



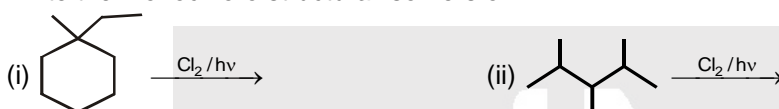
## Exercise-1

☞ Marked questions are recommended for revision.

### PART - I : SUBJECTIVE QUESTIONS

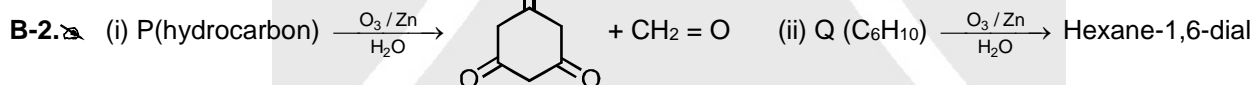
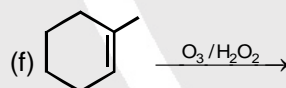
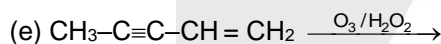
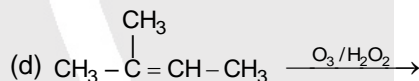
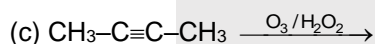
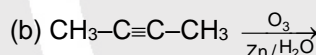
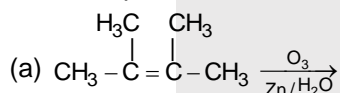
#### Section (A) : Catalytic hydrogenation and Monohalogenation

- A-1. On catalytic hydrogenation how many isomeric alkenes will give 2-Methylbutane?
- A-2. ☞ How many isomeric alkynes on hydrogenation gives 3,3-Dimethylhexane?
- A-3. A cycloalkane having molecular mass 84 and four secondary carbon atoms will form four monochloro structure isomers on chlorination. Identify the structure of cycloalkane.
- A-4. ☞ Write the monochloro structural isomers of :



#### Section (B) : Ozonolysis reactions

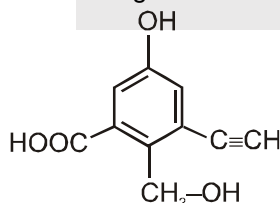
B-1. Write the products of following reactions :



Write the structure of P and Q.

#### Section (C) : Test for acidic hydrogen and unsaturation

C-1. No. of moles of H<sub>2</sub> gas evolved when one mole of the following compound reacts with sodium?

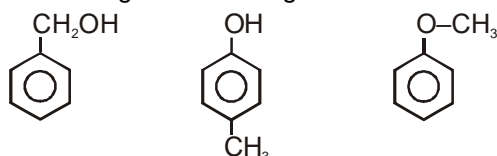


- C-2. Molecular formula C<sub>4</sub>H<sub>6</sub> have two position isomers A and B. Both A and B isomer decolourised the bromine water. B release H<sub>2</sub> gas with sodium metal but isomer A does not release H<sub>2</sub> gas. Write IUPAC name of A and B.
- C-3. A hydrocarbon (P) having molecular formula C<sub>10</sub>H<sub>10</sub>, 1 mole of it liberates 1.5 mole H<sub>2</sub> gas on reaction with Na metal. Compound (P) gives red precipitate on reaction with ammonical cuprous chloride. Compound (P) on hydrogenation followed by reaction with Cl<sub>2</sub>/hν gives 4 monochloro structural products. Identify the structure of hydrocarbon (P).



### Section (D) : Test for alcohols, phenol, nitro group and alkyl halides

D-1. Write suitable reagents to distinguish between the following compounds.



D-2. X  $(C_6H_6O)$  reacts with:

neutral $FeCl_3$	→ +ve
Na metal	→ +ve
Lucas reagent	→ -ve

Identify the structure of X :

D-3. An aromatic organic compound  $C_xH_yO$  (where  $X = 8$ ,  $Y = ?$ ) gives positive test with neutral  $FeCl_3$  and it also gives white precipitate with Tollen's reagent. Find the value of 'Y'.

### Section (E) : Test for aldehydes and ketones (carbonyl compounds)

E-1. A compound X ( $C_5H_{10}O$ ) reacts with 2,4-DNP but does not give silver mirror test and Iodoform test. The possible structure for X is :

E-2. P  $(C_4H_8O)$  reacts with:

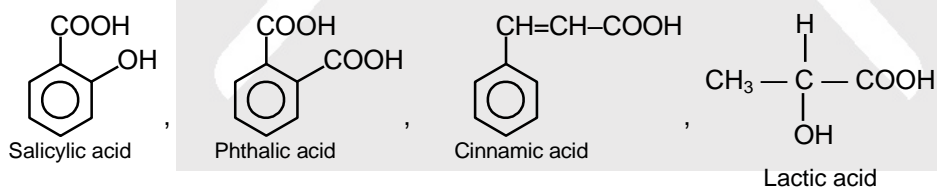
2,4-DNP	→ +ve
$I_2 / OH^-$	→ +ve
Tollen's reagent	→ -ve

Identify the structure of P :

E-3. A paradisubstituted benzene containing compound having formula  $C_9H_{10}O$  (A) neither gives neutral  $FeCl_3$  test nor gives Tollen's test but gives yellow precipitate with iodine in alkali. A is -

### Section (F) : Test for acids, esters and amides

F-1. Which of the following compound will give positive test with  $NaHCO_3$ ?



$CH_3COOH$ ,  $PhSO_3H$ ,  $PhOH$

F-2. Molecular formula  $C_3H_6O_2$  have two structures A & B. Structure A releases  $CO_2$  gas with  $NaHCO_3$  but B does not. Compound B is fruity smelling liquid. Write the structures & IUPAC name of A and B.

### Section (G) : Test for amines

G-1. A symmetrical organic compound of  $C_4H_{11}N$  give yellow oily layer on treatment with  $HNO_2$ . Find the structure of the compound ?

G-2. During the preparation of primary amine by alkyl halide mixture of  $1^\circ$ ,  $2^\circ$  and  $3^\circ$  amines are formed. Which procedure should follow to separate the mixture of amines ?



## Section (H) : Qualitative analysis of elements

- H-1. When Lassaigne extract of methylamine react with  $\text{FeSO}_4$ /dilute  $\text{H}_2\text{SO}_4$  what happened?
- H-2. Explain the reason for the fusion of an organic compound with metallic sodium for testing nitrogen, sulphur and halogen.
- H-3. What will happen during Lassaigne's test for nitrogen if the compound also contains sulphur?
- H-4. Beilstein test is carried out to find presence of organic halide but which organic halide can not be detected by Beilstein test ?
- H-5. During the test of nitrogen in Lassaigne's filtrate, sometimes red colouration is obtained when ferric chloride is added. Give reasons.

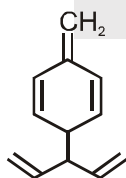
## Section (I) : Quantitative analysis of elements

- I-1. Differentiate between the principle of estimation of nitrogen in an organic compound by (i) Dumas method and (ii) Kjeldahl's method.
- I-2. Why is nitric acid added to sodium extract before adding silver nitrate for testing halogens?
- I-3. Why is a solution of potassium hydroxide used to absorb carbon dioxide evolved during the estimation of carbon present in an organic compound?
- I-4. Why is it necessary to use acetic acid and not sulphuric acid for acidification of sodium extract for testing sulphur by lead acetate test?
- I-5. In Duma's method an organic compound containing N is heated with ?

## PART - II : ONLY ONE OPTION CORRECT TYPE

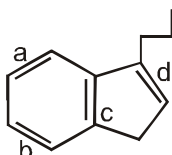
### Section (A) : Catalytic hydrogenation and Monohalogenation

- A-1. Which of the following hydrocarbons give same product on hydrogenation?  
 (A) 2-Methylhex-1-ene & 3-Methylhex-3-ene  
 (B) 3-Ethylhex-1-en-4-yne & 2-Methylhept-2-en-4-yne  
 (C) 3-Ethylcycloprop-1-ene & 1,2-Dimethylcycloprop-1-ene  
 (D) 2-Methylbut-2-ene & 3-Methylbut-1-ene
- A-2. Number of moles of hydrogen will required for complete hydrogenation of one mole of following compound ?



