

DO NOT OPEN THE SEAL UNTIL YOU ARE ASKED TO DO SO

2018

Test Booklet Series

A

**CHEMISTRY**

Time: 2 Hours

Full Marks:

Total Marks 100 (2 × 50)

Answer all questions

Paper consists of 20 pages. Each Multiple Choice Question (MCQ) is provided with four options (A), (B), (C) and (D) Identify the correct option / fill the corresponding circle (A)/(B)/(C)/(D) with Blue/Black Ballpoint OMR Answer Sheet.

Each question, 2 marks will be awarded for correct answer.

1. Haemoglobin contains 0.335% Fe. It has the molecular weight  $1.67 \times 10^4$  considering atomic weight of Fe is 56, calculate the number of Fe-atom(s) in haemoglobin.

(a) 1                      (B) 2                      (C) 3                      (D) 4

2. An organic compound containing C, H and N upon complete combustion of 0.93 gm produces 2.64 gm  $\text{CO}_2$  and 0.63 gm  $\text{H}_2\text{O}$  If molecular weights of the compound is 93 then find its molecular formula

(a)  $\text{C}_6\text{H}_7\text{N}$               (b)  $\text{C}_5\text{H}_5\text{N}_2$               (c)  $\text{C}_4\text{H}_3\text{N}_3$               (d)  $\text{C}_3\text{HN}_4$

3. Calculate the number of emitted photons in 1 sec from a 100 W yellow light source. Given  $\lambda_{\text{yellow}} = 560 \text{ nm}$ .

(a)  $8.46 \times 10^{20}$  (b)  $2.82 \times 10^{20}$  (c)  $0.94 \times 10^{20}$  (d)  $18.66 \times 10^{20}$

4. The value of orbital angular momentum of an electron in 2s-orbital will be

(a)  $\frac{h}{\pi}$  (b)  $\frac{h}{2\pi}$  (c) 0 (d)  $\frac{\sqrt{3}h}{4\pi}$

5. Increasing metallic character of the elements B, Al, Mg and K follows the trend

(a) B < Mg < Al < K (b) Mg < B < Al < K  
(c) Mg < Al < B < K (d) B < Al < Mg < K

6. Decreasing trend of polar character of the compounds HF, H<sub>2</sub>O, NH<sub>3</sub> and SO<sub>2</sub> will be

(A) HF > SO<sub>2</sub> > H<sub>2</sub>O > NH<sub>3</sub> (B) HF > H<sub>2</sub>O > SO<sub>2</sub> > NH<sub>3</sub>  
(C) HF > NH<sub>3</sub> > SO<sub>2</sub> > H<sub>2</sub>O (D) H<sub>2</sub>O > NH<sub>3</sub> > SO<sub>2</sub> > HF

7. At 100 °C temperature and 1 atm pressure, 1 gm-mole water undergoes vaporization. Calculate the change of internal energy of the process. Given, latent heat of vaporization water - 536cal/gm.

(a) 37.40 kJ (B) 40.50 kJ (c) 3.10 kJ (d) 43.60 kJ

8. Applying adiabatic process, 1 mole of an ideal gas at 350 K temperature is being compressed to  $\frac{1}{5}$ th of its original volume. Determine the final temperature of the gas.

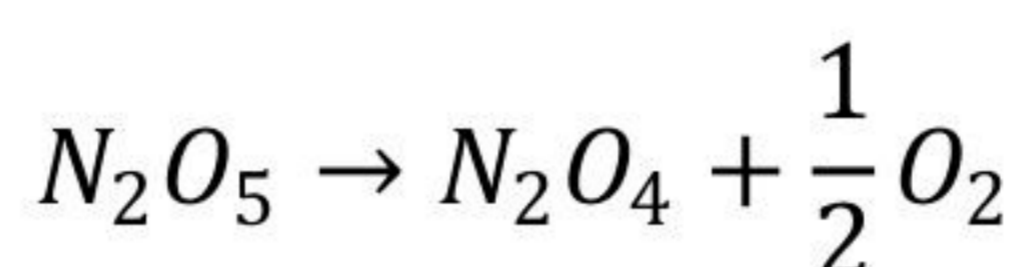
Given,  $C_y$  12.55 JK<sup>-1</sup> mol<sup>-1</sup>

(a) 1011.50 K (b) 738.50 K (c) 1284.50 K (d) 120.98 K

9. Half-life of a first order reaction is 30 min. State how much proportion of reactant will remain after 70 min.

- (a) 5.03                      (b) 0.023                      (c) 0.20                      (d) 0.80

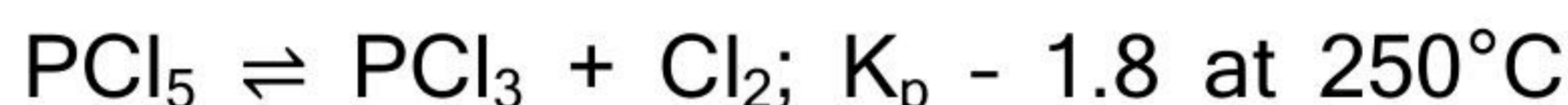
10. Consider the following reaction:



Rate constants of this dissociation reaction are  $3.46 \times 10^{-5}$  and  $4.87 \times 10^{-3}$  at  $25^\circ\text{C}$  and  $65^\circ\text{C}$  respectively. Determine the activation energy of the process. Given,  $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$ .

- (a)  $10.34 \text{ kJ mol}^{-1}$                       (b)  $1034.71 \text{ kJ mol}^{-1}$   
(c)  $48.17 \text{ kJ mol}^{-1}$                       (d)  $103.47 \text{ kJ mol}^{-1}$

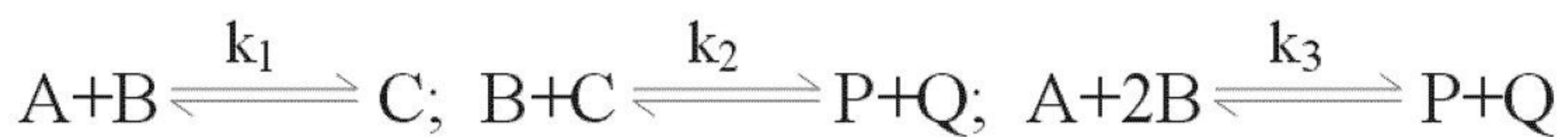
11. Consider the reaction



At what pressure 25%  $PCl_5$  will be dissociated at  $250^\circ\text{C}$ ?

