# KEAM 2026 Pharmacy April 18

## Question Paper with Solutions (Memory-Based)

Conducted by CEE Kerala

### General Instructions

- **Duration:** The total duration of the examination is 1.5 hours (90 minutes).
- **Total Marks:** The complete paper carries a maximum of 300 marks.
- **Structure:** The paper has 2 Sections:
  - **Section A:** 30 Multiple Choice Questions (Physics).
  - **Section B:** 45 Multiple Choice Questions (Chemistry).
- **Compulsory Questions:** All 75 questions are compulsory.
- Each question has four options. Only **one** option is correct.
- **Correct Answer:** +4 marks.
- **Incorrect Answer:** −1 (Negative marking).
- **Unanswered/Marked for Review:** 0 marks.

## Physics

**1. When a magnetic field is applied on a stationary electron, it**

(A) remains stationary

(B) spins about its own axis

(C) moves in the direction of the field

(D) moves perpendicular to the direction of the field

(E) moves opposite to the direction of the field

**Correct Answer:** (A) remains stationary

**Solution:**

**Step 1:** Recall the formula for magnetic force on a charged particle.

The magnetic force (Lorentz force) experienced by a charged particle moving in a magnetic field is given by the formula:

$$\vec{F} = q(\vec{v} \times \vec{B})$$

Where: - $\vec{F}$ is the magnetic force vector. - $q$ is the charge of the particle (for an electron, $q = -e$). - $\vec{v}$ is the velocity vector of the particle. - $\vec{B}$ is the magnetic field vector.

**Step 2:** Apply the condition for a stationary electron.

The problem states that the electron is stationary. This means its initial velocity is zero.

$$\vec{v} = 0$$

**Step 3:** Calculate the magnetic force.

Substitute $\vec{v} = 0$ into the Lorentz force equation:

$$\vec{F} = q(0 \times \vec{B}) = 0$$

Since the cross product of the zero vector with any other vector is the zero vector, the magnetic force on the stationary electron is zero.

**Step 4:** Conclusion.

According to Newton's first law, an object at rest stays at rest if no net force acts on it. Since the magnetic force on the stationary electron is zero, it will not accelerate and will continue to remain stationary.

**Final Answer:** (A) remains stationary

 

**Quick Tip:** The magnetic force acts only on moving charges. A stationary charge experiences no force from a static magnetic field.

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**2. A particle of mass m and charge q with an initial velocity v is subjected to a uniform magnetic field B along the vertical direction. The particle will**

(A) follow a circular path if v is along the vertical direction
(B) make helical motion if v is along the horizontal direction
(C) make helical motion if v is neither parallel nor orthogonal to B
(D) always make circular motion
(E) always make helical motion

**Correct Answer:** (C) make helical motion if v is neither parallel nor orthogonal to B

**Solution:**

**Step 1:** Analyze the motion of a charged particle in a magnetic field.

The path of a charged particle in a uniform magnetic field $\vec{B}$ is determined by the angle $\theta$ between its velocity vector $\vec{v}$ and $\vec{B}$. The force is given by $\vec{F} = q(\vec{v} \times \vec{B})$.

**Step 2:** Analyze the different cases based on the angle $\theta$.

Case 1: $\theta = 0^\circ$ or $180^\circ$ ($\vec{v}$ is parallel or anti-parallel to $\vec{B}$). The cross product $\vec{v} \times \vec{B}$ is zero, so the force $\vec{F} = 0$. The particle moves in a straight line. Option (A) is incorrect because if $\vec{v}$ is vertical (parallel to $\vec{B}$), the path is a straight line, not a circle.

Case 2: $\theta = 90^\circ$ ($\vec{v}$ is perpendicular to $\vec{B}$). The force $F = qvB$ is constant in magnitude and is always perpendicular to $\vec{v}$. This provides the necessary centripetal force for uniform circular motion. Option (B) is incorrect because if $\vec{v}$ is horizontal (perpendicular to the vertical $\vec{B}$), the motion is circular, not helical.

