

CUET 2026 May 26 Shift 1 Chemistry

Question Paper (Memory-Based) with Solutions

Conducted by National Testing Agency (NTA)

1. Given below are two statements :

Given: Molar masses of C, H, O, Cl are 12, 1, 16 and 35.5 g mol⁻¹ respectively.

Statement I: In 30%(w/w) solution of methanol in CCl₄ (at T K), the mole fraction of CCl₄ is equal to 0.33.

Statement II: Mixture of methanol and CCl₄ shows positive deviation from Raoult's law.

In the light of the above statements, choose the correct answer from the option given below :

- (1) Both Statement I and Statement II are true
- (2) Both Statement I and Statement II are false
- (3) Statement I is true but Statement II is false
- (4) Statement I is false but Statement II is true

Correct Answer: (4) Statement I is false but Statement II is true

Solution:

Concept:

Mole fraction is defined as:

$$X_i = \frac{\text{Number of moles of component } i}{\text{Total number of moles}}$$

For solutions showing deviation from Raoult's law:

- Positive deviation occurs when solute-solvent interactions are weaker than solute-solute and solvent-solvent interactions.
- Negative deviation occurs when solute-solvent interactions are stronger.

Methanol is a hydrogen-bonded polar compound whereas CCl₄ is non-polar. Mixing them weakens intermolecular attractions and hence the solution shows positive deviation from Raoult's law.

Step 1: Calculation of mole fraction of CCl₄.

A 30%(w/w) solution of methanol in CCl₄ means:

30 g methanol + 70 g CCl₄

Molar mass of methanol (CH₃OH):

$$12 + 4(1) + 16 = 32 \text{ g mol}^{-1}$$

Number of moles of methanol:

$$n_{\text{CH}_3\text{OH}} = \frac{30}{32} = 0.9375$$

Molar mass of CCl₄:

$$\begin{aligned} 12 + 4(35.5) \\ = 12 + 142 \\ = 154 \text{ g mol}^{-1} \end{aligned}$$

Number of moles of CCl₄:

$$\begin{aligned} n_{\text{CCl}_4} &= \frac{70}{154} \\ &= 0.4545 \end{aligned}$$

Total moles:

$$0.9375 + 0.4545 = 1.392$$

Mole fraction of CCl₄:

$$\begin{aligned} X_{\text{CCl}_4} &= \frac{0.4545}{1.392} \\ &= 0.326 \approx 0.33 \end{aligned}$$

Thus, Statement I is **true**.

Step 2: Checking Statement II regarding deviation from Raoult's law.

Methanol molecules are strongly hydrogen bonded in pure state.

CCl₄ molecules are non-polar and interact mainly through weak van der Waals forces.

When methanol and CCl₄ are mixed:

- The strong hydrogen bonding between methanol molecules gets disrupted.
- The new methanol-CCl₄ interactions are weaker than original methanol-methanol interactions.

Therefore:

$$A - B < A - A \text{ and } B - B$$

Hence, escaping tendency of molecules increases and vapour pressure becomes greater than expected.

Therefore, the mixture shows:

Positive deviation from Raoult's law

Thus, Statement II is also **true**.

Hence, both Statement I and Statement II are true.

(1) Both Statement I and Statement II are true

Quick Tip: For w/w% problems:

$$\text{Mass percentage} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

Always convert masses into moles before calculating mole fraction.

2. Which statements are True?

- A. In Hoffmann bromamide degradation, 4 moles of NaOH and 2 moles of Br₂ are consumed per mole of an amide.
- B. Hoffmann bromamide reaction is not given by alkyl amides.
- C. Primary amines can be synthesized by Hoffmann bromamide degradation.
- D. Secondary amide on reaction with Br₂ and NaOH will give secondary amine.
- E. The by-products of Hoffmann degradation are Na₂CO₃, NaBr and H₂O.

Choose the correct answer from the options given below:

- (1) A, C and E only
- (2) B, C and D only
- (3) C and E only
- (4) C, D and E only

Correct Answer: (3) C and E only

Solution:

Concept:

Hoffmann bromamide degradation (also called Hoffmann rearrangement) converts a primary amide into a primary amine containing one carbon less than the parent amide.

General reaction:



Important points:

- Only primary amides undergo Hoffmann bromamide degradation.
- Product formed is a primary amine.
- One carbon atom is lost during the reaction.

Step 1: Checking Statement A.

From the balanced Hoffmann bromamide degradation reaction:



We observe:

- 1 mole of Br_2 is consumed
- 4 moles of NaOH are consumed

But Statement A says:

2 moles of Br_2

which is incorrect.

