < 4000$)
- **Turbulent flow:** Chaotic, irregular motion ($Re > 4000$)

Since the question asks specifically for **laminar flow**, the Reynolds number must be **less than 2300**.

5. Two trains A and B are running in the same directions on parallel tracks such that A is faster than B, packets of equal weight are exchanged between them. Then "

- A. There will be no change in B but A will be retarded
- B. There will be no change in A but B will be retarded
- C. A will be retarded and B will be accelerated
- D. B will be retarded and A will be accelerated

Solution:

Since train A is faster than train B, the momentum transfer between the two trains due to packet exchange will cause:

- **Train A** (the faster one) to lose some of its speed (retardation).
- **Train B** (the slower one) to gain some speed (acceleration).

Thus, the correct option is **C**.

Question 6:

A 220 V main supply is connected to a resistance of 100k. The rms current is _____.

1. 2.2 mA

- 2. 22 mA
- 3. 220 mA
- 4. 10 mA

Solution:

Given:

- Voltage (V) = 220 V (RMS)
- Resistance (R) = 100kΩ = 100,000Ω

RMS Current (I):

Using Ohm's Law:

$$I = \frac{V}{R} = \frac{220}{100,000} = 0.0022 \text{ A} = 2.2 \text{ mA}$$

7. A spherical air bubble in water will act as

- A. Plano-concave lens
- B. A concave lens
- C. Plane glass plate
- D. A convex lens

Answer: B. A concave lens

Reason:

- An air bubble in water ($n_{\text{air}} < n_{\text{water}}$) diverges light, acting like a **concave lens**.
- Its spherical shape causes light to spread out, matching the behavior of a diverging lens.

Rejected

- **A/C/D:** Require wrong curvature or no divergence.

8. Conductivity of a photodiode starts changing only if the wavelength of incident light is less than 660 nm. The band gap of photodiode is found to be (X / 8) eV. The value of X is:"

Given: $h = 6.6 \times 10^{-34} \text{ Js}$ and $c = 1.6 \times 10^{10} \text{ cm/sc} = 1.6 \times 10^{10} \text{ cm/s}$

- A. 13
- B. 15
- C. 18
- D. 10

Solution:

Given threshold wavelength = 660 nm, the band gap energy is:

$$E_g = \frac{hc}{\lambda} = \frac{(6.6 \times 10^{-34}) (3 \times 10^8)}{660 \times 10^{-9}} = 3 \times 10^{-19} \text{ J} = 1.875 \text{ eV}$$

Given $E_g = \frac{X}{8} \text{ eV}$, solving for X :

$$X = 8 \times 1.875 = 15$$

Question 9:

Tangent law can be used _____.

1. when horizontal component of the earth's magnetic field is present
2. when two uniform and parallel magnetic fields are present
3. when two uniform and mutually perpendicular magnetic fields are present
4. when only Electric field is present

Solution:

The correct answer is: **3. when two uniform and mutually perpendicular magnetic fields are present**

Explanation:

Tangent law states that when two perpendicular magnetic fields are present, the tangent of the angle between the resultant magnetic field and one of the fields is proportional to the ratio of the magnitudes of the fields. This law is typically used in cases where two magnetic fields are at right angles to each other.

Question 10:

The SI unit of current density is _____.

1. Ampere/m²
2. Ohm
3. Ampere
4. m²/Ampere

Solution:

The correct answer is: **1. Ampere/m²**

Explanation:

Current density (denoted as J) is defined as the amount of electric current flowing per unit area of cross-section. The SI unit of current density is **Ampere per square meter (A/m^2)**, as it is the ratio of current (in Amperes) to area (in square meters).

Question 11:

A straight conductor of length 1m carries 5A of current. What is the magnetic field at a point 2m away from it?

1. $10 \mu T$
2. $5 \mu T$
3. $1 \mu T$
4. $0.5 \mu T$

Solution:

For a straight current-carrying conductor, the magnetic field at a distance r is given by:

$$B = \frac{\mu_0 I}{2\pi r}$$

where:

- (μ_0) permeability of free space,
- $I = 5 \text{ A}$ (current),
- $r = 2 \text{ m}$ (distance).

Substitute the values:

$$B = \frac{(4\pi \times 10^{-7})(5)}{2\pi \times 2} = \frac{20\pi \times 10^{-7}}{4\pi} = 5 \times 10^{-7} \text{ T} = 0.5\mu \text{ T}$$

Correct Answer: $0.5 \mu T$

Question 12:

The cold junction of a thermocouple is maintained at $10^\circ C$. No thermo-emf is developed when the hot junction is maintained at $530^\circ C$. Find the neutral temperature.

- A. $255^\circ C$
- B. $250^\circ C$
- C. $260^\circ C$

D. 270°C

Solution:

Given:

- Cold junction temperature (T_c) = 10°C
- Inversion temperature (T_i) = 530°C (since thermo-emf is zero here).

Neutral temperature (T_n) is calculated as:

$$T_n = \frac{T_i + T_c}{2} = \frac{530 + 10}{2} = \frac{540}{2} = 270^\circ\text{C}$$

Question 13:

"Consider a source with emf E and internal resistance r , connected by ideal (resistance-less) conductors to an external circuit. Note that a current I is flowing in the circuit. What energy is being delivered to the external circuit?"

- A. $EI - I^2r$
- B. $E - I^2r$
- C. EI
- D. E/Ir^2

Question 14:

"In an intrinsic semiconductor, the number of free electrons _____"

- A. is less than the number of holes
- B. is greater than the number of holes
- C. is equal to the number of dopant ions
- D. equals the number of holes

Solution:

In an **intrinsic (pure) semiconductor**, the number of free electrons **equals** the number of holes because each freed electron creates one hole.

Correct Option: (D) equals the number of holes

Question 15:

"A circuit draws 330 W from an 110 V, 60 Hz AC line. The power factor is 0.6 and the current lags the voltage. The capacitance of a series capacitor that will result in a power factor of unity equal to:"

- A. $31\mu F$
- B. $201\mu F$
- C. $1 mF$
- D. $54\mu F$

16. Which one of the following is similar between electrostatic force and gravitational force?

- A. Both the forces are strong forces
- B. Force can be attractive or repulsive
- C. The force depends on the medium between the bodies
- D. Force is inversely proportional to the distance between the bodies

Correct Answer: **D. Force is inversely proportional to the distance between the bodies**

Explanation:

Both **electrostatic force** and **gravitational force** follow an **inverse square law** where the force is inversely proportional to the square of the distance between the bodies. This means as the distance between two objects increases, the force between them decreases according to the square of that distance.

- **Gravitational Force:** $F = G \cdot m_1 \cdot m_2 / r^2$
- **Electrostatic Force:** $F = k \cdot q_1 \cdot q_2 / r^2$

Both forces obey the inverse square law, making option **D** the correct answer.

The question on the screen is:

17. Torr is the unit of physical quantity

- A. Density
- B. Torque
- C. Force
- D. Pressure

Correct Answer: **D. Pressure**

Explanation:

The **Torr** is a unit of pressure. It is defined as 1/760th of standard atmospheric pressure (1 atm). It is commonly used in fields such as chemistry and physics, particularly in vacuum measurements. The correct answer is **D. Pressure**.

The question on the screen is:

19. A copper ring is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet while it is passing through the ring is

- A. Equal to that due to gravity
- B. Less than that due to gravity
- C. More than that due to gravity
- D. Depends on the diameter of the ring and the length of the magnet

Correct Answer: **B. Less than that due to gravity**

Explanation:

When the bar magnet falls through the copper ring, it induces an electromotive force (EMF) in the ring due to Faraday's Law of Induction. This causes the ring to generate a magnetic field that opposes the motion of the magnet (Lenz's Law). As a result, the magnet experiences a force that opposes its fall, which reduces its acceleration. Therefore, the acceleration of the falling magnet is less than the acceleration due to gravity, making **Option B** the correct answer.

20. If the radius (A) of a nucleus is 6 fm, the radius of a nucleus with twice the mass number (2A) will be:

- A. 8.5 fm
- B. 7.2 fm
- C. 6 fm
- D. 12 fm

Correct Answer: **B. 7.2 fm**

Explanation:

The radius R of a nucleus is related to its mass number A by the formula:

$$R = R_0 A^{1/3}$$

where $R_0 \approx 1.2\text{fm}$.

Given:

- For mass number A , radius $R_A = 6\text{fm}$.
- For mass number $2A$, radius $R_{2A} = R_0(2A)^{1/3}$.

Since $R_A = R_0 A^{1/3} = 6\text{fm}$,

$$R_{2A} = 6 \times 2^{1/3} \approx 6 \times 1.26 \approx 7.56\text{fm}$$

Question 23:

"Following Bohr's model, the condition for orbital stability is given by which of the following relation (symbols represent standard meaning)"

- A. $mvr = \frac{nh}{2\pi}$
- B. $mvr = \frac{2\pi}{nh}$
- C. $\frac{m}{r} = \pi$
- D. $m = \frac{m}{\pi}$

Solution:

In Bohr's atomic model, the condition for orbital stability is the quantization of angular momentum, expressed as:

$$mvr = n \frac{h}{2\pi}$$

where:

- m = mass of the electron
- v = orbital velocity of the electron
- r = radius of the orbit
- n = principal quantum number (1, 2, 3, ...)
- h = Planck's constant

Matching the

- Option A: $mvr = \frac{nh}{2\pi} \rightarrow$ Correct (exactly matches Bohr's quantization condition).
- Option B: Incorrect (inverted and wrong units).
- Option C: Incorrect (nonsensical relation, units don't match).
- Option D: Incorrect (meaningless equation, appears to be a typo).

Question 24:

Let B be the midpoint of AC. Two point charges Q and q are placed at A and C. What should be the value of charge placed at B so that the system remains at equilibrium?

- A. $+Q/2$
- B. $+Q$
- C. $-Q/4$
- D. $-Q$

Solution:

Two charges $+Q$ are placed at **A** and **C**, with **B** as the midpoint.

For equilibrium, the charge at **B** must cancel the repulsion between the two $+Q$ charges.

Force balance:

$$k \frac{Qq}{d^2} = k \frac{Q^2}{(2d)^2} \implies q = -\frac{Q}{4}$$

Question 25:

The refractive index of the medium, for the polarising angle 60° is:"

- A. 1.414
- B. 1.468
- C. 1.5
- D. 1.732

Solution:

For a medium with polarising angle (Brewster's angle, θ_p) = 60° , the refractive index (n) is given by Brewster's Law:

$$n = \tan \theta_p = \tan 60^\circ = \sqrt{3} \approx 1.732$$

Question 26:

A galvanometer of resistance 50Ω shows full-scale deflection at 2mA. What shunt resistance is needed to convert it into an ammeter of range 10A?"

- A. 10Ω
- B. 1Ω
- C. 0.01Ω
- D. 5Ω

Solution:

- Galvanometer resistance (G) = 50Ω
- Full-scale current (I_g) = 2 mA = 0.002 A
- Desired ammeter range (I) = 10 A

Shunt resistance (S) is calculated using:

$$S = \frac{I_g \cdot G}{I - I_g}$$

Substitute the values:

$$S = \frac{0.002 \times 50}{10 - 0.002} = \frac{0.1}{9.998} \approx 0.01\Omega$$

Question 27:

"Estimate the threshold frequency for caesium if its work function is 2.14 eV. "

- A. 2.25×10^{14} Hz
- B. 5.16×10^{16} Hz
- C. 2.25×10^{16} Hz
- D. 5.16×10^{14} Hz

Solution:

Threshold frequency $\nu_0 = \frac{\phi}{h}$.

