# BYJU'S Part Test for Board Term I
# (CBSE Grade 12)

**Date:** 18/11/2021
**Subject:** Chemistry **Class:** Standard XII

# ANSWER KEYS AND SOLUTIONS

# BYJU'S Part Test for Board Term I (CBSE Grade 12)

Date: 18/11/2021

Subject: Chemistry

Topic : Section A

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1. A crystal (of an element 'X') has a bcc structure. It has an edge length of $4.3\ \mathring{A}$. The shortest distance between the atoms is:

☒ **A.** $1.86\ \mathring{A}$

☒ **B.** $4.3\ \mathring{A}$

☑ **C.** $3.72\ \mathring{A}$

☒ **D.** $7.44\ \mathring{A}$

Given, a crystal has a body centred cubic structure. The edge length of the cell is $4.3\ \mathring{A}$

We know, for bcc

$$\text{Distance of nearest atom 'd'} = \frac{\sqrt{3}\,a}{2}$$

$$= \frac{1}{2} \times \sqrt{3}a = \frac{\sqrt{3}}{2} \times 4.3 = 3.72\ \mathring{A}$$

2. When heated above $916^\circ C$, iron changes its bcc crystalline form to fcc without the change in the radius of atom. The ratio of density of the crystal before and after heating is:
Given:
$[At.\ wt.\ of\ Fe = 56\ g\ mol^{-1}]$

☒ **A.** 1.57

☑ **B.** 0.91

☒ **C.** 0.25

☒ **D.** 1.73

Density of the unit cell,

$$\rho = \frac{Z \times M}{N_A(a^3 \times 10^{-30})} g\ cm^{-3}$$

where,
$Z = \text{No. of atoms in a unit cell}$
$M = \text{Molar mass}$
$N_A = \text{Avagadro number}$

For bcc,

$$\text{Edge length of a bcc, a } = \frac{4r}{\sqrt{3}}$$

$$\therefore$$

$$\rho_1 = \frac{2 \times 56}{\left(\frac{4r}{\sqrt{3}}\right)^3}$$

For fcc,

$$\text{Edge length of a fcc, a } = \frac{4r}{\sqrt{2}}$$

$$\therefore$$

$$\rho_2 = \frac{4 \times 56}{(2\sqrt{2}\ r)^3}$$

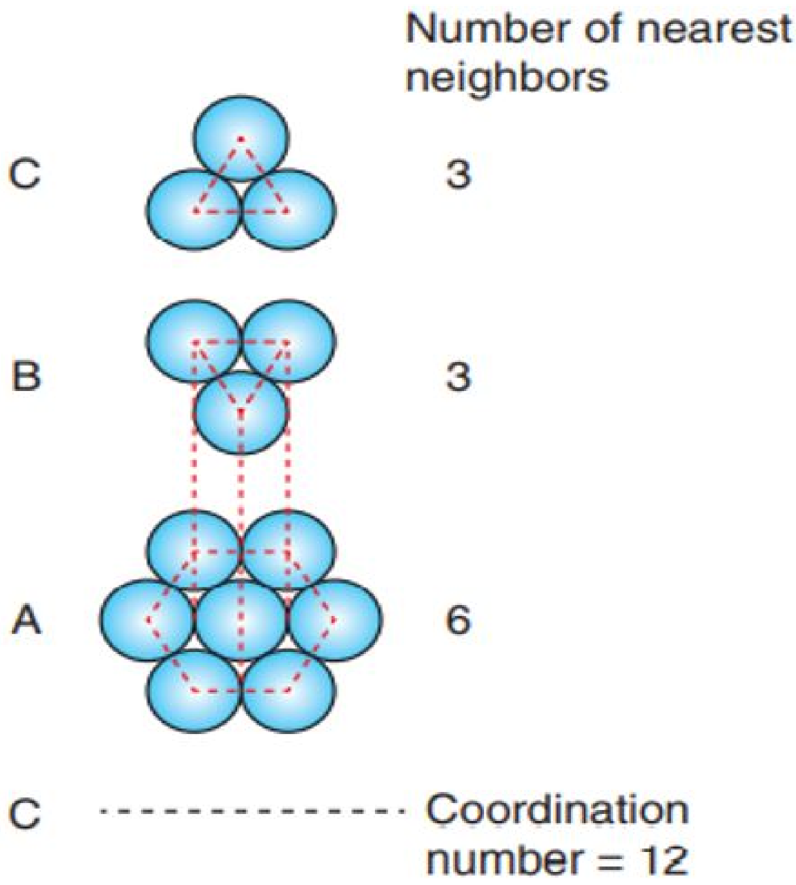
$$\therefore$$

$$\text{Required ratio, } = \frac{\rho_1}{\rho_2} = \frac{1}{2} \times \frac{(2\sqrt{2})^3}{(\frac{4}{\sqrt{3}})^3} = 0.918$$

3. What will be the coordination number of cubic close packing (ccp) lattice?

- ✓ **A.** 12
- ✗ **B.** 8
- ✗ **C.** 6
- ✗ **D.** 4

The third layer isn’t aligned with either first or second layer.
Fourth layer, above third layer, repeats first layer's orientation.
Thus, the lattice has ABCABC.. type of packing.



4. Which of the following is true regarding amorphous solids?

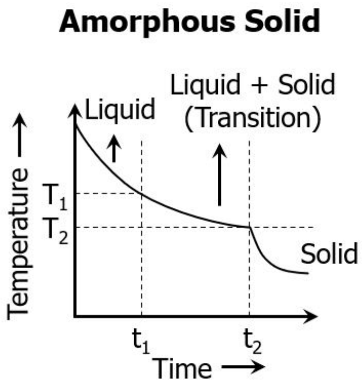
✗ **A.** posses sharp melting points

✗ **B.** undergo clean cleavage when cut with knife

✓ **C.** do not undergo clean cleavage when cut with a knife

✗ **D.** posses orderly arrangement over long distances

Solids are of two types
(i) Crystalline
(ii) Amorphous
Amorphous solids does not have a definite geometrical shape.
Characteristic of amorphous solids:
1. They don't have long-range repetitive internal structures that are found in crystals.
2. Regular patterns are scattered and in between the arrangement is disordered.
3. They are formed by sudden cooling of a liquid. Sometimes they are called supercooled liquids or pseudo solid
4. These are isotropic, which can show same physical properties in all directions.
5. They don't have sharp melting point due to the disordered arrangements. They have a range of temperature for melting.



6. They can be cut along random directions and have irregular surfaces. Thus, do not undergo clean cleavage with knife.
Thus, option (c) is correct.

5. The coordination number of $Zn^{2+}$ and $S^{2-}$ ions in the zinc blende $(ZnS)$ type structure is

☑ **A.** 4 : 4

☒ **B.** 6 : 6

☒ **C.** 8 : 8

☒ **D.** 4 : 8

In Zinc blende,
$S^{2-}$ ions forms the fcc lattice. Thus, it occupies the corners and face centre of the cubic unit cell.
Thus lattice form has 8 tetrahedral voids and 4 octahedral void for an unit cell.
$Zn^{2+}$ ion occupy only alternate (non adjacent) four tetrahedral void.
Each $Zn^{2+}$ in terahedral void is surrounded tetrahedrally by four $S^{2-}$ ions.
Each $S^{2-}$ ion is surrounded tetrahedrally by four $Zn^{2+}$ ions.
Thus, the coordination number of $ZnS$ is 4 : 4

6. The nucleophilicity order of halogens in polar protic solvent is :

☒ **A.** $F^- > Cl^- > Br^- > I^-$

☒ **B.** $F^- > I^- > Br^- > Cl^-$

☑ **C.** $F^- < Cl^- < Br^- < I^-$

☒ **D.** $Cl^- > F^- > Br^- > I^-$

The degree of hydration of anions increases with the decrease in the size of the anions and hence nuclephilicity decreases in polar protic solvent.
Correct order of anionic size is $F^- < Cl^- < Br^- < I^-$.
Correct order of degree of hydration is $F^- > Cl^- > Br^- > I^-$
Correct order of nucleophilicity in polar protic solvent is $F^- < Cl^- < Br^- < I^-$.

7. Gem-dibromide is

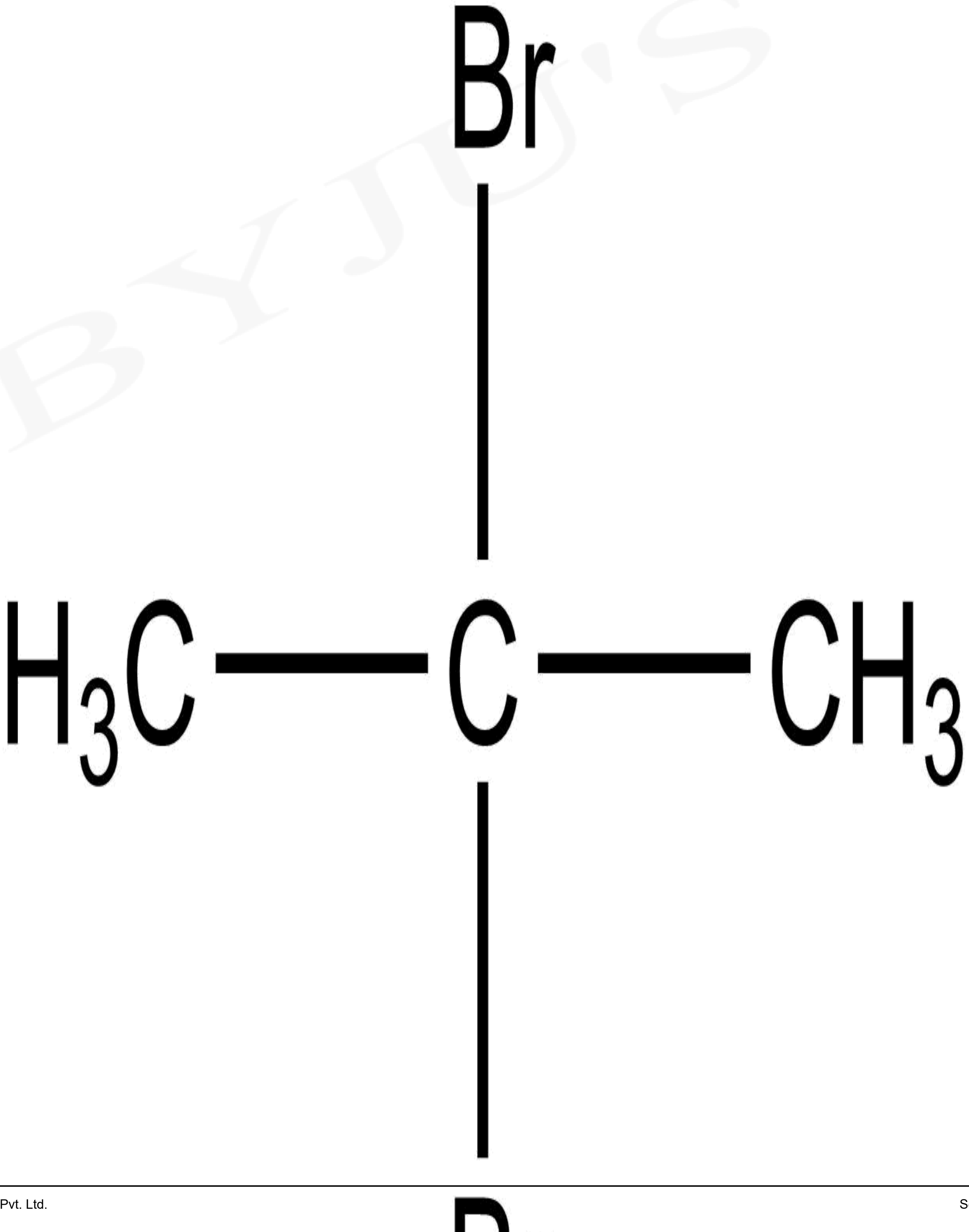
✓ **A.** $CH_3CBr_2CH_3$

✗ **B.** $CH_2BrCH_2Br$

✗ **C.** $CH_2(Br)CH_2CH_3$

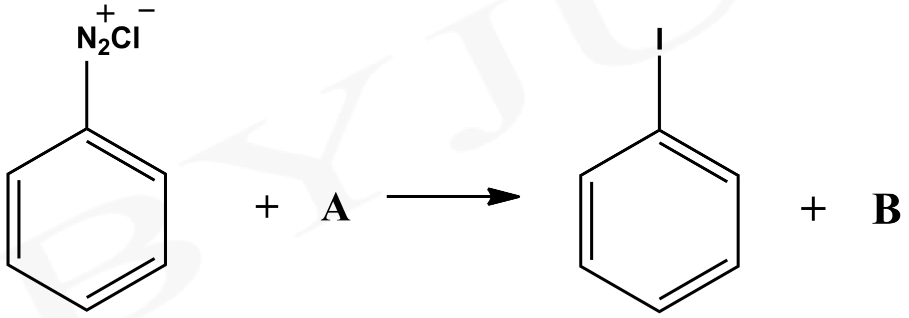
✗ **D.** None of these

When two halogen atoms are attached to same carbon atom then it is known as gem - dihalide.