Hence, Statement A is **false**.

Step 2: Checking Statement B.

Hoffmann bromamide degradation is shown by:

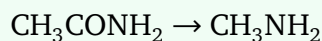


where R can be:

- Alkyl group
- Aryl group

Thus, alkyl amides definitely undergo Hoffmann degradation.

Example:

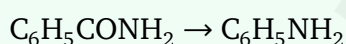


Therefore, Statement B is **false**.

Step 3: Checking Statement C.

Primary amides on Hoffmann degradation produce primary amines.

Example:



Thus, primary amines can indeed be synthesized by this method.

Hence, Statement C is **true**.

Step 4: Checking Statement D.

Secondary amides do not undergo Hoffmann bromamide degradation because the reaction mechanism requires the presence of:



group.

Secondary amides contain:

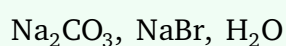


Therefore, secondary amides do not form secondary amines in this reaction.

Hence, Statement D is **false**.

Step 5: Checking Statement E.

The balanced reaction clearly shows by-products:

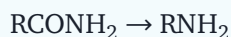


Hence, Statement E is **true**.

Thus, only statements C and E are true.

(3) C and E only

Quick Tip: Hoffmann bromamide degradation:



Always remember:

- Only primary amides react
- One carbon atom is lost
- Product formed is always a primary amine

3. The incorrect statement from the following with respect to carbohydrates is :

- (1) All monosaccharides are reducing sugars.
- (2) The monosaccharide units obtained from hydrolysis of oligosaccharides are always the same.
- (3) Starch and cellulose are typical examples of polysaccharides, which are very high molecular weight compounds of more than ten monosaccharide units.
- (4) Open chain and cyclic structures co-exist at equilibrium that are responsible for certain properties as in the case of D-(+)-glucose.

Correct Answer: (2) The monosaccharide units obtained from hydrolysis of oligosaccharides are always the same.

Solution:

Concept:

Carbohydrates are polyhydroxy aldehydes or ketones or compounds that produce them upon hydrolysis.

They are classified into:

- Monosaccharides
- Oligosaccharides
- Polysaccharides

Reducing sugars contain a free aldehydic or ketonic group capable of reducing Fehling's solution or Tollens' reagent.

Step 1: Checking Statement (1).

All monosaccharides possess either:

- Free aldehyde group
- Or ketone group capable of tautomerisation

Therefore, all monosaccharides act as reducing sugars.

Examples:

Glucose, fructose, galactose

Thus, Statement (1) is correct.

Step 2: Checking Statement (2).

Oligosaccharides may produce:

- Same monosaccharide units
- Different monosaccharide units

Example:

- Sucrose on hydrolysis gives glucose and fructose.

Since the hydrolysis products are not always identical, the statement saying “always the same” is incorrect.

Hence, Statement (2) is incorrect.

Step 3: Checking Statement (3).

Polysaccharides contain large numbers of monosaccharide units.

Starch and cellulose are classical examples of polysaccharides.

They possess:

$$n > 10$$

monosaccharide units and very high molecular masses.

Hence, Statement (3) is correct.

Step 4: Checking Statement (4).

Glucose exists in equilibrium between:

- Open chain structure
- Cyclic hemiacetal structures

This equilibrium explains phenomena like:

- Mutarotation
- Reducing behaviour

Therefore, Statement (4) is also correct.

Thus, the incorrect statement is:

(2)

Quick Tip: Remember:

- All monosaccharides are reducing sugars.
- Oligosaccharides may contain same or different monosaccharide units.
- Glucose shows mutarotation because cyclic and open-chain forms coexist.

4. An organic compound (P) on treatment with aqueous ammonia under hot condition forms compound (Q) which on heating with Br_2 and KOH forms compound (R) having molecular formula $\text{C}_6\text{H}_7\text{N}$. Name P, Q and R respectively are :

- (1) Benzoic acid, benzamide, aniline
- (2) Toluic acid, methylbenzamide, 2-methylaniline
- (3) Benzoic acid, 4-methylbenzamide, 4-methylaniline
- (4) Phenylethanoic acid, phenylethanamide, benzamine

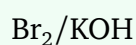
Correct Answer: (1) Benzoic acid, benzamide, aniline

Solution:

Concept:

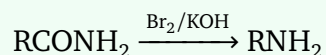
Carboxylic acids react with ammonia under heating to form amides.