- (a) 0.066 atm                      (b) 1.80 atm                      (c) 27.27 atm                      (d) 2.72 atm

12. Consider the following reversible reactions:



If  $K_1 = 2.5$  and  $K_2 = 0.3$ , then the value of  $K_3$  will be

- (a) 8.33                      (b) 0.12                      (c) 0.37                      (d) 0.75

13. If a 0.002 (M) acetic acid solution undergoes 2.3% ionization, then find the pH of that solution.

- (a) 3.34                      (b) 4.74                      (c) 2.69                      (d) 1.63

14. Solubility of  $\text{Pb}(\text{OH})_2$  in water at  $25^\circ\text{C}$  is  $6.7 \times 10^{-6}$  (M). Determine its solubility in a buffer solution having  $\text{pH} = 8$  at  $25^\circ\text{C}$ .

- (a)  $1.2 \times 10^{-15}$  (M)                      (b)  $1.2 \times 10^{-3}$  (M)  
(c)  $1.48 \times 10^{-5}$  (M)                      (d)  $1.0 \times 10^{-12}$  (M)

15. Atomic radius of an element is 75 pm. If the element forms bcc' lattice, then what will be the edge length of its unit cell?

- (a) 173.20 pm              (b) 212.76 pm    (c) 32.47 pm              (d) 259.81 pm

16. The values of a, b, c and d in the redox reaction  $a\text{I}_2 + b\text{NO} + 4\text{H}_2\text{O} \rightarrow c\text{HNO}_3 + d\text{HI}$  will be

- (a) 3, 2, 2, 6              (b) 3, 2, 6, 2    (c) 2, 3, 2, 6    (d) 2, 2, 3, 6

17. At  $15^\circ\text{C}$ , a urea solution having 1 gm urea/lit, shows osmotic pressure 304 mm. Calculate the molecular weight of urea.

- (a) 60                      (b) 3.075                      (c) 59.04                      (d) 5.90

18. 5% sucrose solution (mass-volume) in water is isotonic with 3% aqueous solution of substance A. Determine the molecular weight of A (given  $M_{\text{sucrose}} = 342$ ).

- (a) 570                      (b) 205.2                      (c) 20.52                      (d) 57

19. Consider the following half-cell:



At  $25^\circ\text{C}$ , the above cell has the reduction potential  $-0.3 \text{ V}$ ; state the pH of  $\text{H}_2\text{SO}_4$  in the half cell.

- (a) 5.08                      (b) 1.30                      (c) 4.70                      (d) 3.08

20. Which of the following electrolytes is most effective to coagulate  $\text{AgI}/\text{I}^-$  sol?

- (a)  $\text{NaNO}_3$                       (b)  $\text{Na}_2\text{SO}_4$                       (c)  $\text{Ca}(\text{NO}_3)_2$                       (d)  $\text{Al}_2(\text{SO}_4)_3$

21. Find the strength of 1.6 (N)  $\text{H}_2\text{O}_2$  solutions in volumetric expression.

- (a) 8.96 volume                      (b) 9.86 volume  
(c) 6.98 volume                      (d) 6.89 volume

22. An element X reacts with aqueous solution of  $\text{NaOH}$  to produce compound Y and  $\text{H}_2(\text{g})$ . Aqueous solution of Y upon heating at  $50^\circ\text{C}$ - $60^\circ\text{C}$  followed by passage of  $\text{CO}_2(\text{g})$  to it produces compound Z and  $\text{Na}_2\text{CO}_3$ . Compound z upon heating at  $1200^\circ\text{C}$  produces  $\text{Al}_2\text{O}_3$ , X, Y and Z will be

- (a)  $\text{Al}$ ,  $\text{AlCl}_3$ ,  $\text{NaAlO}_2$                       (b)  $\text{Zn}$ ,  $\text{Na}_2\text{ZnO}_2$ ,  $\text{Al}(\text{OH})_3$   
(c)  $\text{Al}$ ,  $\text{Al}(\text{OH})_3$ ,  $\text{AlCl}_3$                       (d)  $\text{Al}$ ,  $\text{NaAlO}_2$ ,  $\text{Al}(\text{OH})_3$

23. A compound X (crystalline white) reacts with water to produce alkaline solution. Upon heating it forms clean glass bead which again on heating with  $\text{CuSO}_4$  forms green bead Y. Compound X is soluble in  $\text{NaOH}$  but on reaction with conc.  $\text{H}_2\text{SO}_4$  produces acidic crystalline white compound Z. Hence X, Y and Z will be

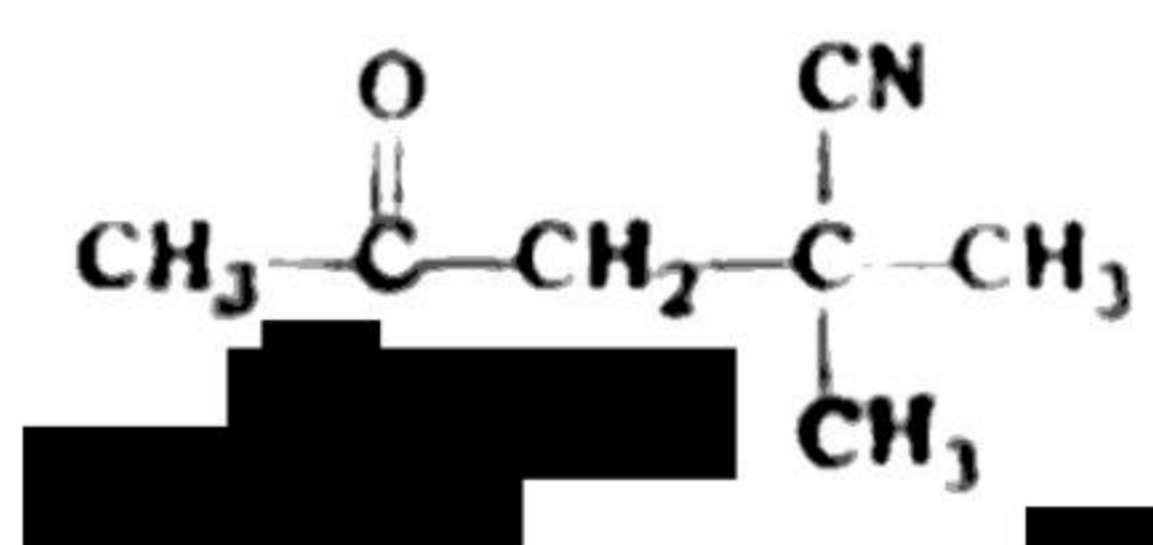
- (a)  $\text{Na}_2[\text{B}_4\text{O}_5(\text{OH})_4] \cdot 8\text{H}_2\text{O}$ ,  $\text{CuO}$ ,  $\text{B}_2\text{O}_3$ ,  $\text{H}_3\text{BO}_3$   
(b)  $\text{NaBO}_2$ ,  $\text{CuO}$ ,  $\text{Na}_2\text{B}_4\text{O}_7$   
(c)  $\text{Na}_2[\text{B}_4\text{O}_7(\text{OH})_8]$ ,  $\text{Cu}_2\text{BO}_2$ ,  $\text{Na}_2\text{SO}_4$   
(d)  $\text{H}_3\text{BO}_3$ ,  $\text{CuO}$ ,  $\text{BO}_2$ ,  $\text{NaB}(\text{SO}_4)_2$