Case 3: $\vec{v}$ is neither parallel nor orthogonal to $\vec{B}$. The velocity vector $\vec{v}$ can be resolved into two components: one parallel to $\vec{B}$ ($v_{\parallel} = v\cos\theta$) and one perpendicular to $\vec{B}$ ($v_{\perp} = v\sin\theta$).

 

The parallel component $v_{\parallel}$ does not interact with the magnetic field (as $\vec{v}_{\parallel} \times \vec{B} = 0$), so the particle moves with constant velocity along the field direction.
The perpendicular component $v_{\perp}$ causes a magnetic force $F = qv_{\perp}B$ that leads to circular motion in the plane perpendicular to $\vec{B}$. The combination of this linear motion along the field and circular motion perpendicular to it results in a helical (spiral) path.

**Step 3:** Evaluate the options.

Based on the analysis in Step 2:
- (A) is incorrect.
- (B) is incorrect.
- (C) correctly describes the condition for helical motion.
- (D) and (E) are incorrect as the motion can be a straight line, circular, or helical depending on the initial velocity's direction.

**Final Answer:** (C) make helical motion if v is neither parallel nor orthogonal to B

**Quick Tip:** The path of a charged particle in a uniform magnetic field is a straight line if $\vec{v} \parallel \vec{B}$, a circle if $\vec{v} \perp \vec{B}$, and a helix for any other angle between them.

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**3. The resistor $R_1 = 30\,\Omega$ and $R_2 = 10\,\Omega$ are connected in parallel to a 20 V battery. Find the heat developed in the resistor $R_1$ in one minute**

(A) 600 J
(B) 800 J
(C) 6000 J
(D) 8000 J
(E) 7000 J

**Correct Answer:** (B) 800 J

 

**Solution:**

**Step 1:** Identify the given information and the formula for heat developed.

Given: - Resistance of the first resistor, $R_1 = 30\,\Omega$. - Voltage of the battery, $V = 20\,\text{V}$. - Time, $t = 1\,\text{minute}$. The formula for heat (Joule's heating) developed in a resistor is given by:

$$H = I^2Rt = \frac{V^2}{R}t = VIt$$

Since the voltage across the resistor is known, the formula $H = \frac{V^2}{R}t$ is the most direct to use.

**Step 2:** Determine the voltage across resistor $R_1$.

The resistors $R_1$ and $R_2$ are connected in parallel to the battery. In a parallel circuit, the voltage across each component is the same as the voltage of the source. Therefore, the voltage across $R_1$ is:

$$V_1 = V = 20\,\text{V}$$

**Step 3:** Convert time to SI units.

The time is given in minutes, which needs to be converted to seconds for consistency in SI units.

$$t = 1\,\text{minute} = 60\,\text{seconds}$$

**Step 4:** Calculate the heat developed in $R_1$.

Substitute the values of $V_1$, $R_1$, and $t$ into the heat formula:

$$H_1 = \frac{V_1^2}{R_1}t$$

$$H_1 = \frac{(20\,\text{V})^2}{30\,\Omega} \times 60\,\text{s}$$

$$H_1 = \frac{400}{30} \times 60$$

$$H_1 = 400 \times \frac{60}{30} = 400 \times 2$$

$$H_1 = 800\,\text{J}$$

 

The heat developed in resistor $R_1$ in one minute is 800 Joules.

**Final Answer:** (B) 800 J

**Quick Tip:** For components connected in parallel, the voltage across them is the same. This makes the power formula $P = V^2/R$ and heat formula $H = (V^2/R)t$ particularly useful.

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**4. The velocity and acceleration of a particle performing simple harmonic motion have a steady phase relationship. The acceleration shows a phase lead over the velocity in radians of**

(A) $+\pi$

(B) 0

(C) $+\pi/2$

(D) $-\pi/2$

(E) $-\pi$

**Correct Answer:** (C) $+\pi/2$

**Solution:**

**Step 1:** Define the equations of motion for a particle in SHM.

Let the displacement of a particle in Simple Harmonic Motion (SHM) be represented by:

$$x(t) = A\sin(\omega t + \phi)$$

where $A$ is the amplitude, $\omega$ is the angular frequency, and $\phi$ is the initial phase.