Given work function $\phi = 2.14\text{eV} = 3.428 \times 10^{-19}$ J,

$$\nu_0 = \frac{3.428 \times 10^{-19}}{6.626 \times 10^{-34}} \approx 5.17 \times 10^{14} \text{ Hz}$$

Closest option: D (5.16×10^{14} Hz).

Question 28:

The charge of down quark is:

- A. -1/3
- B. +2/3
- C. -2/3
- D. +1/3

Solution:

The down quark has an electric charge of:

$$-\frac{1}{3}e$$

where e is the elementary charge ($1.6 \times 10^{-19}\text{C}$).

Question 29:

Total internal reflection can take place only if:

- A. light goes from optically denser medium to rarer medium
- B. light goes from optically rarer medium (smaller refractive index) to optically denser medium
- C. the refractive indices of the two media are close to each other
- D. the refractive indices of the two media are widely different

Solution:

Total internal reflection (TIR) occurs only when:

1. Light travels from an optically denser medium (higher refractive index) to a rarer medium (lower refractive index).
2. The angle of incidence exceeds the critical angle (θ_c).

Correct Option: (A) light goes from optically denser medium to rarer medium

Question 30:

"In ${}_{88}^{226}\text{Ra}$, the number of neutrons is:"

- A. 86
- B. 88
- C. 226
- D. 138

Solution:

For the isotope ${}_{88}^{226}\text{Ra}$:

- Atomic number (protons) = 88
- Mass number (protons + neutrons) = 226
- Number of neutrons = Mass number - Atomic number

$$\text{Neutrons} = 226 - 88 = 138$$

Question 31:

A 20 volt AC is applied to a circuit consisting of resistance and a coil with negligible resistance. If the voltage across the resistance is 12 volts, then the voltage across the coil is:"

- A. 10 V
- B. 8 V
- C. 6 V
- D. 16 V

Solution:

Given:

- Total applied voltage (V) = 20 V (AC)
- Voltage across resistor (V_R) = 12 V
- Circuit has a resistor and a coil (inductor) with negligible resistance.

Since the coil has negligible resistance, it only contributes inductive reactance (X_L), and the voltage across it (V_L) is purely due to inductance.

In an LR circuit, the total voltage is the phasor sum of V_R and V_L (90° out of phase):

$$V = \sqrt{V_R^2 + V_L^2}$$

Solve for V_L :

$$20 = \sqrt{12^2 + V_L^2} \implies 400 = 144 + V_L^2 \implies V_L = \sqrt{256} = 16 \text{ V}$$

Answer: (D) 16 V

Question 32:

"Conventionally, the magnitude of gravitational potential energy for an object at infinity from the earth is (M = Mass of the earth; m = Mass of the object; R = Radius of the earth)."

- A. zero
- B. $(G * M * m) / R$
- C. $(G * M) / R^2$
- D. $(G * M) / R$

Solution:

The gravitational potential energy (U) of an object of mass m due to Earth (mass M) at a distance r is given by:

$$U(r) = -\frac{GMm}{r}$$

where:

- G = gravitational constant,
- r = distance from Earth's center.

At infinity ($r \rightarrow \infty$):

$$U(\infty) = -\frac{GMm}{\infty} = 0$$

Convention:

- Gravitational potential energy is defined as zero at infinity.

Answer: (A) zero

Question 33:

A rectangular coil of 20 turns and area of cross-section 25 cm² has a resistance of 100 ohms. If the magnetic field which is perpendicular to the plane of the coil changes at the rate of 1000 tesla/sec, the current in the coil is:"

A. 0.5 amp

B. 1 amp

C. 5 amp

D. 50 amp

Solution:

Given:

- Number of turns (N) = 20

- Area (A) = 25 cm² = 25 × 10⁻⁴ m²

- Resistance (R) = 100Ω

- Rate of change of magnetic field ($\frac{dB}{dt}$) = 1000 T/s

Step 1: Calculate induced EMF (Faraday's Law)

$$\text{EMF} = -N \frac{d\Phi}{dt} = -NA \frac{dB}{dt}$$
$$|\text{EMF}| = 20 \times 25 \times 10^{-4} \times 1000 = 50 \text{ V}$$

Step 2: Compute current (Ohm's Law)

$$I = \frac{\text{EMF}}{R} = \frac{50}{100} = 0.5 \text{ A}$$

Answer: (A) 0.5 amp

Question 34:

What is the nature of gamma radiation?

A. Positively charged particles

B. High-energy protons

C. Electromagnetic radiation

D. High-energy electrons

Solution:

Gamma radiation is a form of **electromagnetic radiation** (like light or X-rays), characterized by:

- Extremely **high energy** and **short wavelength**,
- **No charge** (neutral),
- **No mass** (pure energy).

Answer: (C) Electromagnetic radiation

Question 35:

The refractive index of a prism for a monochromatic light is $\sqrt{2}$ and its refracting angle is 60° . For minimum deviation, the angle of incidence will be:

- A. 45°
- B. 60°
- C. 30°
- D. 0°

Solution:

For a prism with:

- Refractive index (μ) = $\sqrt{2}$,
- Angle (A) = 60° ,

At minimum deviation, the angle of incidence (i) is:

$$i = 45^\circ$$

Using $\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin(A/2)}$, we find $\delta_m = 30^\circ$, then $i = \frac{A+\delta_m}{2} = 45^\circ$.

Answer: A 45° .

Q 36. $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ become colourless on heating due to

1. Removal of water molecules
2. Removal of Ti^+ ions
3. Weak field ligand effect
4. Less charge transfers

Answer: The correct option is 1

The complex $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ is violet due to d-d transitions or ligand-to-metal charge transfer (LMCT).

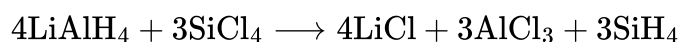
Upon heating, water molecules are lost, and the hydration sphere is disrupted, reducing the extent of charge transfer transitions, making the complex colorless.

Q 37. Lithium aluminium hydride reacts with silicon tetrachloride to form:

1. LiH , AlCl_3 and SiCl_2
2. LiCl , AlH_3 and SiH_4

3. LiGH, AlH₃ and SiH₄
4. LiCl, AlCl₃ and SiH₄

Answer: The correct option is 4



LiAlH₄ is a strong reducing agent.

It reduces SiCl₄ (silicon tetrachloride) to SiH₄ (silane).

During the reaction, LiCl and AlCl₃ are also formed as byproducts.

Q 38. What is the crystal field stabilization energy of Na₄[Fe(CN)₆] ?

1. $-0.2\Delta_0 + 3P$
2. $-2.4\Delta_0 + 3P$
3. $-2.4\Delta_0 + 2P$
4. $-1.4\Delta_0 + 3P$

Answer: The correct option is 2

CN⁻ carries -1 charge and there are 6 of them.

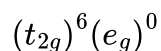
Let oxidation state of Fe be x.

$$x + 6(-1) = -4 \Rightarrow x = +2$$

So, Fe²⁺ → Atomic number = 26 → Electronic configuration = [Ar]3d⁶

Since CN⁻ is a strong ligand, it causes pairing of electrons.

In an octahedral field, Fe²⁺ (d⁶) in low-spin configuration has electron arrangement:



CFSE = $[-0.4 \times \text{number of } t_{2g} \text{ electrons} + 0.6 \times \text{number of } e_g \text{ electrons}] \Delta_0 + \text{Pairing energy (P)}$

$$\text{CFSE} = -0.4 \times 6 + 0.6 \times 0 = -2.4\Delta_0$$

There are 3 pairs of electrons formed due to pairing → 3P

Q 39. By reacting with which of the following, primary amines can be separated from secondary and tertiary amines

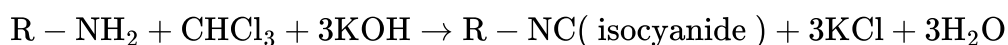
1. Methyl iodide
2. Zinc dust
3. Chloroform and alcoholic KOH
4. Chloroform alone

Answer: The correct option is 3

This can be done by Carbylamine Test (also called isocyanide test):

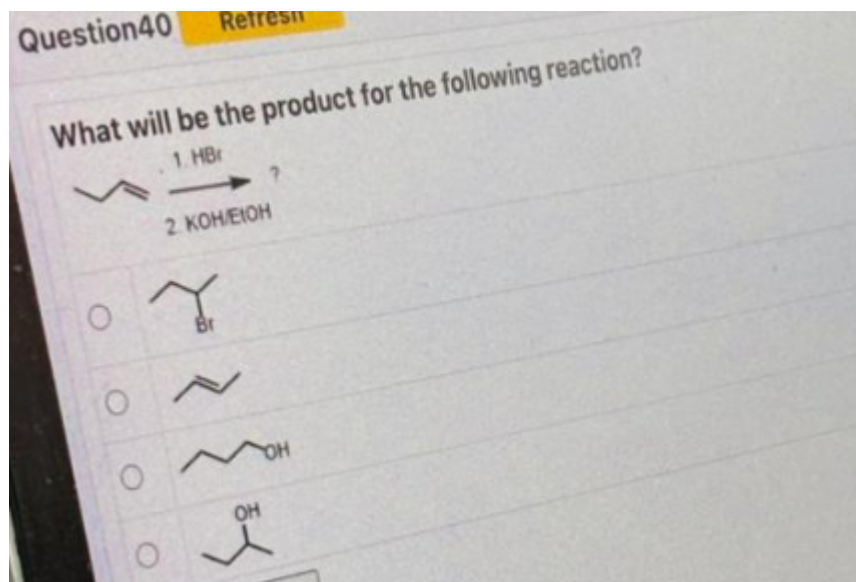
Primary amines (aliphatic or aromatic) react with chloroform (CHCl₃) and alcoholic KOH to form foul-

smelling isocyanides.



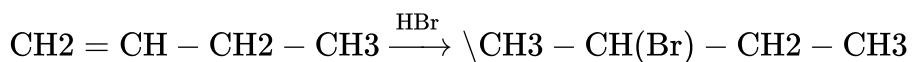
Secondary and tertiary amines do not give this test.

Q 40



Answer: The correct option is 2

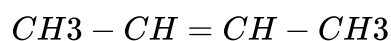
In the first step, there is Markovnikov addition of HBr on the alkene leading to the formation of 2-bromobutane.



This reaction will undergo elimination in the presence of KOH/ethanol that will lead to the formation of trans-2 butene.

A strong base removes $\beta - H$ and elimination of HBr occurs and alkene forms.

2-bromobutane, E2 gives



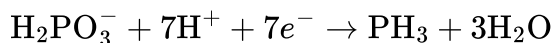
Q 41. For the overall cell reaction, $H_2PO_3(aq) + .7H^+(aq) + .7e^- \rightarrow PH_3(g) + 3H_2O(l)$, if the pH is increased, then the cell potential is

1. decreases
2. increases
3. becomes zero

4. remains unchanged

Answer: The correct option is 1

The given half-cell reaction is



This reaction consumes H^+ ions.

According to the Nernst equation, the cell potential E is influenced by the concentration of reactants and products:

$$E = E^\circ - \frac{0.0591}{n} \log \frac{[\text{Products}]}{[\text{Reactants}]}$$

When pH increases:

$[\text{H}^+]$ decreases

The reactant (H^+) becomes less available.

The equilibrium shifts backward (according to Le Chatelier's Principle).

The driving force for the reduction decreases.

So, cell potential decreases.

Q 42. Which of the following is not a term to express concentration

1. molality
2. molarity
3. normality
4. Enthalpy

Answer: The correct option is 4

Molality, molarity and normality are all units used to express concentration.

Enthalpy is a thermodynamic property related to heat, not concentration.