Further, amides on treatment with:



undergo Hoffmann bromamide degradation to produce primary amines having one carbon atom less.

General reaction:

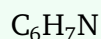


Step 1: Identifying compound R.

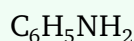
Given:

R

has molecular formula:



This corresponds to:



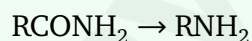
which is aniline.

Thus:

R = aniline

Step 2: Finding compound Q.

In Hoffmann degradation:



If the product is aniline:



then the amide must be:



which is benzamide.

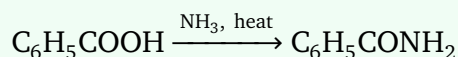
Thus:

Q = benzamide

Step 3: Finding compound P.

Benzamide is formed from benzoic acid by treatment with ammonia and heating.

Reaction:



Thus:

P = benzoic acid

Hence:

P = Benzoic acid

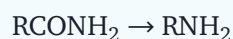
Q = Benzamide

R = Aniline

Therefore, correct option is:

(1)

Quick Tip: In Hoffmann bromamide degradation:



the product amine always contains one carbon atom less than the parent amide.

5. An organic compound P of molecular formula $C_6H_{12}O_3$ gives positive iodoform test but negative Tollens' test. When P is treated with dilute acid, it produces Q . Q gives positive Tollens' test and also iodoform test. Identify compound P .

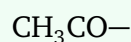
- (1) $CH_3COCH(OCH_3)CH_2OCH_3$
- (2) $CH_3COCH_2CH(OCH_3)_2$
- (3) $HCOCH_2CH_2CH(OCH_3)_2$
- (4) $CH_3COC(OCH_3)_2CH_3$

Correct Answer: (4) $CH_3COC(OCH_3)_2CH_3$

Solution:

Concept:

Iodoform test is given by compounds containing:



group or compounds oxidisable to it.

Tollens' reagent gives positive test mainly with aldehydes.

Acetals and ketals on hydrolysis with dilute acid regenerate carbonyl compounds.

Step 1: Analysing properties of compound P.

Compound P:

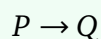
- Gives positive iodoform test
- Gives negative Tollens' test

Therefore:

- P must contain methyl ketone functionality or masked methyl ketone.
- It should not contain free aldehyde group.

Step 2: Analysing compound Q.

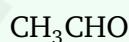
On hydrolysis with dilute acid:



and Q:

- Gives positive Tollens' test
- Gives positive iodoform test

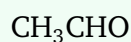
A compound giving both tests is:



that is ethanal.

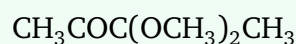
Ethanal:

- Gives Tollens' test because it is an aldehyde.
- Gives iodoform test because it contains:



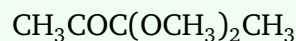
Step 3: Identifying the structure of P.

Option (4):

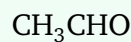


is a ketal derivative.

On acidic hydrolysis:



regenerates:



which satisfies both:

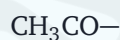
- Positive Tollens' test
- Positive iodoform test

Hence, option (4) is correct.

(4)

Quick Tip: Remember:

- Iodoform test detects:



group.

- Tollens' reagent detects aldehydes.
- Ketals/acetals hydrolyse back to carbonyl compounds in acidic medium.

6. MnO_4^{2-} in acidic medium disproportionates to :

- (1) Mn_2O_7 and MnO_2
- (2) MnO_4^- and MnO
- (3) MnO_4^- and MnO_2
- (4) Mn_2O_7 and MnO

Correct Answer: (3) MnO_4^- and MnO_2

Solution:

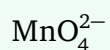
Concept:

Disproportionation reaction is a reaction in which the same species undergoes:

- Oxidation
- Reduction

simultaneously.

In manganate ion:



oxidation state of manganese is:

$$x + 4(-2) = -2$$

$$x - 8 = -2$$

$$x = +6$$

Thus, manganese is in:

$$+6$$

oxidation state.

In acidic medium, manganate ion is unstable and undergoes disproportionation.

Step 1: Understanding the oxidation and reduction processes.

During disproportionation:



undergoes:

- Oxidation to +7
- Reduction to +4

The corresponding compounds are:

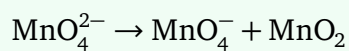
For manganese in +7 oxidation state:



For manganese in +4 oxidation state:

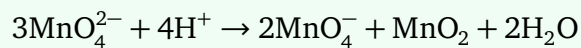


Hence:



Step 2: Writing the balanced disproportionation reaction.

