CUET 2026 May 21 Shift 1 Chemistry

Question Paper (Memory-Based) with Solutions

Conducted by National Testing Agency (NTA)

General Instructions

(i) The examination will be conducted in Computer-Based Test (CBT) mode.

(ii) Each question carries +5 marks for correct answer and -1 mark for wrong answer.

(iii) The total number of questions are 50.

(iv) Duration of the exam is 1 hour (60 minutes).

1. Arrange the following compounds in increasing order of acidic strength:

Phenol, Water, Propan-1-ol, Propan-2-ol

(A) Water < Propan-2-ol < Propan-1-ol < Phenol

(B) Propan-2-ol < Propan-1-ol < Water < Phenol

(C) Propan-1-ol < Propan-2-ol < Water < Phenol

(D) Phenol < Water < Propan-1-ol < Propan-2-ol

Correct Answer: (B) Propan-2-ol < Propan-1-ol < Water < Phenol

Solution:

Concept:

Acidic strength depends upon the ease with which a compound can donate a proton (H^+). Greater stability of the conjugate base formed after loss of proton means stronger acidity.

- Alkyl groups show $+I$ effect and decrease acidity.
- Branching increases electron donation and further decreases acidity.
- Phenoxide ion formed from phenol is resonance stabilized, making phenol highly acidic.

Step 1: Compare propan-1-ol and propan-2-ol.

In propan-2-ol, the carbon attached to $-OH$ group has two alkyl groups, producing stronger $+I$ effect.

This destabilizes the alkoxide ion formed after removal of proton.

Hence:

$$\text{Propan-2-ol} < \text{Propan-1-ol}$$

Step 2: Compare alcohols with water.

Water does not contain electron donating alkyl groups, so the hydroxide ion formed is comparatively more stable.

Therefore:

$$\text{Propan-2-ol} < \text{Propan-1-ol} < \text{Water}$$

Step 3: Compare phenol with water.

Phenol forms phenoxide ion after losing proton.

$$C_6H_5OH \rightarrow C_6H_5O^- + H^+$$

Phenoxide ion is resonance stabilized because the negative charge is delocalized over the benzene ring.

Hence phenol is most acidic.

$$\boxed{\text{Propan-2-ol} < \text{Propan-1-ol} < \text{Water} < \text{Phenol}}$$

Quick Tip: Resonance stabilization increases acidity, while electron donating $+I$ effect decreases acidity.

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2. Among the following amines, the strongest base in aqueous solution is:

$$NH_3,\ CH_3NH_2,\ (CH_3)_2NH,\ (CH_3)_3N$$

(A) NH_3

(B) $(CH_3)_3N$

(C) $(CH_3)_2NH$

(D) CH_3NH_2

Correct Answer: (C) $(CH_3)_2NH$

Solution:

Concept:

Basic strength of amines depends upon:

- Availability of lone pair on nitrogen atom.
- Electron donating $+I$ effect of alkyl groups.
- Stability of the protonated amine in aqueous solution due to solvation.

In gaseous state:

$$3^\circ > 2^\circ > 1^\circ > NH_3$$

But in aqueous solution, solvation plays an important role. Secondary amines become most basic because they have:

- Strong $+I$ effect
- Effective solvation

Hence:

$$2^\circ > 1^\circ > 3^\circ > NH_3$$

Step 1: Understand the effect of alkyl groups.

Methyl groups donate electrons toward nitrogen through $+I$ effect, increasing electron density on nitrogen and making the amine more basic.

$$NH_3 < CH_3NH_2 < (CH_3)_2NH$$

Step 2: Compare tertiary amine in aqueous medium.

Although tertiary amine has maximum $+I$ effect, its protonated form is less stabilized due to poor solvation because of steric hindrance.

Therefore:

$$(CH_3)_3N < (CH_3)_2NH$$

Step 3: Final order of basic strength in aqueous solution.

$$\boxed{(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3}$$

Hence, the strongest base is:

$$\boxed{(CH_3)_2NH}$$

Quick Tip: For amines in aqueous solution:

$$2^\circ \text{ amine} > 1^\circ \text{ amine} > 3^\circ \text{ amine}$$

because solvation of protonated amines is very important.