gem-dibromide

8. What is 'A' and 'B' respectively in the following reaction?



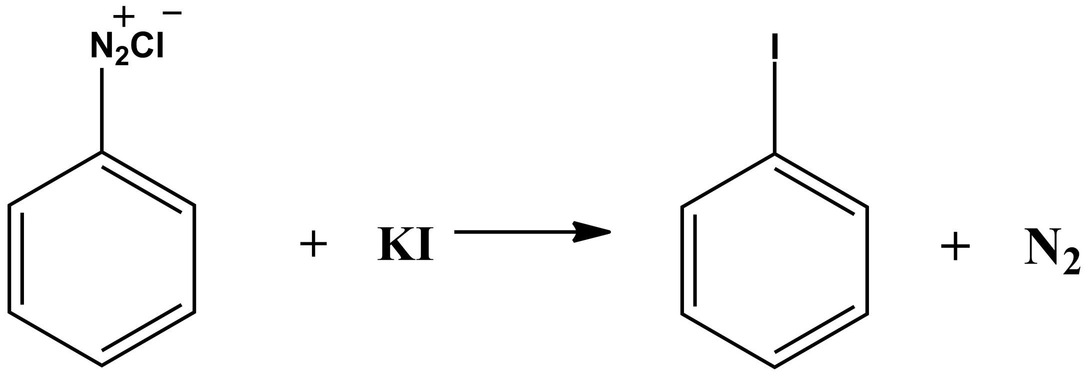
☒ **A.** $A = Cu_2Cl_2,\ B = N_2$

☒ **B.** $A = Cu_2I_2,\ B = I_2$

☒ **C.** $A = I_2,\ B = N_2$

☑ **D.** $A = KI,\ B = N_2$

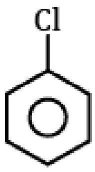
When freshly prepared diazonium salt of primary aromatic amine is treated with $Cu_2X_2(X = Cl, Br)$, aryl amine is formed. This reaction is known as Sandmeyer reaction. But, replacement of diazonium group with iodine doesn’t require cuprous halide, it can be done with KI.



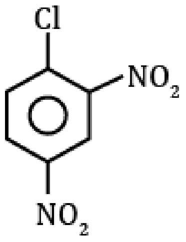
Hence, the correct answer is option (d).

9. Which of the following compound gives fastest aromatic nucleophilic substitution reaction ?

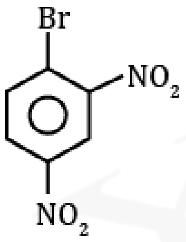
☒ **A.**



☑ **B.**



☒ **C.**



☒ **D.**

Nucleophilic substitution reaction are favoured by strong electron withdrawing group. Electron withdrawing group at ortho and para position favours the nucleophilic substitution reaction. -I effect of Cl is more than Br. Hence, we can neglect option (c). In option (b), electron withdrawing groups are at ortho and para positions. As, the number of EWG increases at the benzene ring, the lower the temperature and pressure is required. Hence, the rate of nucleophilic substitution reaction increases. Therefore, the correct answer is option (b).

10. The product of the following reactions is (are):

$$C_2H_5Br + 2Na + CH_3Br \overset{\text{dry ether}}{\to} ?$$

✗ **A.** ethane

✗ **B.** propane

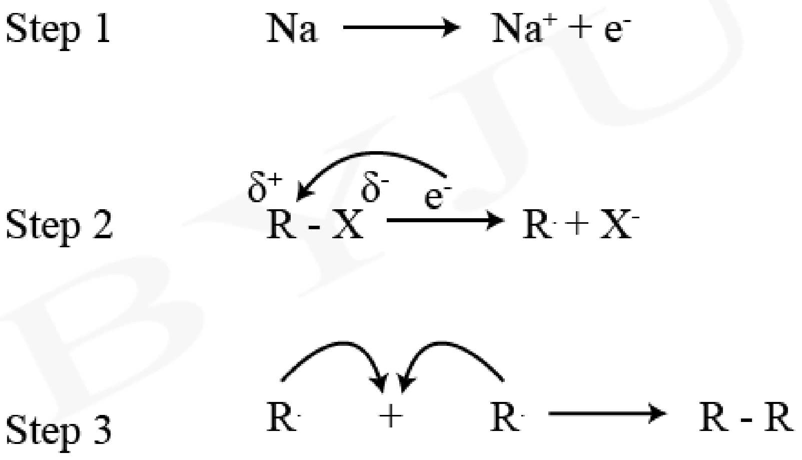
✗ **C.** butane

✓ **D.** ethane, propane and butane

If two different alkyl halides are taken in wurtz reaction then alkanes with both odd and even number of C atoms are obtained.

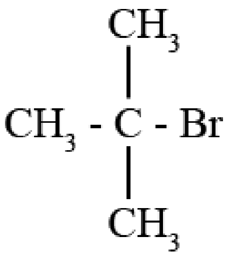
$$C_2H_5Br + 2Na + CH_3 - Br \xrightarrow{\text{Dry ether}} C_2H_5 - CH_3 + C_2H_5 - C_2H_5 + CH_3 - CH_3 + 2NaBr$$

It involves radical mechanism.



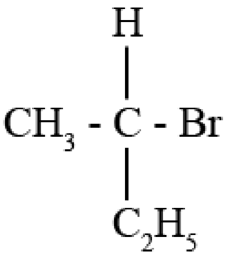
11. Which one of the following compounds will give racemic mixture in $S_N1$ reaction?

☒ **A.**



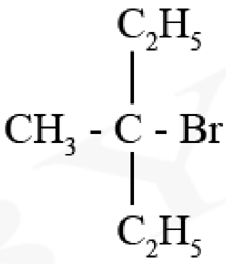
$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-Br$

☑ **B.**



$CH_3-\overset{\overset{H}{|}}{\underset{\underset{C_2H_5}{|}}{C}}-Br$

☒ **C.**



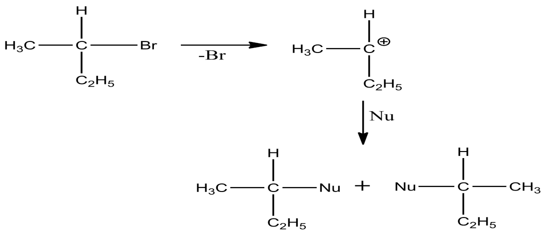
$CH_3-\overset{\overset{C_2H_5}{|}}{\underset{\underset{C_2H_5}{|}}{C}}-Br$

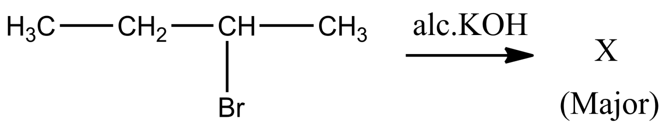
☒ **D.** None of the above

Stereochemistry in nucleophilic substitution reaction arises due to presence of a chiral carbon in compound.

$S_N1$ reaction of an optically active halide is accompanied by racemization and it give equimolar mixture of d and l forms of an optically active compound.

Only b has chiral carbon thus it will give (d) and (l) form in $S_N1$ reaction as major product.



12. 

$$H_3C-CH_2-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow{\text{alc.KOH}} \underset{\text{(Major)}}{X}$$

Product (X) is

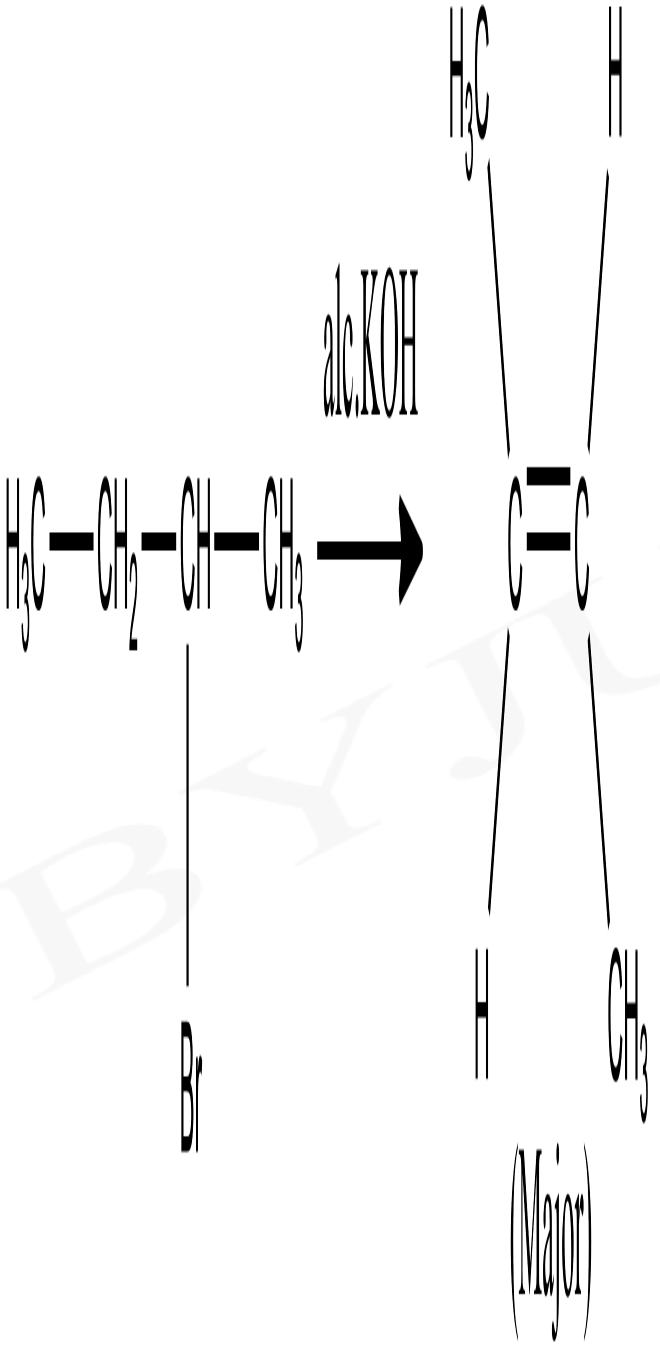
☒ **A.** 1-butene

☒ **B.** Butan-2-ol

☒ **C.** Cis-2-butene

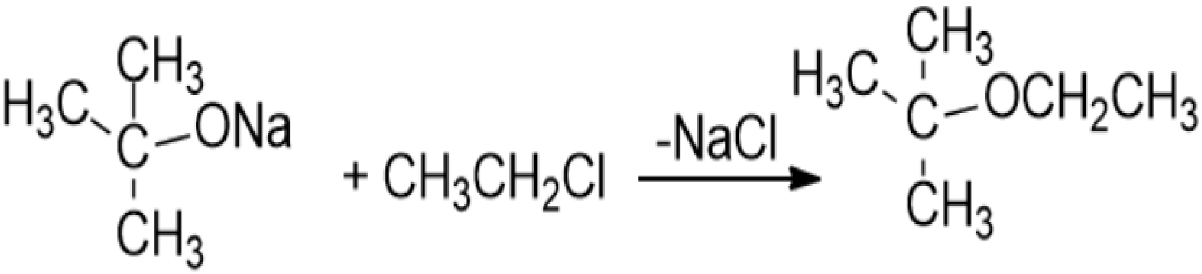
☑ **D.** Trans-2-butene

In given reaction, the reactant is an secondary alkyl halide and the alc. KOH is a strong base so it prefers E2 elimination rather than substitution. The rate of reaction depends on the stability of alkene formed. Thus, more substituted will be the major product and the trans isomer will have less steric repulsion. Thus, the major product X is trans-2-butene. It is a saytzeff product.