**Step 2:** Derive the expressions for velocity and acceleration.

Velocity $v(t)$ is the first derivative of displacement with respect to time:

$$v(t) = \frac{dx}{dt} = \frac{d}{dt}[A\sin(\omega t + \phi)] = A\omega\cos(\omega t + \phi)$$

Acceleration $a(t)$ is the first derivative of velocity with respect to time:

$$a(t) = \frac{dv}{dt} = \frac{d}{dt}[A\omega\cos(\omega t + \phi)] = -A\omega^2\sin(\omega t + \phi)$$

**Step 3:** Express velocity and acceleration using the same trigonometric function to compare their phases.

We can use the trigonometric identities $\cos(\theta) = \sin(\theta + \pi/2)$ and $-\sin(\theta) = \sin(\theta + \pi)$. The velocity equation becomes:

$$v(t) = A\omega\sin(\omega t + \phi + \pi/2)$$

The phase of the velocity is $(\omega t + \phi + \pi/2)$.
The acceleration equation becomes:

$$a(t) = A\omega^2\sin(\omega t + \phi + \pi)$$

The phase of the acceleration is $(\omega t + \phi + \pi)$.
**Step 4:** Calculate the phase difference.

The phase difference is the phase of acceleration minus the phase of velocity.

$$\text{Phase Difference} = (\text{Phase of } a) - (\text{Phase of } v)$$

$$\text{Phase Difference} = (\omega t + \phi + \pi) - (\omega t + \phi + \pi/2)$$

$$\text{Phase Difference} = \pi - \frac{\pi}{2} = +\frac{\pi}{2}$$

A positive phase difference means acceleration leads velocity.

**Final Answer:** (C) $+\pi/2$

**Quick Tip:** In SHM, velocity leads displacement by /2 radians, and acceleration leads velocity by /2 radians. This means acceleration and displacement are out of phase by  radians (180°).

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**5. The quantity which has the same dimensions as that of gravitational potential is**

(A) latent heat

(B) impulse

(C) angular acceleration

(D) specific heat capacity

(E) Planck's constant

**Correct Answer:** (A) latent heat

**Solution:**

**Step 1:** Determine the dimensions of Gravitational Potential.

Gravitational potential ($V_g$) at a point is defined as the work done per unit mass in bringing a test mass from infinity to that point.

$$V_g = \frac{\text{Work Done}}{\text{Mass}} = \frac{W}{m}$$

The dimension of Work (or Energy) is $[W] = \text{ML}^2\text{T}^{-2}$. The dimension of Mass is $[m] = \text{M}$. Therefore, the dimension of gravitational potential is:

$$[V_g] = \frac{[W]}{[m]} = \frac{\text{ML}^2\text{T}^{-2}}{\text{M}} = \text{L}^2\text{T}^{-2}$$

**Step 2:** Determine the dimensions of each of the given options.

(A) Latent Heat (L): It is the heat energy absorbed or released per unit mass during a phase change.

$$L = \frac{\text{Heat Energy}}{\text{Mass}} = \frac{Q}{m}$$

The dimension of Heat (Energy) is $[Q] = \text{ML}^2\text{T}^{-2}$.

$$[L] = \frac{\text{ML}^2\text{T}^{-2}}{\text{M}} = \text{L}^2\text{T}^{-2}$$

This matches the dimensions of gravitational potential.

(B) Impulse (J): It is the change in momentum, or Force $\times$ Time.

$$[J] = [\text{Force}] \times [\text{Time}] = (\text{MLT}^{-2})(\text{T}) = \text{MLT}^{-1}$$

 

(C) Angular Acceleration ($\alpha$): It is the rate of change of angular velocity.

$$[\alpha] = \frac{[\text{Angular Velocity}]}{[\text{Time}]} = \frac{T^{-1}}{T} = T^{-2}$$

(D) Specific Heat Capacity (c): It is the heat energy required per unit mass per unit change in temperature.

$$[c] = \frac{[\text{Energy}]}{[\text{Mass}][\text{Temperature}]} = \frac{ML^2T^{-2}}{M\Theta} = L^2T^{-2}\Theta^{-1}$$

(E) Planck's Constant (h): From $E = hf$, it is Energy per unit frequency.

$$[h] = \frac{[\text{Energy}]}{[\text{Frequency}]} = \frac{ML^2T^{-2}}{T^{-1}} = ML^2T^{-1}$$

**Step 3:** Compare the dimensions and conclude.

By comparing the dimensions calculated in Step 2 with the dimension of gravitational potential ($L^2T^{-2}$), we find that only latent heat has the same dimensions.