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3. Lucas reagent gives immediate turbidity with:

(A) Ethanol

(B) Propan-1-ol

(C) Propan-2-ol

(D) tert-Butyl alcohol

Correct Answer: (D) tert-Butyl alcohol

Solution:

Concept:

Lucas reagent is a mixture of:

$$\text{Conc. HCl} + \text{Anhydrous } ZnCl_2$$

It is used to distinguish primary, secondary and tertiary alcohols.

- Tertiary alcohols react immediately.
- Secondary alcohols react within few minutes.
- Primary alcohols react very slowly.

Turbidity appears due to formation of insoluble alkyl chlorides.

Step 1: Understand reactivity order.

Tertiary alcohols form highly stable tertiary carbocations.

Hence substitution reaction occurs rapidly through S_N1 mechanism.

$$3^\circ > 2^\circ > 1^\circ$$

Step 2: Identify tertiary alcohol.

Among the given compounds:

tert-Butyl alcohol

is a tertiary alcohol.

Step 3: Conclusion.

Therefore it gives immediate turbidity with Lucas reagent.

$$\boxed{\text{tert-Butyl alcohol}}$$

Quick Tip: Lucas reagent test:

3° alcohol $\rightarrow$ Immediate turbidity

2° alcohol $\rightarrow$ Slow turbidity

1° alcohol $\rightarrow$ No turbidity at room temperature

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4. Which of the following compounds has the highest boiling point?

(A) Propane

(B) Propanal

(C) Propan-1-ol

(D) Dimethyl ether

Correct Answer: (C) Propan-1-ol

Solution:

Concept:

Boiling point depends upon intermolecular forces.

- Hydrogen bonding causes maximum attraction.
- Dipole-dipole interactions are weaker.
- Van der Waals forces are weakest.

Step 1: Analyze intermolecular forces.

- Propane contains only weak Van der Waals forces.
- Propanal and dimethyl ether contain dipole-dipole interactions.
- Propan-1-ol contains intermolecular hydrogen bonding.

Step 2: Compare boiling points.

Hydrogen bonding significantly increases boiling point because extra energy is required to break intermolecular attractions.

Therefore:

Propan-1-ol

has maximum boiling point.

Step 3: Final conclusion.

Propan-1-ol

Quick Tip: Compounds capable of intermolecular hydrogen bonding generally possess higher boiling points.

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5. Among the following, the compound having the lowest value of pK_a is:

(A) Ethanol

(B) Water

(C) Phenol

(D) Propan-2-ol

Correct Answer: (C) Phenol

Solution:

Concept:

Lower value of pK_a indicates stronger acidity.

$$pK_a = -\log K_a$$

Hence:

$$\text{Smaller } pK_a \Rightarrow \text{Greater acidity}$$

Acidic strength depends upon the stability of conjugate base formed after removal of proton.

Step 1: Compare alcohols and water.

Alcohols contain alkyl groups which show $+I$ effect and destabilize alkoxide ions.

Therefore alcohols are less acidic than water.

$$\text{Propan-2-ol} < \text{Ethanol} < \text{Water}$$

Step 2: Analyze phenol.

Phenol forms phenoxide ion:

$$C_6H_5OH \rightarrow C_6H_5O^- + H^+$$

The negative charge on oxygen gets delocalized over the benzene ring through resonance.

Hence phenoxide ion becomes highly stable.

Step 3: Determine lowest pK_a.

Since phenol is most acidic among the given compounds, it has the lowest pK_a.

$$\boxed{\text{Phenol}}$$

Quick Tip: Greater the acidic strength, smaller is the value of pK_a.

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6. Which of the following compounds gives a positive Hinsberg test and forms a soluble sulphonamide?

(A) Aniline

(B) Dimethylamine

(C) Trimethylamine

(D) Triphenylamine

Correct Answer: (A) Aniline

Solution:

Concept:

Hinsberg reagent is:

Benzenesulphonyl chloride

It is used to distinguish primary, secondary and tertiary amines.

- Primary amines form sulphonamides soluble in alkali.
- Secondary amines form insoluble sulphonamides.
- Tertiary amines do not react.

Step 1: Understand the reaction of primary amines.

Primary amines contain one replaceable hydrogen atom attached to nitrogen.

They react with Hinsberg reagent to form sulphonamides having acidic hydrogen.

These dissolve in alkali due to salt formation.

Step 2: Identify the primary amine.