31. 0.257 gm of an organic compound containing nitrogen is applied to Kjeldahl's analysis. Evolved ammonia (g) is being absorbed to 50 ml 0.1 (N)  $\text{H}_2\text{SO}_4$  solution. Excess  $\text{H}_2\text{SO}_4$  is being neutralized by 23.2 ml 0.1 (N)  $\text{NaOH}$  solution. Find the percentage nitrogen amount in the organic compound.

- (a) 14.6
- (b) 14.0
- (c) 1.46
- (d) 13.42

32. The IUPAC name of the compound



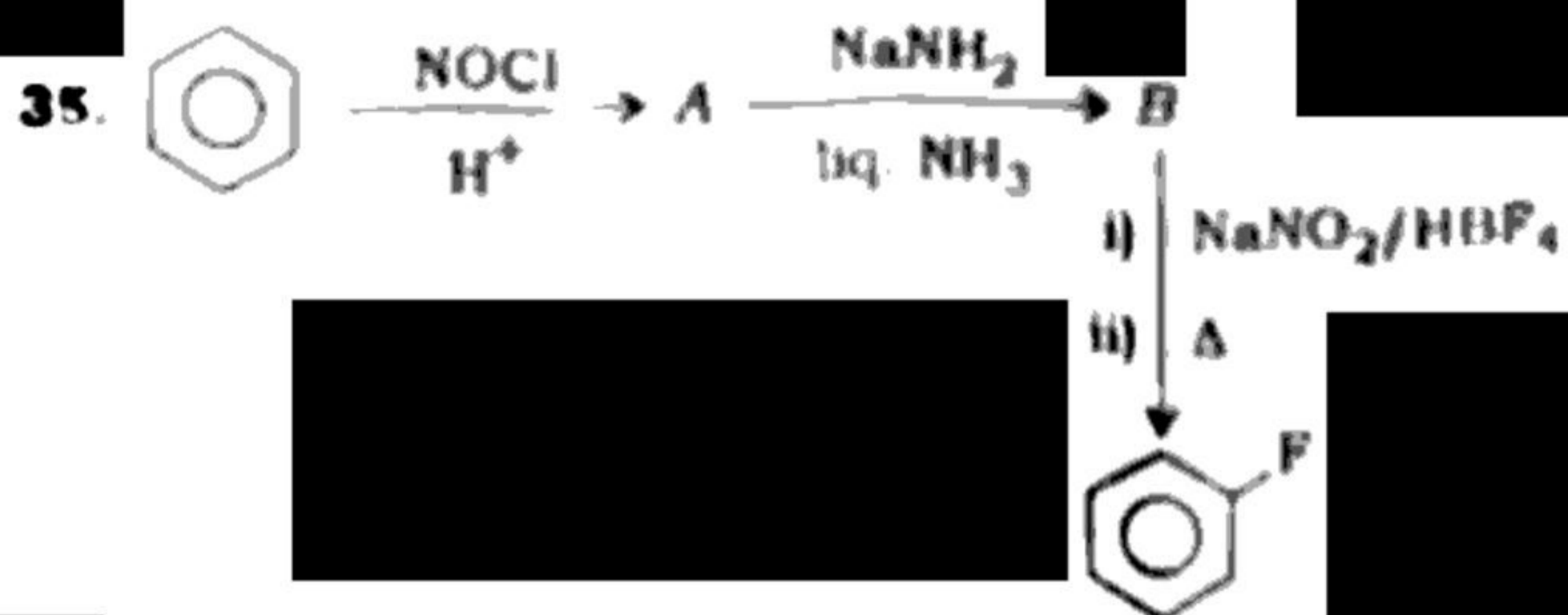
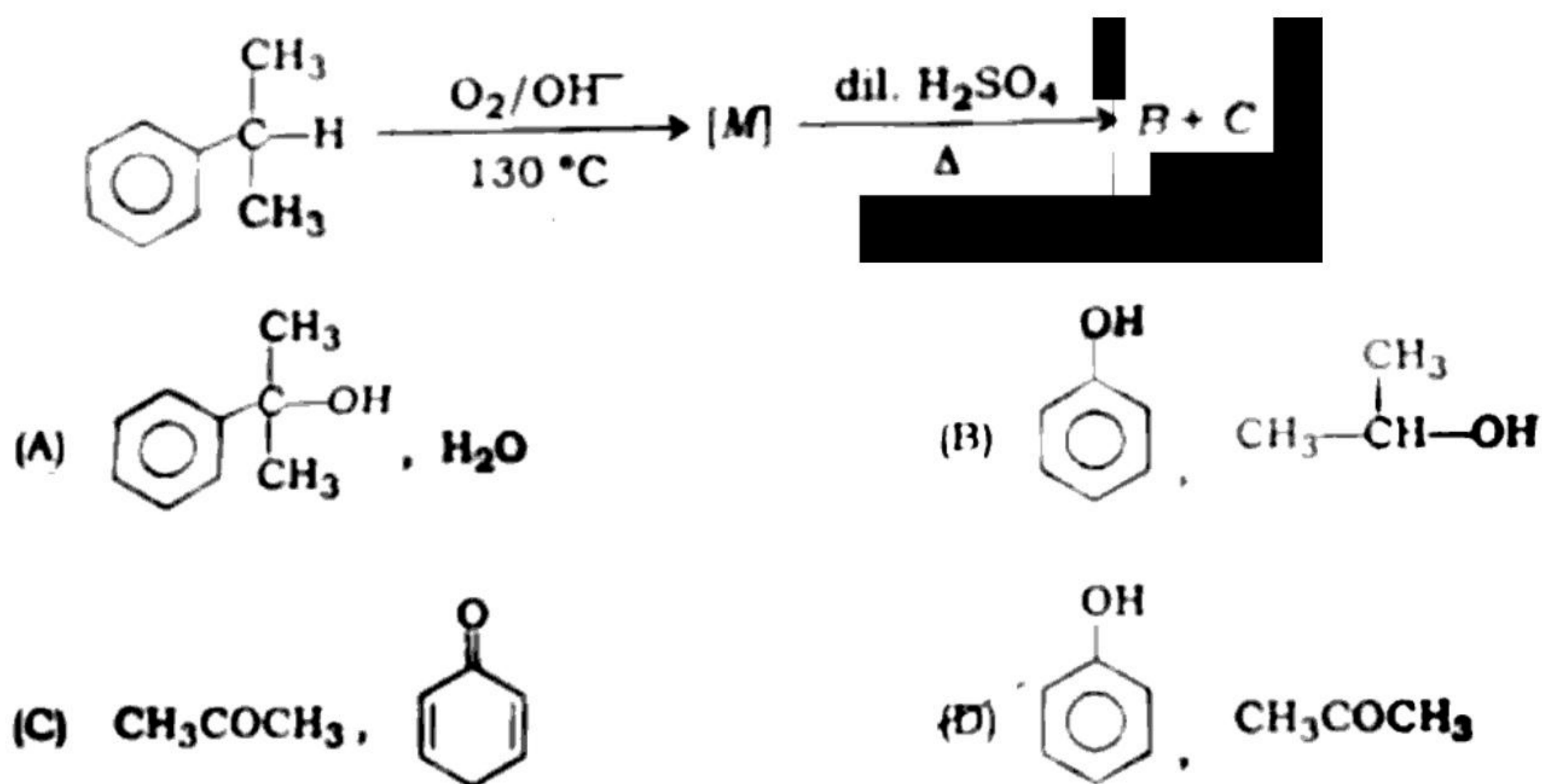
is