- (A) 6 (B) 7 (C) 5 (D) 3

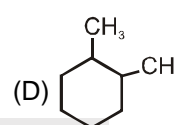
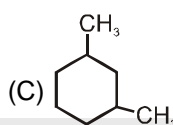
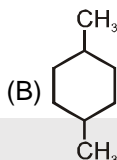
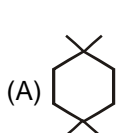
- A-3. If 1 mole  $\text{H}_2$  is reacted with 1 mole of the following compound, which double bond will be hydrogenated?



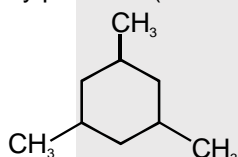
- (A) a (B) b (C) c (D) d



- A-4.** Only two isomeric monochloro derivatives are possible for -  
 (A) n-Pentane (B) 2,4-Dimethyl pentane  
 (C) Toluene (D) 2,3-Dimethyl butane
- A-5.** The number of possible monochloro derivatives of 2,2,3,3-Tetramethylbutane is -  
 (A) 2 (B) 3 (C) 4 (D) 1
- A-6.** Which of the following alkene gives four monochloro (structural isomers) products after hydrogenation ?  
 (A) Pent-2-ene (B) 2-Methylbut-2-ene  
 (C) 3-Methylhex-2-ene (D) 2,3-Dimethylbut-2-ene
- A-7.** Which of the following compound will give four monochloro (structural) products on monochlorination?



- A-8.** How many products (structural isomers only) are formed by monochlorination of given compound?



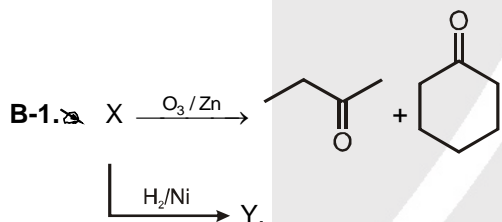
(A) 4

(B) 3

(C) 5

(D) 6

### Section (B) : Ozonolysis reactions

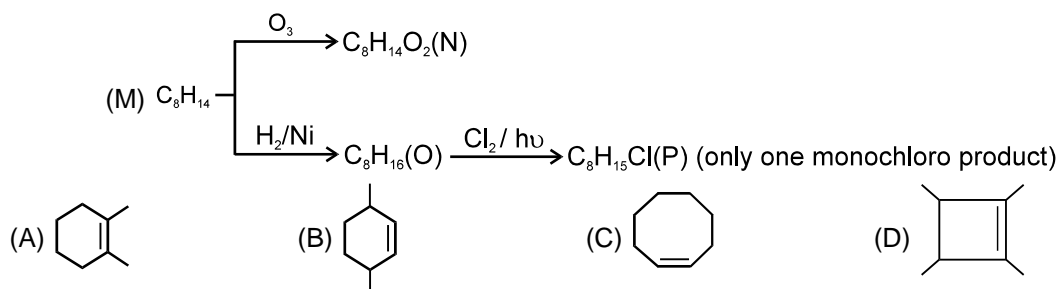


The IUPAC name of compound Y is :

- (A) 2-Cyclohexylbutane (B) 1-Methylpropylcyclohexane  
 (C) Butylcyclohexane (D) 1-Cyclohexylbutane
- B-2.** An alkene give two moles of HCHO, one mole of CO<sub>2</sub> and one mole of  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CHO}$  on ozonolysis. What is structure of alkene?  
 (A)  $\text{CH}_2=\text{CH}-\underset{\text{CH}_3}{\text{CH}}-\text{CH}=\text{CH}_2$  (B)  $\text{CH}_2=\text{C}=\text{CH}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$   
 (C)  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}=\text{CH}-\text{CH}=\text{CH}_2$  (D)  $\text{CH}_2=\text{C}=\text{CH}-\underset{\text{CH}_3}{\text{CH}}-\text{CH}=\text{CH}_2$
- B-3.** An unknown compound on ozonolysis to give acid C<sub>3</sub>H<sub>6</sub>O<sub>2</sub> and a ketone C<sub>4</sub>H<sub>8</sub>O. From this information, identify structure of unknown compound.
- (A) (CH<sub>3</sub>)<sub>2</sub>C=CHCH<sub>2</sub>-CH<sub>2</sub>CH<sub>3</sub> (B)  $\text{CH}_3\text{CH}_2-\overset{\text{CH}_3}{\text{C}}=\text{CHCH}_2\text{CH}_3$   
 (C) (CH<sub>3</sub>)<sub>2</sub>CHCH=CHCH<sub>2</sub>CH<sub>3</sub> (D) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH=CHCH<sub>2</sub>CH<sub>3</sub>

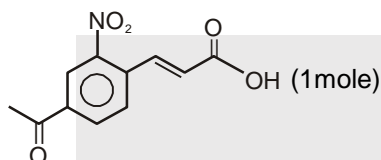


- B-4.** The chemical reactions of an unsaturated compound 'M' are given below. Determine the possible structural formula of 'M'

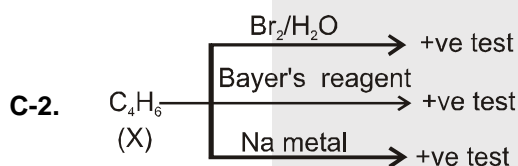


### Section (C) : Test for acidic hydrogen and unsaturation

- C-1.** When one mole of the given compound reacts with sodium metal then how many moles of  $H_2$  gas will release?

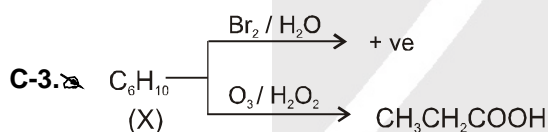


- (A) 1 mole (B) 1.5 mole (C) 2 mole (D) 0.5 mole




Compound X is

- (A)  $H_3C-C\equiv C-CH_3$  (B)  $CH_2=CH-CH=CH_2$   
 (C)  $CH_3-CH_2-C\equiv CH$  (D) 







Identify X :

- (A)  $CH_3-CH_2-C\equiv C-CH_2-CH_3$  (B)  $CH_3-C\equiv C-CH_2-CH_2-CH_3$   
 (C)  (D) 

- C-4.** Ammonical  $AgNO_3$  gives white ppt after reaction with any compound then this reflects the presence of  
 (A) one CHO group (B) one triple bond  
 (C) a terminal alkyne (D) compound is unsaturated

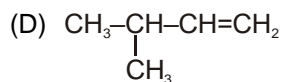
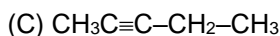
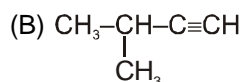
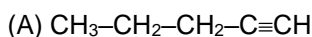
- C-5.** Which of the following compound gives red ppt with  $Cu_2Cl_2, NH_4OH$  ?  
 (A)  $CH_3-C\equiv C-CH_3$  (B)  $CH_3-CH_2-C\equiv CH$   
 (C)  $CH_3-CH_2-CH=CH_2$  (D)  $CH_3-C\equiv C-CH=CH_2$

- C-6.** Identify the hydrocarbon having molecular formula  $C_5H_6$  which gives white ppt with ammonical  $AgNO_3$  ?  
 (A)  (B)  (C)  (D) 

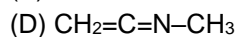
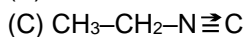
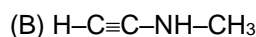
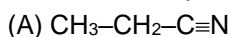


C-7. Red precipitate  $\xleftarrow[\text{NH}_4\text{OH}]{\text{Cu}_2\text{Cl}_2}$  P(C<sub>5</sub>H<sub>8</sub>)  $\xrightarrow{\text{Ozonolysis}}$  2-Methylpropanoic acid + compound (Q)

Structure of P can be -



C-8. Compound A(C<sub>3</sub>H<sub>5</sub>N) gives precipitate with Tollen's reagent and H<sub>2</sub> gas is also evolved on addition of Na metal. Compound A can be :



### Section (D) : Test for alcohols, phenol, nitro group and alkyl halides

D-1. The group reagent for the test of alcohols is :

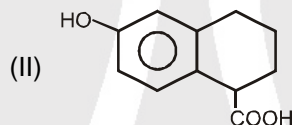
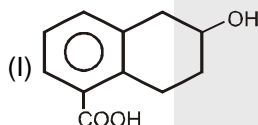
(A) Ceric ammonium nitrate