Among the given compounds:

Aniline ($C_6H_5NH_2$)

is a primary amine.

Step 3: Conclusion.

Hence aniline forms soluble sulphonamide in Hinsberg test.

Aniline

Quick Tip: Hinsberg test:

1° amine $\rightarrow$ Soluble product

2° amine $\rightarrow$ Insoluble product

3° amine $\rightarrow$ No reaction

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7. The compound which is most basic in gaseous phase is:

(A) Ammonia

(B) Methylamine

(C) Dimethylamine

(D) Trimethylamine

Correct Answer: (D) Trimethylamine

Solution:

Concept:

In gaseous phase, solvation effects are absent.

Hence basicity depends mainly upon:

- Electron donating $+I$ effect of alkyl groups.
- Availability of lone pair on nitrogen.

More alkyl groups increase electron density on nitrogen and increase basic strength.

Step 1: Understand inductive effect.

Alkyl groups donate electrons toward nitrogen through $+I$ effect.

Therefore:

$$NH_3 < CH_3NH_2 < (CH_3)_2NH < (CH_3)_3N$$

Step 2: Analyze gaseous phase condition.

Since no hydration or solvation occurs in gaseous phase, steric hindrance does not reduce basicity significantly.
Hence tertiary amine becomes strongest base.

Step 3: Final conclusion.

$$\boxed{(CH_3)_3N}$$

Quick Tip: In gaseous phase:

$$3^\circ > 2^\circ > 1^\circ > NH_3$$

because only $+I$ effect dominates.

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8. Which of the following compounds can show metamerism?

(A) Propanal
(B) Propanone
(C) Methoxyethane
(D) Ethanol

Correct Answer: (C) Methoxyethane

Solution:

Concept:
Metamerism arises due to different alkyl groups attached on either side of a polyvalent functional group.
Common functional groups showing metamerism:

- Ether ($-O-$)
- Secondary amine ($-NH-$)
- Ketone ($-CO-$)

Step 1: Understand structure requirement.

For metamerism:

$$R-X-R'$$

must be possible where R and R' are different alkyl groups.

Step 2: Analyze each compound.

- Propanal does not possess suitable polyvalent atom.
- Propanone has only one possible arrangement for three carbons.
- Methoxyethane is an ether and can exhibit metamerism.
- Ethanol cannot show metamerism.

Step 3: Conclusion.

Methoxyethane

Quick Tip: Ethers commonly show metamerism because oxygen can connect two different alkyl groups.

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9. The half-life of a first order reaction is 1386 s. The rate constant k is:

(A) 5×10^{-4} s^{-1}
(B) 2×10^{-4} s^{-1}
(C) 1×10^{-3} s^{-1}
(D) 4×10^{-3} s^{-1}

Correct Answer: (A) 5×10^{-4} s^{-1}

Solution:

Concept:

For a first order reaction:

$$t_{1/2} = \frac{0.693}{k}$$

where:

- $t_{1/2}$ = half-life
- k = rate constant

Step 1: Write the formula.

$$k = \frac{0.693}{t_{1/2}}$$

Step 2: Substitute the given value.

$$k = \frac{0.693}{1386}$$

$$k = 5 \times 10^{-4}\ s^{-1}$$

Step 3: Final answer.

$$\boxed{5 \times 10^{-4}\ s^{-1}}$$

Quick Tip: For first order reactions:

$$t_{1/2} \propto \frac{1}{k}$$

Half-life is independent of initial concentration.

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10. Which of the following biomolecules acts as the genetic material in most organisms?

(A) Protein

(B) DNA

(C) Lipid

(D) Polysaccharide

Correct Answer: (B) DNA

Solution:

Concept:

Biomolecules are chemical compounds present in living organisms.

DNA stands for:

Deoxyribonucleic Acid

It carries hereditary information from one generation to another.

Step 1: Understand the role of DNA.

DNA contains genes responsible for inheritance and expression of characters.

It stores biological information in the sequence of nitrogenous bases.

Step 2: Analyze other biomolecules.

- Proteins mainly perform structural and enzymatic functions.
- Lipids store energy and form membranes.
- Polysaccharides mainly act as energy reserves.

Step 3: Conclusion.

Hence DNA acts as genetic material in most organisms.

DNA

Quick Tip: RNA acts as genetic material only in some viruses, while DNA is the genetic material in most living organisms.