- (a) 4-cyano-4-methyl-2-oxopentane      (b) 2-cyano-2-methyl-4-oxopentane
- (c) 2,2-dimethyl-4-oxopentane nitrile      (D) 4-cyano-4-methyl-2-pentanone

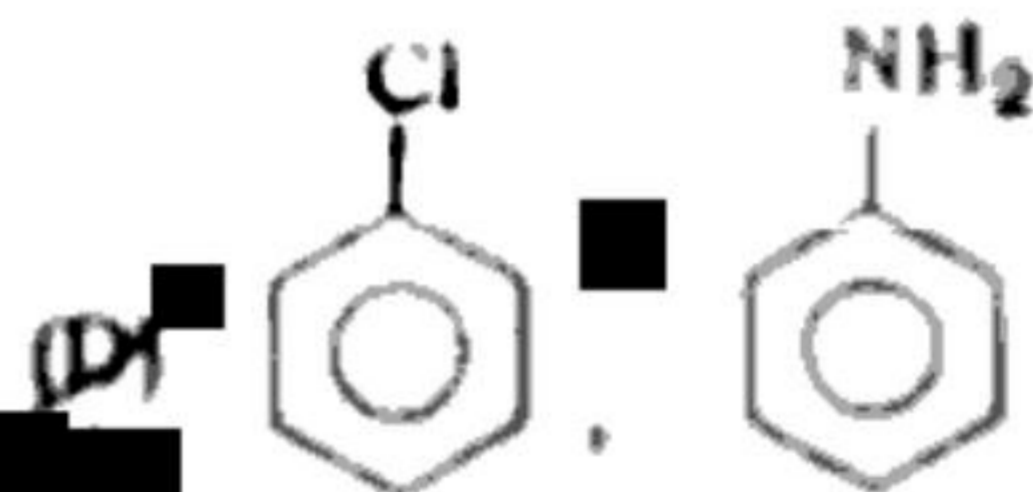
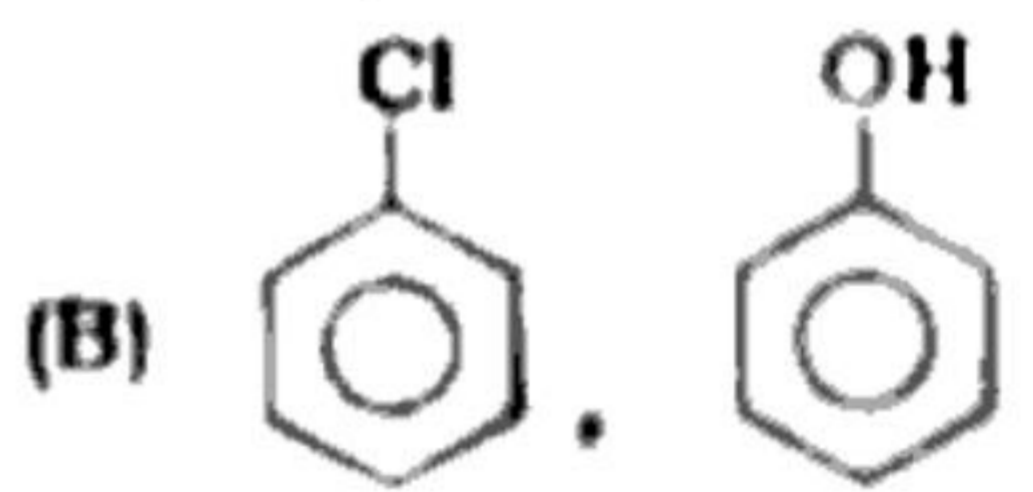
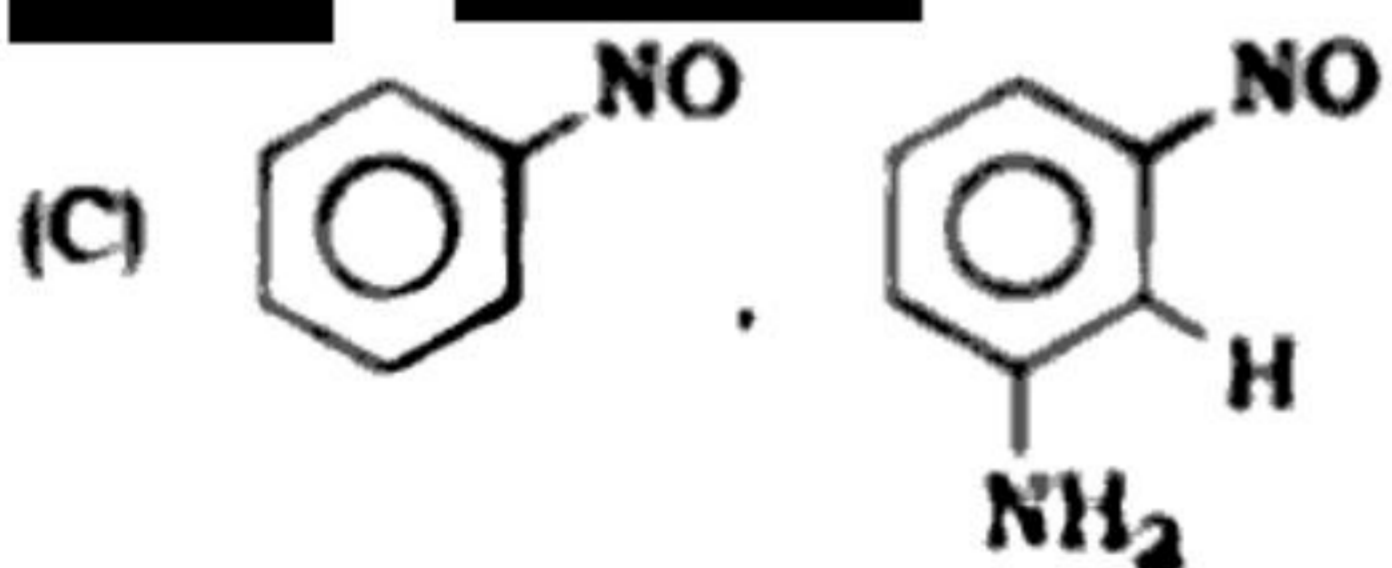
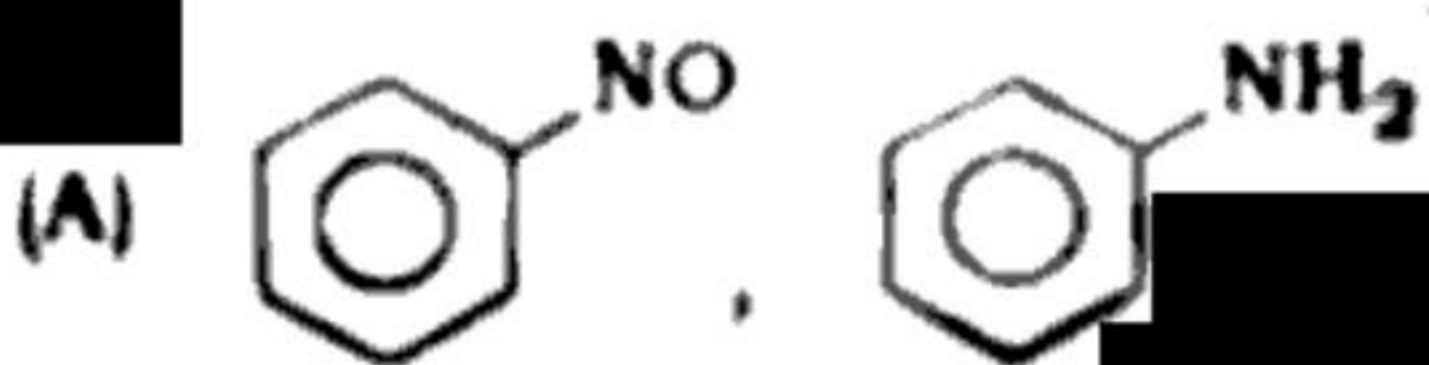
33. A hydrocarbon X decolourises alk.  $\text{KMnO}_4$  at cold and reacts with warm dil.  $\text{HgSO}_4/\text{H}_2\text{SO}_4$  solution to generate compound Y. Y responds to iodoform test but declines to Tollens' test. Y when distilled with 80%  $\text{H}_2\text{SO}_4$  produces 1,3,5-trimethyl benzene. Compounds X and Y will be