(Saytzeff product)

13. The reaction,



is called:

☒ **A.** Etard reaction

☒ **B.** Gattermann-koch reaction

☑ **C.** Williamson synthesis

☒ **D.** Esterification reaction

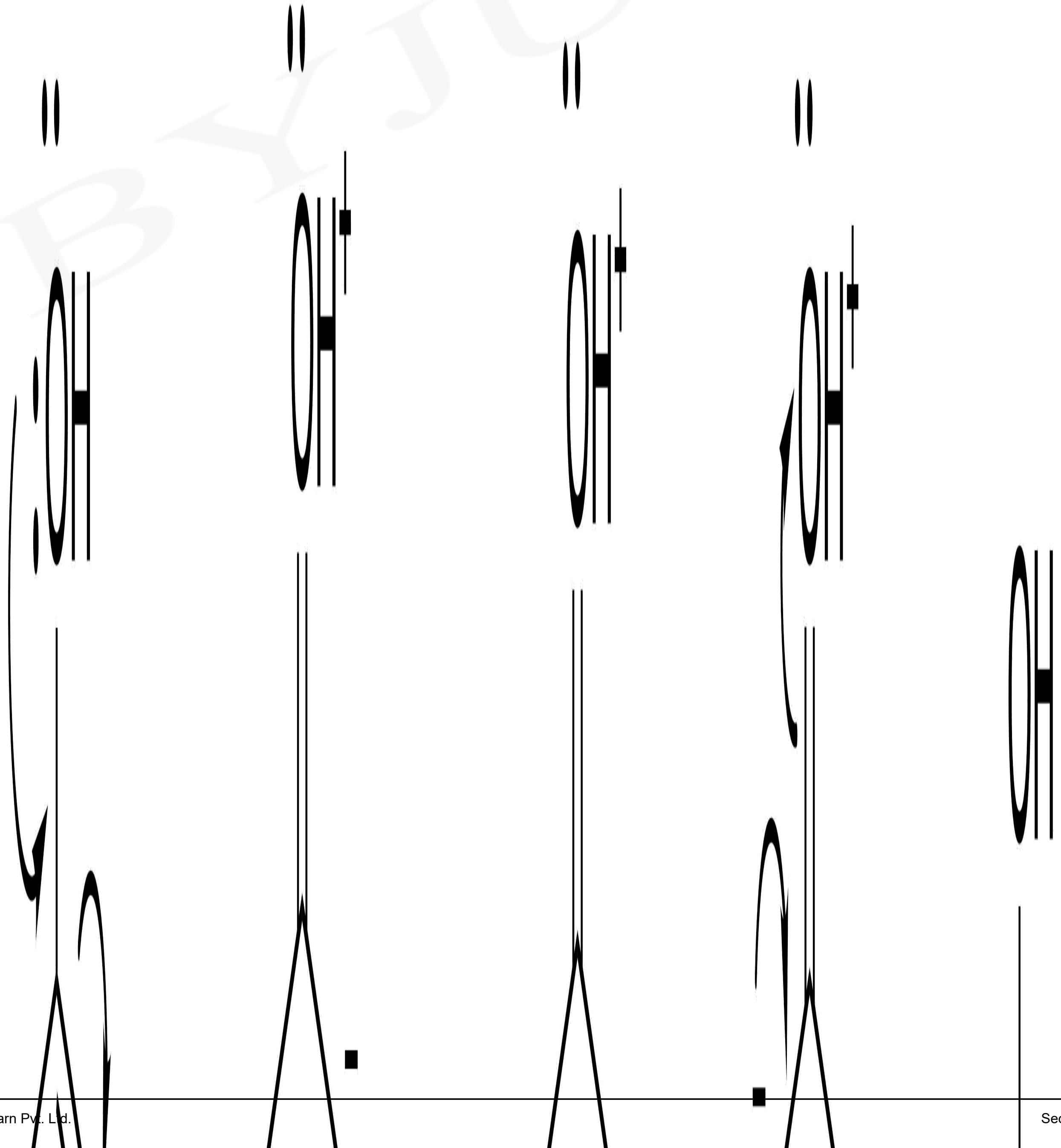
Williamson's ether synthesis reaction involves the treatment of sodium alkoxide with a suitable alkyl halide to form an ether.

14. Electrophilic substitution reaction in phenol takes place at:

- ☒ **A.** para position
- ☒ **B.** meta position
- ☒ **C.** ortho position
- ☑ **D.** ortho and para position

Electrophilic substitution in phenol takes place at ortho and para position because -OH is an ortho para directing group.

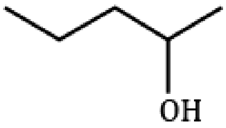
The electron density at ortho and para positions will be higher than the electron density at meta position as shown in the resonating structure of phenol.



15. Which of the following exhibit highest boiling point?

☒ **A.** 

☑ **B.** 

☒ **C.** 

☒ **D.** 

Boiling point of alcohol and phenol are higher than that of hydrocarbons, ethers and halo compounds of comparable molar masses due to presence of Hydrogen bonding. thus ether has lower boiling point than alcohol.

For same molecular formula, as branching in chain of alcohol increases surface area decreases due to which van der Waals force decreases and thus Boiling point decreases.Therefore the order of boiling point is primary alcohol > secondary alcohol > tertiary alcohol. So overall order of boiling point is

$b > c > d > a.$

Hence, the correct option is b.

16. The compound in which intermolecular hydrogen bonding is not possible is :

☑ **A.** $CH_3OCH_3$

☒ **B.** $CH_3CH_2OH$

☒ **C.** $H_2O$

☒ **D.** $CH_3COOH$

Due to the presence of methyl groups that bound to oxygen on both the side in dimethyl ether, there is no hydrogen bonding exist.

Also, It does not have hydrogen attached to oxygen, so it can not form hydrogen bonds with itself.

Alcohols, water and carboxylic acid have -OH which can undergoes intermolecular hydrogen bonding

Hence, option (a) is correct.

17. The nature of 2, 4, 6-trinitrophenol is :

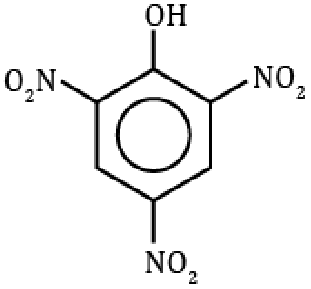
✗ **A.** neutral

✗ **B.** basic

✓ **C.** acidic

✗ **D.** weak basic

2,4,6-trinitrophenol is picric acid. It is acidic in nature. The withdrawing nature of $-NO_2$ groups make the compound acidic.



18. Which one of the following reagents can not be used to oxidise primary alcohols to aldehydes?

✗ **A.** $CrO_3$ in anhydrous medium

✓ **B.** $KMnO_4$ in acidic medium

✗ **C.** Pyridium chlorochromate

✗ **D.** Heat in presence of $Cu$ at $573K$

$KMnO_4$ will oxidise primary alcohol to carboxylic acids. Remaining all the threee reagents can be used to oxide primary alcohols to aldehydes. Hence, the correct answer is option (b).

19. Which of the following aldehydes can produce $1^o$ alcohols when treated with Grignard reagent?

- ☑ **A.** Methanal
- ☒ **B.** Ethanal
- ☒ **C.** Propanal
- ☒ **D.** Butanal

Grignard reagent is a strong nucleophile. It undergoes nucleophilic addition reaction when it reacts with aldehyde, ester and ketone.
Grignard reagent reacts with formaldehyde to form $1^\circ$ alcohol.
Grignard reagent reacts with aldehyde except formaldehyde to form $2^\circ$ alcohol.

Methanal on treatment with Grignard reagent forms an adduct which has only one alkyl group attached to the C atom along with two hydrogens and one O-MgX (X=halogen) group. This on hydrolysis will form a primary alcohol where the OH group will replace the O-MgX group.

$RMgX + HCHO \xrightarrow{H_3O^+} RCH_2OH + Mg(OH)X$
Hence correct option is a.

20. Sucrose on hydrolysis gives:

- ☒ **A.** $\beta - D - \text{glucose} + \alpha - D - \text{fructose}$
- ☒ **B.** $\alpha - D - \text{glucose} + \beta - D - \text{glucose}$
- ☑ **C.** $\alpha - D - \text{glucose} + \beta - D - \text{fructose}$
- ☒ **D.** $\beta - D - \text{fructose} + \alpha - D - \text{fructose}$

In sucrose, two monosaccharides are held together by a glycosidic linkage between $C - 1$ of $\alpha - D - \text{glucose}$ and $C - 2$ of $\beta - D - \text{fructose.}$
$\text{Sucrose} \xrightarrow{hydrolysis} \alpha - D - \text{glucose} + \beta - D - \text{fructose}$

21. A unit formed by the attachment of a nitrogenous base to $1'$ position of sugar is known as

- ☒ **A.** Nucleotide
- ☑ **B.** Nucleoside
- ☒ **C.** Nucleic acid
- ☒ **D.** Peptide

A unit formed by the attachment of a nitrogenous base to $1'$ position of sugar is known as nucleoside.

22. Which of the following statement is not true about RNA?

✗ **A.** It controls the synthesis of protein

✓ **B.** It has always double stranded $\alpha-$ helix structure

✗ **C.** It can replicate

✗ **D.** It is present in the nucleus of the cell

RNA does not have double stranded $\alpha$-helix structure. Helixes present in RNA are single-stranded but sometimes they fold back on themselves to form a double helix structure. RNA has the ability to replicate. It is present in the nucleus of the cell. It controls the synthesis of protein. RNA molecules are of three types, i.e. messenger's RNA (m-RNA), ribosomal RNA (rRNA), transfer RNA (t-RNA)

23. Two forms of D-glucopyranose, are called

✗ **A.** Enantiomers

✓ **B.** Anomers

✗ **C.** Epimers

✗ **D.** Diastereomers

$\alpha$ and $\beta$ cyclic hemiacetals of $D-glucose$ having difference in configuration at $C-1$ only are called anomers.

24. The secondary structure of a protein refers to:

✓ **A.** Regular folding patterns of continuous portions of the polypeptide chain

✗ **B.** Three-dimensional structure, specially the bond between amino acid residues that are distant from each other in the polypeptide chain

✗ **C.** Mainly denatured proteins and structures of prosthetic groups

✗ **D.** Linear sequence of amino acid residues in the polypeptide chain

The secondary structure of a protein refers to regular folding patterns of continuous portions of the polypeptide chain.
The secondary structure of protein refers to the shape in which a long polypeptide chain can exist. They are found to exist in two different types of structures viz. $\alpha-$helix and $\beta$-pleated sheet structure. These structures arise due to the regular folding of the backbone of the polypeptide chain due to hydrogen bonding between $>C=O$ and $-NH-$ groups of the peptide bond.