**Final Answer:** (A) latent heat

**Quick Tip:** Dimensional analysis can often be simplified by looking at the definitions. Both gravitational potential and latent heat are defined as "energy per unit mass". This relationship immediately implies they must have the same dimensions.

## Chemistry

**1. The equilibrium concentrations of the species in the reaction A + B $\rightleftharpoons$ C + D are 2, 3, 10 and 6 mol $L^{-1}$ respectively at 300 K. $\Delta G^0$ for the reaction is**

**(R = 2 cal/mol K)**

(A) −13.73 cal

(B) 1372.60 cal

(C) −137.26 cal

(D) −1381.80 cal

**Correct Answer:** (D) −1381.80 cal

 

**Solution:**

**Step 1: Understanding the Question:**

The question asks to calculate the standard Gibbs free energy change ($\Delta G^0$) for the given chemical reaction at 300 K.

We are provided with the equilibrium concentrations of reactants and products, the temperature, and the gas constant $R$.

**Step 2: Key Formula or Approach:**

The standard Gibbs free energy change is related to the equilibrium constant ($K_c$) by the formula:

$$\Delta G^0 = -RT \ln K_c$$

Where:

$R$ is the gas constant (2 cal/mol K)

$T$ is the absolute temperature (300 K)

$K_c$ is the equilibrium constant based on molar concentrations.

**Step 3: Detailed Explanation:**

First, we find the equilibrium constant $K_c$ for the reaction:

$$\mathrm{A + B \rightleftharpoons C + D}$$

$$K_c = \frac{[\mathrm{C}][\mathrm{D}]}{[\mathrm{A}][\mathrm{B}]}$$

Substituting the given equilibrium concentrations:

$$K_c = \frac{10 \times 6}{2 \times 3} = \frac{60}{6} = 10$$

Now, calculate $\Delta G^0$:

$$\Delta G^0 = -R \times T \times \ln(K_c)$$

Using the relation $\ln(x) \approx 2.303 \log_{10}(x)$:

$$\Delta G^0 = -2 \times 300 \times 2.303 \times \log_{10}(10)$$

 

Since $\log_{10}(10) = 1$:

$$\Delta G^0 = -600 \times 2.303$$

$$\Delta G^0 = -1381.8 \text{ cal}$$

**Step 4: Final Answer:**

The standard Gibbs free energy change for the reaction is $-1381.80$ cal.

**Quick Tip:** Remember that $\ln(10) \approx 2.303$.

In multiple-choice questions, if $K_c > 1$, $\Delta G^0$ must be negative.

Check the units of R (cal vs Joules) to match the options.

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**2. What is the IUPAC name of the organic compound formed in the following chemical reaction?**

**Acetone $\xrightarrow{\text{(i) } C_2H_5MgBr\text{, dry ether}}$ (ii) $H_2O$, $H^+$ Product**

(A) Pentan-2-ol

(B) Pentan-3-ol

(C) 2-methyl butan-2-ol

(D) 2-methyl propan-2-ol

**Correct Answer:** (C) 2-methyl butan-2-ol

**Solution:**

**Step 1: Understanding the Question:**

The reaction involves the addition of a Grignard reagent (ethyl magnesium bromide) to a ketone (acetone), followed by acidic hydrolysis.

**Step 2: Key Formula or Approach:**

Reaction of a ketone with a Grignard reagent yields a tertiary alcohol.

Nucleophilic addition of the ethyl group ($C_2H_5^-$) to the carbonyl carbon of acetone occurs first.