(B) Schiff's reagent

(C) Molisch's reagent

(D) Bromine water

D-2. The following two compounds I and II can be distinguished by using reagents-



(a) aq. NaHCO<sub>3</sub>

(b) Neutral FeCl<sub>3</sub>

(c) Blue litmus solution

(d) Na metal

(e) HCl/ZnCl<sub>2</sub> anhydrous

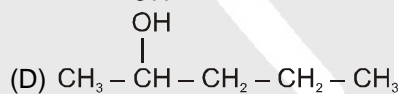
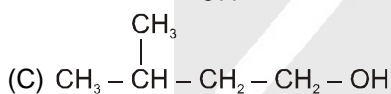
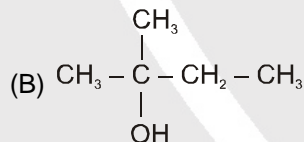
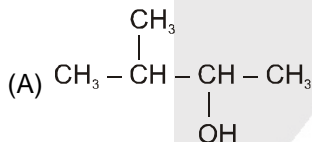
(A) a or c

(B) b or e

(C) d or e

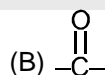
(D) c or d

D-3. Structure of an organic compound (C<sub>5</sub>H<sub>12</sub>O), which responds with Lucas reagent immediately?



D-4. A compound is heated with zinc dust and ammonium chloride followed by addition of the Tollen's reagent. Formation of silver mirror indicates the presence of following group-

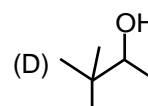
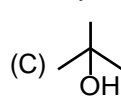
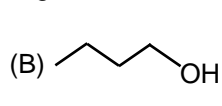
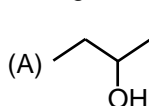
(A) -CHO



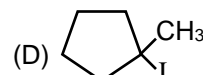
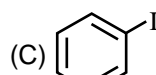
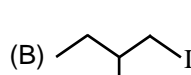
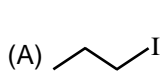
(C) -NO<sub>2</sub>

(D) -NH<sub>2</sub>

D-5. During determination of degree of alcohol by Victor Meyer test, red colour is obtained by -



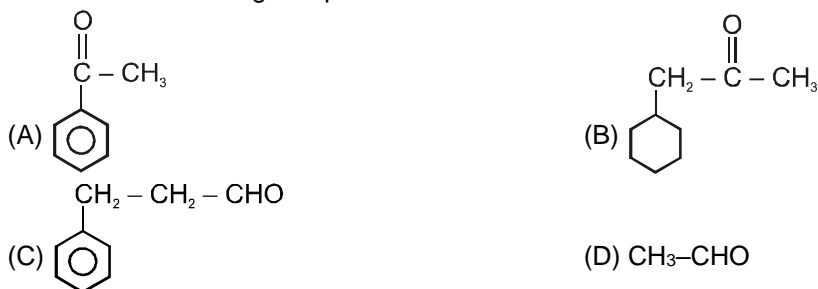
D-6. Which can give yellow precipitate with aqueous silver nitrate solution ?



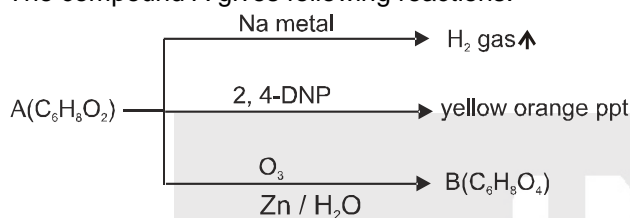


### Section (E) : Test for aldehydes and ketones (carbonyl compounds)

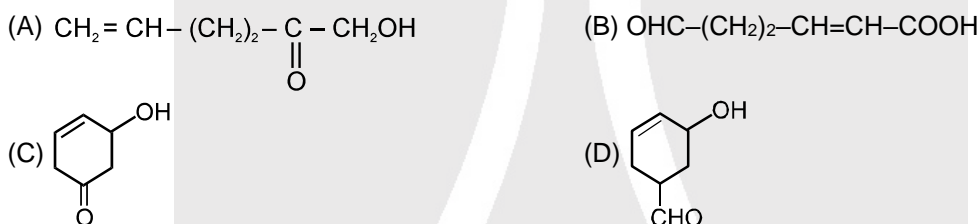
E-1. Which of the following compound will not react with  $I_2 / OH^-$  ?



E-2. The compound A gives following reactions.



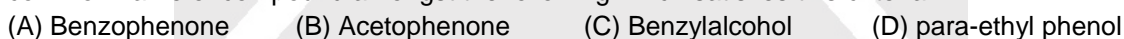
Its structure can be



E-3. A unsaturated hydrocarbon (P) on reductive ozonolysis produces a dicarbonyl compound (Q). (Q) forms precipitate with 2,4-DNP but no reaction with Tollen's reagent. Identify the structure of (P).

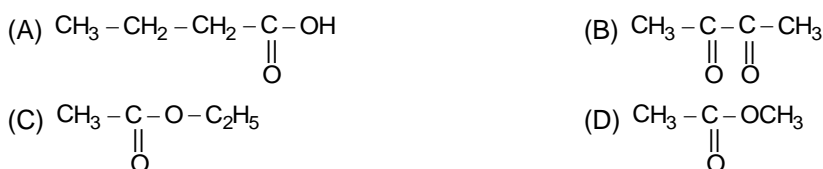


E-4. An organic compound  $C_8H_8O$  gives positive 2,4-DNP test and positive iodoform test. What is the common name of compound amongst the following which satisfies this criteria?

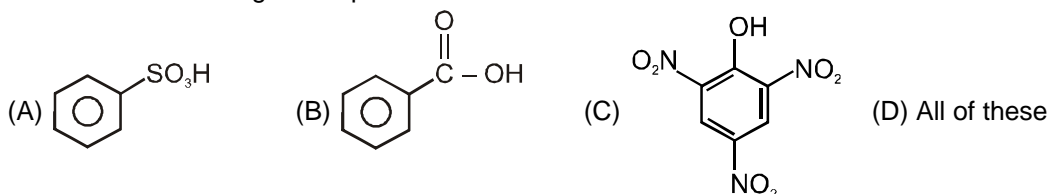


### Section (F) : Test for acids, esters and amides

F-1. An organic compound X ( $C_4H_8O_2$ ) gives positive test with NaOH and phenolphthalein. Structure of X will be :

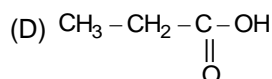
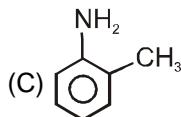
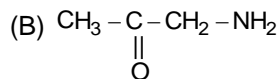
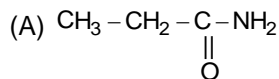


F-2. Which of the following would produce effervescence with sodium bicarbonate?

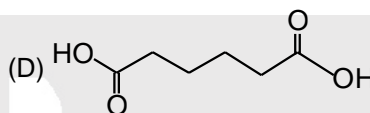
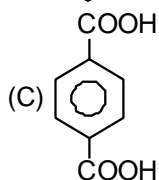
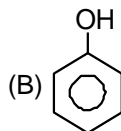
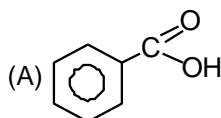




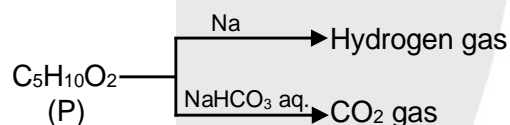
F-3. Which of the following compound will give smell of  $\text{NH}_3$  with conc.  $\text{NaOH}$  ?



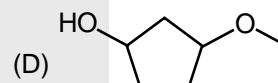
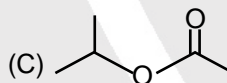
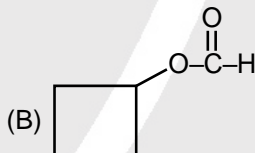
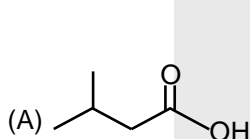
F-4. An aromatic organic compound with 68.9% of C and 4.92% of H gives  $\text{CO}_2$  with  $\text{NaHCO}_3$ . The organic compound is :



F-5.