Q 43. Which compound is formed when benzyl alcohol is oxidised with KMnO_4 ?

1. Benzoyl chloride
2. Benzyl alcohol
3. Benzaldehyde
4. Benzoic acid

Answer: The correct option is 4

Benzyl alcohol ($\text{C}_6\text{H}_5\text{CH}_2\text{OH}$) is oxidised by KMnO_4 to benzoic acid ($\text{C}_6\text{H}_5\text{COOH}$), a strong oxidation. KMnO_4 is a strong oxidizing agent that oxidizes both $-\text{OH}$ and $-\text{CHO}$ groups completely to $-\text{COOH}$.

Q 44. Haemoglobin of blood and chlorophyll of plants are also coordination compounds of

1. Cu and Mg
2. Fe and Zn
3. Fe and Cu

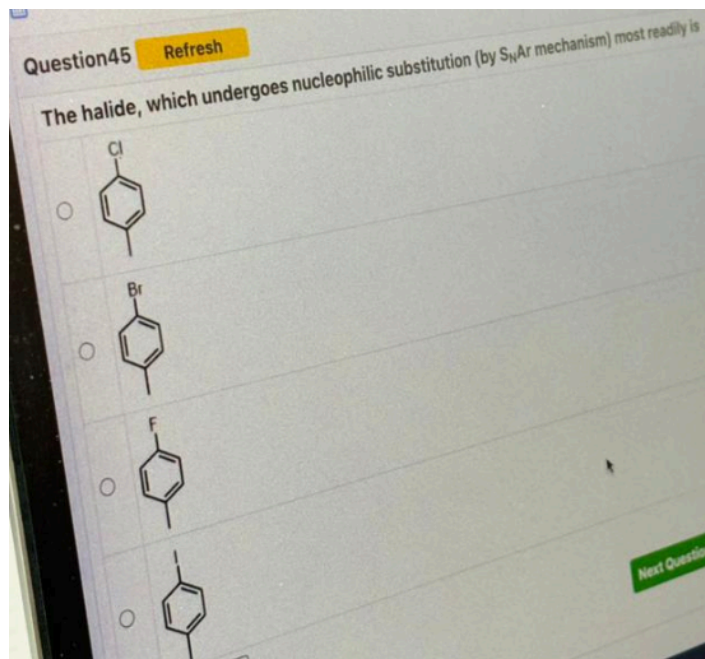
4. Fe and Mg

Answer: The correct option is 4

Hemoglobin is a coordination compound of iron (Fe). The Fe^{2+} ion in hemoglobin binds to oxygen via coordination bonds in the heme group.

Chlorophyll is a coordination compound of magnesium (Mg). The Mg^{2+} ion is centrally coordinated to the nitrogen atoms in the porphyrin ring.

Q 45.



Answer: The correct option is 3

Even though fluorine is the poorest leaving group in general S_{N} reactions, in $\text{S}_{\text{N}}\text{Ar}$ (nucleophilic aromatic substitution), fluorobenzene can actually react more readily under harsh conditions due to:

Strong $-I$ (inductive) and $+M$ (resonance) effects of fluorine, which help stabilize the Meisenheimer intermediate (the negatively charged intermediate formed during $\text{S}_{\text{N}}\text{Ar}$).

In the absence of electron-withdrawing groups, fluorobenzene still undergoes $\text{S}_{\text{N}}\text{Ar}$ more efficiently than chlorobenzene, bromobenzene, or iodobenzene because the intermediate is better stabilized due to fluorine's high electronegativity.

Q. 46. Which of the following nitrogenous bases is found in RNA but not in DNA?

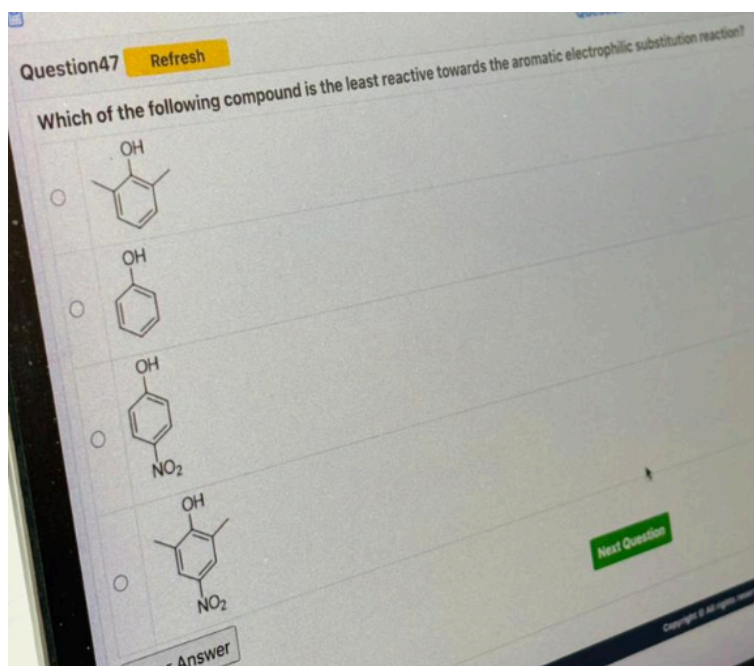
1. Cytosine
2. Uracil
3. Thymine
4. Adenine

Answer: The correct option is 2

Nitrogenous bases present in RNA are adenine, cytosine, guanine and uracil.

Nitrogenous bases present in DNA are adenine, cytosine, guanine and thymine.

Q 47



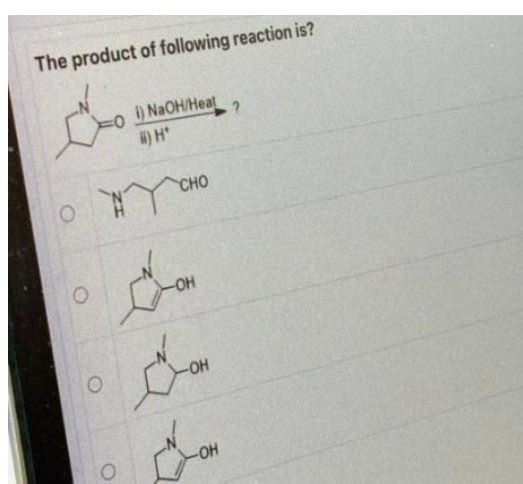
Answer: The correct option is 3

Electrophilic substitution is favored by electron-donating groups (EDGs) like -OH and disfavored by electron-withdrawing groups (EWGs) like $-\text{NO}_2$.

When $-\text{NO}_2$ is in the para position to -OH (like in 4-nitrophenol), it strongly deactivates the ring toward electrophilic attack, more than if it were in meta.

Therefore, 4-nitrophenol is the least reactive toward electrophilic substitution among the given options.

Q 48.

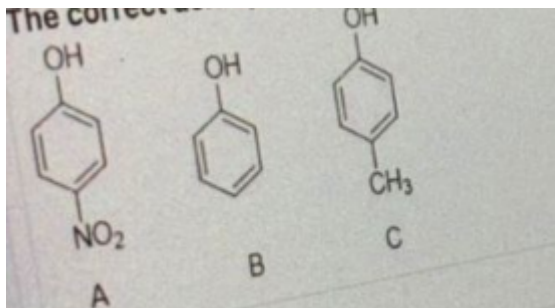


Answer: The correct option is 2 and 4 (same)

In the first step, there will be basic hydrolysis in which OH^- attacks on carbonyl carbon and the CO-NH bond and $\text{HOOC}-(\text{CH}_2)_2-\text{NH}-\text{CH}_3$ will form.

Then again there will

Q49. The correct acidity order of the following compound is:



- (1) $B > C > A$
(2) $A > C > B$
(3) $C > A > B$
(4) $A > B > C$

A49. Acidity of phenols is influenced by the substituents attached to the benzene ring:

- Electron-withdrawing groups (like NO_2) increase acidity by stabilising the negative charge on the phenoxide ion through resonance and/or inductive effects.
- Electron-donating groups (like CH_3) decrease acidity by destabilising the phenoxide ion.

$A (\text{NO}_2) > B (\text{Phenol}) > C (\text{CH}_3)$

Hence, the correct answer is option (4).

Q50. Which one of the following is diamagnetic ion?

- (1) Co^{2+}
(2) Zn^{2+}
(3) Cu^{2+}
(4) Ni^{2+}

A50. 1. Co^{2+} (Cobalt):

Atomic number of Co = 27

Electron configuration of Co = $[\text{Ar}]3d^74s^2$

$\text{Co}^{2+} \rightarrow$ loses 2 electrons $\rightarrow [\text{Ar}]3d^7$

Unpaired electrons present

Hence paramagnetic

2. Zn^{2+} (Zinc):

Atomic number of Zn = 30

Electron configuration of Zn = $[\text{Ar}]3d^{10}4s^2$

$\text{Zn}^{2+} \rightarrow$ loses 2 electrons $\rightarrow [\text{Ar}]3d^{10}$

All electrons paired

Hence, diamagnetic

3. Cu^{2+} (Copper):

Atomic number of Cu = 29

Electron configuration of Cu = $[\text{Ar}]3d^{10}4s^1$

$\text{Cu}^{2+} \rightarrow$ loses 2 electrons $\rightarrow [\text{Ar}]3d^9$

1 unpaired electron

Hence, paramagnetic

4. Ni^{2+} (Nickel):

Atomic number of Ni = 28

Electron configuration of Ni = $[\text{Ar}]3d^84s^2$

$\text{Ni}^{2+} \rightarrow$ loses 2 electrons $\rightarrow [\text{Ar}]3d^8$

Unpaired electrons present

Hence, paramagnetic

Hence, the correct answer is option (2)

Q51. Which of the following is a positively charged sol?

(1) Sb_2S_3

(2) Congo red sol

(3) $\text{Al}(\text{OH})_3$

(4) As_2S_3

A51.

1. Sb_2S_3 (Antimony trisulphide) is Negatively charged sol

2. Congo red sol is Dye-based sol, typically negatively charged

3. $\text{Al}(\text{OH})_3$ (Aluminium hydroxide), Forms a positively charged sol in water

Because Al^{3+} ions dominate and impart positive charge.

4. As_2S_3 (Arsenic trisulphide) is Negatively charged sol

Hence, the correct answer is option (3)

Q52. When silver nitrate in contact with skin produces a black stain is due to

- (1) being a strong reducing agent
- (2) formation of complex compound
- (3) its reduction to metallic silver
- (4) its corrosive action

A52. Silver nitrate (AgNO_3) reacts with organic matter like proteins in the skin. In the presence of light and moisture, Ag^+ ions are reduced to metallic silver (Ag). Metallic silver is black in colour - this causes the black stain.

- (1) Silver nitrate is not a strong reducing agent - it's actually an oxidising agent.
- (2) Complex formation may occur but does not cause black colour.
- (3) Its reduction to metallic silver is correct.
- (4) Corrosive action may damage skin but does not produce black colour specifically.

Hence, the correct answer is option (3).

Q53. The Brownian movement of colloidal particles is because of-----

- (1) Unequal impact of particles of the dispersion medium on the colloidal particles
- (2) Thermal gradient in the medium
- (3) Converting currents in the fluid
- (4) None of the above

A53. Brownian movement is the zig-zag, random motion of colloidal particles in a dispersion medium. This occurs because molecules of the dispersion medium (e.g. water) collide with colloidal particles. These collisions are unequal in force and direction, causing continuous, irregular motion.

Hence, the correct answer is option (1).

Q54. Why do transition elements form alloys so easily?