25. Total number of voids in $0.5\ mol$ of a compound forming hexagonal closed packed structure are

☒ **A.** $6.022 \times 10^{23}$

☒ **B.** $3.011 \times 10^{23}$

☑ **C.** $9.033 \times 10^{23}$

☒ **D.** $4.516 \times 10^{23}$

In hcp, there are 6 atoms per unit cell.

$\therefore\ N = 6$

$\text{Number of octahedral voids } = N = 6$

$\text{Numer of tetrahedral voids } = 2N = 2 \times 6 = 12$

$\therefore$

$\text{Total number of voids per unit cell } = 18$

$$\text{Total number of voids per atom } = \frac{18}{6} = 3$$

Thus, the total no. of voids per mole will be $3 \times 6.023 \times 10^{23}$

$\therefore$

In $0.5\ mol$ compound,

$\text{Total no. of voids } = 3 \times 0.5 \times 6.023 \times 10^{23} = 9.034 \times 10^{23}$

# BYJU'S Part Test for Board Term I (CBSE Grade 12)

Date: 18/11/2021

Subject: Chemistry

Topic : Section B

Class: Standard XII

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1. Three elements A,B and C crystalize in a cubic lattice with A atoms at the corners, B atoms at the cube center and C atoms at the centre of the face of the cube.
   When all the atoms from two different body diagonals are removed, then find the ratio of effective number of particles $(Z_{eff})$ initially (before removal of atoms) to the effective number of particles finally (after removal of atoms).

   ✗ **A.** $5:3$

   ✗ **B.** $3:5$

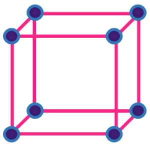
   ✗ **C.** $7:10$

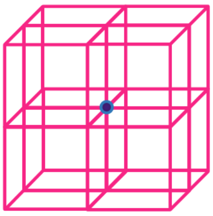
   ✓ **D.** $10:7$

# BYJU'S Part Test for Board Term I (CBSE Grade 12)

Three elements A, B and C crystalize in a cubic solid lattice
A atoms are present at the corners of the cube.

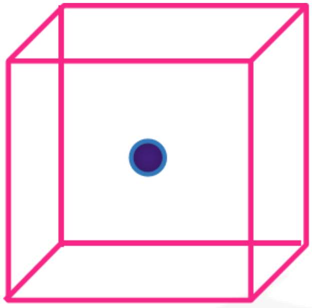
$$\text{Number of A atoms } = 8 \times \frac{1}{8} = 1$$





B atoms are present at the cubic center.
There is only one cubic center.
Each atom contributes 1 to the cube.

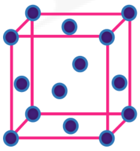
$$\text{Number of B atoms } = 1$$

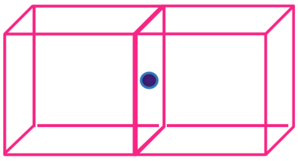


C atoms are present at the center of the face of the cube.

$$\text{Number of C atoms } = 6 \times \frac{1}{2} = 3$$

$$(Z_{eff})_{\text{initially}} = 1 + 1 + 3 = 5$$





When atoms from two body diagonals are removed :
4 corner atoms and 1 body centre atom is removed

$$\text{Number of A atoms } = 4 \times \frac{1}{8} = \frac{1}{2}$$

$$\text{Number of B atoms } = 1 - 1 = 0$$

$$\text{Number of C atoms } = 6 \times \frac{1}{2} = 3$$

$$(Z_{eff})_{\text{finally}} = 0.5 + 0 + 3 = 3.5$$

$$\frac{(Z_{eff})_{\text{initially}}}{(Z_{eff})_{\text{finally}}} = \frac{5}{3.5} = \frac{10}{7}$$

2. Which of the following is correct relation between radius of octahedral void (r) and radius of atom (R) in closed packed structure?

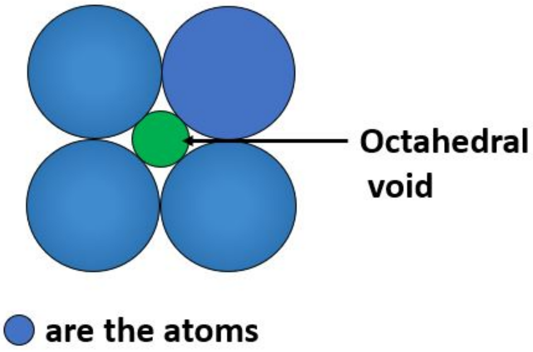
✗ **A.** $R = 0.732r$

✗ **B.** $r = 0.732R$

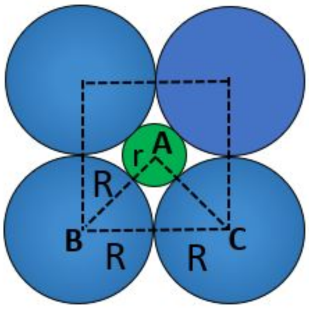
✗ **C.** $R = 0.414r$

✓ **D.** $r = 0.414R$

A sphere fitting into octahedral void is shown in the figure (green colour)
A sphere above and sphere below this green coloured sphere is not shown :



$\triangle ABC$ is a right angled triangle.
$AB = AC = (R + r)$ as shown :



**AB=AC=(R+r)**

Applying pythagoras theorem :

$$BC^2 = AB^2 + AC^2$$
$$(2R)^2 = (R + r)^2 + (R + r)^2$$
$$2R^2 = (R + r)^2$$
$$(\sqrt{2}R)^2 = (R + r)^2$$
$$\sqrt{2}R = R + r$$
$$r = \sqrt{2}R - R$$
$$r = 0.414R$$

# BYJU'S Part Test for Board Term I (CBSE Grade 12)

3. The radius of a divalent cation $A^{2+}$ is $94\ pm$ and that of a divalent anion $B^{2-}$ is $146\ pm$. The compound $AB$ has:

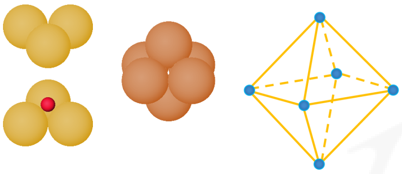
☑ **A.** Rock salt structure

☒ **B.** Zinc blende structure

☒ **C.** Antifluorite structure

☒ **D.** Caesium chloride like structure

Radius ratio of ionic compounds helps in determining the structure of compounds.



Radius of cation, $r^+ = 94\ pm$
Radius of anion, $r^- = 146\ pm$
Radius ratio,

$$\frac{r^+}{r^-} = \frac{94}{146} = 0.64$$

It is in the range of $0.414 - 0.732$, which represent octahedral type of structure.
Thus, it has the coordination number of 6.
Rock salt has the octahedral type of structure.
Hence, correct option is Rock salt structrue.

4. Which of the following is an example of Sandmeyer's reaction?

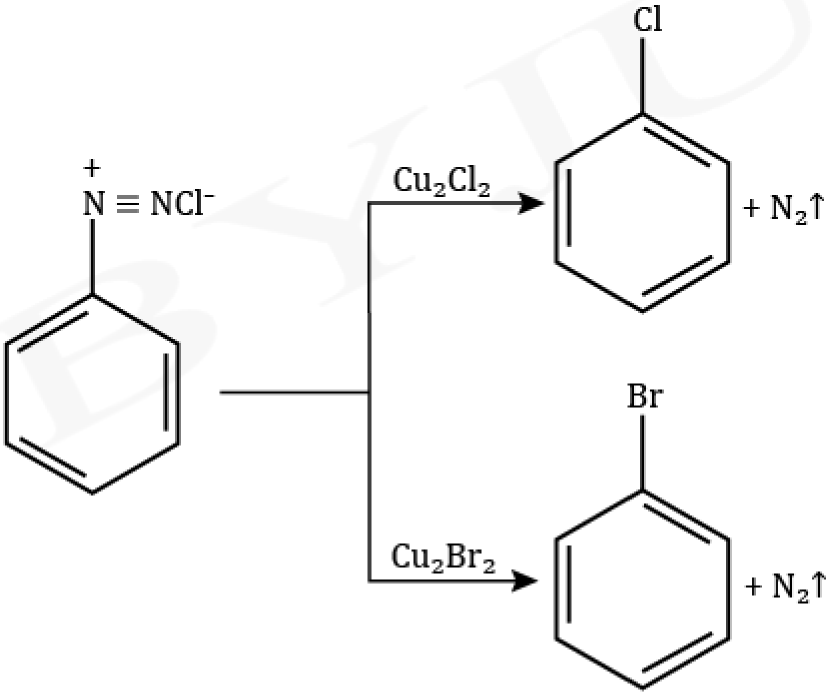
☑ **A.** $C_6H_5N_2^+Cl^- \xrightarrow{Cu_2Cl_2} C_6H_5Cl$

☒ **B.** $C_6H_5N_2^+Cl^- \xrightarrow{H_2O} C_6H_5OH$

☒ **C.** $C_6H_5N_2^+Cl^- \xrightarrow{KCN} C_6H_5CN$

☒ **D.** None of the above

When freshly prepared diazonium salt of primary aromatic amine is treated with $Cu_2X_2$ (X = Cl, Br), aryl halide is formed. This reaction is known as Sandmeyer's reaction.



Hence, the correct answer is option (a).

# BYJU'S Part Test for Board Term I (CBSE Grade 12)

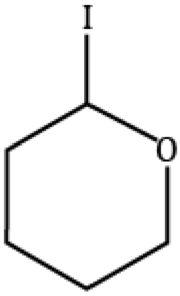
5. Same halogen atom (-X), increased in the size of the alkyl chain
$CH_3Cl,\ CH_3CH_2Cl,\ CH_3(CH_2)_2Cl, CH_3(CH_2)_3Cl$
What is the effect on the boiling point and the density?

- ✓ **A.** Boiling point increases, density increases
- ✗ **B.** Boiling point increases, density decreases
- ✗ **C.** Boiling point decreases, density decreases
- ✗ **D.** Boiling point decreases, density increases

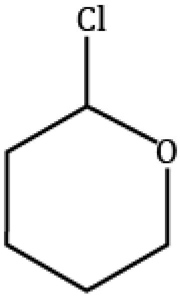
For the same halogen atom, Intermolecular forces of attractions increases as molecular size increases. So, large amount of heat require to break strong intermolecular forces and thus boiling point increases.
Here, the order of molecular size is as follows:
$CH_3Cl < CH_3CH_2Cl < CH_3(CH_2)_2Cl < CH_3(CH_2)_3Cl$
Therefore, the boiling point order will be
$CH_3Cl < CH_3CH_2Cl < CH_3(CH_2)_2Cl < CH_3(CH_2)_3Cl$
Increase in number of C and H atoms or increase in atomic mass of halogen atoms increase density of haloalkane, density order will be
$CH_3Cl < CH_3CH_2Cl < CH_3(CH_2)_2Cl < CH_3(CH_2)_3Cl.$

6. Which of the following compound will be most reactive for $S_N1$ reactions?

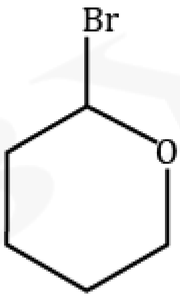
☑ **A.**



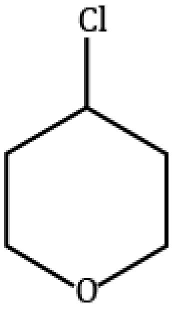
☒ **B.**



☒ **C.**



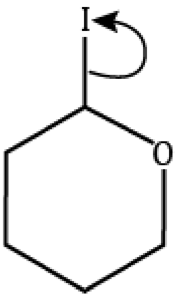
☒ **D.**

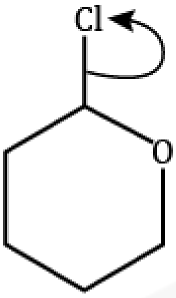


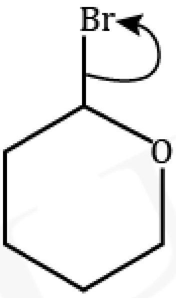
Since the rate determining step of $S_N1$ reaction involves Carbocation formation.
$\text{Rate of reaction} \propto \text{Stability of carbocation}$
Also, $\text{Rate of } S_N1 \propto \text{Leaving tendency of leaving group}$

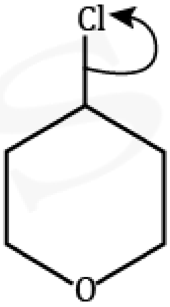
Carbocation formed by (a), (b) and (c) are stabilised by formation of oxonium ion intermediate. Hence, (a), (b) and (c) are more reactive than (d).