- (a)  $\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_3$ ,  $\text{CH}_3\text{COCH}_3$
- (b)  $\text{CH}_3 - \text{C} \equiv \text{CH}$ ,  $\text{CH}_3\text{COCH}_3$
- (c)  $\text{HC} \equiv \text{CH}$ ,  $\text{CH}_3\text{CHO}$
- (d)  $\text{CH}_3\text{CH}_2 - \text{C} \equiv \text{CH}$ ,  $\text{CH}_3 \text{COCH}_3$

34. Analyze the following reaction and predict the structures of B and C:



Compound A and B will be



36. Phenol on reaction with a solution of KBr and  $\text{KBrO}_3$  produces the chief product as

(a) 3-bromophenol

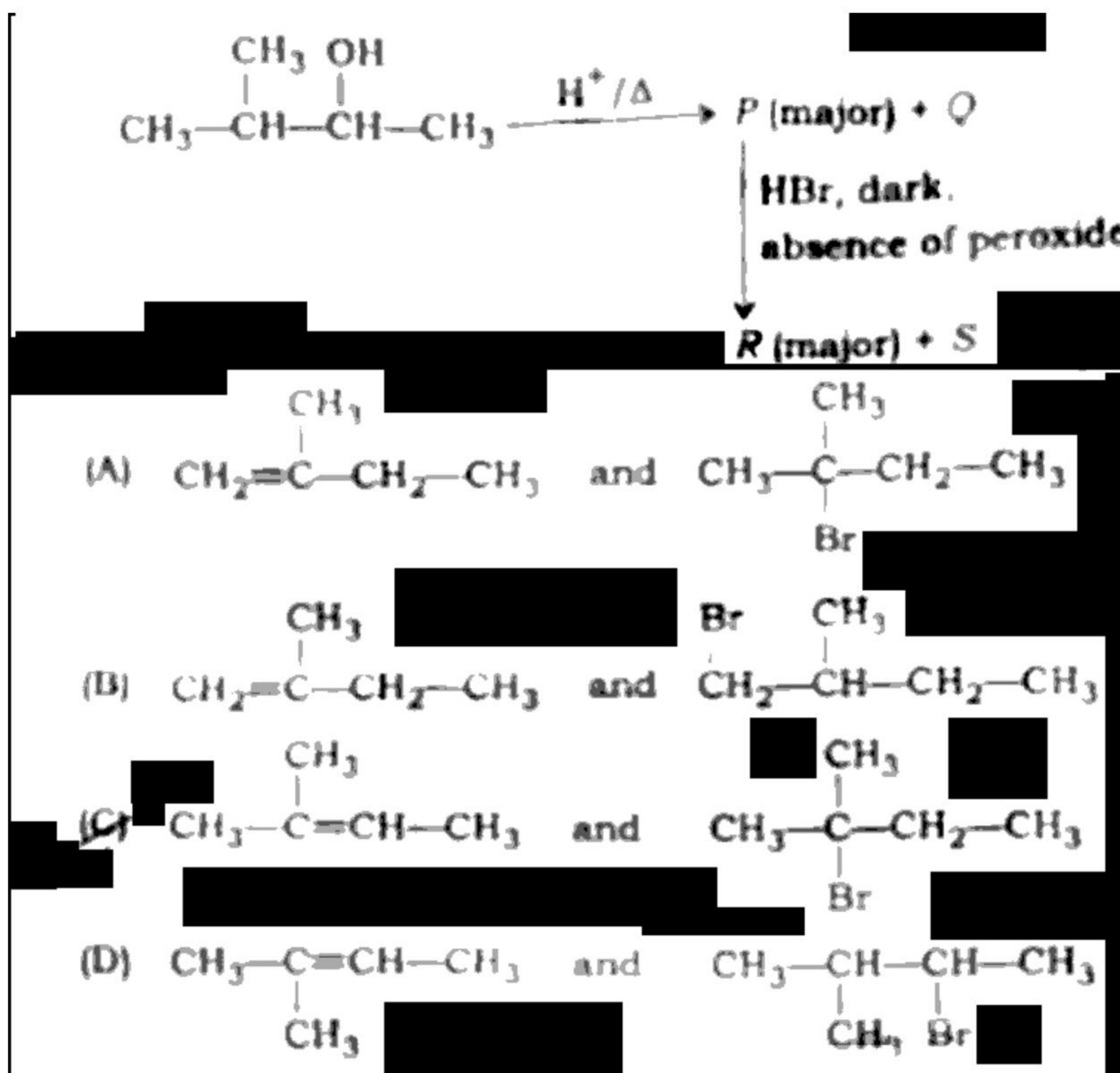
(b) 4-bromophenol

(c) 2,4,6-tribromophenol