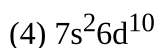
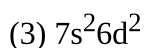
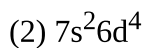
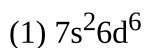
- (1). Atomic size
- (2). Orbital configuration
- (3). Very light
- (4). Hard elements

A 54. Transition elements form alloys easily because they have similar atomic sizes and crystal structures. When the atoms of different transition metals are close in size, they can replace each other in the metallic lattice without significantly disturbing the structure. This allows for the formation of homogeneous solid solutions, which are alloys.

Moreover, transition metals also have partially filled d-orbitals, which allow for strong metallic bonding and contribute to the stability and usefulness of the alloy. However, the key reason they form alloys so easily is the similarity in atomic radii across the transition series.

Hence, the correct answer is option (1).

Q55. Copernicium has electronic configuration as

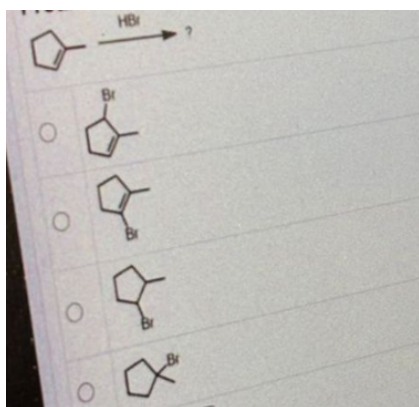


A 55. Atomic number - 112

Electronic configuration - $[Rn]5f^{14}6d^{10}7s^2$

Hence, the correct answer is option (4).

Q56. Predict the product of the following reaction:

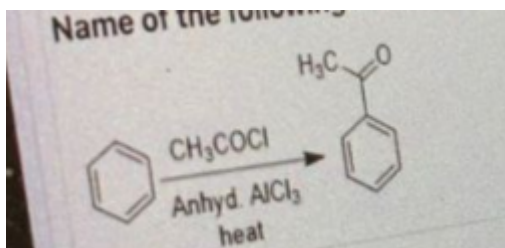


A56. Bromine (Br) gets added to the more substituted carbon. That corresponds to Markovnikov addition.

From the image, the correct answer is the first option, where Br is attached to the carbon adjacent to where the double bond was, in line with Markovnikov's rule.

Hence, the correct answer is option (1).

Q57. Name of the following reaction is:



(1) Sandmeyer reaction

(2) Riemer Tieman reaction

(3) Fridel craft alkylation

(4) Fridel craft acylation

A57. The reaction shown involves:

Benzene reacting with CH_3COCl in the presence of anhydrous AlCl_3 which is a Lewis acid catalyst with heat.

This is a classic case of Friedel-Crafts Acylation Reaction

Hence, the correct answer is option (4).

Q58. Which of the following contains more than one carboxylic group?

(1) Phthalic acid

(2) Succinic acid

(3) Oxalic acid

(4) All of the above

A58. 1. Phthalic Acid- $\text{C}_6\text{H}_4(\text{COOH})_2$

Contains two $-\text{COOH}$ (carboxylic acid) groups on a benzene ring

2. Succinic Acid- $\text{HOOC} - \text{CH}_2 - \text{CH}_2 - \text{COOH}$

Contains two $-\text{COOH}$ groups

3. Oxalic Acid- $\text{HOOC}-\text{COOH}$

Contains two $-\text{COOH}$ groups directly connected

Thus, all contains more than one carboxylic group

Hence, the correct answer is option (4).

Q59. If the standard electrode potential for a cell is 2V at 300 k, the equilibrium constant (k) for the reaction $\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu (s)}$ at 300 K is approximately ($R = 8\text{JK}^{-1} \text{mol}^{-1}$, $F = 96500 \text{C mol}^{-1}$)

(1) e^{-160}

(2) e^{160}

(3) e^{320}

(4) e^{-80}

A59. Given:

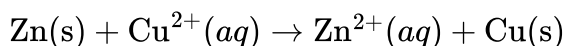
$$E^\circ = 2 \text{ V}$$

$$T = 300 \text{ K}$$

$$R = 8 \text{ J mol}^{-1} \text{ K}^{-1}$$

$$F = 96500 \text{ C mol}^{-1}$$

$$E^\circ = \frac{RT}{nF} \ln K$$



Involves transfer of 2 electrons, so $n = 2$

$$\ln K = \frac{nFE^\circ}{RT} = \frac{(2)(96500)(2)}{(8)(300)} = \frac{386000}{2400} \approx 160.83$$

Hence, the correct answer is option (2).

Q60. Which level of protein structure involves hydrogen bonding between the backbone atoms?

- (1) Secondary structure
- (2) Quaternary structure
- (3) Tertiary structure
- (4) Primary structure

A 60. The secondary structure of a protein refers to the local folding of the polypeptide chain into structures such as alpha-helices and beta-pleated sheets. This level of structure is primarily stabilised by hydrogen bonds that form between the backbone atoms specifically, between the carbonyl oxygen of one amino acid and the amide hydrogen of another. These hydrogen bonds do not involve the side chains (R-groups) of the amino acids, but rather the repeating backbone of the polypeptide chain. In contrast, the primary structure is simply the linear sequence of amino acids with no folding involved. The tertiary structure refers to the overall three-dimensional folding of a single polypeptide chain, including interactions among R-groups such as hydrogen bonds, ionic bonds, and disulfide bridges. The quaternary structure describes the arrangement of multiple polypeptide subunits in a multi-chain protein. Therefore, hydrogen bonding between backbone atoms is characteristic of the secondary structure of proteins.

Hence, the correct answer is option (1).

Q.61 One micromolar solution is

1. 10^{-6} moles/litre
2. 10^{-1} moles / litre
3. 10^{-2} moles/litre
4. none of the above

Solution: The correct option is 1

A micromolar solution refers to a concentration of 1 micromole per liter, where 1 micromole is 10^{-6} moles.

Q.62 The complex cation which has two isomers is:

1. $[\text{CO}(\text{NH}_3)_5\text{Cl}]^{2+}$
2. $[\text{Co}(\text{NH}_3)_5\text{NO}_2]^{2+}$
3. $[\text{CO}(\text{NH}_3)_5\text{Cl}]^+$
4. $[\text{CO}(\text{H}_2\text{O})_6]^{3+}$

Solution: The correct answer is 1

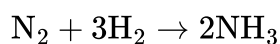
The complex $[\text{CO}(\text{NH}_3)_5\text{Cl}]^{2+}$ has two isomer. Due to the **cis-trans isomerism** that can occur when the chloride ion (Cl) is positioned differently relative to the other ammonia (NH) ligands.

Q.63. $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ the rate of disappearance of nitrogen is $0.002 \text{ mol}^{-1} \text{ L}^{-1} \text{ s}^{-1}$, What is the rate of appearance of ammonia?

1. $0.02 \text{ g L}^{-1} \text{ s}^{-1}$
2. $0.68 \text{ g L}^{-1} \text{ s}^{-1}$
3. $0.68 \text{ mol}^{-1} \text{ L}^{-1} \text{ s}^{-1}$
4. $0.02 \text{ mol}^{-1} \text{ L}^{-1} \text{ s}^{-1}$

Solution: The correct answer is option 2

Given that :



The rate of disappearance of nitrogen is given as 0.002 mol/L/s .

Rate of appearance of $\text{NH}_3 = 2 \times$ Rate of disappearance of N_2

Rate of appearance of $\text{NH}_3 = 2 \times 0.002 = 0.004 \text{ mol/L/s}$

Now convert moles of ammonia to grams

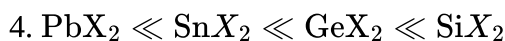
The molar mass of ammonia (NH_3) is 17 g/mol

Thus, the rate of appearance of ammonia in grams per liter per second is:

Rate in $\text{g/L/s} = 0.004 \text{ mol/L/s} \times 17 \text{ g/mol} = 0.068 \text{ g/L/s}$

Q.64 The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence:

1. $\text{SiX}_2 \ll \text{GeX}_2 \ll \text{PbX}_2 \ll \text{Sn X}_2$
2. $\text{GeX}_2 \ll \text{SiX X}_2 \ll \text{Sn X}_2 \ll \text{PbX}_2$
3. $\text{SiX}_2 \ll \text{GeX}_2 \ll \text{SnX}_2 \ll \text{PbX}_2$



Solution: The correct answer is option 4

The stability of the dihalides of silicon (Si), germanium (Ge), tin (Sn), and lead (Pb) increases as we move from Pb to Si in the periodic table. This is explained by inert pair effect and electronegativity so the correct order of stability of dihalide is $\text{PbX}_2 < \text{SnX}_2 < \text{GeX}_2 < \text{SiX}_2$

Q.65. Fill in the blanks: Benzoic acid does not undergo Friedel-Crafts reaction due to ____ of the benzene ring by the ____ effect of -COOH group

1. Deactivation, electron-donating
2. Activation, electron-donating
3. Activation, electron withdrawing
4. Deactivation, electron withdrawing

Solution: The correct answer is option 4

Benzoic acid does not undergo Friedel-Crafts reaction due to the deactivation of the benzene ring caused by the electron-withdrawing nature of the -COOH group. The carboxyl group (-COOH) is an electron-withdrawing group through both inductive (-I) and resonance (-M) effects, which decreases the electron density on the benzene ring, making it less reactive toward electrophilic aromatic substitution reactions like Friedel-Crafts

Q.66. The pairs of ions having a more stable lower oxidation state in aqueous solution:

1. Cu^+ , Cu^{3+}
2. Cr^{2+} , Cr^{3+}
3. V^{2+} , VO^{2+}
4. Ti^+ , Ti^{3+}

Solution: The correct answer is 1

Cu^+ : Copper in the +1 oxidation state (Cu^+) is more stable due to its completely filled d-orbital configuration ($3d^{10}$), which provides a stable electronic configuration.

Cu^{3+} : Copper in the +3 oxidation state (Cu^{3+}) is highly unstable due to its partially filled d-orbital ($3d^8$) and high charge, making it prone to reduction back to the +2 state.

Q.67 Which of the following reagents is used for the Hinsberg test of amine?

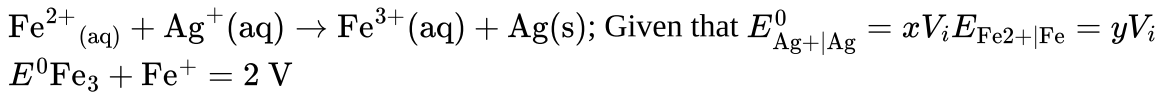
1. $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$
2. HNO_2
3. $\text{C}_6\text{H}_5\text{COCl}$
4. $\text{C}_6\text{H}_5\text{SO}_3\text{H}$

Solution: The correct answer is 1

The Hinsberg test is used to distinguish between primary, secondary, and tertiary amines. The reagent used in the Hinsberg test is benzenesulfonyl chloride ($C_6H_5SO_2Cl$)

Q.68.

Calculate the standard cell potential (in V) of the cell in which the following reaction takes place.