**Step 3: Detailed Explanation:**

 

Structure of Acetone: $CH_3 - C(=O) - CH_3$

Step (i): Addition of $C_2H_5MgBr$

The $C_2H_5$ group attacks the central carbon of acetone.

Intermediate: $CH_3 - C(OMgBr)(C_2H_5) - CH_3$

Step (ii): Hydrolysis with $H_2O$, $H^+$

The OMgBr group is converted to OH.

Final Product: $CH_3 - C(OH)(CH_3) - CH_2 - CH_3$

Determining IUPAC Name:

1. Longest carbon chain containing the OH group: 4 carbons (Butane).

2. Numbering from the end closer to OH: $C_1$ is $CH_3$, $C_2$ has OH and a methyl group.

Name: 2-methylbutan-2-ol.

**Step 4: Final Answer:**

The correct IUPAC name is 2-methyl butan-2-ol.

**Quick Tip:** Count the total number of carbons: Acetone (3 carbons) + Ethyl (2 carbons) = 5 carbons in the product alcohol.

Ketone + Grignard → Tertiary alcohol.

Only option (C) fits a 5-carbon tertiary alcohol structure.

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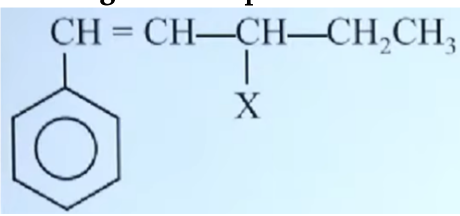
**3. The given compound**




is an example of

(A) vinylic halide

(B) benzylic halide

(C) aryl halide

(D) allylic halide

**Correct Answer:** (D) allylic halide

**Solution:**

**Step 1: Understanding the Question:**

The question asks to classify the given halogen-containing compound based on the position of the halogen atom (X).

Structure: Benzene-CH=CH-CH(X)-$CH_2CH_3$

**Step 2: Detailed Explanation:**

Let's analyze the position of the halogen atom X:

1. The halogen X is bonded to an $sp^3$ hybridized carbon atom.

2. This $sp^3$ carbon is directly adjacent to a carbon-carbon double bond ($C = C$).

By definition:

- **Vinylic halide:** Halogen is bonded to an $sp^2$ carbon of a $C = C$ bond.
- **Allylic halide:** Halogen is bonded to an $sp^3$ carbon adjacent to a $C = C$ bond.
- **Benzylic halide:** Halogen is bonded to an $sp^3$ carbon adjacent to an aromatic ring.
- **Aryl halide:** Halogen is bonded directly to the aromatic ring.

In the given structure, X is on a carbon adjacent to a $CH = CH$ group. This is an allylic position.

**Step 3: Final Answer:**

The compound is an allylic halide.

**Quick Tip:** Look for the pattern $C = C - C - X$.

The carbon bearing the X must be single-bonded to four groups to be allylic.

If X was on the first carbon next to the benzene ring in a saturated chain, it would be benzylic.

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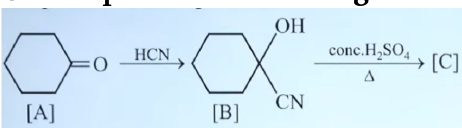
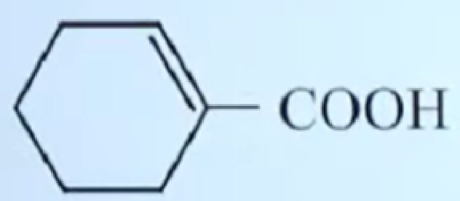
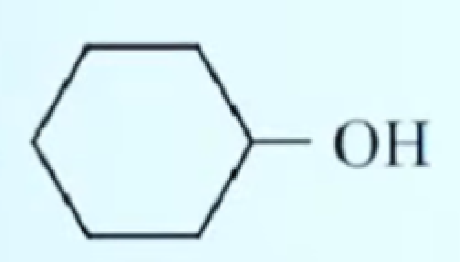
**4. Complete the following reaction :**