The balanced reaction in acidic medium is:



This clearly shows the formation of:

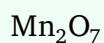


and



Step 3: Checking all options carefully.

Option (1):



is manganese(VII) oxide and is not formed in this disproportionation.

Hence incorrect.

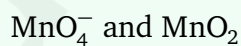
Option (2):



contains manganese in +2 oxidation state, not formed here.

Hence incorrect.

Option (3):

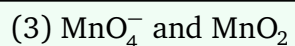


This matches the actual disproportionation products.

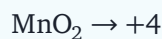
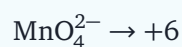
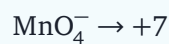
Hence correct.

Option (4): Again contains incorrect products.

Thus, the correct answer is:



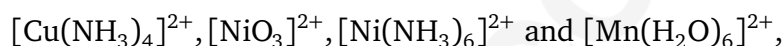
Quick Tip: Remember the oxidation states of manganese:



Manganate ion (MnO_4^{2-}) is unstable in acidic medium and disproportionates into permanganate and manganese dioxide.

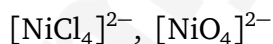
7. Given below are two statements:

Statement I: Among

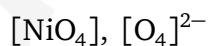


$[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ has the maximum number of unpaired electrons.

Statement II: The number of pairs among



and



that contain only diamagnetic species is two.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Statement I is false but Statement II is true
- (2) Both Statement I and Statement II are true
- (3) Both Statement I and Statement II are false
- (4) Statement I is true but Statement II is false

Correct Answer: (2) Both Statement I and Statement II are true

Solution:

Concept:

The magnetic behaviour of coordination compounds depends on:

- Number of unpaired electrons
- Strength of ligand field
- Electronic configuration of metal ion

Species containing all paired electrons are:

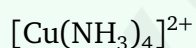
- Diamagnetic

Species containing one or more unpaired electrons are:

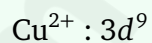
- Paramagnetic

Step 1: Checking Statement I.

We determine the number of unpaired electrons in each complex.



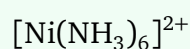
Copper:



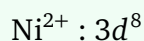
Electronic configuration gives:

1

unpaired electron.



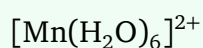
Nickel:



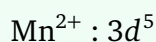
Octahedral complex with ammonia.

Number of unpaired electrons:

2



Manganese:



Water is a weak field ligand.

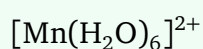
Thus high-spin configuration is formed.

Hence:

5

unpaired electrons are present.

Therefore, among all the given complexes:



has maximum number of unpaired electrons.

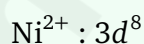
Thus, Statement I is **true**.

Step 2: Checking Statement II.

First species:



Nickel is:



Chloride is weak field ligand.

Tetrahedral complex forms.

Complex is paramagnetic with:

2

unpaired electrons.

Thus, not diamagnetic.

Second species:



Nickel oxidation state:

0

Electronic configuration:



All electrons are paired.

Hence diamagnetic.

Third species:



This species is diamagnetic.

Fourth species:



This species is also diamagnetic.

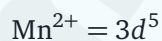
Thus, two pairs contain only diamagnetic species.

Therefore, Statement II is also **true**.

Hence:

(2) Both Statement I and Statement II are true

Quick Tip: Important configurations:



usually has maximum unpaired electrons.

Also remember:



is diamagnetic because nickel attains:



configuration.

8. Identify the correct statements.

- A. Arginine and Tryptophan are essential amino acids.
- B. Histidine does not contain heterocyclic ring in its structure.
- C. Proline is a six membered cyclic ring amino acid.
- D. Glycine does not have chiral centre.

E. Cysteine has characteristic feature of side chain as $\text{MeS} - \text{CH}_2 - \text{CH}_2 -$

- (A) C and E Only
- (B) B and E Only
- (C) C and D Only
- (D) A and D Only

Correct Answer: (D) A and D Only

Solution:

Concept:

Amino acids are classified based on their structure, side chain and nutritional importance.

- Essential amino acids cannot be synthesized by the human body.
- Glycine is achiral because it contains two hydrogen atoms attached to the α -carbon.
- Histidine contains an imidazole heterocyclic ring.
- Proline contains a five-membered cyclic ring.

Step 1: Check statement A

Arginine and Tryptophan are considered essential amino acids.

Hence statement A is correct.

Step 2: Check statement B

Histidine contains an imidazole ring which is heterocyclic.

Hence statement B is incorrect.

Step 3: Check statement C

Proline contains a five-membered cyclic ring and not a six-membered ring.