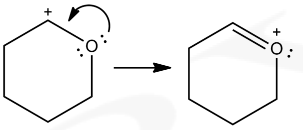
Leaving tendency of leaving group is given by $\Rightarrow I^{\ominus} > Br^{\ominus} > Cl^{\ominus}$
So, (a) is most reactive for $S_N1$ followed by (c) and then (b).
Hence, overall stability order will be a>c>b>d.

(a)


(b)


(c)


(d)




Oxonium ion

7. Which one of the following solvents favors $S_N2$ reaction?

   1. DMSO
   2. Ethanol
   3. Acetone
   4. water

✓ **A.** 1 & 3

✗ **B.** 1 & 2

✗ **C.** 1 & 4

✗ **D.** All four

Polar aprotic solvent favours $S_N2$ reaction because polar aprotic solvent is unable to solvate the nucleophile due to this nucleophilicity of a nucleophile does not decrease in such solvent. Both DMSO and acetone are polar aprotic solvent hence they favour $S_N2$ reaction.
Ethanol and water are polar protic solvent and hence both favours $S_N1$ reaction.

8. The order of reactivities of the following alkyl halides for a $S_N2$ reaction is

☑ **A.** RI > RBr > RCl > RF

☒ **B.** RF > RBr > RCl > RI

☒ **C.** RF > RCl > RBr > RI

☒ **D.** RCl > RBr > RF > RI

The reactivity of the alkyl halide in $S_N2$ reaction is decided by the ease with which the halide leaves the substrate. Larger the size of the halide ion, more is the leaving ability.
As per the leaving ability, the order is $I^- > Br^- > Cl^- > F^-$. Hence reactivity order is RI > RBr > RCl > RF

9. Among the following, which reaction of alcohol does not show cleavage of $R-O$ linkage:

☒ **A.** $ROH + PCl_5$

☒ **B.** $ROH + SOCl_2$

☒ **C.** $ROH + HCl$

☑ **D.** $ROH + Na$

$R—OH + HCl \rightarrow R—Cl + H_2O$
$R—OH + PCl_3 \rightarrow R—Cl + 3HCl + H_3PO_3$
$R—OH + PCl_5 \rightarrow R—Cl + HCl + POCl_3$
$R—OH + Na \rightarrow R—O—Na + H_2 \uparrow$

10. The compound which reacts fastest with Lucas reagent at room temperature is:

☒ **A.** Butan-1-ol

☒ **B.** Butan-2-ol

☒ **C.** 2-methylpropan-1-ol

☑ **D.** 2-methylpropan-2-ol

Tertiary alcohol reacts fastest with Lucas reagent at room temperature, 2-methyl propan-2-ol is a tertiary alcohol, thus reacts immediately with Lucas reagent since it goes through SN1 mechanism.
2-Methylpropan-2-ol reacts rapidly with Lucas reagent at room temperature.

# BYJU'S Part Test for Board Term I (CBSE Grade 12)

11. When phenol is treated with $CHCl_3$ and $NaOH$, the product formed is:

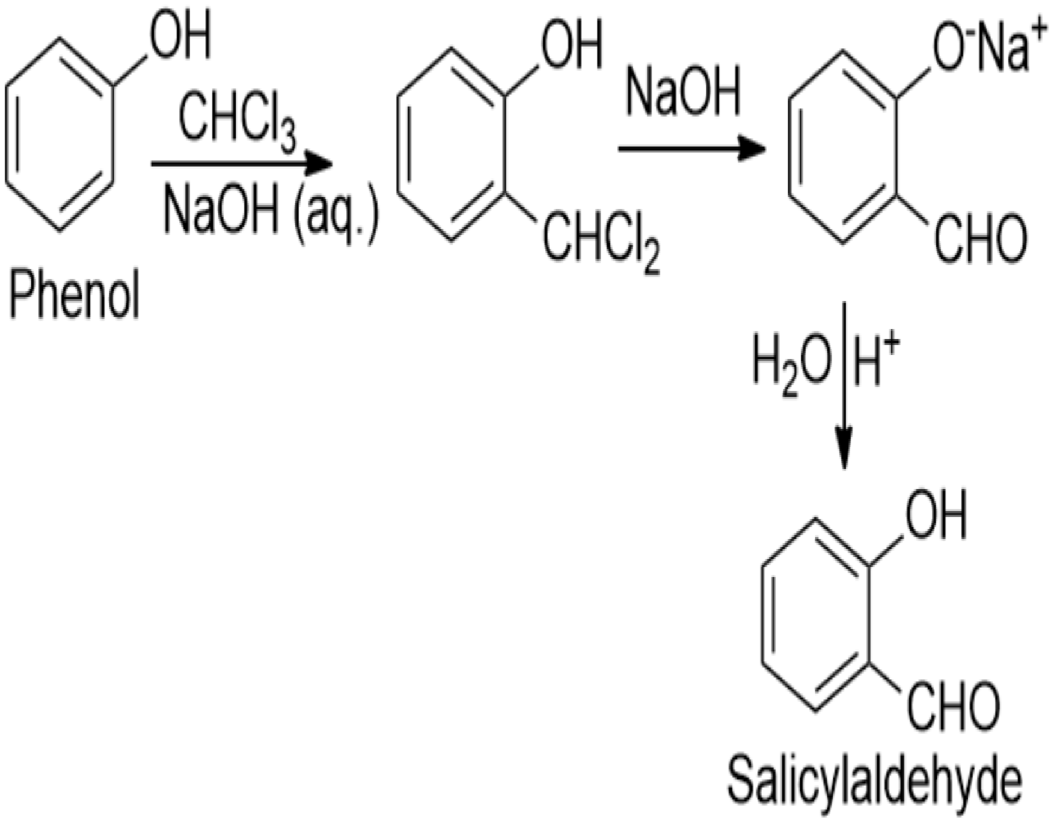
☒ **A.** Benzaldehyde

✓ **B.** Salicylaldehyde

☒ **C.** Salicylic acid

☒ **D.** Benzoic acid

This reaction is called Reimer-Tiemann reaction.



12. Identify the nucleophile that attacks the carbocation in the second step of acid catalysed hydration of alkenes.

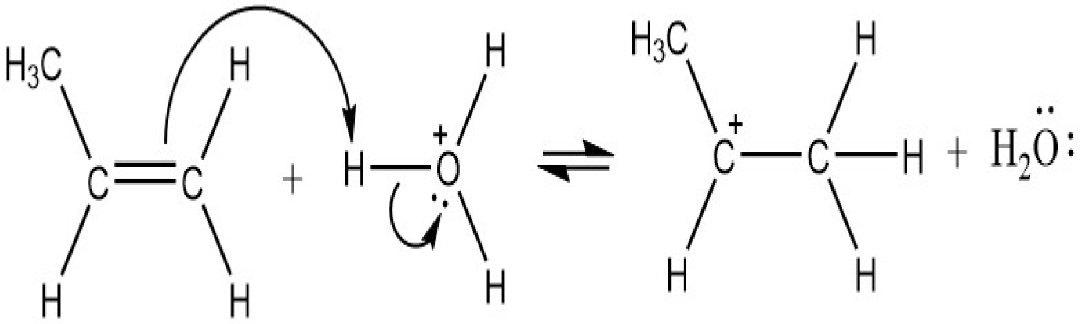
☒ **A.** $OH^-$

☑ **B.** $H_2O$

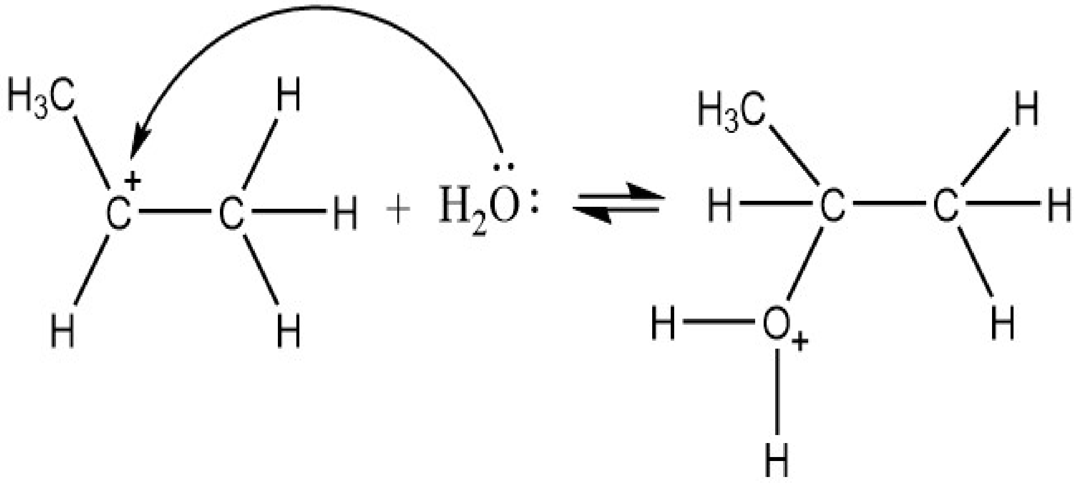
☒ **C.** $H^+$

☒ **D.** $H_3O^+$

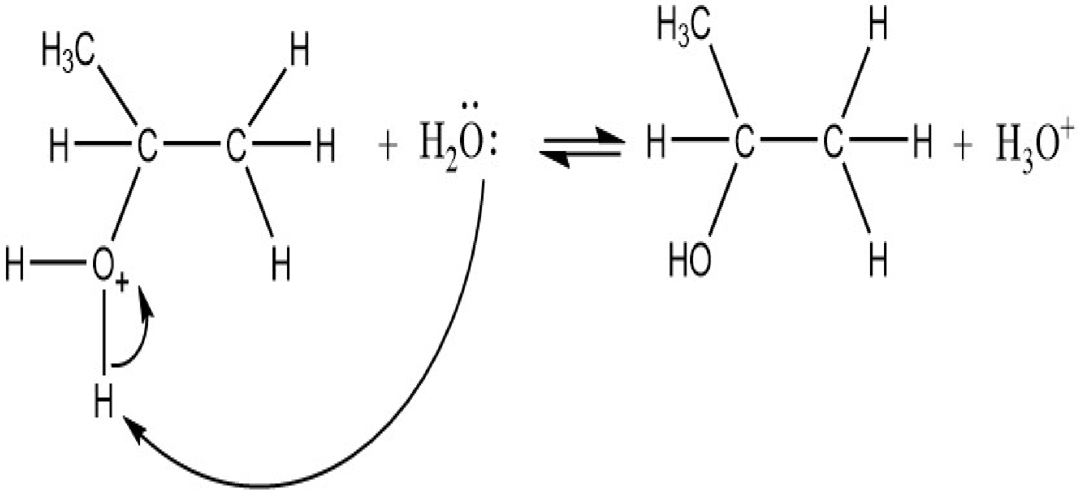
Acid catalysed hydration of alkene produces alcohol.
Nucleophiles are electron rich species that attack the part of the structure that is electron deficient. In this step, the $H_2O$ nucleophile attacks the carbocation forming a protonated alcohol.
The mechanism involves three steps.
Step-1: Formation of Carbocation