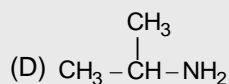
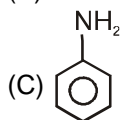
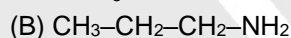
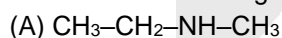


Find the isomer of P which fails to give above tests ?

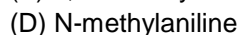
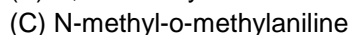


### Section (G) : Test for amines

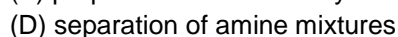
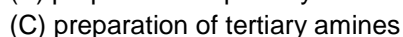
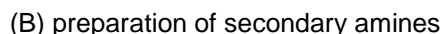
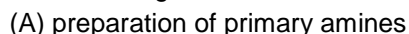
G-1. Which of the following will not give positive test with  $\text{CHCl}_3 / \text{KOH}$  ?



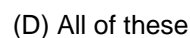
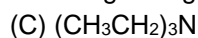
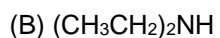
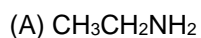
G-2. A positive carbylamine test is given by :



G-3. The Hinsberg's method is used for :

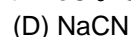
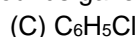
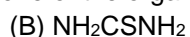
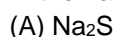


G-4. Which of the following amine does not react with Hinsberg's reagent ?



### Section (H) : Qualitative analysis of elements

H-1. In the Lassaigne's test, one of the organic compounds gave red colour with  $\text{FeCl}_3$ . Compound can be :







- H-2.** The compound that does not give a blue colour in Lassaigne's test is  
 (A)  $C_6H_5-NH_2$  (B)  $CH_3CONH_2$  (C)  $NH_2-NH_2$  (D)  $C_6H_5-NO_2$
- H-3.** Nitrogen containing organic compound when fused with sodium metal forms:  
 (A)  $NaNO_2$  (B)  $NaCN$  (C)  $NaNH_2$  (D)  $NaNC$
- H-4.** The sodium extract of an organic compound on acidification with acetic acid and addition of lead acetate solution gives a black precipitate. The organic compound contains-  
 (A) Nitrogen (B) Halogen (C) Sulphur (D) Phosphorus
- H-5.** The sodium extract of an organic compound on treatment with  $FeSO_4$  solution,  $FeCl_3$  and  $HCl$  gives red solution. The Red colour of :  
 (A)  $Fe(CN)_3$  (B)  $Fe_4[Fe(CN)_6]_3$  (C)  $[Fe(SCN)]^{2+}$  (D)  $FeS$

### Section (I) : Quantitative analysis of elements

- I-1.** In Kjeldahl's method, nitrogen present in the sample is estimated as :  
 (A)  $N_2$  (B)  $NH_3$  (C)  $NO_2$  (D) None of these
- I-2.** Catalyst used in Kjeldahl's method for the estimation of nitrogen is :  
 (A) Sodium (B) Magnesium (C) Mercury (D) Copper
- I-3.** The dessicants used for absorbing water during Liebig's method for estimation of carbon and hydrogen are:  
 (A)  $CaCl_2$  (B)  $Na_2SO_4$  (C)  $MgSO_4 \cdot 7H_2O$  (D)  $Mg(ClO_4)_2$
- I-4.** The equivalent weight of an acid is equal to  
 (A) Molecular weight  $\times$  acidity (B) Molecular weight  $\times$  basicity  
 (C) Molecular weight/basicity (D) Molecular weight/acidity
- I-5.** Liebig test is used to estimate :  
 (A) H (B) C (C) C and H both (D) N
- I-6.** In Carius method of estimation of halogen, 0.15 g of an organic compound gave 0.12 g of  $AgBr$ . What is the percentage of bromine in the compound ?  
 (A) 18.05 (B) 53.19 (C) 63.10 (D) 34.04
- I-7.** An organic compound having molecular mass 60 is found to contain C = 20%, H = 6.67% and N = 46.67%. The compound is  
 (A)  $CH_3NCO$  (B)  $CH_3CONH_2$  (C)  $(NH_2)_2CO$  (D)  $CH_3CH_2CONH_2$
- I-8.** A gaseous hydrocarbon has 85% carbon and vapour density of 28. The possible formula of the hydrocarbon will be.  
 (A)  $C_3H_6$  (B)  $C_2H_4$  (C)  $C_2H_2$  (D)  $C_4H_8$
- I-9.** Quantitative measurement of nitrogen in an organic compounds is done by the which method?  
 (A) Berthelot method (B) Beilstein method  
 (C) Lassaigne test (D) Kjeldahl's method
- I-10.** Kjeldahl's method of estimation for nitrogen is not applicable to-  
 (A) Acetamide (B) Aliphatic amines  
 (C) Diazo compounds (D) Amino acids





## PART - III : MATCH THE COLUMN

1. Match the column :

	Column - I (Compound)		Column - II (No. of monochloro structural product)
(A)	$\xrightarrow{\text{Cl}_2/h\nu}$	(p)	= 1
(B)	$\xrightarrow{\text{Cl}_2/h\nu}$	(q)	= 2
(C)	$\xrightarrow{\text{Cl}_2/h\nu}$	(r)	= 3
(D)	$\xrightarrow{\text{Cl}_2/h\nu}$	(s)	= 4

2. Match the compounds of column-I with the reagent of column-II, which can distinguish between the compounds of column-I.

	Column-I		Column-II
(A)	$\text{CH}_3-\text{C}\equiv\text{C}-\text{H}$ (I), $\text{CH}_3-\text{CH}=\text{O}$ (II)	(p)	Tollen's reagent
(B)	 (I) (II)	(q)	$\text{I}_2 / \text{NaOH}$
(C)	$\text{CH}_3-\underset{\text{OH}}{\text{CH}}-\text{CH}_3$ (I), $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$ (II)	(r)	Lucas reagent
(D)	 (I) (II)	(s)	Neutral $\text{FeCl}_3$
		(t)	2, 4-DNP



3.\_ Match the following :

(Possible Ozonolysis product)	(Original compound)
(A)	(P)
(B)	(Q)
(C) HCHO	(R)
(D)	(S)

4.\_ Match the following :

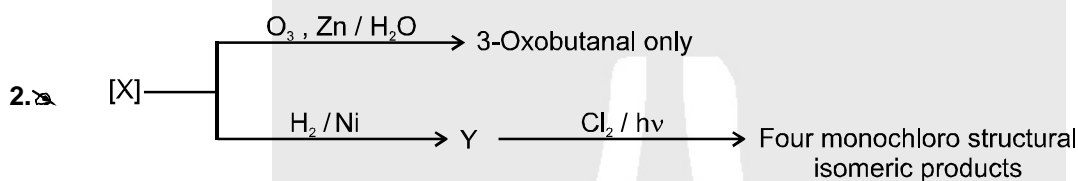
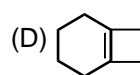
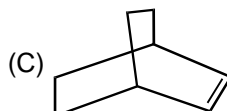
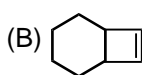
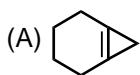
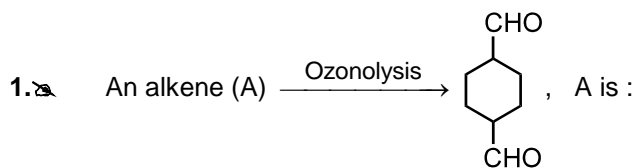
Compounds	Lab Test
(A)	(P) Neutral $\text{FeCl}_3$
(B)	(Q) Bromine water test
(C)	(R) Precipitate with ammonical silver nitrate
(D) $\text{H}_3\text{C}-\text{C}\equiv\text{C}-\text{CH}_2-\text{CH}_2-\text{COOEt}$	(S) Liberate $\text{H}_2$ with Na/dry ether



## Exercise-2

Marked questions are recommended for Revision.

### PART - I : ONLY ONE OPTION CORRECT TYPE



Compound 'X' is :

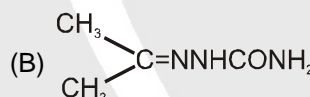
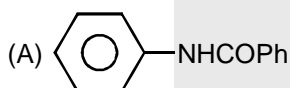
(A) 1-Methylcyclopropene

(B) 1, 4-Dimethylcyclohexa-1,4-diene

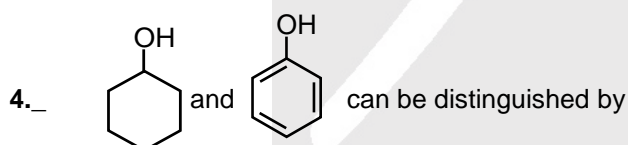
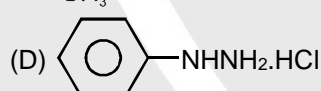
(C) 1, 4-Dimethylcyclohexa-1,3-diene

(D) 1, 2-Dimethylcyclohexa-1,4-diene

3. Lassaigne's test for the detection of nitrogen will fail in the case of



(C)  $\text{NH}_2\text{-NH}_2\text{.HCl}$



(A) Neutral  $\text{FeCl}_3$

(B)  $\text{Br}_2/\text{H}_2\text{O}$

(C) conc.  $\text{HCl}$ , anhy.  $\text{ZnCl}_2$

(D) All of these

5. Why lassaigne extract is first reacted with conc.  $\text{HNO}_3$  before testing the presence of halogens in the sample ?

(A) to make the solution acidic

(B) to make the solution clear

(C) to convert  $\text{Fe}^{2+}$  to  $\text{Fe}^{3+}$

(D) to remove  $\text{CN}^-$  and  $\text{S}^{2-}$  ions

6. lassaigne test is not shown by diazonium salts because they :

(A) form  $\text{NH}_3$  gas on heating much before the reaction with sodium.

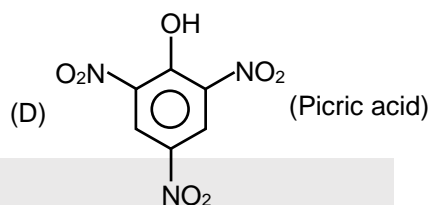
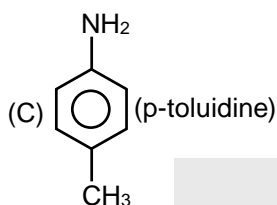
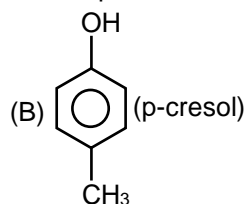
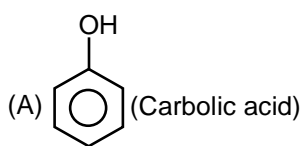
(B) form  $\text{N}_2$  gas on heating much before the reaction with sodium.

(C) are highly volatile and evaporated before the reaction with sodium.

(D) All of the above



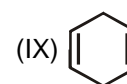
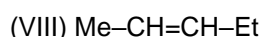
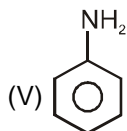
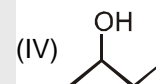
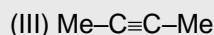
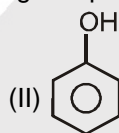
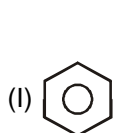
7. Benzyl alcohol and benzyl chloride can not be distinguished by-  
 (A) Ceric ammonium nitrate (B) Beilstein test  
 (C) Lucas reagent (D) Blue litmus
8. Which amongs the following will release  $\text{CO}_2$  gas with aqueous  $\text{NaHCO}_3$  solution ?



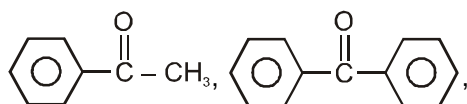
9. In Kjeldahl's method, an organic compound is digested with concentrated sulphuric acid convert its nitrogen into?  
 (A)  $\text{NH}_3$  (B)  $(\text{NH}_4)_2\text{SO}_4$  (C)  $(\text{NH}_4)_2\text{SO}_3$  (D)  $\text{N}_2$
10. In Dumas' method for estimation of nitrogen, 0.3 g of an organic compound gave 50 mL of nitrogen collected at 300 K temperature and 715mm pressure. What will be the percentage composition of nitrogen in the compound? (Aqueous tension at 300K=15 mm)  
 (A) 22.38% (B) 17.46% (C) 55.11% (D) 82.74%

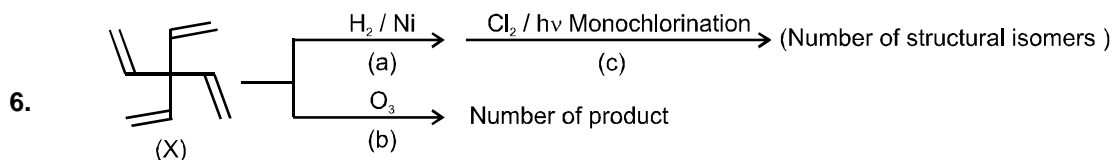
## PART - II : NUMERICAL VALUES QUESTIONS

1. How many isomeric alkynes on catalytic hydrogenation gives 3-Ethyl-4-methylheptane ?
2. Find the number of structural isomers of fully saturated cycloalkane of molecular formulae  $\text{C}_6\text{H}_{12}$  which give three monochloro structural products.
3. How many of the following compounds decolorise  $\text{Br}_2$  water solution ?



4. How many structures are possible for a compound with the molecular formula  $\text{C}_6\text{H}_{12}\text{O}$  which can give both iodoform and 2,4-DNP test?
5. Among the followings the number of compounds which will react with Fehling's solution is ?  
 $\text{PhCH}=\text{O}$ ,  $\text{CH}_3\text{CH}=\text{O}$ ,  $\text{C}_2\text{H}_5\text{CH}=\text{O}$ ,  $\text{HCHO}$ ,  $\text{HCOOH}$ ,  $\text{CH}_3\text{COCH}_3$ ,





Calculate sum of number of products formed in the reaction a, b and c ?

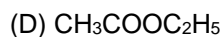
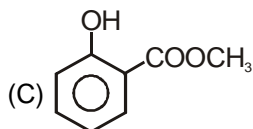
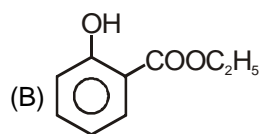
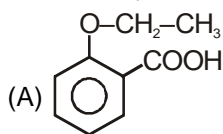
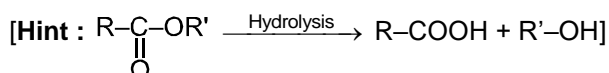
7. How many of the following compounds will not give positive iodoform test?  
 Acetophenone, Benzophenone, 2-Pentanone, 3-Pentanone, Acetaldehyde,  
 $\text{CH}_3\text{COCH}_3$ ,  $(\text{CH}_3)_2\text{CHOH}$ ,  $(\text{CH}_3\text{CH}_2)_2\text{CH-OH}$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{CH}_3\text{CONH}_2$ ,  $\text{CH}_3\text{COOCH}_3$ ,  $\text{CH}_3\text{COCl}$
8. How many no. of active hydrogen atoms are present in a compound (mol.mass 90)? When 0.45g of it treated with Na metal, liberates 112 ml of the  $\text{H}_2$  gas at STP.
9. 6 g of the organic compound on heating with NaOH gave  $\text{NH}_3$  which is neutralised by 200 mL of 1N HCl. Percentage of nitrogen is :
10. 0.28g of a nitrogenous compound was subjected to Kjeldahl's process to produce 0.17 g of  $\text{NH}_3$ . The percentage of nitrogen in the organic compound is :
11. In sulphur estimation, 0.157 g of an organic compound gave 0.4813 g of barium sulphate. What is the percentage of sulphur in the compound ?
12. How many cyclic structural isomeric alcohol having molecular formula  $\text{C}_4\text{H}_8\text{O}$  liberates  $\text{H}_2$  gas on reaction with Na metal ?
13. How many of following can give yellow precipitate with  $\text{I}_2$  in NaOH ?  
 (1) Benzophenone (2) Acetophenone (3) Acetaldehyde (4) Acetone  
 (5) Benzaldehyde (6) Crotonaldehyde (7) Ethylalcohol (8) Isopropanol  
 (9) Tertiarybutylalcohol (10) Sec.butylalcohol
14. On Complete combustion 0.122 g of an organic compound gave 0.308 g of carbon dioxide and 0.054 g of water. Calculate the percentage of carbon and hydrogen in the sample?

### PART - III : ONE OR MORE THAN ONE OPTIONS CORRECT TYPE

1. Which of the following compounds is/are react with Na metal & liberate hydrogen gas?  
 (A)  $\text{CH}_3\text{-OH}$  (B)  $\text{CH}_3\text{-C}\equiv\text{CH}$  (C)  $\text{Ph-OH}$  (D)
2. Which of the following compound gives 1,4-Dimethyl cyclohexane when undergo catalytic hydrogenation?  
 (A) (B) (C) (D)
3. Which of the following will perform iodoform reaction with  $\text{I}_2/\text{OH}^-$  ?  
 (A)  $\text{CH}_3\text{COCH}_2\text{CH}_3$  (B)  $\text{CH}_3\text{CONH}_2$  (C)  $\text{C}_6\text{H}_5\text{COCH}_3$  (D)  $\text{CH}_3\text{CHO}$
4.  $\xrightarrow{\text{O}_3 / \text{Zn}, \text{H}_2\text{O}}$  (X) + (Y)  
 Compound (X) and (Y) can be distinguished by  
 (A) Tollen's reagent (B) Fehling solution (C) Haloform test (D) 2,4-DNP Test



5. A compound (X) gives fruity smell. [X] on hydrolysis gives an acid and an alcohol. Acid give violet colour with neutral  $\text{FeCl}_3$  while alcohol give yellow precipitate on boiling with  $\text{I}_2$  and  $\text{NaOH}$ . (X) can be :



6. Formic acid and acetaldehyde can be distinguish by -  
 (A)  $\text{I}_2 + \text{NaOH}$  (B) Tollen's reagent  
 (C) Fehling solution (D) 2,4-DNP test

7. Correct statement(s) about is/are  
 (A) It gives coloured solution with neutral  $\text{FeCl}_3$  solution.  
 (B) It liberates  $\text{H}_2$  gas with Na metal.  
 (C) It gives positive Iodoform test.  
 (D) It forms sweet smelling compound with alcohols.

8. Correct statment(s) about is /are :  
 (A) librate  $\frac{3}{2}$  mole of  $\text{H}_2$  on treatment with Na.  
 (B) Positive test with  $\text{FeCl}_3$   
 (C) Positive test with  $\text{NaHCO}_3$   
 (D) Positive test with tollen's reagent

9. Phenyl acetylene and styrene can not be distinguished by ?  
 (A)  $\text{Br}_2/\text{H}_2\text{O}$  (B) Na metal (C)  $\text{AgNO}_3 + \text{NH}_4\text{OH}$  (D)  $\text{Cu}_2\text{Cl}_2 + \text{NH}_4\text{OH}$

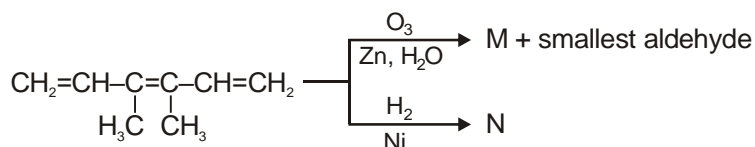
10. Phenol can be distinguished from ethanol by  
 (A) Cerric ammonium nitrate (B) Neutral  $\text{FeCl}_3$   
 (C)  $\text{Br}_2, \text{H}_2\text{O}$  (D) Blue litmus

11. If sodium fusion extract of halogen is acidified with nitric acid followed by addition of  $\text{AgNO}_3$ . Find out the correct statements  
 (A) A white precipitate soluble in ammonium hydroxide confirm the presence of chloride ion.  
 (B) A yellow precipitate partially soluble in ammonium hydroxide confirm the presence of bromide ion.  
 (C) A yellow precipitate insoluble in ammonium hydroxide confirm the presence of iodine ion.  
 (D) This sodium fusion extract of halogen is first boiled with conc.  $\text{HNO}_3$  to decompose cyanide or sulphide ions formed during Lassaigne's test that interfere with  $\text{AgNO}_3$  test for halogens.



## PART - IV : COMPREHENSION

### Comprehension # 1



1. Product M cannot respond with :
 

(A) 2,4-DNP	(B) Ammonical silver nitrate
(C) Sodium hypoiodite	(D) Sodium bicarbonate
2. Number of moles of ozone used for one mole of the given unsaturated hydrocarbon is ?
 

(A) 1	(B) 2	(C) 3	(D) 4
-------	-------	-------	-------
3. How many total monochloro structural isomers obtained on chlorination of product (N) ?
 

(A) 2	(B) 4	(C) 6	(D) 8
-------	-------	-------	-------

### Comprehension # 2

Answer Q.4, Q.5 and Q.6 by appropriately matching the information given in the three columns of the following table.

Different reagents are used for the identification of different functional groups. eg. (i) Tollens reagent is used for the identification of -CHO. (ii) Ceric ammonium nitrate (CAN) is used for alcohol.		
Column-1	Column-2	Column-3
(I) Benzaldehyde	(i) I <sub>2</sub> + NaOH (aq.)	(P) Yellow crystals is formed
(II) Butan-1-ol	(ii) AgNO <sub>3</sub> (aq.) + NH <sub>4</sub> OH	(Q) White ppt is formed
(III) Formic acid	(iii) anhy. ZnCl <sub>2</sub> + conc. HCl	(R) Silver mirror is formed
(IV) Acetophenone	(iv) (NH <sub>4</sub> ) <sub>2</sub> [Ce(NO <sub>3</sub> ) <sub>6</sub> ]	(S) Wine red colouration

4. The only correct combination in which the reaction does not proceed through redox mechanism.
 

(A) (I), (ii), (R)	(B) (IV), (i), (P)	(C) (II), (iv), (S)	(D) (III), (ii), (R)
--------------------	--------------------	---------------------	----------------------
5. For the formation of two different organic compounds the only correct combination is :
 

(A) (I), (ii), (R)	(B) (IV), (i), (P)	(C) (II), (iii), (Q)	(D) (IV), (ii), (R)
--------------------	--------------------	----------------------	---------------------
6. For the formation of silver mirror the only correct combination is :
 

(A) (IV), (ii), (R)	(B) (II), (ii), (R)	(C) (III), (i), (R)	(D) (I), (ii), (R)
---------------------	---------------------	---------------------	--------------------

## Exercise-3

\* Marked Questions may have more than one correct option.

## PART - I : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

1. Identify a reagent from the following list which can easily distinguish between 1-butyne and 2-butyne?
 

(A) bromine, CCl <sub>4</sub>	(B) H <sub>2</sub> , Lindlar catalyst [IIT-JEE-2002(S), 3/90]
(C) dilute H <sub>2</sub> SO <sub>4</sub> , HgSO <sub>4</sub>	(D) ammonical Cu <sub>2</sub> Cl <sub>2</sub> solution





2. Four isomeric para-disubstituted aromatic compounds A to D with molecular formula  $C_8H_8O_2$  were given for identification. Based on the following observations, give structures of the compounds.

[JEE 2002(M), 5/60]

- (i) Both A and B form a silver mirror with Tollen's reagent; also B gives a positive test with  $FeCl_3$  solution.  
 (ii) C gives positive iodoform test.  
 (iii) D is readily extracted in aqueous  $NaHCO_3$  solution.

3. In conversion of 2-butanone to propanoic acid which reagent is used? [JEE 2005, 3/84]  
 (A)  $NaOH, NaI / H^+$  (B) Fehling solution (C)  $NaOH, I_2 / H^+$  (D) Tollen's reagent

## PART - II : JEE (MAIN) / AIEEE ONLINE PROBLEMS (PREVIOUS YEARS)

1. In the Victor-Meyer's test, the colour given by  $1^\circ$ ,  $2^\circ$  and  $3^\circ$  alcohols are respectively:

[JEE(Main) 2014 (20-04-14), 4/120]

- (1) Red, colourless, blue (2) Red, blue, colourless  
 (3) Colourless, red, blue, (4) Red, blue, violet

2. Match the organic compounds in column-I with the Lassaigne's test results in column-II appropriately :

[JEE(Main) 2015 (11-04-15), 4/120]

	Column-I		Column-II
(A)	Aniline	(i)	Red colour with $FeCl_3$
(B)	Benzene sulfonic acid	(ii)	Violet colour with sodium nitroprusside
(C)	Thiourea	(iii)	Blue colour with hot and acidic solution of $FeSO_4$

- (1) A - (ii); (B) - (iii) ; (C) - (i) (2) A - (iii); (B) - (i) ; (C) - (ii)  
 (3) A - (iii); (B) - (ii) ; (C) - (i) (4) A - (ii); (B) - (i) ; (C) - (iii)

3. The test to distinguish primary, secondary and tertiary amine is: [JEE(Main) 2016 (09-04-16), 4/120]

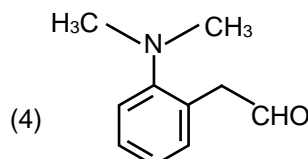
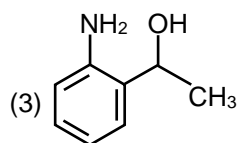
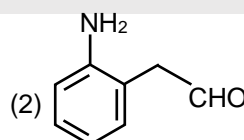
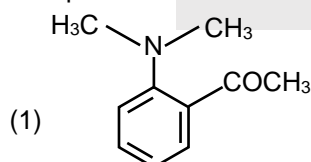
- (1) Mustard oil test (2)  $C_6H_5SO_2Cl$   
 (3) Sandmeyer's reaction (4) Carbylamine reaction

4. The tests performed on compound X and their inferences are :

Test	Inference
(a) 2,4-DNP test	Coloured
(b) Iodoform test	yellow precipitate
(c) Azo-dye test	No dye formation

Compound 'X' is :

[JEE(Main) 2019 (09-01-19), 4/120]



5. Hinsberg's reagent is :

[JEE(Main) 2019 (09-04-19)S2, 4/120]

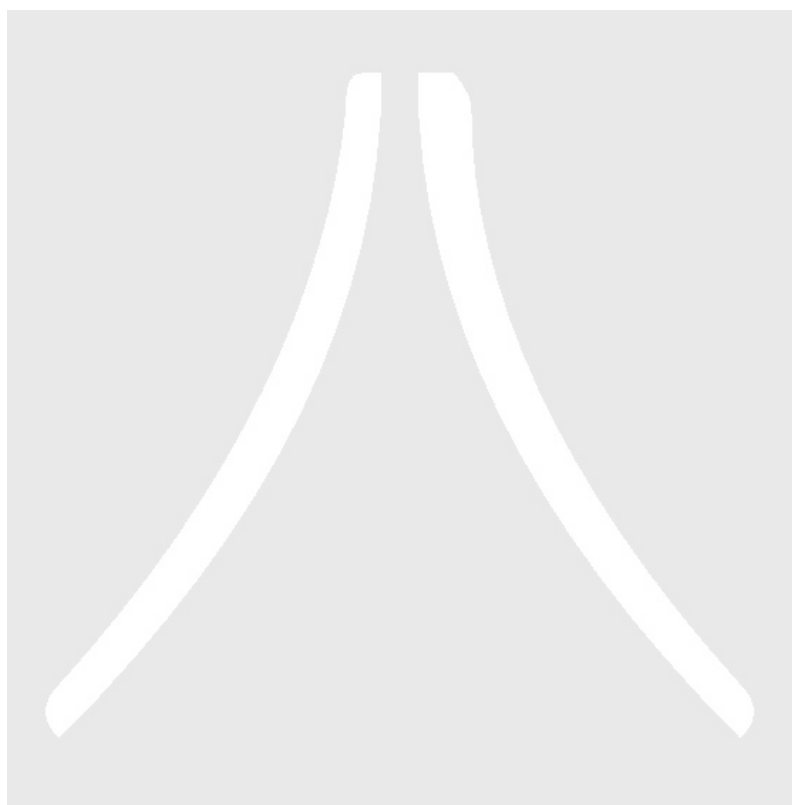
- (1)  $SOCl_2$  (2)  $C_6H_5COCl$  (3)  $(COCl)_2$  (4)  $C_6H_5SO_2Cl$



6. An organic compound 'A' is oxidized with  $\text{Na}_2\text{O}_2$  followed by boiling with  $\text{HNO}_3$ . The resultant solution is then treated with ammonium molybdate to yield a yellow precipitate. Based on above observation, the element present in the given compound is **[JEE(Main) 2019 (12-04-19)S1, 4/120]**  
(1) Fluorine                      (2) Sulphur                      (3) Nitrogen                      (4) Phosphorus

7. Kjeldahl's method cannot be used to estimate nitrogen for which of the following compounds? **[JEE(Main) 2020 (08-01-20)S2, 4/120]**

- (1)  $\text{C}_6\text{H}_5\text{NO}_2$                       (2)  $\text{NH}_2 - \overset{\text{O}}{\parallel} \text{C} - \text{NH}_2$                       (3)  $\text{CH}_3\text{CH}_2 - \text{C}\equiv\text{N}$                       (4)  $\text{C}_6\text{H}_5\text{NH}_2$





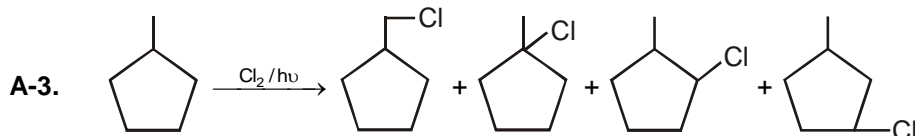
# Answers

## EXERCISE # 1

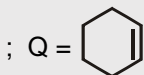
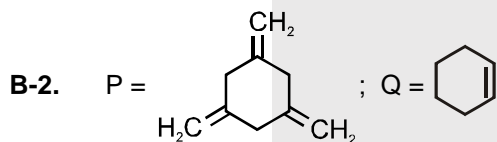
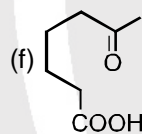
### PART - I

A-1. 3

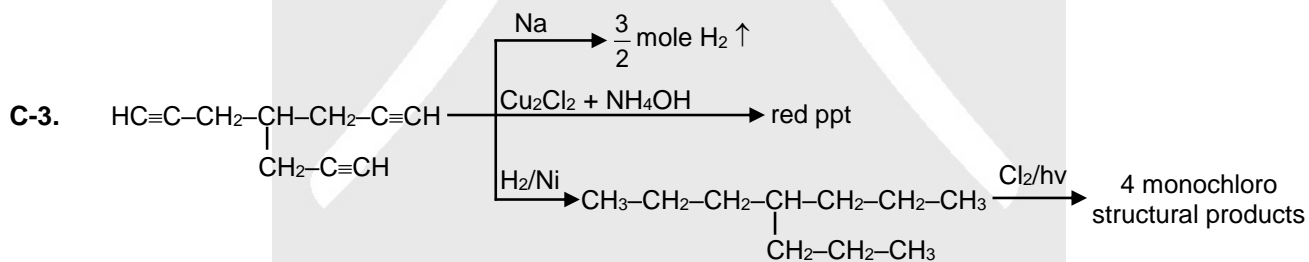
A-2. 3



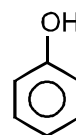
A-4. (i) 6 (ii) 4



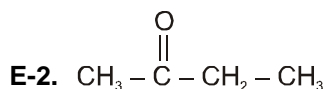
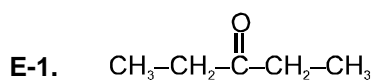
C-1. 2

D-1. Lucas reagent ( $\text{HCl}/\text{ZnCl}_2$ ) or Neutral  $\text{FeCl}_3$ 

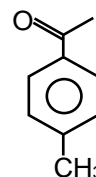
D-2.



D-3. 6



E-3.



gives iodoform test :

F-1. Salicylic acid, Phthalic acid, Cinnamic acid, Lactic acid, acetic acid and benzene sulphonic acid.