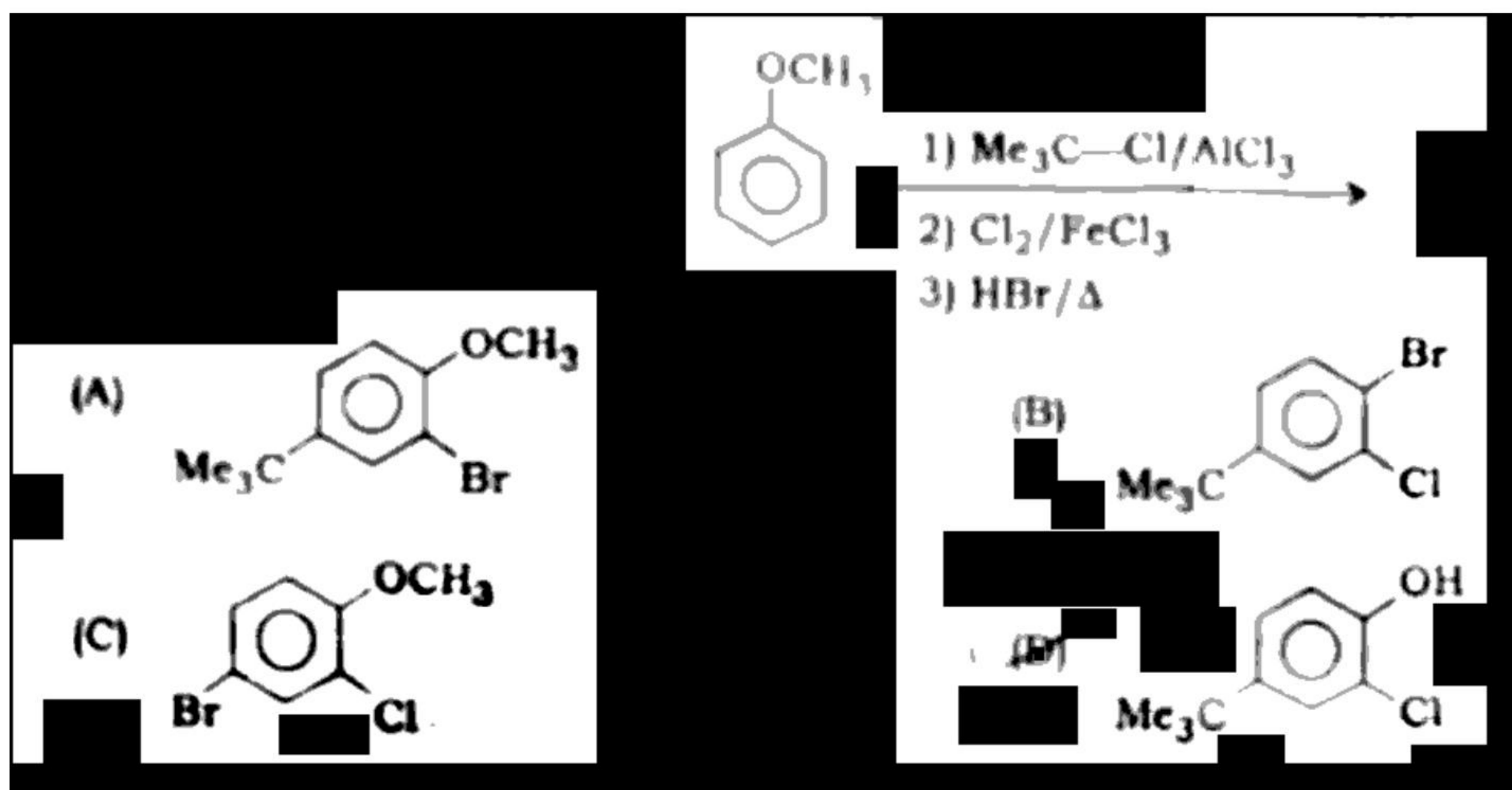
(d) 2-bromophenol



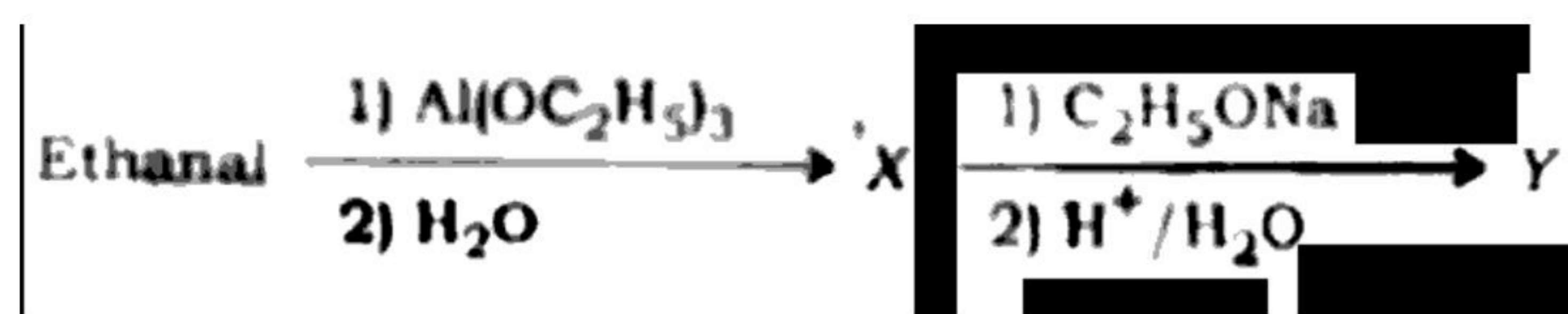
37. Identify the major products P and R of the following reactions:



38. Predict the ultimate product, following the sequences of reactions:



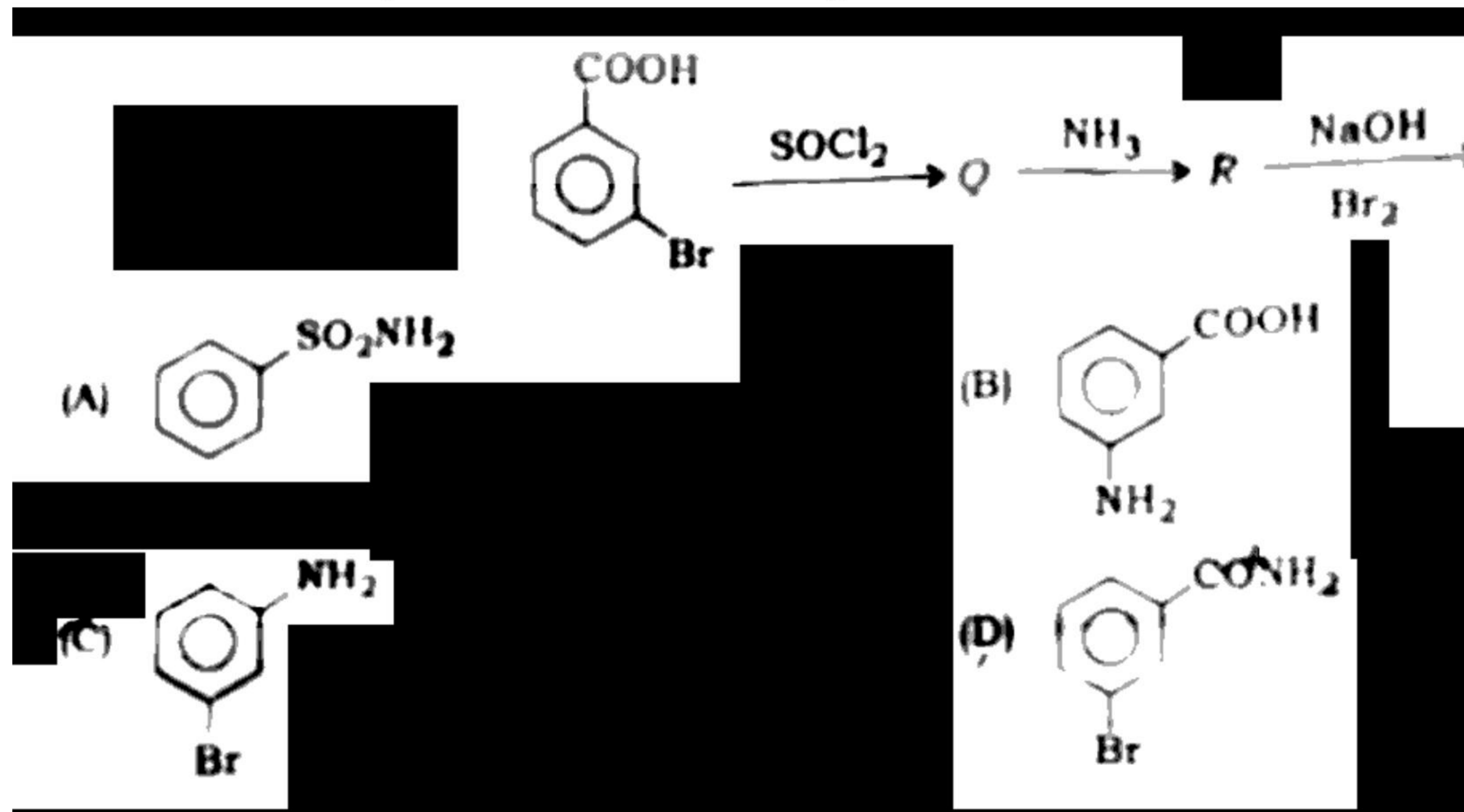
39. Consider the following reactions:



X and Y will be

- (a)  $\text{CH}_3\text{COOH}$ ,  $\text{CH}_3\text{COOC}_2\text{H}_5$
- (b)  $\text{CH}_3\text{COOC}_2\text{H}_5$ ,  $\text{CH}_3\text{COCH}_2\text{COOC}_2\text{H}_5$
- (c)  $\text{CH}_3\text{COOH}$ ,  $\text{CH}_3\text{COCH}_3$
- (d)  $\text{CH}_3\text{COOC}_2\text{H}_5$ ,  $\text{CH}_3\text{COCH}_3$