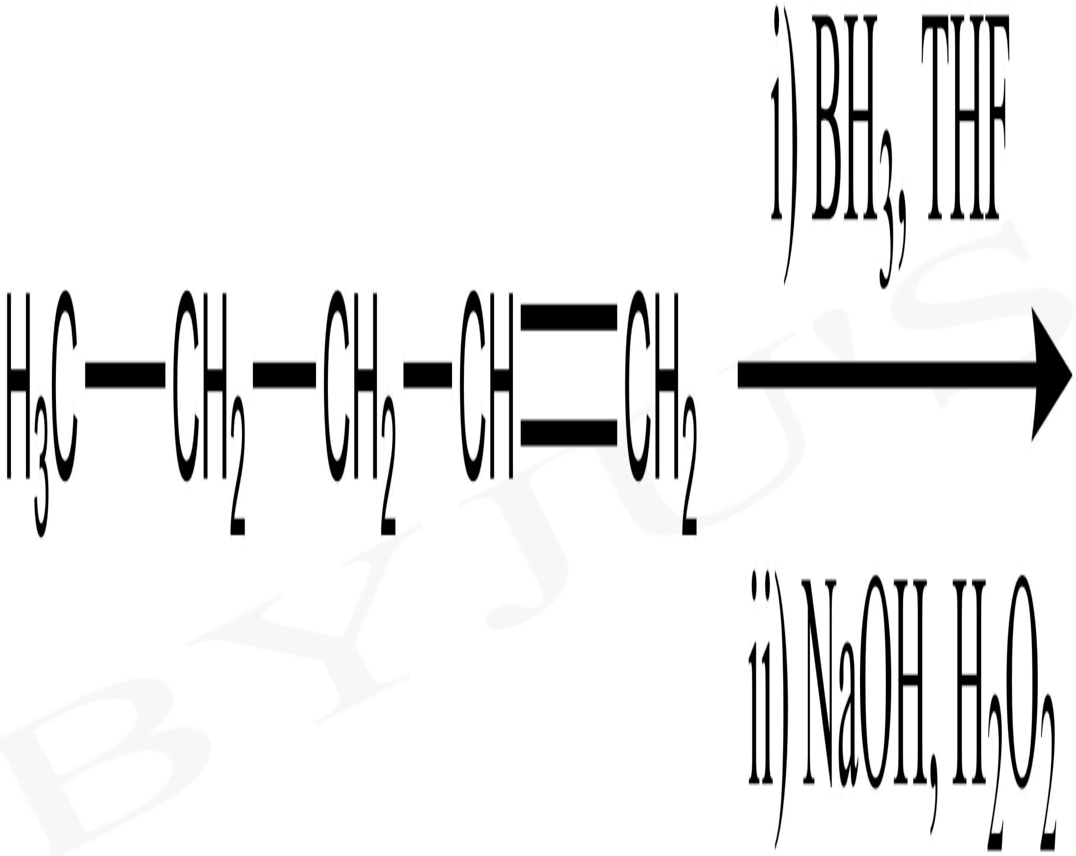
Step-2: Attack of Nucleophile



Step-3: Deprotonation to form an alcohol



13. The product of following reaction is:



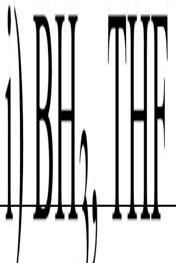
✓ **A.** Pentan-1-ol

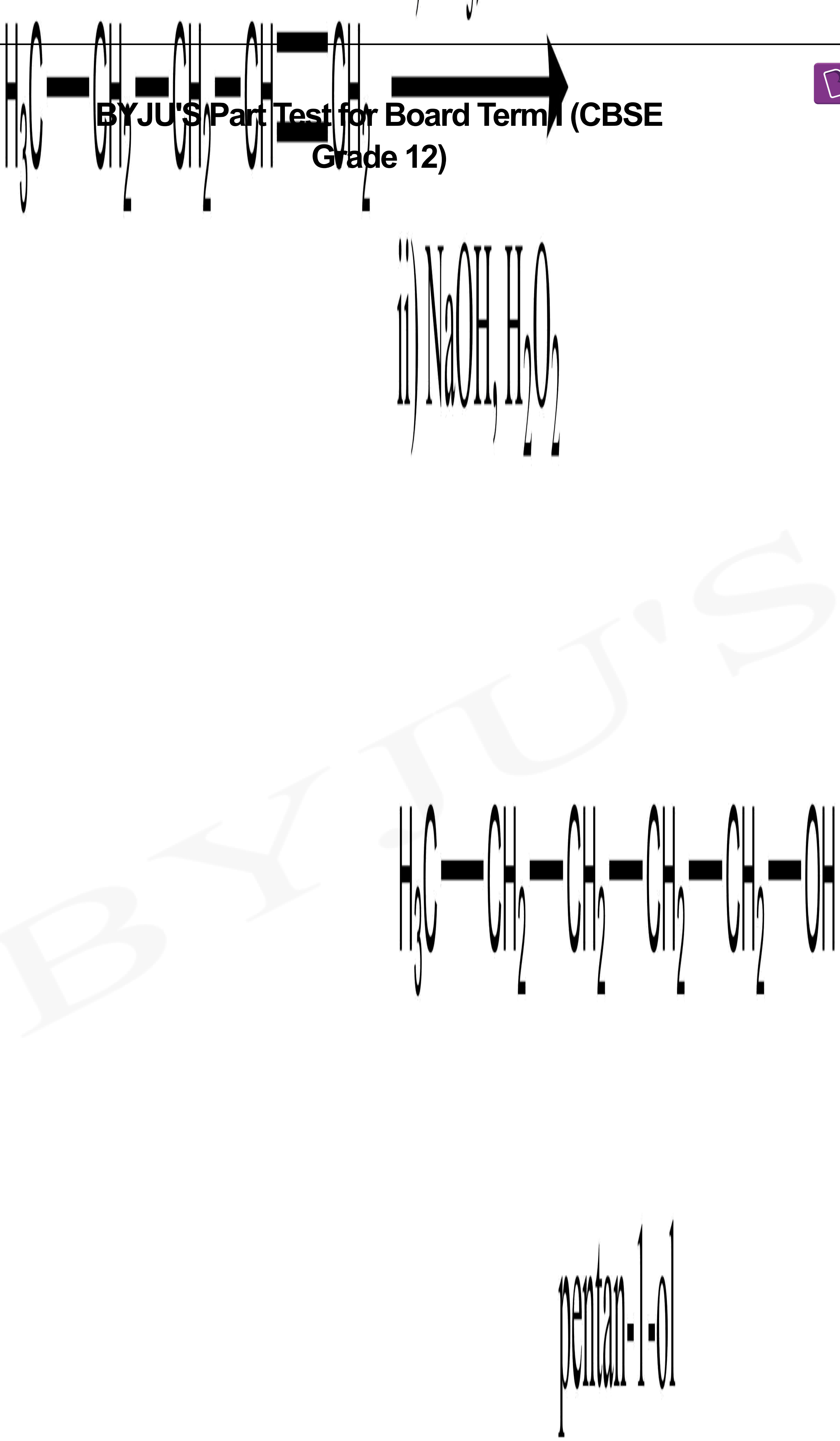
✗ **B.** Pentan-2-ol

✗ **C.** Pentane

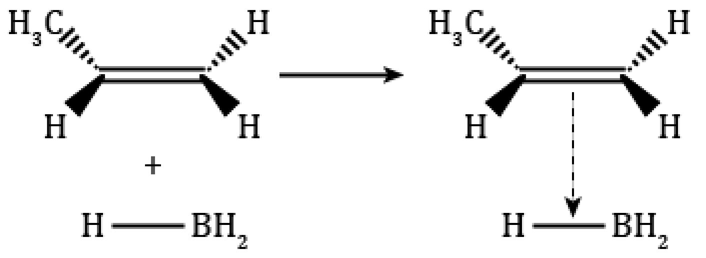
✗ **D.** 1,2-Pentanediol

The reagents $BH_3, THF$ followed by $NaOH, H_2O_2$ are hydroxylating agents. This reaction is called hydroboration-oxidation reatction. Alkenes undergo oxidation and anti-markovnikov's alcohol is the end product.

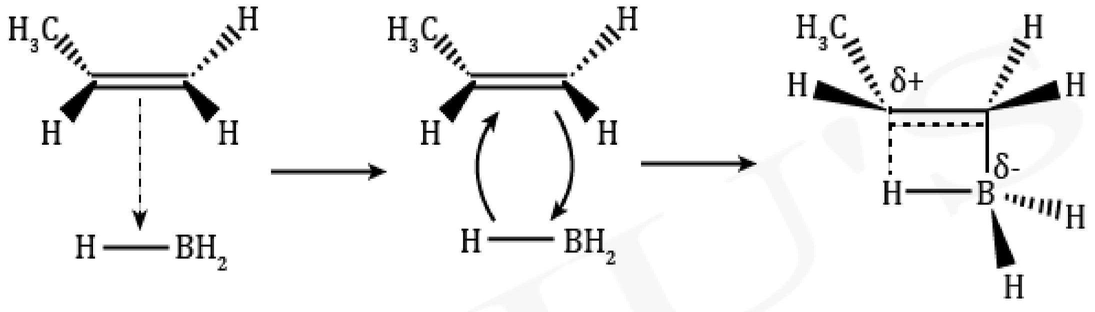




Mechanism of a simple hydroboration-oxidation reaction:

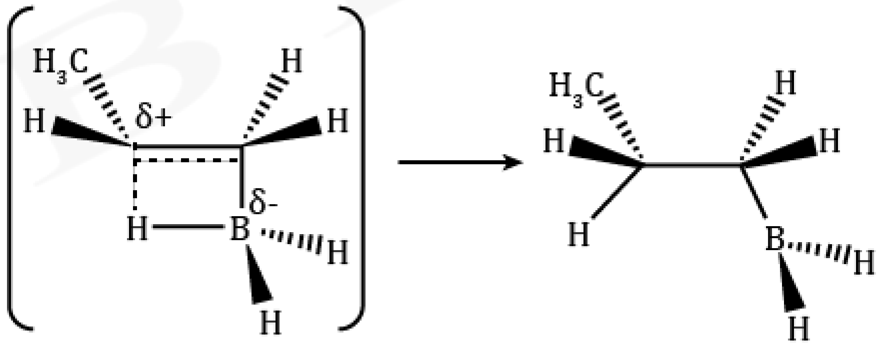


π complex



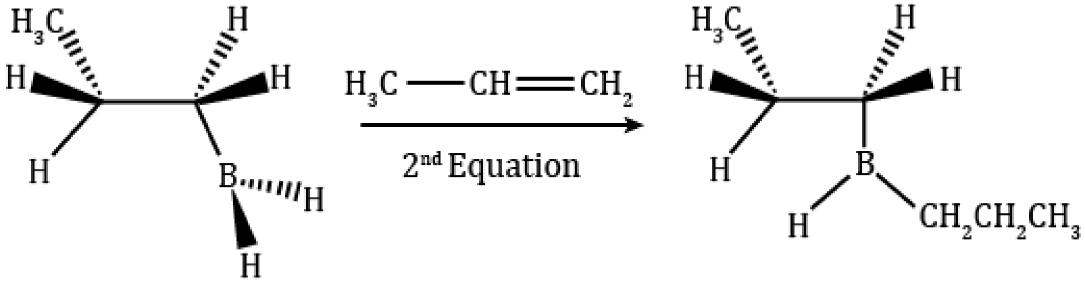
π complex

4-atom cyclic
Transition state

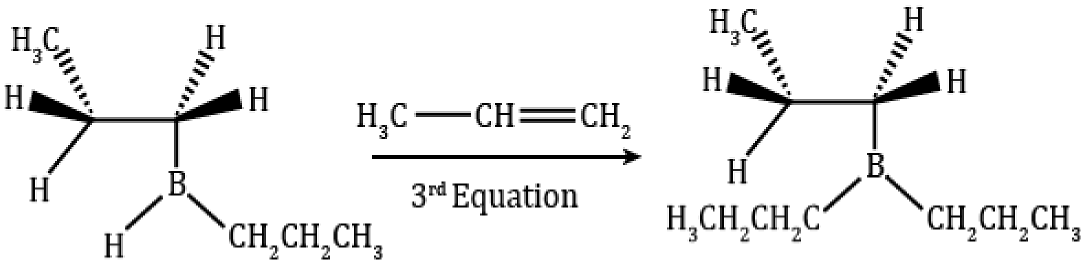


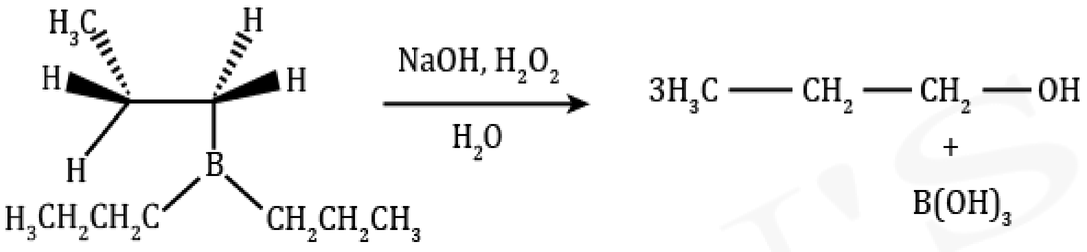
4-atom cyclic
Transition state

Anti-Markovnikov
addition



Anti-Markovnikov
addition





Oxidized product of hydroboration

14. Name the reagent used for Bromination of phenol to 2,4,6-tribromophenol :

☒ **A.** $Br_2$ in $CS_2/CHCl_3$

☒ **B.** $NBS$

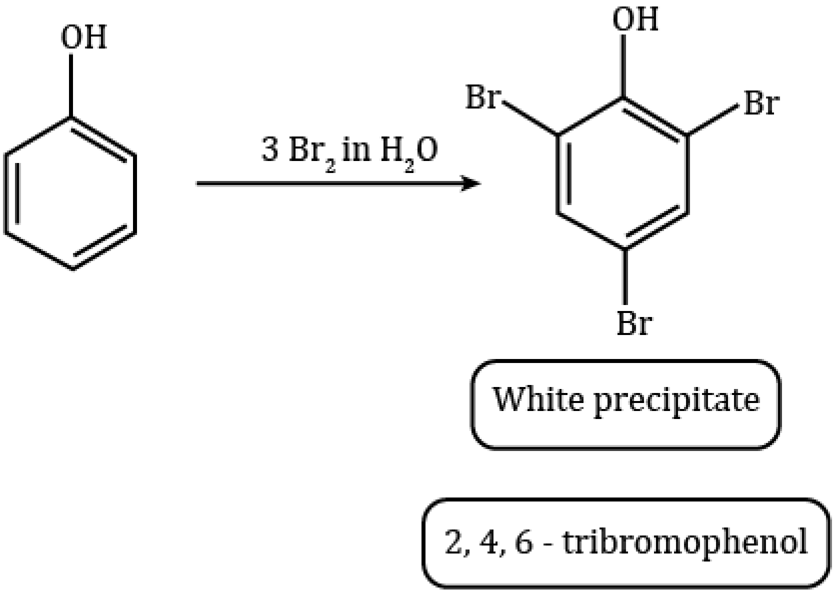
☒ **C.** $Br_2$ in $H_2O_2$

☑ **D.** $Br_2$ in $H_2O$

The reaction of phenol with bromine is known as bromination of phenol. Solvent has great influence on the reaction. In different solvents, different products are obtained. The action of bromine on phenol can be explained as:
(i) Reaction with bromine in water: Phenol reacts with bromine water to give 2,4,6-tribromophenol.

(ii) Reaction with bromine in $CS_2/CHCl_3$: Phenol reacts with bromine in a presence of Carbon disulphide to form a mixture of o-bromophenol and p-bromophenol.

In water, ionisation is facilitated. Phenol gets ionised to form phenoxide ion, which is even better ortho, para-directing. Bromine also gets ionised to a larger extent to form a large number of bromonium ions. And Bromine ions are highly stabilized in ionic solvents. So the formation of strong o,p-directing group and stabilization of $Br^+$ enhances the formation of tribromophenol.



15. The product of the reaction of hot hydrogen iodide with 1-propoxypropane is

☒ **A.** Propan-1-ol

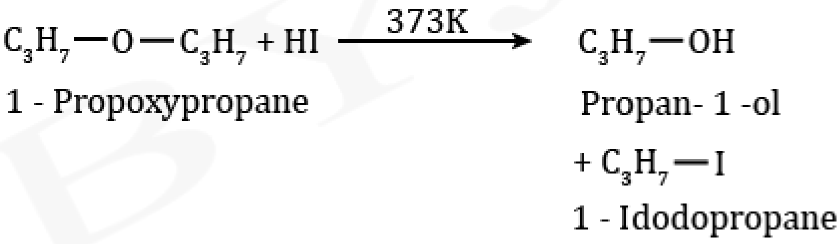
☒ **B.** 1-Iodopropane

☑ **C.** Both (a) and (b)

☒ **D.** None of the above

Ethers can be reactive under drastic reaction conditions (high temperature, high concentration) due to the cleavage of the C-O bond.
In first step of the reaction, protonation of ether $(O)$ group take place.
In second step, $I^-$ will undergo $S_N2$ nucleophilic attack. Since, 1-Propoxy propane is a symmetrical ether attack at both side will result in similar products.

Thus, it gives Propan-1-ol and 1-Iodo propane. Hence correct option is (c).



$$C_3H_7-O-C_3H_7 + HI \xrightarrow{373K} C_3H_7-OH + C_3H_7-I$$

16. Which of the following statement is incorrect about the fibrous protein?

☒ **A.** The polypeptide chains are parallel to each other

☑ **B.** The polypeptides chains are held together by hydrogen bonds only

☒ **C.** Fibrous proteins are generally insoluble in water

☒ **D.** Some common examples of fibrous protein are keratin and myosin

In case of fibrous protein the polypeptide chains are parallel to each other and are held together by hydrogen and disulphide bonds. Such proteins are generally insoluble in water. Some common examples are keratin and myosin.

17. Which of the statements about “Denaturation” given below are correct?

(1) Denaturation of proteins causes loss of secondary and tertiary structures of the protein

(2) The coagulation of egg white on boiling is a common example of denaturation.

(3) Denaturation affects primary structure which gets distorted

✗ **A.** (2) and (3)

✗ **B.** (1) and (3)

✓ **C.** (1) and (2)

✗ **D.** (1), (2) and (3)

Denaturation does not change the primary structure of protein. The coagulation of egg white on boiling is a common example of denaturation.During denaturation secondary and tertiary structures are destroyed but primary structure remains intact.

18. Which of the following is an acidic amino acid ?

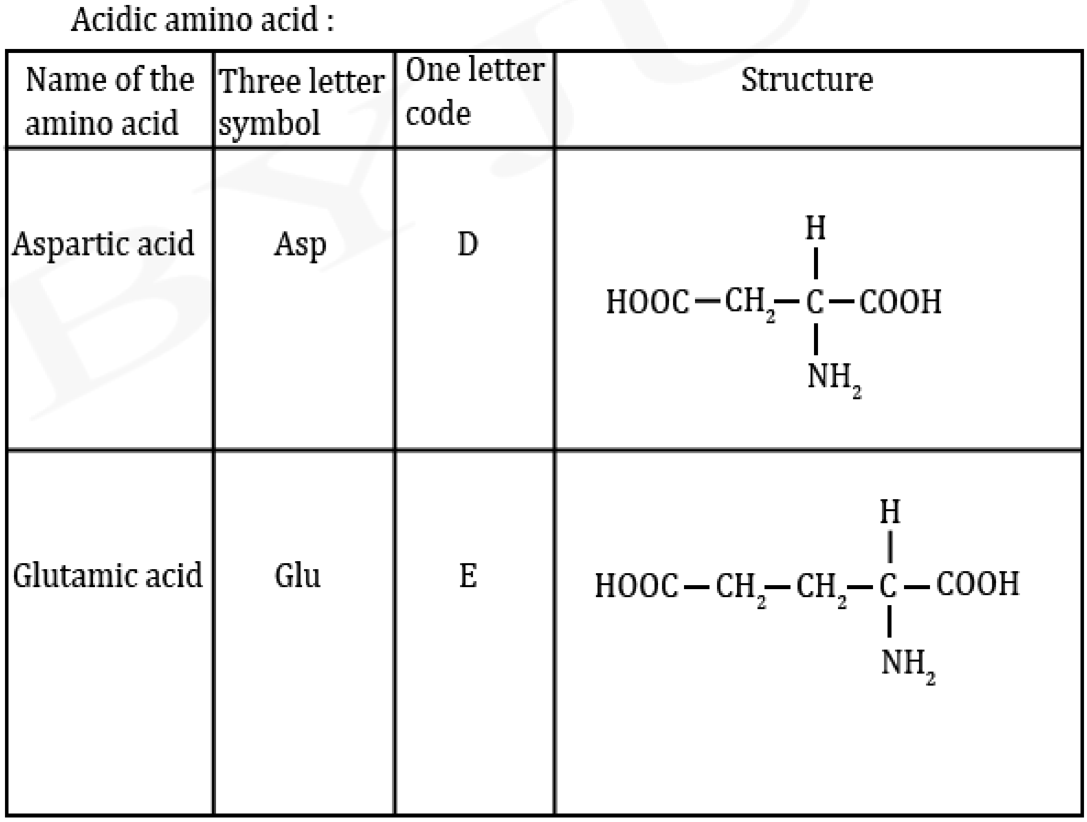
✗ **A.** Glycine

✗ **B.** Valine

✗ **C.** Leucine

✓ **D.** Glutamic acid

Two amino acids have acidic side chains at neutral pH. These are aspartic acid or aspartate(Asp) and glutamic acid or glutamate (Glu). Their side chains have carboxylic acid groups.
Hence, (d) is correct.



Acidic amino acid :

| Name of the amino acid | Three letter symbol | One letter code | Structure |
|---|---|---|---|
| Aspartic acid | Asp | D | $\mathrm{HOOC-CH_2-\overset{\displaystyle H}{\underset{\displaystyle NH_2}{C}}-COOH}$ |
| Glutamic acid | Glu | E | $\mathrm{HOOC-CH_2-CH_2-\overset{\displaystyle H}{\underset{\displaystyle NH_2}{C}}-COOH}$ |

19. Glucose is oxidised by nitric acid and produce

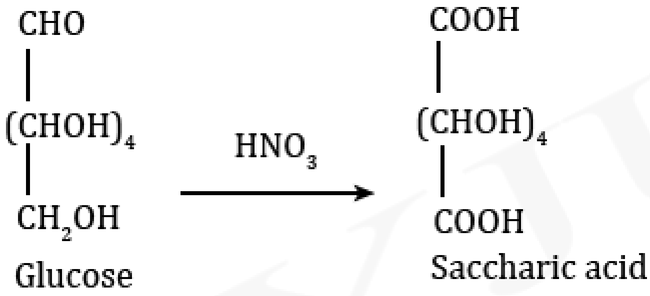
☒ **A.** sorbitol

☑ **B.** saccharic acid

☒ **C.** glucocyanohydrin

☒ **D.** gluconic acid

Glucose is oxidized by nitric acid and it forms a dicarboxylic acid i.e., saccharic acid.



$$\begin{array}{c} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \\ \text{Glucose} \end{array} \xrightarrow{HNO_3} \begin{array}{c} COOH \\ | \\ (CHOH)_4 \\ | \\ COOH \\ \text{Saccharic acid} \end{array}$$

This suggest the presence of primary alcoholic group i.e. $(-OH)$ group in glucose.