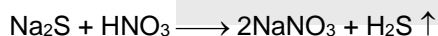
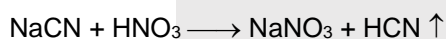
- F-2.** A is  $\text{CH}_3\text{CH}_2\text{COOH}$  (Propanoic acid)  
B is  $\text{CH}_3\text{COOCH}_3$  (Methyl ethanoate) or Ethyl methanoate ( $\text{HCOOC}_2\text{H}_5$ )
- G-1.**  $\text{CH}_3\text{CH}_2\text{NHCH}_2\text{CH}_3$
- G-2.** Hinsberg's reagent ( $\text{PhSO}_2\text{Cl}$ ) is generally used to separate the mixture of amines.  
**1° Amine :**  $\text{R-NH}_2 + \text{PhSO}_2\text{Cl} \xrightarrow{\text{Pyridine}} \text{R-NH-SO}_2\text{-Ph} \xrightarrow{\text{Base}} \text{Compound is soluble in base.}$   
**2° Amine :**  $\text{R}_2\text{NH} + \text{PhSO}_2\text{Cl} \xrightarrow{\text{Pyridine}} \text{R}_2\text{N-SO}_2\text{-Ph} \xrightarrow{\text{Base}} \text{Compound is insoluble in base.}$   
**3° Amine :**  $\text{R}_3\text{N} + \text{PhSO}_2\text{Cl} \xrightarrow{\text{Pyridine}} \text{No reaction.}$
- H-1.** Prussian blue colour of  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$  will appear.
- H-2.** As the elements present in the organic compounds are in their covalent form, these are fused with sodium metal to convert them into ionic form (like  $\text{NaCN}$ ,  $\text{Na}_2\text{S}$ ,  $\text{NaX}$ ).
- H-3.** Appearance of blood-red coloration with  $\text{FeCl}_3$  indicates the presence of both sulphur and nitrogen.
- H-4.** The Beilstein test does not detect fluorine/fluorides.
- H-5.** When nitrogen and sulphur both are present in an organic compound. sodium thiocyanates is formed which gives red colouration with  $\text{FeCl}_3$ .
- I-1.** **Duma's method** → A known mass of organic compound is heated with excess of  $\text{CuO}$  in an atmosphere of  $\text{CO}_2$ , when nitrogen of organic compound is converted into  $\text{N}_2$  gas. The volume of  $\text{N}_2$  thus obtained is taken into NTP.

$$\% \text{N} = \frac{28}{22400} \times \frac{\text{vol. of } \text{N}_2 \text{ at NTP}}{\text{mass of substance}} \times 100$$

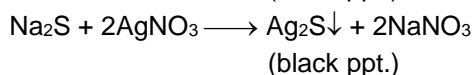
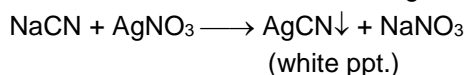
**Kjeldahl's method** → A known mass of the organic compound is heated with concentrated sulphuric acid. The nitrogen in the organic compound is quantitatively converted into ammonium sulphate. The resulting liquid is then distilled with excess of sodium hydroxide solution and the ammonia evolved is passed into a known but excess volume of the standard acid ( $\text{HCl}$  or  $\text{H}_2\text{SO}_4$ ). The acid left unused is estimated by titration with some standard alkali. The amount of acid used against ammonia can thus, be known and from this, the percentage of nitrogen in the compound can be calculated.

$$\% \text{N} = \frac{1.4 \times M_{(\text{acid})} \times \text{basicity of acid} \times V_{(\text{acid used})}}{W_{\text{Substance}}}$$

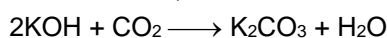
- I-2.** Sodium extract is boiled with nitric acid to decompose  $\text{NaCN}$  and  $\text{Na}_2\text{S}$  if present, in gaseous product.



Otherwise these ions react with  $\text{AgNO}_3$  and interfere in the test as given –



- I-3.**  $\text{CO}_2$  is acidic in nature, therefore it reacts with the strong base  $\text{KOH}$  to form  $\text{K}_2\text{CO}_3$ .

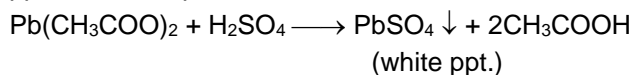


The increase in the mass of U-tube containing  $\text{KOH}$  then gives the mass of  $\text{CO}_2$  produced.

$$\% \text{C} = \frac{12}{44} \times \frac{\text{mass of } \text{CO}_2 \text{ formed}}{\text{mass of substance taken}} \times 100$$



- I-4. For testing sulphur, the sodium extract is acidified with acetic acid because lead acetate is soluble and does not interfere with the test. If  $\text{H}_2\text{SO}_4$  is used, lead acetate itself will react with  $\text{H}_2\text{SO}_4$  to form white ppt. of lead sulphate, which will interfere with test.



- I-5. CuO

### PART - II

- |          |          |          |           |          |
|----------|----------|----------|-----------|----------|
| A-1. (D) | A-2. (C) | A-3. (D) | A-4. (D)  | A-5. (D) |
| A-6. (B) | A-7. (D) | A-8. (B) | B-1. (B)  | B-2. (B) |
| B-3. (B) | B-4. (C) | C-1. (D) | C-2. (C)  | C-3. (A) |
| C-4. (C) | C-5. (B) | C-6. (A) | C-7. (B)  | C-8. (B) |
| D-1. (A) | D-2. (B) | D-3. (B) | D-4. (C)  | D-5. (B) |
| D-6. (D) | E-1. (C) | E-2. (C) | E-3. (D)  | E-4. (B) |
| F-1. (C) | F-2. (D) | F-3. (A) | F-4. (A)  | F-5. (C) |
| G-1. (A) | G-2. (B) | G-3. (D) | G-4. (C)  | H-1. (B) |
| H-2. (C) | H-3. (B) | H-4. (C) | H-5. (C)  | I-1. (B) |
| I-2. (C) | I-3. (A) | I-4. (C) | I-5. (C)  | I-6. (D) |
| I-7. (C) | I-8. (D) | I-9. (D) | I-10. (C) |          |

### PART - III

- |  |  |
|--|--|
| 1. (A – q); (B – s); (C – p); (D – r)        | 2. (A – p,q,t) ; (B – s) ; (C – r,t) ; (D – q,r,s) |
| 3. (A) - PQR; (B) - PQS; (C) - PQR; (D) - PS | 4. (A) - PQRS; (B) - QRS; (C) - PQS; (D) – Q       |

## EXERCISE # 2

### PART - I

- |        |        |        |        |         |
|--------|--------|--------|--------|---------|
| 1. (C) | 2. (D) | 3. (C) | 4. (D) | 5. (D)  |
| 6. (B) | 7. (D) | 8. (D) | 9. (B) | 10. (B) |

### PART - II

- |                            |          |                        |       |          |
|----------------------------|----------|------------------------|-------|----------|
| 1. 3                       | 2. 3     | 3. 5                   | 4. 4  | 5. 4     |
| 6. 5                       | 7. 7     | 8. No. of active H = 2 |       | 9. 46.67 |
| 10. 50                     | 11. 42.1 | 12. 4                  | 13. 6 |          |
| 14. 68.85 % C and 4.92 % H |          |                        |       |          |



## PART - III

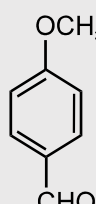
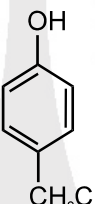
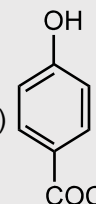
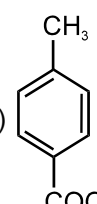
- |            |          |           |         |            |
|------------|----------|-----------|---------|------------|
| 1. (ABC)   | 2. (ABC) | 3. (ACD)  | 4. (AC) | 5. (B)     |
| 6. (AD)    | 7. (ABC) | 8. (ABCD) | 9. (A)  | 10. (ABCD) |
| 11. (ABCD) |          |           |         |            |

## PART - IV

- |        |        |        |        |        |
|--------|--------|--------|--------|--------|
| 1. (D) | 2. (C) | 3. (B) | 4. (C) | 5. (B) |
| 6. (D) |        |        |        |        |

## EXERCISE # 3

## PART - I

- |        |  |  |   |  |
|--------|--|--|---|--|
| 1. (D) | 2. (A)   | (B)  | (C)   | (D)  |
|        |  |  |  |  |

3. (C)

## PART - II

- |        |        |        |        |        |
|--------|--------|--------|--------|--------|
| 1. (2) | 2. (3) | 3. (2) | 4. (1) | 5. (4) |
| 6. (4) | 7. (1) |        |        |        |