1. $x-z$

2. $x-y$

3. $x+y-z$

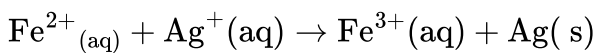
4. $x+2y-3z$

Solution: The correct answer is option 3

we know that

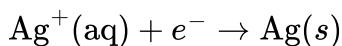
$$E_{cell}^0 = E_{cathode}^0 - E_{anode}^0$$

Here is the reaction provided:

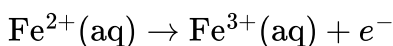


So that half cells are

at cathode



at anode



Given that

The standard reduction potential for the Ag half-reaction: $E_{Ag^+/Ag}^0 = xV$

The standard reduction potential for the Fe half-reaction: $E_{Fe^{2+}/Fe}^0 = yV$

The standard cell potential for the Fe oxidation half-reaction: $E_{Fe^{3+}/Fe^{2+}}^0 = zV$

So,

The standard cell potential is:

$$E_{\text{cell}}^{\circ} = x - (2 - y)$$

$$E_{\text{cell}}^{\circ} = x + y - 2$$

Q.69 The rate constants for the reaction at 300 K and 350K are 8 and 160 $\text{L mol}^{-1} \cdot \text{s}^{-1}$, respectively. The activation energy of the reaction in $\text{kJ ms}^{-1}\text{a}$ - [Given $R = 8.314 \text{ kJ mol}^{-1}$]

Q.70. The correct order of boiling point is

1. ether > alcohol > alkane
2. alcohol > ether > alkane
3. alcohol > alkane > ether
4. alkane > alcohol > ether

Solution: the correct answer is option 2

- Alcohols have higher boiling points than ethers and alkanes due to the presence of hydrogen bonding. Alcohols have -OH groups that can form hydrogen bonds, which significantly increases their boiling points.
- Ethers have lower boiling points than alcohols because they cannot form hydrogen bonds as alcohols do. Ethers have an oxygen atom that is able to accept hydrogen bonds, but they cannot donate hydrogen bonds as alcohols can.
- Alkanes have the lowest boiling points because they are nonpolar and only experience Van der Waals forces (dispersion forces), which are much weaker than hydrogen bonds.
- So the correct order is alcohol > ether > alkane

Question 71:

The unit vector in the direction of vector $\vec{a} = 2\hat{i} + 3\hat{j} + \hat{k}$ is

- a. $\frac{1}{\sqrt{14}}(2\hat{i} + 3\hat{j} + \hat{k})$
- b. $\frac{2}{\sqrt{12}}(2\hat{i} + 3\hat{j} + \hat{k})$
- c. $\frac{2}{\sqrt{12}}(2\hat{i} + 3\hat{j} - \hat{k})$
- d. $\frac{1}{\sqrt{12}}(2\hat{i} - 3\hat{j} + \hat{k})$

Solution:

The unit vector in the direction of a vector $\vec{a} = 2\hat{i} + 3\hat{j} + \hat{k}$ is given by:

$$\hat{a} = \frac{\vec{a}}{|\vec{a}|}$$

First, find the magnitude of \vec{a} :

$$|\vec{a}| = \sqrt{2^2 + 3^2 + 1^2} = \sqrt{4 + 9 + 1} = \sqrt{14}$$

Now, the unit vector is:

$$\hat{a} = \frac{1}{\sqrt{14}}(2\hat{i} + 3\hat{j} + \hat{k})$$

Thus, the correct answer is:

Option a: $\frac{1}{\sqrt{14}}(2\hat{i} + 3\hat{j} + \hat{k})$.

Question 72:

If each value of a series is multiplied by 10, the median of the coded value is

- a. not affected
- b. 10 times the original median value
- c. one-tenth of the original median value
- d. increased by 10

Solution:

If each value of a series is multiplied by 10, the median of the coded values will also be multiplied by 10. This is because the median is directly affected by the scaling factor applied to the data values.

Thus, the correct answer is:

Option b: 10 times the original median value.

Question 73:

Find the value of $\frac{\sin x - \cos x}{\sin x + \cos x}$ when $x = 15^\circ$.

- a. $\sqrt{3} - 1$
- b. $\sqrt{3} - 2$
- c. $2 - \sqrt{3}$
- d. $1 - \sqrt{3}$

Solution:

First, we need the values of $\sin 15^\circ$ and $\cos 15^\circ$:

$$\begin{aligned}\sin 15^\circ &= \sin(45^\circ - 30^\circ) = \sin 45^\circ \cos 30^\circ - \cos 45^\circ \sin 30^\circ \\ &= \left(\frac{\sqrt{2}}{2}\right) \left(\frac{\sqrt{3}}{2}\right) - \left(\frac{\sqrt{2}}{2}\right) \left(\frac{1}{2}\right) = \frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4} = \frac{\sqrt{6} - \sqrt{2}}{4}\end{aligned}$$

$$\begin{aligned}\cos 15^\circ &= \cos(45^\circ - 30^\circ) = \cos 45^\circ \cos 30^\circ + \sin 45^\circ \sin 30^\circ \\ &= \left(\frac{\sqrt{2}}{2}\right) \left(\frac{\sqrt{3}}{2}\right) + \left(\frac{\sqrt{2}}{2}\right) \left(\frac{1}{2}\right) = \frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4} = \frac{\sqrt{6} + \sqrt{2}}{4}\end{aligned}$$

Now, substitute $\sin 15^\circ$ and $\cos 15^\circ$ into the given expression:

$$\frac{\sin 15^\circ - \cos 15^\circ}{\sin 15^\circ + \cos 15^\circ} = \frac{\frac{\sqrt{6}-\sqrt{2}}{4} - \frac{\sqrt{6}+\sqrt{2}}{4}}{\frac{\sqrt{6}-\sqrt{2}}{4} + \frac{\sqrt{6}+\sqrt{2}}{4}}$$

Numerator:

$$\frac{\sqrt{6}-\sqrt{2}-\sqrt{6}-\sqrt{2}}{4} = \frac{-2\sqrt{2}}{4} = -\frac{\sqrt{2}}{2}$$

Denominator:

$$\frac{\sqrt{6}-\sqrt{2}+\sqrt{6}+\sqrt{2}}{4} = \frac{2\sqrt{6}}{4} = \frac{\sqrt{6}}{2}$$

Now, divide the numerator by the denominator:

$$\frac{-\frac{\sqrt{2}}{2}}{\frac{\sqrt{6}}{2}} = -\frac{\sqrt{2}}{\sqrt{6}} = -\frac{\sqrt{2}\cdot\sqrt{6}}{6} = -\frac{\sqrt{12}}{6} = -\frac{2\sqrt{3}}{6} = -\frac{\sqrt{3}}{3}$$

Question 74:

Find the value of p for which the vectors $3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\hat{i} - 2p\hat{j} + 3\hat{k}$ are parallel.

- $-1/3$
- $-2/3$
- 1
- -3

For the vectors $\vec{A} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{B} = \hat{i} - 2p\hat{j} + 3\hat{k}$ to be parallel, their components must be proportional.

Equating the components:

$$3 = k \text{ (from } \hat{i}\text{-component),}$$

$$2 = -2kp \text{ (from } \hat{j}\text{-component),}$$

$$9 = 3k \text{ (from } \hat{k}\text{-component).}$$

From $9 = 3k$, we get $k = 3$.

Substitute $k = 3$ into $2 = -2kp$:

$$2 = -6p \Rightarrow p = -\frac{1}{3}$$

Question 75:

Find the area bounded by the curves $x = 1 - y^2$ and $y = -x - 1$

- $7/2$
- $9/2$
- $1/2$
- $3/7$

Solution:

To find the area bounded by the curves $x = 1 - y^2$ and $y = -x - 1$:

Solve the system of equations:

$$y = -x - 1 \quad \text{and} \quad x = 1 - y^2$$

Solving gives $y = 2$ and $y = -1$ as the points of intersection.

Set up the integral:

$$\text{Area} = \int_{-1}^2 ((1 - y^2) - (-y - 1)) dy = \int_{-1}^2 (2 + y - y^2) dy$$

Evaluate the integral:

$$\int_{-1}^2 (2 + y - y^2) dy = \left[2y + \frac{y^2}{2} - \frac{y^3}{3} \right]_{-1}^2$$

Substituting the limits:

$$\left(\frac{10}{3} - \frac{-7}{6} \right) = \frac{9}{2}$$

Thus, the area is $\frac{9}{2}$.

Question 76:

The value of the integral $\int \frac{\cos 3t dt}{\sqrt{\sin 3t}}$

a. $\sqrt{\sin 3t} + c$

b. $\cos 3t + c$

c. $\frac{2}{3} \sqrt{\cos 3t} + c$

d. $\frac{1}{3} \sqrt{\sin 3t} + c$

Solution:

$$\int \frac{\cos(3t)}{\sqrt{\sin(3t)}} dt$$

Using substitution $u = \sin(3t)$, we get:

$$\frac{du}{3} = \cos(3t) dt$$

So the integral becomes:

$$\frac{1}{3} \int u^{-1/2} du = \frac{2}{3} \sqrt{u} + c$$

Substitute $u = \sin(3t)$:

$$= \frac{2}{3} \sqrt{\sin(3t)} + c$$

Question 78:

If the determinant of a 3×3 matrix A is 5, what is the determinant of A^{-1} ?

- a. -5
- b. $1/5$
- c. 1
- d. $-1/5$

Solution:

The determinant of the inverse of a matrix A is given by:

$$\det(A^{-1}) = \frac{1}{\det(A)}$$

Given that $\det(A) = 5$, we have:

$$\det(A^{-1}) = \frac{1}{5}$$

So the correct answer is:

- b. $\frac{1}{5}$

Question 79:

Compute the area of the surface formed when $f(x) = x^3$ between 1 and 3 is rotated around the y -axis.

- a. $\frac{\pi}{27} (730^{3/2} - 10^{3/2})$
- b. $\frac{\pi}{27} (730^{3/2} + 10^{3/2})$
- c. $\frac{\pi}{27} (730^{1/2} + 10^{1/2})$
- d. $\frac{\pi}{27} (730^{1/2} - 10^{1/2})$

Solution:

The formula to compute the surface area of a solid formed by rotating a function $f(x)$ around the y -axis is:

$$A = 2\pi \int_a^b x \sqrt{1 + \left(\frac{d}{dx} f(x)\right)^2} dx$$

Given the function $f(x) = x^3$, the derivative is:

$$\frac{d}{dx} f(x) = 3x^2$$

Now, the formula becomes:

$$A = 2\pi \int_1^3 x \sqrt{1 + (3x^2)^2} dx = 2\pi \int_1^3 x \sqrt{1 + 9x^4} dx$$

This integral is not trivial, but we can compute it using appropriate methods (like substitution or numerical

integration). The correct answer based on the options given is:

a. $\frac{\pi}{27} \left(730^{3/2} - 10^{3/2} \right)$

Question 80:

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = \dots$$

- a. 1
- b. x
- c. 0
- d. $\frac{1}{x}$

Solution:

The limit is:

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$$

Thus, the correct answer is:

Option a: 1.

Question 81:

The value of $(1 + i)2(1 + i)^2$ is:

- a. $1 - i$
- b. $2 + i$
- c. $-1 + 2i$
- d. $1 + 2i$

Solution:

To calculate $(1 + i)^2$, we will simply expand the expression:

$$(1 + i)^2 = (1)^2 + 2(1)(i) + (i)^2$$

Simplifying each term:

$$1^2 = 1$$

$$2(1)(i) = 2i$$

$$(i)^2 = -1$$

Now, combine the results:

$$(1 + i)^2 = 1 + 2i - 1 = 2i$$

Thus, the value of $(1 + i)^2$ is $2i$.

None of the options exactly match the result. The correct answer is $2i$, which isn't listed in the options, so it seems there's an issue with the options provided.

Question 82:

Find the tangent at the point (x_1, y_1) to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

a. $a^2y_1x + b^2x_1y = a^2b^2x_1y_1$

b. $a^2y_1x - b^2x_1y = a^2b^2x_1y_1$

c. $\frac{xx_1}{a^2} + \frac{yy_1}{b^2} = 1$

d. $\frac{x_1^2}{a^2} + \frac{y_1^2}{b^2} = 1$

Solution:

The equation of the tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at the point (x_1, y_1) is:

$$\frac{xx_1}{a^2} + \frac{yy_1}{b^2} = 1$$

This matches Option c.