Hence statement C is incorrect.

Step 4: Check statement D

Glycine has structure $\text{NH}_2 - \text{CH}_2 - \text{COOH}$.

Since the central carbon contains two hydrogen atoms, it is achiral.

Hence statement D is correct.

Step 5: Check statement E

The side chain $\text{MeS} - \text{CH}_2 - \text{CH}_2 -$ belongs to Methionine and not Cysteine.

Hence statement E is incorrect.

Therefore, the correct statements are A and D only.

Quick Tip:

Remember:

- Glycine is the only achiral amino acid.
- Proline has a five-membered ring.
- Histidine contains an imidazole ring.
- Methionine contains sulfur in thioether form.

9. The correct statements are:

- A. Activation energy for enzyme catalysed hydrolysis of sucrose is lower than that of acid catalysed hydrolysis.
- B. During denaturation, secondary and tertiary structures of a protein are destroyed but primary structure remains intact.
- C. Nucleotides are joined together by glycosidic linkage between C_1 and C_4 carbons of the pentose sugar.
- D. Quaternary structure of proteins represents overall folding of the polypeptide chain.

(A) A, C and D Only

(B) A, B and D Only

(C) A and B Only

(D) B and C Only

Correct Answer: (C) A and B Only

Solution:**Concept:**

Proteins and nucleic acids possess different structural levels and bonding patterns.

- Enzymes lower activation energy.
- Denaturation destroys higher structures of proteins.
- Nucleotides are linked by phosphodiester bonds.

- Quaternary structure refers to association of multiple polypeptide chains.

Step 1: Check statement A

Enzymes act as catalysts and lower the activation energy of reactions.

Hence enzyme catalysed hydrolysis has lower activation energy.

Statement A is correct.

Step 2: Check statement B

Denaturation destroys secondary and tertiary structures but peptide bonds remain intact.

Thus primary structure remains unchanged.

Statement B is correct.

Step 3: Check statement C

Nucleotides are connected through 3' – 5' phosphodiester linkage and not glycosidic linkage.

Hence statement C is incorrect.

Step 4: Check statement D

Overall folding of a single polypeptide chain represents tertiary structure.

Quaternary structure involves arrangement of multiple chains.

Hence statement D is incorrect.

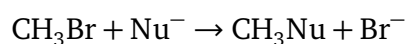
Therefore, statements A and B only are correct.

Quick Tip:

Important facts:

- Enzymes decrease activation energy.
- Denaturation does not break peptide bonds.
- DNA nucleotides are linked by phosphodiester linkage.
- Tertiary structure represents overall folding of a chain.

10. The correct order of the rate of the reaction for the following reaction with respect to nucleophiles is:



(A) $\text{PhO}^- > \text{OH}^- > \text{CH}_3\text{COO}^- > \text{ClO}_4^-$ (B) $\text{ClO}_4^- > \text{CH}_3\text{COO}^- > \text{OH}^- > \text{PhO}^-$ (C) $\text{CH}_3\text{COO}^- > \text{PhO}^- > \text{OH}^- > \text{ClO}_4^-$

(D) $\text{OH}^- > \text{PhO}^- > \text{CH}_3\text{COO}^- > \text{ClO}_4^-$

Correct Answer: (D) $\text{OH}^- > \text{PhO}^- > \text{CH}_3\text{COO}^- > \text{ClO}_4^-$

Solution:

Concept:

The reaction shown is an S_N2 nucleophilic substitution reaction.

Rate depends on nucleophilicity of the attacking nucleophile.

- Greater electron density implies stronger nucleophile.
- Resonance decreases nucleophilicity.
- Stable ions are weaker nucleophiles.

Step 1: Compare OH^-

Hydroxide ion has high electron density and no resonance stabilization.

Thus it is a very strong nucleophile.

Step 2: Compare PhO^-

Phenoxide ion undergoes resonance stabilization.

Hence electron density is delocalized and nucleophilicity decreases compared to OH^- .

Step 3: Compare CH_3COO^-

Acetate ion is strongly resonance stabilized.

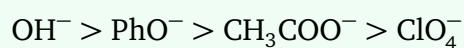
Thus it is weaker than phenoxide ion.

Step 4: Compare ClO_4^-

Perchlorate ion is highly resonance stabilized and extremely stable.

Hence it is the weakest nucleophile.

Therefore, the correct order is



Quick Tip:

For oxygen nucleophiles:

Less resonance stabilization $\Rightarrow$ Greater nucleophilicity

Thus:

