CUET 2026 May 29 Shift 1 Chemistry

Question Paper (Memory-Based) with Solutions

Conducted by National Testing Agency (NTA)

1. Aniline is converted into benzene by the following sequence of reactions:

$$\text{Aniline} \xrightarrow[0\text{–}5^\circ C]{NaNO_2/HCl} A \xrightarrow{H_3PO_2} B$$

The compounds A and B respectively are:

(A) Benzene diazonium chloride, Benzene

(B) Nitrobenzene, Benzene

(C) Benzene diazonium chloride, Phenol

(D) Chlorobenzene, Benzene

Correct Answer: (1) Benzene diazonium chloride, Benzene

Solution:

Concept:

This question is based on:

- Diazotisation reaction
- Reduction of diazonium salts
- Important NCERT named reactions

Primary aromatic amines react with nitrous acid at low temperature to form diazonium salts. Further reduction using hypophosphorous acid replaces diazonium group by hydrogen.

Step 1: Formation of diazonium salt.

Aniline:

$$C_6H_5NH_2$$

reacts with:

$$NaNO_2 + HCl$$

at:

$$0 - 5^\circ C$$

to form benzene diazonium chloride:

$$C_6H_5N_2^+Cl^-$$

Thus:

$$A = \text{Benzene diazonium chloride}$$

Reaction:

$$C_6H_5NH_2 \rightarrow C_6H_5N_2^+Cl^-$$

Step 2: Reduction of diazonium salt.

Hypophosphorous acid:

$$H_3PO_2$$

reduces diazonium group into hydrogen.

Thus:

$$C_6H_5N_2^+Cl^- \rightarrow C_6H_6$$

Hence:

$$B = \text{Benzene}$$

Step 3: Identify the correct option.

Therefore:

$$A = \text{Benzene diazonium chloride}$$

and

$$B = \text{Benzene}$$

Hence correct option is:

$$\boxed{(A)}$$

Quick Tip: Remember:

$$ArN_2^+Cl^- \xrightarrow{H_3PO_2} ArH$$

Hypophosphorous acid replaces diazonium group by hydrogen.

2. Among the following compounds, the correct order of acidic strength is:

Phenol, p-Nitrophenol, p-Methoxyphenol

(A) p-Methoxyphenol > Phenol > p-Nitrophenol

(B) p-Nitrophenol > Phenol > p-Methoxyphenol

(C) Phenol > p-Nitrophenol > p-Methoxyphenol

(D) p-Nitrophenol > p-Methoxyphenol > Phenol

Correct Answer: (2) p-Nitrophenol > Phenol > p-Methoxyphenol

Solution:

Concept:

Acidic strength depends upon stability of conjugate base.

- Electron withdrawing groups increase acidity
- Electron donating groups decrease acidity

Greater stabilization of phenoxide ion means stronger acid.

Step 1: Analyse p-nitrophenol.

Nitro group:

$$(-NO_2)$$

is strongly electron withdrawing.

It stabilizes phenoxide ion by:

- $-I$ effect
- $-R$ effect

Thus acidity increases significantly.

Therefore:

p-Nitrophenol is most acidic

Step 2: Analyse phenol.

Phenol has no strong substituent.

Hence its acidity is intermediate.

Step 3: Analyse p-methoxyphenol.

Methoxy group:

$$(-OCH_3)$$

is electron donating through resonance.

It destabilizes phenoxide ion.

Thus acidity decreases.

Therefore:

p-Methoxyphenol is least acidic

Step 4: Write the correct order.

Hence:

p-Nitrophenol > Phenol > p-Methoxyphenol

Thus the correct option is:

$$\boxed{(B)}$$

Quick Tip: Electron withdrawing groups increase acidity by stabilizing conjugate base, while electron donating groups decrease acidity by destabilizing the conjugate base.

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3. The major product formed in the following reaction is:

$$CH_3CH = CH_2 \xrightarrow{HBr,\ peroxide} ?$$

(A) $CH_3CHBrCH_3$

(B) $CH_3CH_2CH_2Br$

(C) $CH_2BrCH = CH_2$

(D) $CH_3CHBrCH_2Br$

Correct Answer: (2) $CH_3CH_2CH_2Br$

Solution:

Concept:

Addition of HBr in presence of peroxide follows:

Anti-Markovnikov rule

This reaction is known as:

Peroxide effect or Kharasch effect

Free radical mechanism causes bromine to attach to less substituted carbon atom.

Step 1: Identify the alkene.

Given alkene:

$$CH_3CH = CH_2$$

This is propene.

Step 2: Understand peroxide effect.

In presence of peroxide:

$$HBr$$

adds through free radical mechanism.

Bromine attaches to terminal carbon.

Thus:

$$CH_3CH = CH_2 \rightarrow CH_3CH_2CH_2Br$$

Step 3: Identify the product.

The product formed is:

1-Bromopropane

Structure:

$$CH_3CH_2CH_2Br$$

Hence correct option is:

$$\boxed{(B)}$$

Quick Tip: Peroxide effect is shown only by HBr and not by HCl or HI.

$$HBr + \text{Peroxide} \Rightarrow \text{Anti-Markovnikov addition}$$

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4. The SI unit of rate constant for a first order reaction is:

(A) $mol\, L^{-1}s^{-1}$

(B) s^{-1}

(C) $L\, mol^{-1}s^{-1}$

(D) $mol^{-1}L\, s^{-1}$

Correct Answer: (2) s^{-1}

Solution:

Concept:

For a first order reaction:

$$\text{Rate} = k[A]$$

The unit of rate constant depends on reaction order.

Step 1: Write units of rate and concentration.

Units of rate:

$$mol\, L^{-1}s^{-1}$$

Units of concentration:

$$mol\, L^{-1}$$

Step 2: Substitute into rate law.

For first order:

$$k = \frac{\text{Rate}}{[A]}$$

Thus:

$$k = \frac{mol\, L^{-1}s^{-1}}{mol\, L^{-1}}$$

Cancelling concentration units:

$$k = s^{-1}$$

Step 3: Write final answer.

Hence SI unit of first order rate constant is:

$$\boxed{s^{-1}}$$

Therefore correct option is:

$$\boxed{(B)}$$

Quick Tip: For a first order reaction:

$$k = s^{-1}$$

The unit depends only on reaction order, not on reaction mechanism.

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5. Which of the following complexes shows maximum number of unpaired electrons?

(A) $[Fe(CN)_6]^{4-}$

(B) $[FeF_6]^{3-}$

(C) $[Co(NH_3)_6]^{3+}$

(D) $[Ni(CO)_4]$

Correct Answer: (2) $[FeF_6]^{3-}$

Solution:

Concept:

Number of unpaired electrons depends on:

- Oxidation state of metal
- Nature of ligand
- Crystal field splitting
- Weak field or strong field ligands

Weak field ligands produce high spin complexes with more unpaired electrons.

Step 1: Analyse $[Fe(CN)_6]^{4-}$.

Oxidation state of Fe:

$$x + 6(-1) = -4$$

$$x = +2$$

Electronic configuration:

$$Fe^{2+} = 3d^6$$

CN^- is strong field ligand.

Thus low spin complex forms.

Number of unpaired electrons:

0

Step 2: Analyse $[FeF_6]^{3-}$.

Oxidation state:

$$x + 6(-1) = -3$$

$$x = +3$$

Thus:

$$Fe^{3+} = 3d^5$$

F^- is weak field ligand.

Hence high spin complex forms.

Electronic arrangement gives:

5 unpaired electrons

Step 3: Analyse $[Co(NH_3)_6]^{3+}$.

$$Co^{3+} = 3d^6$$

NH_3 acts as strong field ligand for Co^{3+}.

Low spin complex forms.

Number of unpaired electrons:

0

Step 4: Analyse $[Ni(CO)_4]$.

Nickel oxidation state:

$$0$$

CO is strong field ligand.

All electrons become paired.

Thus:

$$0 \text{ unpaired electrons}$$

Step 5: Identify the complex with maximum unpaired electrons.

Maximum unpaired electrons:

$$5$$

present in:

$$\boxed{[FeF_6]^{3-}}$$

Therefore, the correct option is:

$$\boxed{(B)}$$

Quick Tip: Weak field ligands such as:

$$F^-,\ Cl^-,\ Br^-$$

usually form high spin complexes with maximum unpaired electrons.

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6. The correct increasing order of basic strength of the following amines/compounds is:

(I) $C_6H_5NH_2$ **(Aniline)**

(II) NH_3 **(Ammonia)**

(III) $C_6H_5CH_2NH_2$ **(Benzylamine)**

(IV) $C_2H_5NH_2$ **(Ethylamine)**

(V) $(C_2H_5)_2NH$ **(Diethylamine)**

(A) $C_6H_5NH_2 < NH_3 < C_6H_5CH_2NH_2 < C_2H_5NH_2 < (C_2H_5)_2NH$

(B) $NH_3 < C_6H_5NH_2 < C_6H_5CH_2NH_2 < C_2H_5NH_2 < (C_2H_5)_2NH$

(C) $C_6H_5CH_2NH_2 < C_6H_5NH_2 < NH_3 < C_2H_5NH_2 < (C_2H_5)_2NH$

(D) $C_2H_5NH_2 < (C_2H_5)_2NH < C_6H_5NH_2 < NH_3$

Correct Answer: (A) $C_6H_5NH_2 < NH_3 < C_6H_5CH_2NH_2 < C_2H_5NH_2 < (C_2H_5)_2NH$

Solution:

Concept:

The basic strength of amines depends upon the availability of the lone pair of electrons on the nitrogen atom for donation to a proton (H^+). Greater the availability of the lone pair, greater will be the basic strength.

The important factors affecting basicity are:

- **Inductive Effect ($+I$ effect):** Alkyl groups donate electron density toward nitrogen, increasing basicity.
- **Resonance Effect:** Delocalization of lone pair decreases its availability and decreases basicity.
- **Solvation Effect:** Stabilization of protonated species in aqueous medium affects basicity.
- **Steric Hindrance:** Bulky groups can reduce protonation efficiency.

Step 1: Analyzing Aniline ($C_6H_5NH_2$).

In aniline, the lone pair on nitrogen is directly involved in resonance with the benzene ring.

$$C_6H_5NH_2 \longleftrightarrow \text{Resonance structures}$$

Due to resonance:

- Lone pair becomes delocalized.
- Electron density on nitrogen decreases.
- Availability of lone pair for protonation decreases.

Hence, Aniline is the weakest base among all the given compounds.

$$C_6H_5NH_2 < NH_3$$

Step 2: Analyzing Ammonia (NH_3).

Ammonia contains a localized lone pair on nitrogen.

There is:

- No resonance effect.
- No electron donating alkyl group.

Thus, Ammonia is more basic than Aniline but weaker than aliphatic amines.

Step 3: Analyzing Benzylamine ($C_6H_5CH_2NH_2$).

In Benzylamine:

- The $-NH_2$ group is attached to sp^3 hybridized carbon.
- Lone pair cannot participate in resonance with benzene ring.

Therefore:

- Lone pair remains available.
- Basicity increases compared to ammonia.

Thus:

$$NH_3 < C_6H_5CH_2NH_2$$

Step 4: Analyzing Ethylamine and Diethylamine.

Ethyl groups show strong $+I$ effect.

- Ethylamine has one ethyl group.
- Diethylamine has two ethyl groups.

More alkyl groups increase electron density on nitrogen.

Thus:

$$C_2H_5NH_2 < (C_2H_5)_2NH$$

Also both are stronger bases than ammonia and benzylamine.

Step 5: Combining all observations.

Final increasing order of basic strength becomes:

$$C_6H_5NH_2 < NH_3 < C_6H_5CH_2NH_2 < C_2H_5NH_2 < (C_2H_5)_2NH$$

Hence, the correct option is:

$$\boxed{(A)}$$

Quick Tip: Aromatic amines are weaker bases because resonance delocalizes the lone pair on nitrogen. Aliphatic amines are stronger due to the $+I$ effect of alkyl groups.

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7. When blood cells are placed in 1% (w/v) NaCl aqueous solution, what will happen to the cells?

(A) Cell will burst

(B) Cell will shrink

(C) Cell will swell

(D) Cell remains as such

Correct Answer: (B) Cell will shrink

Solution:

Concept:

This question is based on:

- Osmosis
- Hypertonic and hypotonic solutions
- Osmotic pressure

Osmosis is the movement of solvent molecules through a semipermeable membrane from lower solute concentration to higher solute concentration.

For human blood cells:

0.9% NaCl solution

is approximately isotonic.

Step 1: Identify the nature of the external solution.

Given external solution:

1% NaCl

Normal isotonic concentration:

0.9% NaCl

Since:

$1\% > 0.9\%$

the external solution is hypertonic.

Step 2: Determine direction of osmosis.

In a hypertonic solution:

- Solute concentration outside cell is greater.
- Water moves out of the cell.

This outward movement of water is called:

Exosmosis

Step 3: Determine the effect on blood cell.

As water leaves the blood cell:

- Cell volume decreases.
- Cell membrane contracts inward.

Therefore, the blood cell shrinks.

This shrinking is known as:

Crenation

Step 4: Write the final answer.

Hence:

Cell will shrink

Therefore, the correct option is:

$\boxed{(B)}$

Quick Tip: Remember:

- Hypertonic solution → Cell shrinks
- Hypotonic solution → Cell swells/bursts
- Isotonic solution → No change

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8. Which of the following solutions is isotonic with human blood?

(A) 0.1% NaCl solution

(B) 0.5% NaCl solution

(C) 0.9% NaCl solution

(D) 2% NaCl solution

Correct Answer: (C) 0.9% NaCl solution

Solution:

Concept:

An isotonic solution is a solution having the same osmotic pressure as the fluid inside human blood cells.

In isotonic conditions:

- No net movement of water occurs.
- Blood cells neither shrink nor swell.

Human blood plasma is isotonic with approximately:

0.9% NaCl solution

Step 1: Understand isotonicity.

If external solution concentration equals internal cell concentration:

$$\text{Water entering} = \text{Water leaving}$$

Thus:

- Cell size remains unchanged.
- Osmotic equilibrium is maintained.

Step 2: Compare all options.

- 0.1% NaCl: Hypotonic
- 0.5% NaCl: Hypotonic
- 0.9% NaCl: Isotonic
- 2% NaCl: Hypertonic

Thus only:

$$\text{0.9\% NaCl}$$

matches blood osmotic pressure.

Step 3: Write the final answer.

Hence, isotonic solution is:

$$\boxed{\text{0.9\% NaCl solution}}$$

Therefore, the correct option is:

$$\boxed{(C)}$$

Quick Tip: Physiological saline or normal saline used in hospitals is:

$$\text{0.9\% NaCl}$$

because it is isotonic with human blood.

9. Which of the following compounds will not undergo an Azo coupling reaction?

(A) Aniline

(B) Phenol

(C) Anisole

(D) Nitrobenzene

Correct Answer: (D) Nitrobenzene

Solution:

Concept:

Azo coupling reaction is an important electrophilic aromatic substitution reaction involving diazonium salts.

In this reaction:

$$ArN_2^+$$

acts as a weak electrophile.

Therefore, azo coupling occurs only with highly activated aromatic rings containing strong electron donating groups.

Important points:

- Electron donating groups activate the ring.
- Electron withdrawing groups deactivate the ring.
- Activated rings undergo azo coupling easily.

Examples of activating groups:

$$-OH,\ -NH_2,\ -OR$$

Examples of deactivating groups:

$$-NO_2,\ -COOH,\ -CN$$

Step 1: Analyzing Aniline ($C_6H_5NH_2$).

Aniline contains:

$$-NH_2$$

group.

The lone pair on nitrogen participates in resonance and increases electron density in the benzene ring.

Thus:

- Ring becomes highly activated.
- Electrophilic substitution becomes easier.

Hence, Aniline undergoes azo coupling reaction.

Step 2: Analyzing Phenol (C_6H_5OH).

Phenol contains:

$$-OH$$

group.

Oxygen donates electron density through resonance effect.

Therefore:

- Ring becomes activated.
- Phenol reacts readily with diazonium salts.

Hence, Phenol undergoes azo coupling reaction.

Step 3: Analyzing Anisole ($C_6H_5OCH_3$).

Anisole contains:

$$-OCH_3$$

group.

Methoxy group donates electrons through resonance.

Thus:

- Aromatic ring becomes electron rich.
- Electrophilic substitution occurs easily.

Hence, Anisole also undergoes azo coupling reaction.

Step 4: Analyzing Nitrobenzene ($C_6H_5NO_2$).

Nitro group:

$$-NO_2$$

is a strong electron withdrawing group.

It withdraws electron density by:

- $-I$ effect
- $-M$ effect

As a result:

- Benzene ring becomes strongly deactivated.
- Weak diazonium electrophile cannot attack the ring.

Therefore, Nitrobenzene does not undergo azo coupling reaction.

Step 5: Write the final answer.

Hence:

$$\boxed{\text{Nitrobenzene}}$$

Therefore, the correct option is:

$$\boxed{(D)}$$

Quick Tip: Azo coupling occurs easily with activated aromatic compounds such as phenols and aromatic amines. Strong electron withdrawing groups like $-NO_2$ prevent azo coupling.

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10. Which of the following are fat soluble vitamins?

(A) Vitamin A

(B) Vitamin B

(C) Vitamin D

(D) Vitamin E

(E) Vitamin K

Choose the correct answer from the options given below:

(A) (A), (B), (D) and (E) only

(B) (A), (B), (C) and (D) only

(C) (A), (C), (D) and (E) only

(D) (B), (C), (D) and (E) only

Correct Answer: (C) (A), (C), (D) and (E) only

Solution:

Concept:

Vitamins are essential organic compounds required in small quantities for proper growth, metabolism and maintenance of body functions.

Based on solubility, vitamins are classified into:

- Fat-soluble vitamins
- Water-soluble vitamins

Fat-soluble vitamins:

$$A,\ D,\ E,\ K$$

Water-soluble vitamins:

B-complex and Vitamin C

Fat-soluble vitamins:

- Dissolve in fats and oils
- Are stored in liver and adipose tissues
- Can accumulate in body

Step 1: Identify Vitamin A.

Vitamin A:

Retinol

is fat soluble.

It is important for:

- Vision

- Healthy epithelial tissues

Thus:

$$(A) \text{ is correct}$$

Step 2: Identify Vitamin B.

Vitamin B belongs to:

$$\text{Vitamin B-complex}$$

These vitamins are water soluble.

Therefore:

$$(B) \text{ is not fat soluble}$$

Step 3: Identify Vitamins D, E and K.

- Vitamin D helps calcium absorption.
- Vitamin E acts as antioxidant.
- Vitamin K is essential for blood clotting.

All three are fat soluble vitamins.

Thus:

$$(C),\ (D),\ (E)$$

are correct.

Step 4: Select the correct combination.

Fat-soluble vitamins are:

$$A,\ D,\ E,\ K$$

Hence correct combination is:

$$(A),\ (C),\ (D),\ (E)$$

Therefore, the correct option is:

$$\boxed{(C)}$$

Quick Tip: Remember the mnemonic:

$$\boxed{ADEK}$$

These are the four fat-soluble vitamins. Vitamins B and C are water soluble.