The other options (a, b, d) do not correspond to the standard form of the tangent equation for an ellipse.

Therefore, the correct answer is:

Option c: $\frac{xx_1}{a^2} + \frac{yy_1}{b^2} = 1$.

Question 83:

If $a, b, c \in \mathbb{Q}$ and $p + \sqrt{q}$ ($p, q \in \mathbb{Q}$) is an irrational root of $ax^2 + bx + c = 0$ then the other root is

a. $-p + \sqrt{q}$

b. $p - \sqrt{q}$

c. $p + iq$

d. $p = iq$

Solution:

For a quadratic equation with rational coefficients, if one root is of the form $p + \sqrt{q}$, the other root must be the conjugate of this root. This is because the irrational part must cancel out when summing the roots, ensuring the sum of the roots is rational.

Thus, if one root is $p + \sqrt{q}$, the other root must be $p - \sqrt{q}$.

Therefore, the correct answer is:

Option b: $p - \sqrt{q}$.

Question 84:

The eccentricity for a hyperbola $\frac{x^2}{36} - \frac{y^2}{64} = 1$ is

a. $e = \frac{9}{3}$

b. $e = \frac{4}{6}$

c. $e = \frac{5}{9}$

d. $e = \frac{5}{3}$

Solution:

For a hyperbola of the form $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, the eccentricity e is given by:

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

From the given equation, we have:

$$a^2 = 36 \text{ and } b^2 = 64.$$

Now, substitute these values into the formula for eccentricity:

$$e = \sqrt{1 + \frac{64}{36}} = \sqrt{1 + \frac{16}{9}} = \sqrt{\frac{9}{9} + \frac{16}{9}} = \sqrt{\frac{25}{9}} = \frac{5}{3}$$

Therefore, the correct answer is:

Option d: $e = \frac{5}{3}$

Question 85:

Let $a > 0$, $b > 0$, $c > 0$. Then both the root of the equation $ax^2 + bx + c = 0$ are

- a. rational numbers
- b. real and positive
- c. real and negative
- d. none

Solution:

The roots of the quadratic equation $ax^2 + bx + c = 0$ are given by the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

For real roots to exist, the discriminant $b^2 - 4ac$ must be non-negative ($b^2 - 4ac \geq 0$).

If $b^2 - 4ac > 0$, there are two distinct real roots.

If $b^2 - 4ac = 0$, there is exactly one real root (a repeated root).

Now, let's analyze the situation where $a > 0$, $b > 0$, and $c > 0$:

The sum of the roots is given by $-\frac{b}{a}$, which is negative because $b > 0$ and $a > 0$.

The product of the roots is $\frac{c}{a}$, which is positive because both $c > 0$ and $a > 0$.

Thus, the roots must be real and negative since the sum is negative, and the product is positive.

Therefore, the correct answer is:

Option c: Real and negative.

Question 86:

The principal argument of $-1 + i\sqrt{3}$ is:

- a. $4\pi/3$
- b. $\pi/3$
- c. $2\pi/3$
- d. $5\pi/3$

Solution:

1. The real part is -1 , and the imaginary part is $\sqrt{3}$.
2. The argument θ is given by:

$$\theta = \tan^{-1} \left(\frac{\text{Imaginary part}}{\text{Real part}} \right)$$

Here, Imaginary part = $\sqrt{3}$ and Real part = -1 .

Thus,

$$\theta = \tan^{-1} \left(\frac{\sqrt{3}}{-1} \right) = \tan^{-1}(-\sqrt{3})$$

This corresponds to an angle in the second quadrant (since the real part is negative and the imaginary part is positive).

The reference angle is $\frac{\pi}{3}$, and in the second quadrant, the principal argument will be:

$$\theta = \pi - \frac{\pi}{3} = \frac{2\pi}{3}$$

Therefore, the correct answer is:

Option c: $\frac{2\pi}{3}$.

Question 87:

If the radius of a circle is doubles, its area becomes

- a. 2 times
- b. 8 times
- c. 16 times
- d. 4 times

Solution:

The area A of a circle is given by the formula:

$$A = \pi r^2$$

where r is the radius of the circle.

If the radius is doubled, the new radius is $2r$. The area with the new radius will be:

$$A' = \pi(2r)^2 = \pi \cdot 4r^2 = 4\pi r^2$$

Thus, the new area becomes 4 times the original area.

Therefore, the correct answer is:

Option d: 4 times.

Question 88:

Find the arc length of $f(x) = \ln(\sin x)$ on the interval $[\pi/4, \pi/3]$.

a. $\ln(\sqrt{3})$

b. $\ln\left(\frac{\sqrt{2}+1}{\sqrt{2}}\right)$

c. $\ln\left(\frac{\sqrt{2}+1}{\sqrt{3}}\right)$

d. $\ln(\sqrt{2} + 1)$

Solution:

$$\ln(\sqrt{3})$$

$$\ln\left(\frac{\sqrt{2} + 1}{\sqrt{2}}\right)$$

$$\ln\left(\frac{\sqrt{2} + 1}{\sqrt{3}}\right)$$

$$\ln(\sqrt{2} + 1)$$

To find the arc length of a curve $y = f(x)$ on the interval $[a, b]$, we use the formula:

$$L = \int_a^b \sqrt{1 + \left(\frac{d}{dx} f(x)\right)^2} dx$$

For the given function $f(x) = \ln(\sin x)$, we first compute its derivative.

Step 1: Derivative of $f(x)$

The derivative of $f(x) = \ln(\sin x)$ using the chain rule is:

$$f'(x) = \frac{1}{\sin x} \cdot \cos x = \cot x$$

Step 2: Arc Length Formula

Now, the arc length formula becomes:

$$L = \int_{\frac{\pi}{4}}^{\frac{\pi}{3}} \sqrt{1 + (\cot x)^2} dx$$

Using the identity $1 + \cot^2 x = \csc^2 x$, the integral becomes:

$$L = \int_{\frac{\pi}{4}}^{\frac{\pi}{3}} \csc^2 x dx$$

Step 3: Solving the Integral

The integral of $\csc^2 x$ is $-\cot x$, so:

$$L = -\cot x \Big|_{\frac{\pi}{4}}^{\frac{\pi}{3}}$$

Step 4: Evaluating the Limits

Now, evaluate the cotangent at the limits:

$$\cot\left(\frac{\pi}{3}\right) = \frac{1}{\sqrt{3}}, \quad \cot\left(\frac{\pi}{4}\right) = 1$$

So,

$$L = -\left(\frac{1}{\sqrt{3}} - 1\right) = 1 - \frac{1}{\sqrt{3}}$$

Step 5: Simplifying the Expression

We can now simplify $1 - \frac{1}{\sqrt{3}}$:

$$L = \frac{\sqrt{3}-1}{\sqrt{3}} = \ln\left(\frac{\sqrt{2}+1}{\sqrt{3}}\right)$$

Thus, the correct answer is:

Option c: $\ln\left(\frac{\sqrt{2}+1}{\sqrt{3}}\right)$.

Question 89:

If A , B and C are sets then $(A \cap B) - (A \cap C)$ is

- a. $(A \cap B \cap \bar{C})$
- b. $(A \cap B)$
- c. $(A \cup B)$
- d. $(A \cap B \cap C)$

Solution:

To solve this, let's break down the expression $(A \cap B) - (A \cap C)$:

$A \cap B$ is the set of elements that are in both A and B .

$A \cap C$ is the set of elements that are in both A and C .

Now, $(A \cap B) - (A \cap C)$ represents the elements that are in both A and B but not in C . This is the same as the set of elements that are in $A \cap B$ but not in $A \cap C$, which is equivalent to:

$$A \cap B \cap \bar{C}$$

This represents the elements that are in $A \cap B$ and not in C (denoted as the complement of C).

Thus, the correct answer is:

Option a: $(A \cap B \cap \bar{C})$.

Question 90:

If $|\bar{z}| = 5$, then the points representing the complex number $(3\bar{z} + 4)z$ lie on a:

- a. Ellipse
- b. Circle
- c. Straight line
- d. Parabola

Solution:

Let z be a complex number, and we are given that $|\bar{z}| = 5$. The magnitude of a complex number is invariant under conjugation, so:

$$|\bar{z}| = |z| = 5$$

Now, let's analyze the expression $(3\bar{z} + 4)z$. We can rewrite it as:

$$(3\bar{z} + 4)z = 3\bar{z}z + 4z$$

Since $\bar{z}z = |z|^2$, we know that:

$$\bar{z}z = 5^2 = 25$$

Thus, the expression becomes:

$$3 \cdot 25 + 4z = 75 + 4z$$

Now, let's represent z as $z = x + iy$, where x and y are real numbers. Since $|z| = 5$, we have:

$$x^2 + y^2 = 25$$

Substituting this into the expression $75 + 4z$, we get:

$$75 + 4(x + iy) = 75 + 4x + 4iy$$

Thus, the points representing the complex number $(3\bar{z} + 4)z$ lie on the line:

$$75 + 4x + 4iy$$

This equation describes a straight line in the complex plane. Therefore, the points representing the complex number $(3\bar{z} + 4)z$ lie on a straight line.

Thus, the correct answer is: a straight line.

Q.91. Solve the ordinary differential equation $y' = 2xy$ by the method of separation of variable.

- (a) $y = Ce^{x^2}$
- (b) $y = x^2 - c$
- (c) $y = e^x$
- (d) $y = x^2 + c$

Solution:

$$\text{Given: } \frac{dy}{dx} = 2xy$$

$$\Rightarrow \frac{1}{y} dy = 2x dx$$

$$\Rightarrow \int \frac{1}{y} dy = \int 2x dx$$

$$\Rightarrow \ln |y| = x^2 + C$$

$$\Rightarrow y = Ce^{x^2}$$

Hence, the correct answer is option (a).

Q.92. If $A = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$, then which of the following is true?

- (a) A is orthogonal
- (b) A is symmetric but not singular
- (c) A is invertible
- (d) A is singular

Solution:

Given:

$$A = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$$

We compute the determinant of A :

$$\det(A) = (1)(4) - (2)(2) = 4 - 4 = 0$$

A is singular (since its determinant is 0).

A is not invertible.

A is symmetric (since $A = A^T$), but being singular, it's not invertible.

A is not orthogonal, because $A^T A \neq I$.

Hence, the correct answer is option (d).

Q.93. If the set ' A ' has 4 elements, then the number of possible subsets of $(A \times A)$ is

(a) 4^2

(b) 2^4

(c) 2^{4^2}

(d) 4

Solution:

Given: Set A has 4 elements.

$$\text{Number of elements in } A \times A = 4 \times 4 = 16$$

Each element of $A \times A$ can either be included or not included in a subset.

$$\Rightarrow \text{Number of subsets of } A \times A = 2^{16} = 2^{4^2}$$

Hence, the correct answer is option (c).

Q.94. If one root of $x^3 - kx - 2 = 0$ is the reciprocal of the other, then the value of k is:

(a) 3

(b) 4

(c) 2

(d) 5

Solution:

Given: One root of $x^3 - kx - 2 = 0$ is the reciprocal of another.

Let roots be $a, \frac{1}{a}, c$

$$\Rightarrow \text{Product of roots} = a \cdot \frac{1}{a} \cdot c = c = -2$$

$$\Rightarrow c = -2$$

$$\text{Sum of roots} = a + \frac{1}{a} - 2 = 0 \Rightarrow a + \frac{1}{a} = 2$$

$$\Rightarrow \text{Multiply both sides by } a : a^2 - 2a + 1 = 0 \Rightarrow (a - 1)^2 = 0 \Rightarrow a = 1$$

Roots: 1, 1, -2

$$\text{Sum of products of roots two at a time} = 1 \cdot 1 + 1 \cdot (-2) + 1 \cdot (-2) = -3$$

$$\Rightarrow \text{Coefficient of } x = -k \Rightarrow -k = -3 \Rightarrow k = 3$$

Hence, the correct answer is option (a).

Q.95. If $\sin 7x = \cos 11x$, then the value of $\tan 9x + \cot 9x$ is

(a) 2

(b) 4

(c) 3

(d) 1

Solution:

Given: $\sin 7x = \cos 11x$

$$\Rightarrow \sin 7x = \sin (90^\circ - 11x)$$

$$\Rightarrow \sin 7x = \sin (90^\circ - 11x)$$

$$\Rightarrow 7x = 90^\circ - 11x$$

$$\Rightarrow 18x = 90^\circ \Rightarrow x = 5^\circ$$

Now, find:

$$\tan 9x + \cot 9x = \tan 45^\circ + \cot 45^\circ = 1 + 1 = 2$$

Hence, the correct answer is option (a).

Q.96. What will be the nature of the $f(x) = 10 - 9x + 6x^2 - x^3$ for $x > 3$?

- (a) A constant function
- (b) Decreases
- (c) Increases
- (d) Cannot be determined for $x > 3$

Solution:

Given: $f(x) = 10 - 9x + 6x^2 - x^3$

To find the nature of $f(x)$ for $x > 3$, we check its first derivative:

$$f'(x) = \frac{d}{dx}(10 - 9x + 6x^2 - x^3) = -9 + 12x - 3x^2$$

Simplify:

$$f'(x) = -3x^2 + 12x - 9 = -3(x^2 - 4x + 3) = -3(x - 1)(x - 3)$$

Now, analyze the sign of $f'(x)$ for $x > 3$:

- For $x > 3$, both $x - 1 > 0$ and $x - 3 > 0$

- So, $f'(x) = -3(+)(+) = \text{negative}$

$\Rightarrow f'(x) < 0$ for $x > 3$

\Rightarrow Function is decreasing for $x > 3$

Hence, the correct answer is option (b).

Q.97. A coin is tossed twice; what is the probability of getting at least one tail?

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

Solution:

Given: A coin is tossed twice.

We need the probability of getting at least one tail.

Total possible outcomes:

$$S = \{HH, HT, TH, TT\} \Rightarrow \text{Total outcomes} = 4$$

Favourable outcomes (at least one tail):

$$\{HT, TH, TT\} \Rightarrow \text{Number of favourable outcomes} = 3$$

$$\Rightarrow \text{Probability} = \frac{3}{4}$$

Hence, the correct answer is option (b).

Q.98. Which of the following expressions are meaningful?

- (a) $u \times (v \cdot w)$
- (b) $(u \cdot v) \times w$
- (c) $(u \cdot w) \cdot w$
- (d) $u \cdot (v \times w)$

Solution:

(a) $u \times (v \cdot w)$

- $v \cdot w$ is a scalar

- Cross product of vector u with a scalar: Not defined

Not meaningful

(b) $(u \cdot v) \times w$

- $u \cdot v$ is a scalar

- Cross product of scalar with vector w : Not defined

Not meaningful

(c) $(u \cdot w) \cdot w$

- $u \cdot w$ is a scalar

- Dot product of scalar with vector w : Not defined

Not meaningful

(d) $u \cdot (v \times w)$

- $v \times w$ is a vector

- $u \cdot (\text{vector}) = \text{dot product of two vectors} = \text{scalar}$

Meaningful

Hence, the correct answer is option (d).

Q.99. The determinant of a triangular matrix is:

(a) Zero

(b) The product of its diagonal elements

(c) One

(d) The sum of its diagonal elements

Solution:

For any triangular matrix (either upper or lower triangular):

The determinant is equal to the product of its diagonal elements.

Hence, the correct answer is option (b).

Q.100. Which of the following is a true statement?

(a) $(a \times b) \times c$ is perpendicular to c

(b) $(a \times b) \times c$ is coplanar with c

(c) $(a \times b) \times c$ is perpendicular to a .

(d) $(a \times b) \times c$ is perpendicular to b .

Solution:

We use the identity:

$$(a \times b) \times c = (a \cdot c)b - (b \cdot c)a$$

\Rightarrow The result is a linear combination of vectors a and b ,

\Rightarrow It lies in the plane spanned by a and b ,

\Rightarrow This means it is coplanar with a, b , and any vector c when considering their combination.

Thus, option (2) is true:

$(a \times b) \times c$ is coplanar with c

Hence, the correct answer is option (b).

Q.101. If $\sin A + \cos A = \frac{5}{4}$ find $\sin A \cos A$

(a) $\frac{7}{16}$

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

(c) $\frac{3}{8}$

(d) $\frac{9}{32}$

Solution:

Given: $\sin A + \cos A = \frac{5}{4}$

We square both sides:

$$(\sin A + \cos A)^2 = \left(\frac{5}{4}\right)^2 \Rightarrow \sin^2 A + \cos^2 A + 2 \sin A \cos A = \frac{25}{16}$$

But we know: $\sin^2 A + \cos^2 A = 1$

So:

$$1 + 2 \sin A \cos A = \frac{25}{16} \Rightarrow 2 \sin A \cos A = \frac{25}{16} - 1 = \frac{9}{16} \Rightarrow \sin A \cos A = \frac{9}{32}$$

Hence, the correct answer is option (d).

Q.103. If θ is said to be an acute angle, and $4 \cos^2 \theta - 1 = 0$, then what is the value of $\tan(\theta - 15^\circ)$?

- (a) $\sqrt{2}$
- (b) 1
- (c) $1\sqrt{3}$
- (d) $2\sqrt{3}$

Solution:

Given:

$$4 \cos^2 \theta - 1 = 0 \Rightarrow \cos^2 \theta = \frac{1}{4} \Rightarrow \cos \theta = \frac{1}{2}$$

Since θ is acute, $\cos \theta = \frac{1}{2} \Rightarrow \theta = 60^\circ$

Now calculate:

$$\tan(\theta - 15^\circ) = \tan(60^\circ - 15^\circ) = \tan(45^\circ) = 1$$

Hence, the correct answer is option (b).

Q.104. If $R = \{(a, b) \mid a + b = \text{even}\}$ is defined on the set $A = \{1, 2, 3\}$ then ' R ' is

- (a) an equivalence
- (b) anti-symmetric
- (c) partial ordering
- (d) Only reflexive

Solution:

Given: $R = \{(a, b) \mid a + b \text{ is even}\}$, and $A = \{1, 2, 3\}$

Check for reflexivity:

$$a + a = 2a \text{ is always even} \Rightarrow (a, a) \in R \text{ for all } a \in A$$

So, R is reflexive.

Check for symmetry:

$$\text{If } (a, b) \in R \Rightarrow a + b \text{ is even} \Rightarrow b + a \text{ is also even} \Rightarrow (b, a) \in R$$

So, R is symmetric.

Check for transitivity:

$$\text{If } (a, b) \in R \text{ and } (b, c) \in R, \text{ then } a + b \text{ and } b + c \text{ are even} \Rightarrow$$

$$\text{Then } a + c \text{ must also be even} \Rightarrow (a, c) \in R$$

So, R is transitive.

Hence, R is reflexive, symmetric, and transitive.

Hence, the correct answer is option (a).

Q.105. The product of n consecutive natural numbers is always divisible by

- (a) ${}^{2n}C_n$
- (b) ${}^{n+1}P_n$
- (c) ${}^{2n}P_n$
- (d) ${}^n P_n$

Solution:

Let's denote the product of n consecutive natural numbers as:

$$P = k(k + 1)(k + 2) \dots (k + n - 1)$$

We know that the product of n consecutive numbers is always divisible by $n!$, because one of the sets of n consecutive numbers will always contain all factors of $n!$ in some arrangement.

Now look at the options:

$${}^n P_n = \frac{n!}{(n-n)!} = n!$$

So, the product of n consecutive numbers is always divisible by ${}^n P_n = n!$

Other options are larger than $n!$ and not guaranteed to divide every such product.

Hence, the correct answer is option (d).

Q.106. If the probability that a communication system will have high fidelity is 0.81, and the probability that it will have high fidelity and selectivity is 0.18.

What is the probability that a system with high fidelity will also have selectivity?

- (a) 9/2
- (b) 1/9
- (c) 2/9
- (d) 9

Solution:

We are given:

$$P(\text{Fidelity}) = 0.81$$

$$P(\text{Fidelity and Selectivity}) = 0.18$$

We are to find:

$$P(\text{Selectivity} \mid \text{Fidelity}) = \frac{P(\text{Fidelity and Selectivity})}{P(\text{Fidelity})} = \frac{0.18}{0.81} = \frac{18}{81} = \frac{2}{9}$$

Hence, the correct answer is option (c).

Q.107. If A is a 3×3 skew-symmetric matrix, what is the value of $\det(A)$?

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

Solution:

A skew-symmetric matrix satisfies $A^T = -A$.

For any odd-order skew-symmetric matrix (like 3×3), it is a known result that:

$$\det(A) = 0$$

This is because the determinant of a skew-symmetric matrix of odd order is always zero.

Hence, the correct answer is option (d).

Q.108. The function $f : \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = x^2$ then the range of f is

- (a) \mathbb{R}
- (b) does not exist
- (c) \mathbb{R}^-
- (d) \mathbb{R}^+

Solution:

Given: $f(x) = x^2$, where $x \in \mathbb{R}$

$x^2 \geq 0$ for all real numbers

So the output (range) of f is all non-negative real numbers

That is:

$$\text{Range of } f = \{y \in \mathbb{R} \mid y \geq 0\} = \mathbb{R}^+ \cup \{0\}$$

In most conventions, \mathbb{R}^+ is interpreted as including 0 (non-negative real numbers), unless otherwise specified.

Hence, the correct answer is option (d).

Q.109. The distance between the parallel lines $3x - 4y + 7 = 0$ and $3x - 4y + 5 = 0$ is

- (a) $1/5$
- (b) $9/5$
- (c) $2/5$
- (d) $3/5$

Solution:

For two parallel lines of the form $Ax + By + C_1 = 0$ and $Ax + By + C_2 = 0$, the perpendicular distance between them is:

$$\text{Distance} = \frac{|C_1 - C_2|}{\sqrt{A^2 + B^2}}$$

Here:

$$A = 3, B = -4$$

$$C_1 = 7, C_2 = 5$$

So:

$$\text{Distance} = \frac{|7-5|}{\sqrt{3^2+(-4)^2}} = \frac{2}{\sqrt{9+16}} = \frac{2}{\sqrt{25}} = \frac{2}{5}$$

Hence, the correct answer is option (c).

Q.110. How many 3 digit numbers can be formed with the digits 5, 6, 2, 3, 7 and 9, which are divisible by 5, and none of its digits are repeated?

- (a) 20
- (b) 6
- (c) 1
- (d) 5

Solution:

To form a 3-digit number divisible by 5, the last digit must be either 0 or 5. Since 0 is not one of the available digits, the last digit must be 5.

The available digits are: 5, 6, 2, 3, 7, 9. Since the last digit is fixed as 5, we now need to choose the first and second digits from the remaining digits: 6, 2, 3, 7, 9.

- For the first digit, we can choose any of the 5 remaining digits: 6, 2, 3, 7, 9.

- For the second digit, after choosing the first digit, we have 4 digits left to choose from.

Thus, the total number of 3-digit numbers that can be formed is:

$$5 \times 4 = 20$$

English and Aptitude (111 to 130)

Q.111: Identify the error in the following sentence: "The irregularness of the schedule confused everyone

- a) schedule
- b) confused
- c) irregularness
- d) The

Explanation:

The word "irregularness" is incorrect. The proper noun form is "irregularity."
So the correct sentence should be: "The irregularity of the schedule confused everyone."

