CHEMISTRY – JEE ADVANCED PAPER – 2 (2019)

SECTION – 1

1. With reference to aqua regia, choose the correct option(s):

   (a) Aqua regia is prepared by mixing conc. HCl and conc. HNO_3 in 3: 1 molar ratio.

   (b) Reaction of gold with aqua regia produces an anion having Au in +3 oxidation state.

   (c) Reaction of gold with aqua regia produces NO_2 in the absence of air

   (d) The yellow colour of aqua regia is due to the presence of NOCl & Cl_2.

Solution::

A, B, D

$$Au + HNO_3 + 4HCl[AuCl_4]^- + [NO] + H_3O^+ + H_2O$$

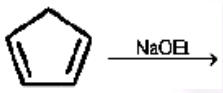
a) Aqua regia is HCl & HNO_3 (conc.) in a 3 : 1

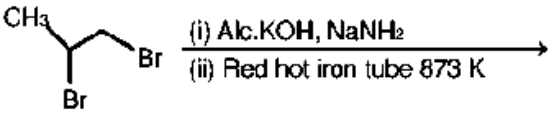
b) Oxidation state of Au in $[AuCl_4]^-$ is +3.

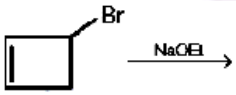
c) NOCl/NO is formed

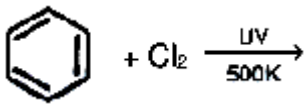
d) NOCl is yellow in colour

2. Choose the correct option that gives aromatic compound as major product:

(a) 

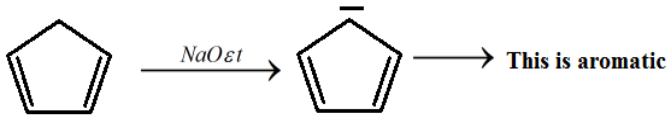
(b) 

(c) 

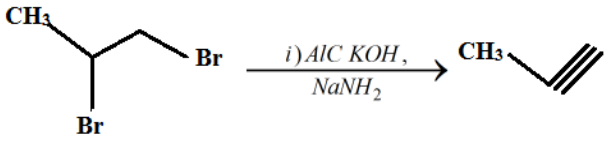
(d) 

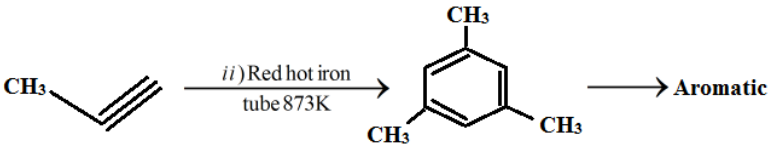
Solution::

A, B

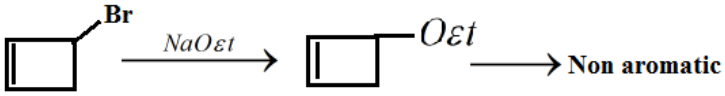
(a) 

(b)



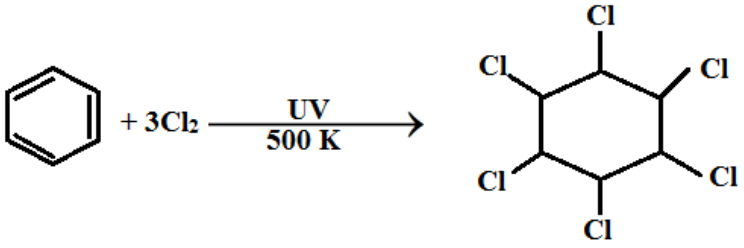


(c)



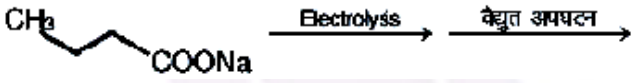
This will not give  as it is anti aromatic.

(d)

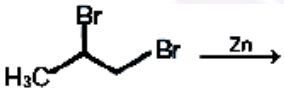


3. Which of the following reaction produce propane as major product?

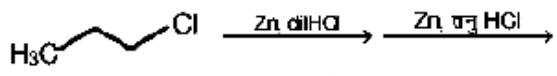
(a)



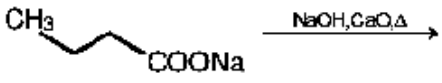
(b)



(c)



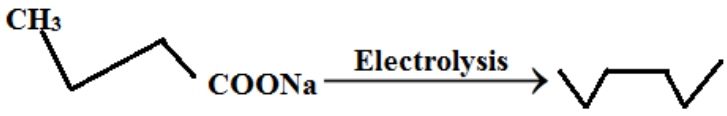
(d)

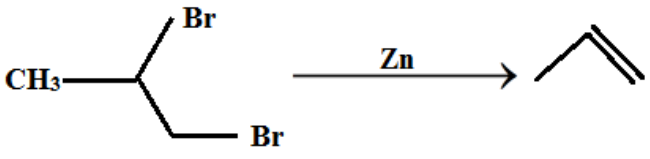


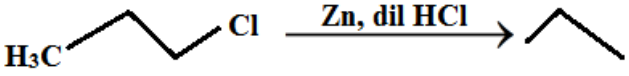
Solution:

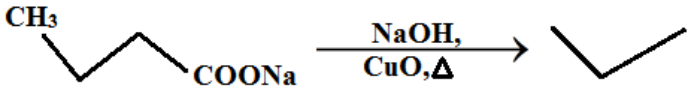
(C, D)

(A)



(B) 

(C) 

(D) 

4. Which of the following is/are correct

(a) Teflon is formed by polymerization of tetrafluoroethene.

(b) Natural rubber is the trans from of polyisoprene.

(c) Cellulose contains only α-D-glucose linkage

(d) Nylon-6 contains amide linkage.

Solution:

(A, D)

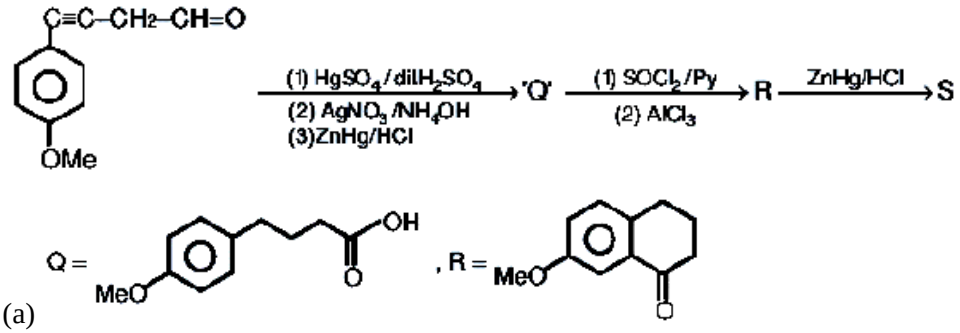
A) Fact.

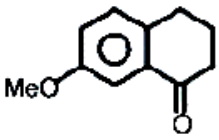
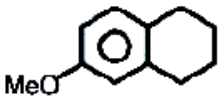
B) Natural rubber is Cis form of polyisoprene

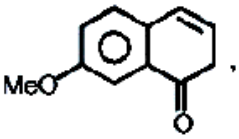
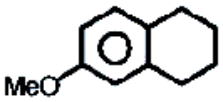
C) Cellulose contains B – 1, 4 – glycosidic linkage

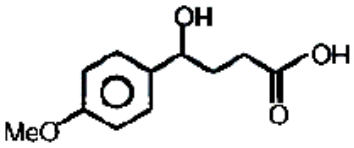
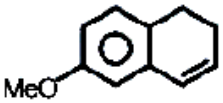
D) Nylon 6 contains amide linkage.

5.

(a) 

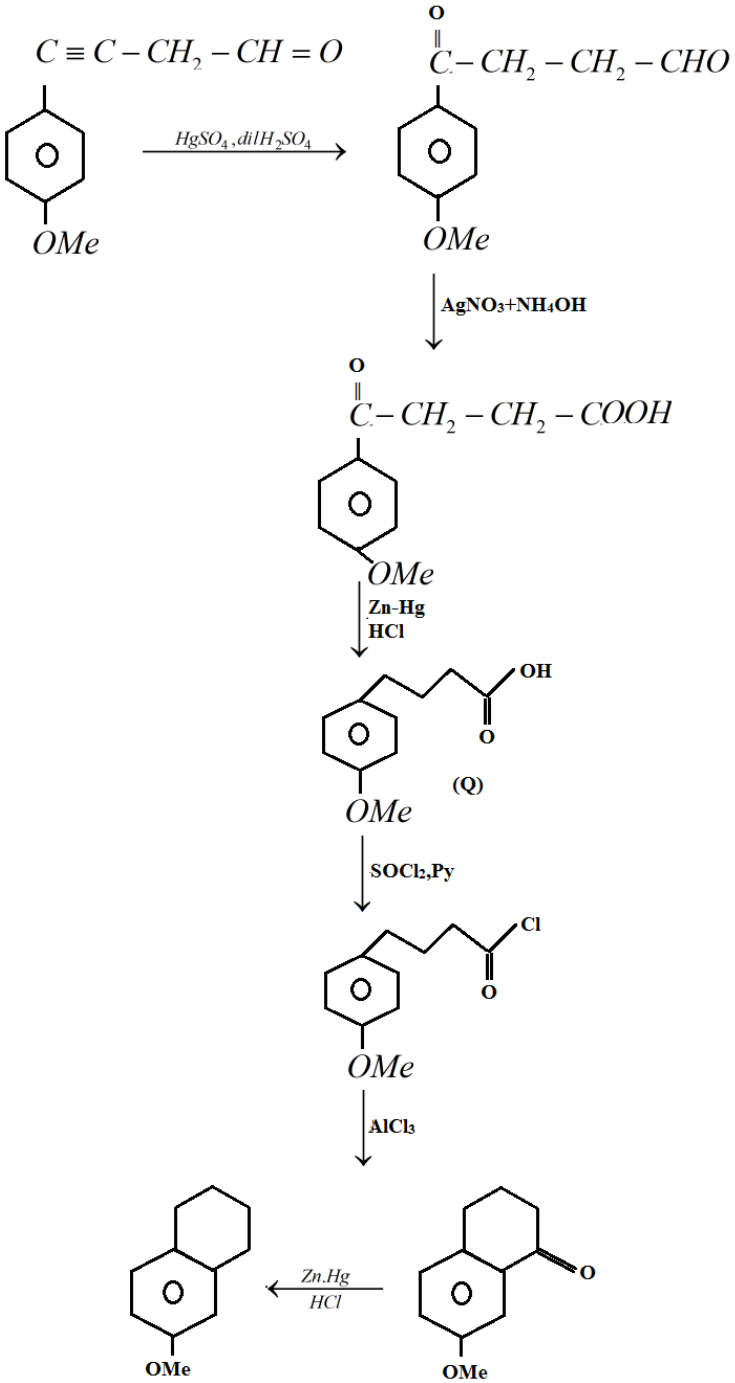
(b) R =  , S = 

(c) R =  , S = 

(d) Q =  , S = 

Solution:

(A, B)



6. Consider the following reaction (unbalanced)

Zn + Hot conc. $H_2SO_4 \rightarrow G + R + X$

Zn + conc. $NaOH \rightarrow T + Q$

$G + H_2S + NH_3\,(aq) \rightarrow Z$ (precipitate) + X + Y

Choose the correct option(s)

(a) R is a V-shaped molecule

(b) Z is dirty white in colour

(c) Bond order of Q is 1 in its ground state (d) The oxidation state of Zn in T is +1.

Solution:

A, B, C

$$\underset{}{Zn} + \underset{(conc)}{H_2SO_4} \rightarrow \underset{G}{ZnSO_4} + \underset{R}{SO_2} + \underset{X}{H_2O}$$

$$Zn + conc.NaOH \rightarrow \underset{T}{Na_2ZnO_2} + \underset{Q}{H_2}$$

$$\underset{G}{ZnSO_4} + H_2S + NH_{3(aq)} \rightarrow \underset{(Z)}{ZnS} \downarrow + \underset{(Y)}{(NH_4)_2SO_4} + \underset{(X)}{H_2O}$$

A) SO_2 is v shaped.

B) ZnS is dirty white in colour.

C) Bond order of H_2 is 1.

D) Oxidation state of Zn in Na_2ZnO_2 is +2.

7. In the Mac. Arthur process of extraction

$$Au \xrightarrow{NaCN+Q} R \xrightarrow[with\ Y]{extracted} Z$$

(a) R is $[Au(CN_4)]^{(-)}$ (b) Z is $[Zn(CN)_4]^{2-}$ (c) Q is O_2 (d) Y is Zn

Solution:

B, C, D (from text book).

8. For He^+ the electron is in orbit with energy equal to 3.4eV. The azimuthal quantum number for that orbit is 2 and magnetic quantum number is 0. Then which of the following is/are correct.
   (a) The subshell is 4d.
   (b) The number of angular nodes in it is 2.
   (c) The numbers of radial nodes in it is 3.
   (d) The nuclear charge experienced in n = 4 is 2e less than that in n = 1, where e is electric charge.

Solution::

A, B

$$E = E_0 \frac{z^2}{n^2}$$

$$3.4 = 13.6 \times \frac{4}{n^2}$$

n = 4

l = 2

a) Subshell is 4 d

b) Number of angular nodes is 2

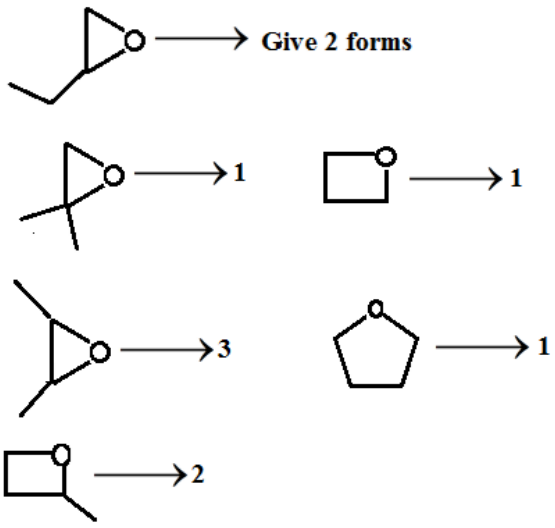
c) Number of radial nodes is 1.

d) Nuclear charge would be the same.

SECTION – 2

9. Calculate the total number of cyclic ether (including stereo) having formula C_4H_8O

Solution:



Total 10

10. 1 mole of Rhombic sulphur is treated with conc. HNO_3. Find the mass of H_2O formed.

Solution:

$$S_8 + HNO_3 \rightarrow H_2SO_4 + NO_2 + H_2O$$

Balancing

$$S_8 + 48HNO_3 \rightarrow 8H_2SO_4 + 48NO_2 + 16H_2O$$

∴ Mass of H_2O = 288

11. Mole fraction of urea in 900 gram water is 0.05. Density of Solution is 1.2 g/cm^3. Find molarity of Solution.

Solution:

No of moles of H_2O $= \frac{900}{18} = 50$

$\therefore \frac{n_1}{n_1 + 50} = 0.05$ (n_1 is No. of moles of urea)

$\Rightarrow n_1 = 2.63$

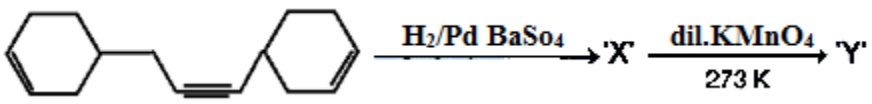
Weight of urea = 2.63 × 60 = 157.8 g

Total weight = 157.8 + 900 = 1057.8g

$$\therefore Volume = \frac{1057.8}{1.2} = 881.5\, cm^3$$

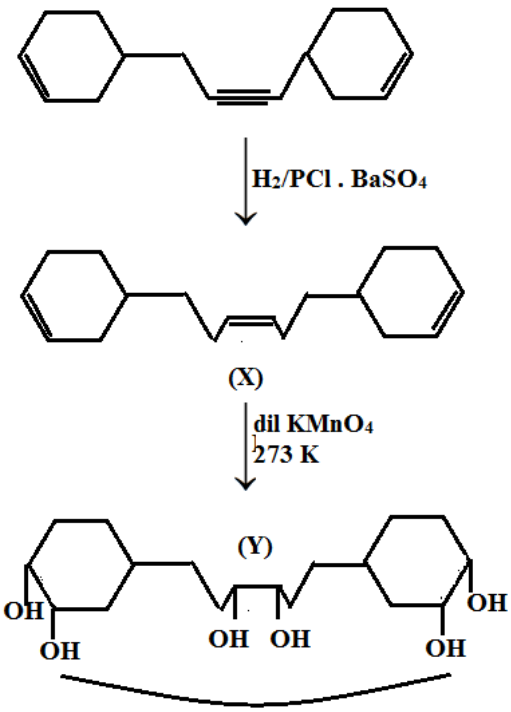
$$\therefore Molarity = \frac{2.63}{0.8} = 2.99$$

12. Number of hydroxyl group in compound 'Y' is:



Solution:

(6)



Total 6 – OH groups.

13. In following reaction the value of K is 5×10^{-4} S^{-1}.

$$2N_2O_5 \xrightarrow{\Delta} 2N_2O_4 + O_2$$

Initial pressure was 1 atm, while the final pressure was 1.45 atm at time $y \times 10^3$ sec calculate 'y'.

Solution::

From unit of K reaction is first order.

$$2N_2O_5 \xrightarrow{\Delta} 2N_2O_4 + O_2$$

t = 0	1	0	0
t = t	1 – P	P	P/2
t = ∞	0	1	0.5

P_0 = 1 atm, P_t = 1.45 atm, P_∞ = 1.5 atm

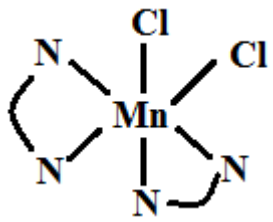
$$t = \frac{1}{2K} \ln \left(\frac{P_\infty - P_0}{P_\infty - P_1} \right)$$

$$= 2.3 \times 10^3$$

$$\Rightarrow y = 2.3$$

14. Number of N-Mn-Cl bonds [N-Mn bonds is cis to Mn-Cl bond] in cis $[Mn(en)_2Cl_2]$ are …….

Solution:



→ This is the Cis form of $[Mn(en)_2Cl_2]$

∴ No of N – Mn – Cl bonds = 6

SECTION – 3

Match the column

	List 1		List 2
P	Radius	I	$l \propto n^{-1}$
Q	Angular momentum	II	$II \propto n^{-2}$
R	Kinetic energy	III	$III \propto n^{-0}$
S	Potential energy	IV	$IV \propto n^{1}$
			$V \propto n^{2}$

15. Which of the following is correct

(a) P I (b) P II (c) P V (d) P III

Solution:

$$r_n = 0.529 \left(\frac{n^2}{Z} \right) A^\circ \Rightarrow r_n \propto n^2$$

(C)

16. Which of following is correct.

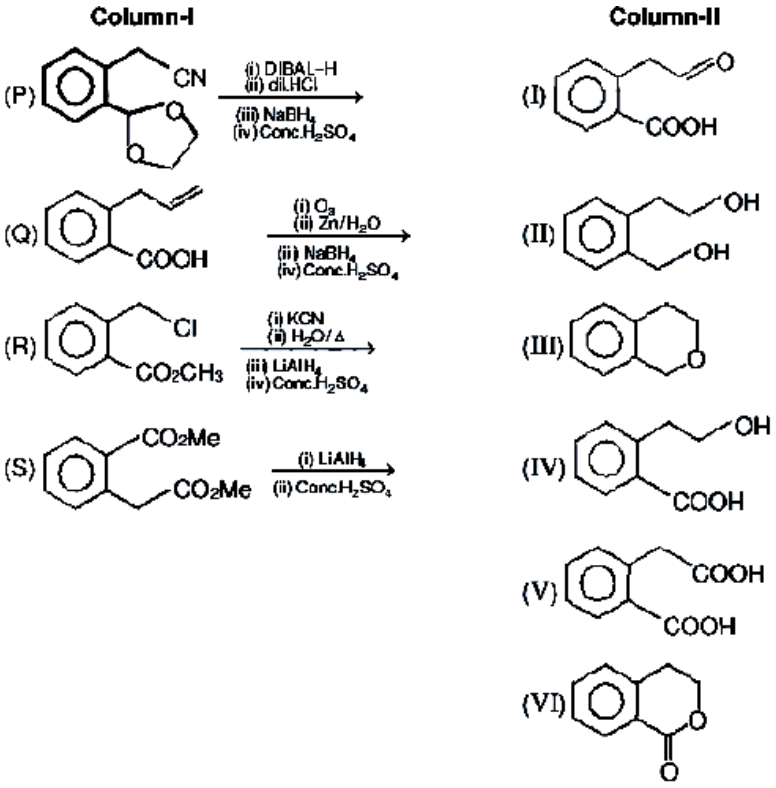
(a) S IV (b) R I (c) R II (d) S III

Solution:

$$K.E \propto \frac{Z^2}{n^2}$$

(C)

Answer the question no. 17 & 18 on the basis of information given in Column – I & Column – II. Match the reactant in column – I with the possible intermediates and products of Column – II.

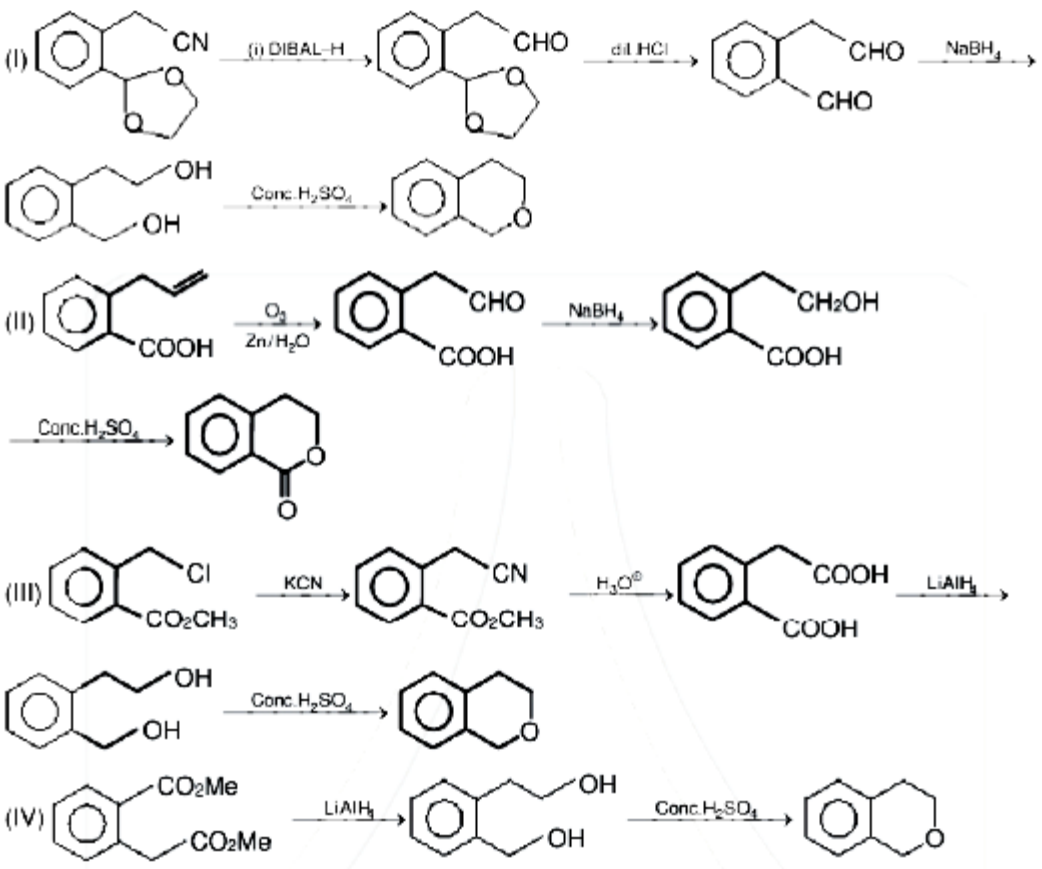


17. Which of the following is correct?

(a) P – II, III; S – II, III (b) P – II, IV; S – II, III (c) P – III, VI; S – II, III (d) P – I, III; S – IV, V

Solution::

(a)



18. Which of the following is correct?

(a) Q – I, IV, VI; R – II, III, V

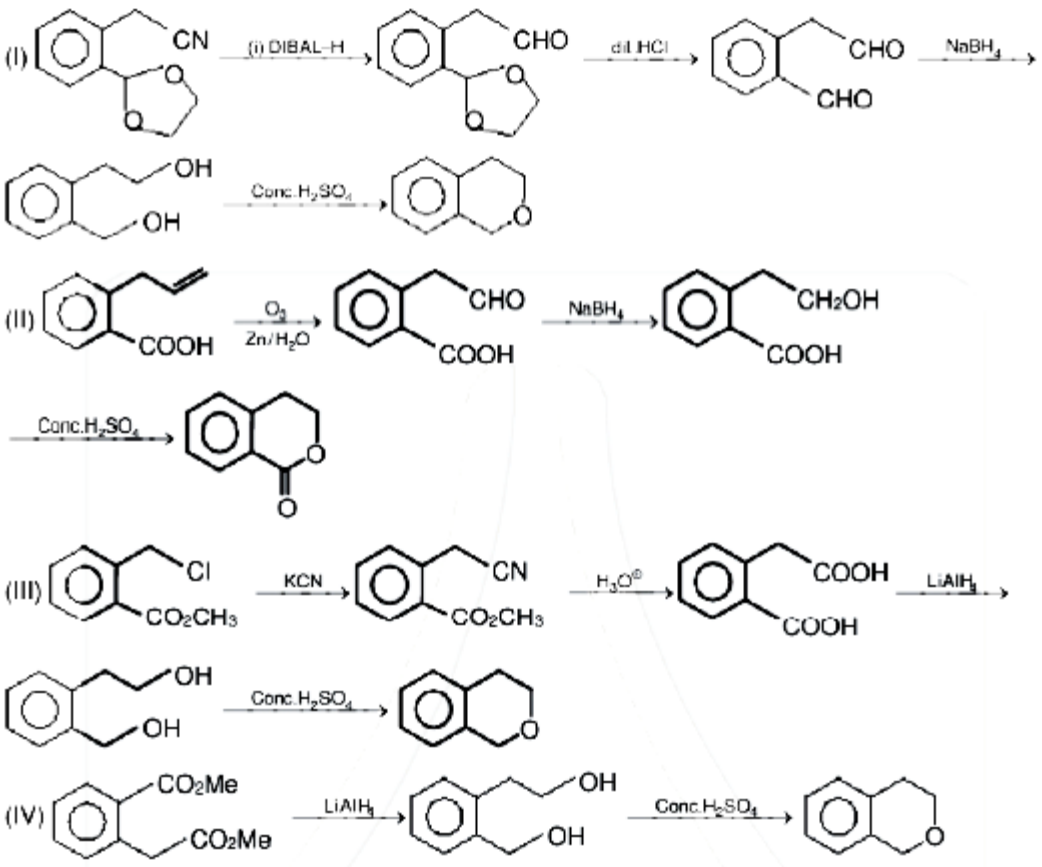
(b) Q – I, III, VI; R – II, IV, V

(c) Q – I, II, VI; R – II, III, VI

(d) Q – I, IV, V; R – III, I, V

Solution::

(a)


(I)
CN
(i) DIBAL–H
CHO
dil. HCl
CHO
CHO
NaBH4
OH
OH
Conc. H2SO4
(II)
COOH
O3
Zn/H2O
CHO
COOH
NaBH4
CH2OH
COOH
Conc.H2SO4
O
O
(III)
Cl
CO2CH3
KCN
CN
CO2CH3
H3O⊕
COOH
COOH
LiAlH4
OH
OH
Conc. H2SO4
O
(IV)
CO2Me
CO2Me
LiAlH4
OH
OH
Conc.H2SO4
O