20. Given below are two statements labelled as Assertion (A) and Reason (R).
**Assertion (A):** Glucose and fructose are reducing sugars.

**Reason (R):** Glucose and fructose contain a free aldehydic and ketonic froup adjacent to a $H\overset{|}{\underset{|}{C}}OH$ group.

✓ **A.** Both A and R are true and R is the correct explanation of A

✗ **B.** Both A and R are true but R is not the correct explanation of A

✗ **C.** A is true but R is false

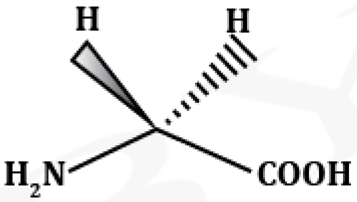
✗ **D.** A is false but R is true

Reducing sugars contain a free aldehydic or ketonic group adjacent to a $H\overset{|}{\underset{|}{C}}OH$ group and reduce Tollen's reagent, Schiff's reagent or Benedict's solution.
Thus, both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

21. Given below are two statements labelled as Assertion (A) and Reason (R).
**Assertion (A):** All naturally occurring $\alpha -$ amino acids except glycine are optically acive.
**Reason (R):** Most naturally occurring amino acids have L-configuration.

☒ **A.** Both A and R are true and R is the correct explanation of A
☑ **B.** Both A and R are true but R is not the correct explanation of A
☒ **C.** A is true but R is false
☒ **D.** A is false but R is true

Assertion and Reason both are correct and Reason is not correct explanation of Assertion. All naturally occurring $\alpha -$ amino except glycine are optically active. Glycine is optically inactive because glycine does not have all four different substituent as shown below:



Glycine

22. Given below are two statements labelled as Assertion (A) and Reason (R).
**Assertion (A):** There are two atoms per unit cell in bcc.
**Reason (R):** A body-centred cubic (bcc) unit cell has an atom at each of corners and also one atom at its body centre.

☑ **A.** Both A and R are true and R is the correct explanation of A
☒ **B.** Both A and R are true but R is not the correct explanation of A
☒ **C.** A is true but R is false
☒ **D.** A is false but R is true

A body-centred cubic (bcc) unit cell has an atom at each of corners and also one atom at its body centre.

So effective number of atoms per unit cell $= \frac{1}{8} \times 8 + 1 = 2$

23. Given below are two statements labelled as Assertion (A) and Reason (R).
**Assertion (A):** In monohaloarenes, further electrophilic substitution occurs at ortho and para positions.
**Reason (R):** Halogen atom is a ring deactivator.

- ✗ **A.** Both A and R are true and R is the correct explanation of A
- ✓ **B.** Both A and R are true but R is not the correct explanation of A
- ✗ **C.** A is true but R is false
- ✗ **D.** A is false but R is true

Halogen being more electronagative, acts as ring deactivator as they dominates -I effect over +m. However lone pairs on halogen delocalises in the ring which enable further electrophilic substitution at ortho and para positions.
Thus Assertion and Reason both are correct and Reason is not correct explanation of Assertion

24. Given below are two statements labelled as Assertion (A) and Reason (R).
**Assertion (A):** o-nitrophenol is less soluble in water than the m- and p-isomers.
**Reason (R):** m- and p-nitrophenols exist as associated molecules.

- ✗ **A.** Both A and R are true and R is the correct explanation of A
- ✓ **B.** Both A and R are true but R is not the correct explanation of A
- ✗ **C.** A is true but R is false
- ✗ **D.** A is false but R is true

Both assertion and reason are correct statements but the reason is not a correct explanation of assertion.
Correct Explanation (R): Due to the presence of **intramolecular** hydrogen bonding, o-nitrophenol does not form hydrogen bonds with $H_2O$ but meta and para-nitrophenol form hydrogen bonds with water.

# BYJU'S Part Test for Board Term I (CBSE Grade 12)

Date: 18/11/2021

Subject: Chemistry

Topic : Section C

Class: Standard XII

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1.

| | I | | II |
|---|---|---|---|
| (i) | Amino acids | (A) | Protein |
| (ii) | Thymine | (B) | Nucleic acid |
| (iii) | Insulin | (C) | DNA |
| (iv) | Phosphodiester linkage | (D) | Zwitter ion |
| (v) | Uracil | | |

Which of the following is the best matched option?

✗ **A.** i- AD ii - B, iii - C, iv - B, v - A

✓ **B.** i- AD, ii- C, iii - A, iv - BC, v - B

✗ **C.** i- A, ii - CD, iii - A, iv - B, v - C

✗ **D.** i- D, ii- BC, iii - B, iv - B, v - A

Amino acids form proteins and exist as zwitter ion.
Thymine is a nitrogenous base in $DNA$.
Insuline is a protein.
Phosphodiester linkage is found in nucleic acids and also in $DNA$.
Uracil is nitrogenous base found in $RNA$ which is a nucleic acid.

2. Which of the following analogies is correct for RNA base pairs?
Adenine(A):________________::Guanine(G):Cytosine(C)

✗ **A.** Urin

✓ **B.** Uracil

✗ **C.** Thymin

✗ **D.** Purine

| Nucleic Acid | Nucleobases | Base complement |
|---|---|---|
| DNA | adenine(A), thymine(T), guanine(G), cytosine(C) | $A = T, G \equiv C$ |
| RNA | adenine(A), uracil(U), guanine(G), cytosine(C) | $A = U, G \equiv C$ |

3. Which of the following analogies is correct?
Choloform : Trichloromethane :: Ethylene dichloride :

✗ **A.** Dichloromethane

✗ **B.** 1,2-Dichloroethene

✗ **C.** 1,1-Dichloroethane

✓ **D.** 1,2-Dichloroethane

IUPAC name of chloroform $(CHCl_3)$ is trichloromethane.
IUPAC name of ethylene dichloride $(C_2H_4Cl_2)$ is 1,2-dichloroethane.

# BYJU'S Part Test for Board Term I (CBSE Grade 12)

4. The adjective, 'crystalline' when applied to solids, implies an ideal crystal in which the structural units, termed as unit cells, are repeated regularly and indefinitely in three demansions in space. The unit cell containing at least one molecule, has a definite orientation and shape defined by the translational vectors, $a,\ b$ and $c$. The unit cell therefore has a definite volume, $V$ that contains the atoms and molecules necessary for generating the crystal.
Every crystal can be classified as a member of one of the seven possible crystal systems or crystal classes that are defined by relationships, $a,\ b$ and $c$ of the unit cell and between the individual angles. $\alpha, \beta$ and $\gamma$ of the unit cell. The structure of the given crystal may be assigned to one of the $230$ space groups. These uniquely define the possible ways of arranging atoms in a three-dimentional solid.
Based on these observations, seven crystal systems were identified: tricilinic, monoclinic, trogonal or rhombohedral, tetragonal, hexagonal, rhombic or orthorhombic and cubic.

Identify the type of crystal system of the following:
$(A)\ \mathrm{KNO_3};\ (B)\ \mathrm{CaCO_3};\ (C)\ \mathrm{TiO_2};\ (D)\ \mathrm{CuSO_4} \cdot 5H_2O;$

☒ **A.** $A-$ Cubic; $B-$Triclinic; $C-$Hexagonal; $D-$Rhombohedral

☒ **B.** $A-$Tetragonal ; $B-$Monoclinic; $C-$Triclinic; $D-$Hexagonal

☑ **C.** $A-$Orthorhombic ; $B-$Rhombohedral; $C-$Tetragonal; $D-$Triclinic

☒ **D.** $A-$Rhombohedral ; $B-$Hexagonal ; $C-$Trigonal; $D-$Orthorhombic

(A) $\mathrm{KNO_3}-$ Orthorhombic
(B) $\mathrm{CaCO_3}-$ Rhombohedral
(C) $\mathrm{TiO_2}-$ Tetragonal
(D) $\mathrm{CuSO_4} \cdot 5H_2O-$ Triclinic

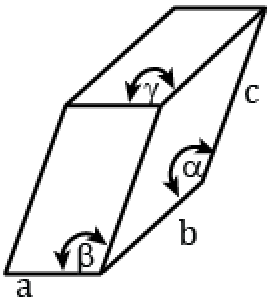
5. The adjective, 'crystalline' when applied to solids, implies an ideal crystal in which the structural units, termed as unit cells, are repeated regularly and indefinitely in three demansions in space. The unit cell containing at least one molecule, has a definite orientation and shape defined by the translational vectors, $a,\ b$ and $c$. The unit cell therefore has a definite volume, $V$ that contains the atoms and molecules necessary for generating the crystal.

   Every crystal can be classified as a member of one of the seven possible crystal systems or crystal classes that are defined by relationships, $a,\ b$ and $c$ of the unit cell and between the individual angles. $\alpha, \beta$ and $\gamma$ of the unit cell. The structure of the given crystal may be assigned to one of the $230$ space groups. These uniquely define the possible ways of arranging atoms in a three-dimentional solid.

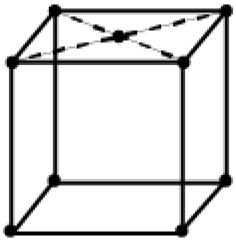
   Based on these observations, seven crystal systems were identified: tricilinic, monoclinic, trogonal or rhombohedral, tetragonal, hexagonal, rhombic or orthorhombic and cubic.

   In which of the following structure unit cell shows the triclinic strusture?

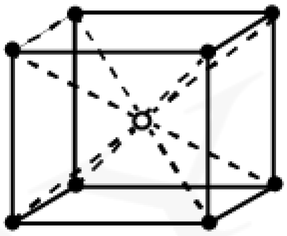
✓ **A.**



✗ **B.**



✗ **C.**



✗ **D.**

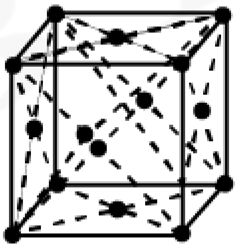


Fig. (a) represents structure of triclinic crystal system as, $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma \neq 90^\circ$.
Whereas, the structures in option $(a), (c)$ and $(d)$ represents end-centered, body centered and face-centered cubic system.

6. The adjective, 'crystalline' when applied to solids, implies an ideal crystal in which the structural units, termed as unit cells, are repeated regularly and indefinitely in three demansions in space. The unit cell containing at least one molecule, has a definite orientation and shape defined by the translational vectors, $a,\ b$ and $c$. The unit cell therefore has a definite volume, $V$ that contains the atoms and molecules necessary for generating the crystal.

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The crystal structure is obtained by associating structural motifs with lattice points. Each repeated motif has

☒ **A.** Same structure but different spatial arrangement

☒ **B.** Same spatial arrangement but different structure

☒ **C.** Different structure and different spatial arrangement

☑ **D.** Same structure and same spatial arrangement

As the motifs are the structural unit of a crystal lattice.
Therefore, to form a crystal lattice each motif must have same structure and same spatial arrangement.