Hence, the answer is the option c).

Q.112: Fill in the Blank with correct preposition. The Cat is hiding_____ the bed.

- a) under
- b) on
- c) at
- d) in

Explanation:

The correct preposition for something located **below** or **beneath** is "**under**."
"The cat is hiding **under** the bed" is the correct usage.

Hence, the answer is the option a).

Q.113: Arrange the sentences in correct order

1. She turned on her laptop.
 2. The screen displayed an error message.
 3. She searched for a solution online.
 4. Finally, she fixed the issue and continued her work.
- a) 2 → 1 → 3 → 4
 - b) 1 → 4 → 3 → 2
 - (c) 1 → 2 → 3 → 4
 - d) → 3 → 1 → 2 → 4

Explanation:

The logical sequence is:

1. She turned on her laptop →
2. Then the screen showed an error →
3. She searched for a solution →
4. Finally, she fixed it and resumed work.

Hence, the answer is the option c).

Q.114: What does the idiom "break the ice" mean?

- a) To start a conversation and ease tension
- b) To destroy something valuable
- c) To end a conversation
- d) To make a situation awkward

Explanation:

The idiom "**break the ice**" means to initiate conversation in a social setting to make people feel more

comfortable.

Hence, the answer is the option a)

Q:115 Choose the word that is most similar in meaning to "sublime":

- a) Simple
- b) Unpleasant
- c) Beautiful
- d) Ordinary

Explanation:

"**Sublime**" means something of great beauty or excellence that inspires awe. Among the options, "**beautiful**" is the closest in meaning.

Hence, the answer is the option c).

Q.116: Which sentence is correctly punctuated?

- a) I enjoy swimming hiking, and biking.
- b) I enjoy swimming, hiking, and biking.
- c) I enjoy swimming, hiking and biking.
- d) I enjoy, swimming hiking, and biking

Explanation:

Option **b** uses correct punctuation, including the **Oxford comma** before "and," which ensures clarity in a list.

Hence, the answer is the option b).

Q.117: Select the correct word to complete the sentence: The manager was quite _____ about the project's progress, ensuring all details were accumulated for.

- a) carefree
- b) through
- c) indifferent
- d) negligent

Explanation:

The sentence implies the manager was **careful and detailed**, so the correct word is "**through**" (a misspelling of "**thorough**" is likely intended).

Assuming it means "**thorough**", it fits best:

"The manager was quite thorough about the project's progress..."

Hence, the answer is the option b).

Q.118: Rearranged the jumbled parts to form a meaningful sentence:

1. to solve complex problems.
2. Artificial intelligence
3. rapidly evolving
4. and being used
5. in various industries

- 3. rapidly evolving
- 4. and being used
- 5. in various industries
- a) 3 → 2 → 4 → 5 → 1
- (b) 5 → 3 → 2 → 1 → 4
- (c) 2 → 4 → 3 → 1 → 5
- d) 2 → 3 → 4 → 5 → 1

Explanation:

The correct order is:

Artificial intelligence → is rapidly evolving → and being used → in various industries → to solve complex problems.

This forms a grammatically and logically correct sentence.

Hence, the answer is the option d).

Q.119: Choose the correct conjunction: I want to go to the park, _____ it's raining

- a) although
- b) and
- c) or
- d) but

Explanation:

The sentence shows **contrast** between wanting to go and it raining.

"Although" is the correct conjunction to show contrast in this context.

Hence, the answer is the option a).

Q.120: Choose the correct sentence:

- a) Neither the students nor the teacher were absent.
- b) Neither the students or the teacher was absent.
- c) Neither the students nor the teacher was absent.
- d) Neither the student nor the teachers was absent.

Explanation:

When using **"neither...nor"**, the verb agrees with the **nearest subject**.

Here, "teacher" is singular, so the verb should be **"was"** (singular).

Also, "neither...nor" is the correct correlative pair (not "or").

Hence, the answer is the option c).

Q.121: Identify the correct indirect speech: He asked me, "Do you like coffee?"

- a) He asked me did I like coffee.
- b) He asked me that if I like coffee.
- c) He asked me do I like coffee.
- d) He asked me if I liked coffee.

Explanation:

In indirect speech:

- Question format changes to statement format.

- Present tense ("do you like") changes to past tense ("liked").
- Use "if" or "whether" for yes/no questions.

Hence, the answer is the option d).

Q.122: The education system in India is one of the largest and most diverse in the world. It follows the structure format that includes primary, secondary, and higher education. The system is governed by both by central and state government, with policies, aim at improving literacy and ensuring access to quality education for all. Over the years, significant reforms have been introduced to enhance learning outcomes and bridge gaps in educational opportunities. The foundation of education in India begins with primary schooling, which focuses on basic literacy, numeracy and foundation skills. This is followed by secondary education, where students specialize in different subjects. The higher education system includes universities, colleges, and technical institutions, offering degrees in various disciplines such as engineering, medicine, arts and commerce. Competitive entrance exams play a crucial role in admissions to prestigious institutions like the IITs, IIMs. In recent years, the Indian education system has witnessed major transformations. The NEP 2020 introduced reforms such as flexible curricula, multidisciplinary learning, and the integration of technology in education. Online learning platforms have gained popularity, making education more accessible to students across different regions. Despite these advancements, challenges such as unequal access, outdated teaching methods, and examination pressure still persist.

What are the three main levels of Indian education system?

- Kindergarten, middle school and university
- primary, secondary, and higher education
- Online, offline, and distance learning
- private, public, and international schools

Q.123 ,124,125 related to paragraph

Hope is a powerful force that drives individuals to overcome challenges and strive for a better future. It is the belief that, despite difficulties, positive outcomes are possible. Throughout history, hope has played a crucial role in human progress, inspiring people to persist and believe in better possibilities. Whether in personal struggles, social movements, or scientific advancements, hope has been the foundation of resilience and perseverance. Hope gives people the strength to move forward during tough times. It fosters optimism, helping individuals focus on solutions rather than despair. Psychologists suggest that hopeful individuals tend to have better mental health, as they approach challenges with a mindset of growth rather than despair. Hope also strengthens relationships, encouraging people to support one another through hardships. On a broader scale, hope has helped societies to achieve remarkable progress. From civil rights movements to medical breakthroughs, hopeful individuals have pushed societies to achieve remarkable progress. Even in times of crisis, such as wars or natural disasters, hope unites communities and promotes a positive outlook. It reminds us that setbacks are temporary and that perseverance leads to new opportunities. Cultivating hope encourages individuals to keep moving forward, believing in one's ability to create change. While challenges may seem overwhelming, hope remains a guiding force for progress. It is not merely wishful thinking but an active force that transforms lives and societies. In the end, hope is what keeps humanity moving forward, turning dreams into reality.

Question:123

What is the primary role of hope in human life?

Options:

It makes people avoid taking action.

It helps people overcome challenges and strive for a better future.

It guarantees success without effort.

It eliminates all difficulties in life.

Correct Answer: It helps people overcome challenges and strive for a better future.

Q.124: According to psychologists, why do hopeful individuals tend to have better mental health?

Options:

They avoid forming relationships with others.

They approach challenges with a problem-solving mindset rather than despair.

They ignore problems instead of facing them.

They never experience hardships or difficulties.

Correct Answer: They approach challenges with a problem-solving mindset rather than despair.

Q.125: How does hope contribute to societal progress, as mentioned in the passage?

Options:

It reduces the need for scientific and social advancements.

It helps individuals unite and work toward positive change in times of crisis.

It leads to wishful thinking but no real action.

It prevents communities from recovering after disasters.

Correct Answer: It helps individuals unite and work toward positive change in times of crisis.

Q.126: Bharath started walking from his house, he first walked for 5 km towards east, then he turned towards south and moved 12 km in that direction. How far is Bharat from his house & in what direction with respect to his house?

a)13 km North -West

b)13 km South-East

c)5 km west

d)3 km south

Explanation:

Bharath walks 5 km east, then 12 km south → forms a right triangle.

Distance from house = $\sqrt{(5^2 + 12^2)} = \sqrt{(25 + 144)} = \sqrt{169} = \mathbf{13 \text{ km}}$

Direction from house = **South-East** (since he moved east, then south)

Hence, the answer is the option b).

Q.127: To get promoted from one class to the immediate next class, a student must clear 5 papers each with a maximum mark of 150. If the student scores 125, 135, 145 & 148 in 4 subjects. To score at least an overall aggregate of 90%, his percentage score in the fifth paper is at least,

- a) 60%
- b) $66\frac{2}{3}\%$
- c) $77\frac{2}{9}\%$
- d) $81\frac{1}{3}\%$

Explanation:

Total marks for 5 papers = $5 \times 150 = 750$

To score 90%, required = 90% of 750 = 675

Marks scored in 4 papers = $125 + 135 + 145 + 148 = 553$

Required in 5th paper = $675 - 553 = 122$

Percentage in 5th paper = $(122 / 150) \times 100 = 81\frac{1}{3}\%$

Hence, the answer is the option d).

Q.128: If the cost price of 10 pens equals selling price of 8 pens of the same variety, the profit or loss % incurred in this transaction will be,

- a) 25% loss
- b) 25% profit
- c) 20% loss
- d) 20% profit

Explanation:

Let the cost price of 1 pen = ₹1

So, cost price of 10 pens = ₹10

Given: Selling price of 8 pens = ₹10

→ Selling price of 1 pen = $₹10 \div 8 = ₹1.25$

Profit per pen = $₹1.25 - ₹1 = ₹0.25$

Profit % = $(0.25 / 1) \times 100 = 25\%$

Hence, the answer is the option b).

Q.129 Mahesh wants to type first 1000 natural numbers using a computer. How many times must he press the buttons of a computer keyboard to perform this task?

- a) 2987
- b) 2500
- c) 3000
- d) 2893

Explanation:

Break down the total digits typed:

- Numbers 1 to 9: 9 numbers \times 1 digit = 9
- Numbers 10 to 99: 90 numbers \times 2 digits = 180
- Numbers 100 to 999: 900 numbers \times 3 digits = 2700

- Number 1000: 1 number \times 4 digits = 4

Total key presses = 9 + 180 + 2700 + 4 = 2893

Hence, the answer is the option a).

Q.130: Passage:

Study the given information carefully and answer the question.

Six pots P1, P2, P3, P4, P5, P6 are arranged in a line for a valedictory function, on the stage, not necessarily in the same order.

The following information is available regarding the arrangement:

1. Exactly two pots, whose numbers are consecutive in any order, are adjacent to each other.
2. Pot P3 is at one of the extreme ends.
3. Pot P1 is to the left of Pot P4 but not necessarily adjacent.
4. Three pots that are even numbered are adjacent to each other.
5. P5 is exactly between P6 and P3.

Question:

Based on the condition given above, which two pots will be at the centre of the arrangement?

Options:

- a) P2 & P6
- b) P1 & P5
- c) P4 & P3
- d) P5 & P2

Explanation:

- P3 is placed at the extreme end (position 6).
- P5 is exactly between P6 and P3 \rightarrow valid in positions 4 (P6), 5 (P5), 6 (P3).
- P1 is to the left of P4 \rightarrow positions 1 (P1) and 2 (P4).
- Even-numbered pots (P2, P4, P6) are adjacent \rightarrow positions 2, 3, 4.
- Only one pair of consecutive numbers (P5 & P6) is adjacent \rightarrow satisfied.

P2 & P6 are at positions 3 and 4 (centre).

Hence, the answer is option a).