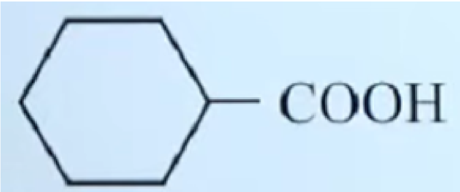


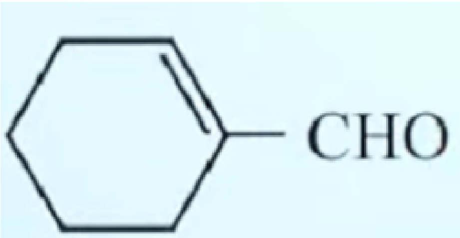

C

is

(A) 

(B) 

(C) 

(D) 

**Correct Answer:** (A) (Cyclohex-1-ene-1-carboxylic acid)

**Solution:**

**Step 1: Understanding the Question:**

The reaction sequence starts from Cyclohexanone [A].

Step 1: Reaction with HCN.

Step 2: Reaction with concentrated $H_2SO_4$ and heat.

**Step 2: Detailed Explanation:**

**Reaction 1:** Cyclohexanone ($[A]$) reacts with HCN to form cyclohexanone cyanohydrin ($[B]$). The $CN^-$ nucleophile attacks the carbonyl carbon, and $H^+$ adds to the oxygen.

Structure of [B]: 1-hydroxycyclohexanecarbonitrile (a cyclohexane ring with an OH and a CN group on the same carbon).

**Reaction 2:** Treatment with concentrated $H_2SO_4$ and heat causes two things:

1. **Hydrolysis:** The nitrile group (—CN) is hydrolyzed to a carboxylic acid group (—COOH).

2. **Dehydration:** The tertiary OH group is eliminated along with a neighboring hydrogen atom to form a double bond ($C = C$).

Because of the presence of heat and strong acid, dehydration is favorable, leading to an $\alpha, \beta$-unsaturated acid.

The final product [C] is Cyclohex-1-ene-1-carboxylic acid.

**Step 3: Final Answer:**

The final product [C] is cyclohex-1-ene-1-carboxylic acid, represented by option (A).

**Quick Tip:** When $H_2SO_4$ and heat are mentioned together for a cyanohydrin, expect both the $CN \rightarrow COOH$ conversion and OH removal to form a double bond.

Check the oxidation state: Nitriles always hydrolyze to acids, not aldehydes.

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**5. Which one of the following alcohols reacts instantaneously with Lucas reagent?**

(A) $CH_3-CH(CH_3)-CH_2OH$

(B) $CH_3-C(CH_3)(OH)-CH_3$

(C) $CH_3-CH_2-CH_2-CH_2OH$

(D) $CH_3-CH_2-CH(OH)-CH_3$

**Correct Answer:** (B) $CH_3-C(CH_3)(OH)-CH_3$

**Solution:**

**Step 1: Understanding the Question:**

The Lucas test (conc. $HCl +$ anhyd. $ZnCl_2$) is used to distinguish between 1°, 2°, and 3° alcohols.

The speed of reaction depends on the stability of the carbocation intermediate.

**Step 2: Detailed Explanation:**

The reactivity order towards Lucas reagent is:

Tertiary (3°) > Secondary (2°) > Primary (1°).

- **Tertiary alcohols** react **instantaneously** to produce turbidity (alkyl chloride).
- **Secondary alcohols** react within 5-10 minutes.
- **Primary alcohols** do not react at room temperature.

 

Analyzing the options:

(A) 2-methylpropan-1-ol: Primary alcohol.

(B) 2-methylpropan-2-ol (tert-butyl alcohol): **Tertiary alcohol**.

(C) Butan-1-ol: Primary alcohol.

(D) Butan-2-ol: Secondary alcohol.

Since option (B) is a tertiary alcohol, it reacts immediately.

**Step 3: Final Answer:**

The alcohol that reacts instantaneously is 2-methylpropan-2-ol.

**Quick Tip:** Identify the degree of the alcohol by counting the carbons attached to the C-OH carbon.

Instant turbidity $= 3^\circ$ Alcohol.

Delayed turbidity $= 2^\circ$ Alcohol.

No reaction $= 1^\circ$ Alcohol.

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