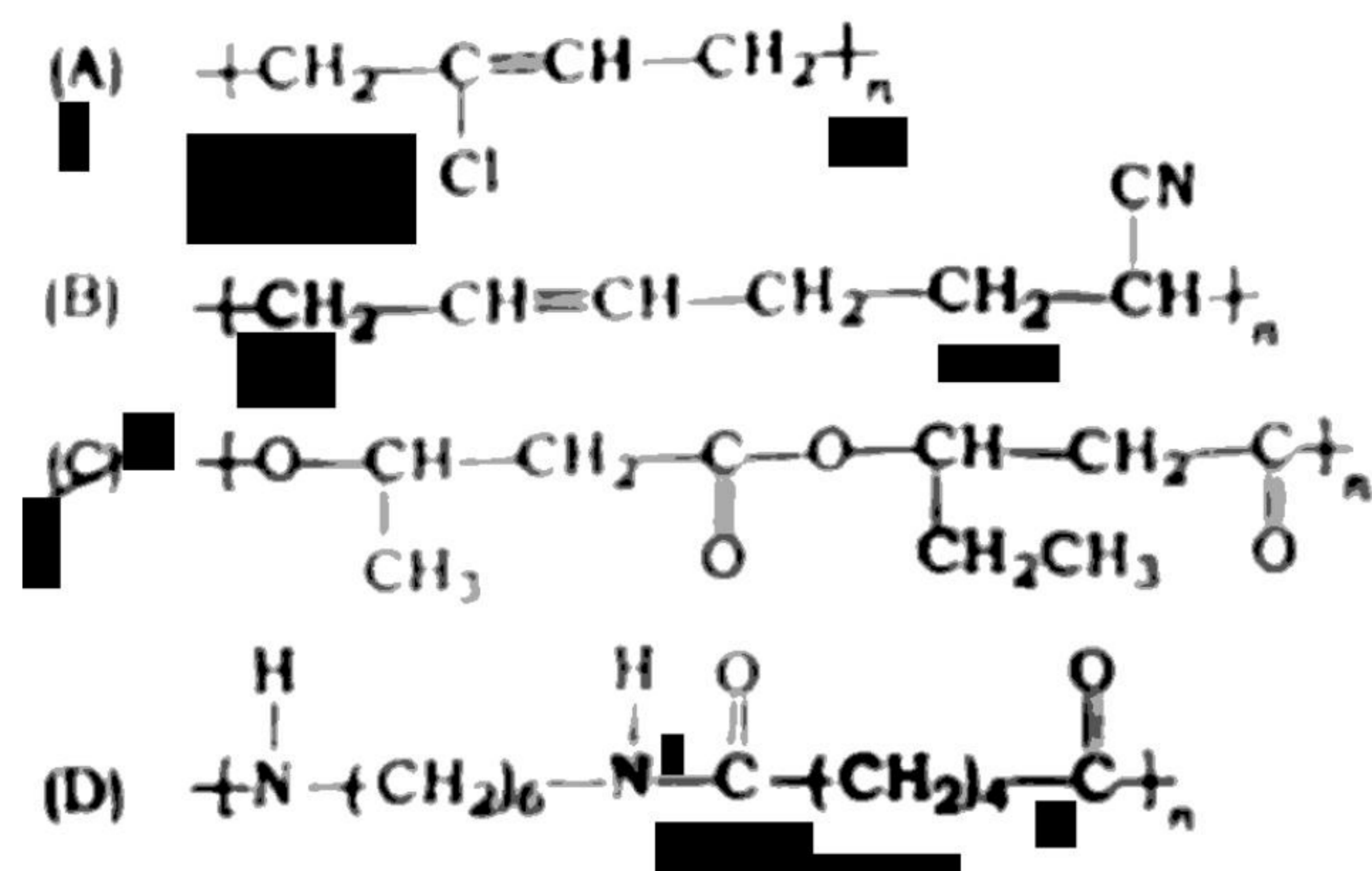
40. Predict the final product S of the following reactions:



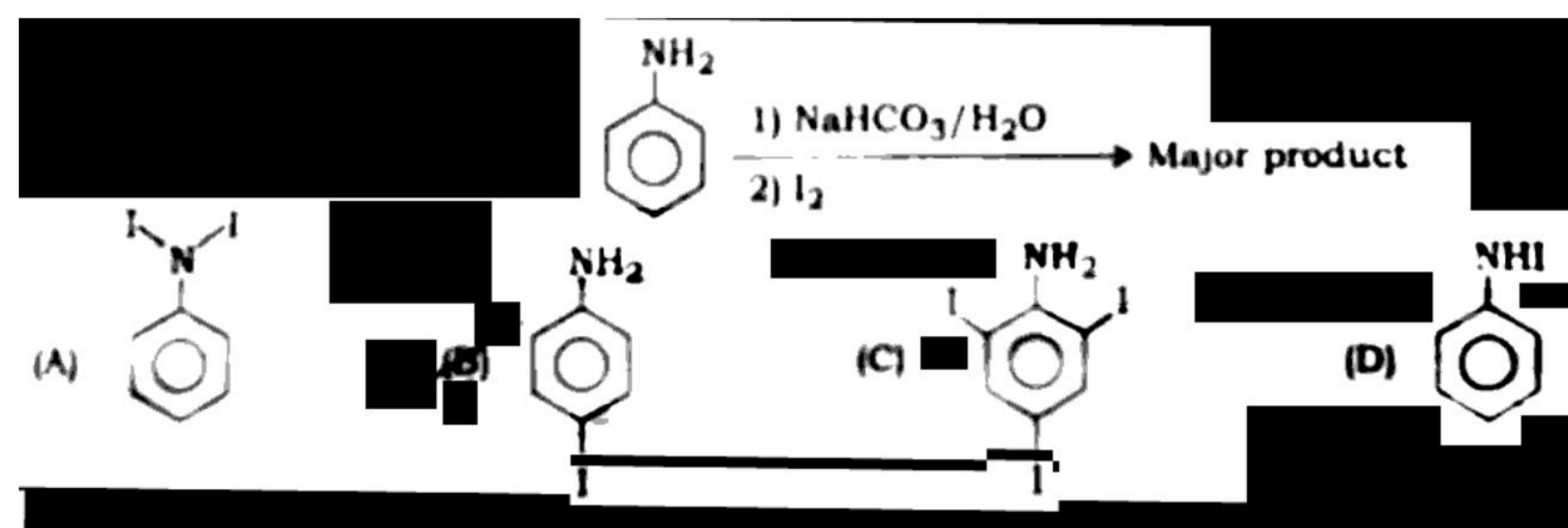
41. A sample of sea-water contains amount of dissolved  $\text{O}_2$ ,  $5 \times 10^{-3}$  gm in 1 kg. Write the concentration of dissolved  $\text{O}_2$  in ppm unit

- (a) 5
- (b)  $5 \times 10^{-3}$
- (c)  $5 \times 10^{-2}$
- (d)  $5 \times 10^{-1}$

42. Which of the following polymers is biodegradable?



43. Mention the major product of the following reaction:



44. Match the following matrix:

Column X		Column Y	
1.	Nitromethane and nitrobenzene can be differentiated by	(a)	ZnSO <sub>4</sub>
2.	Methyl carbonyl amine if heated	(b)	generates tetramethyl hydrazine
3.	$\text{Me} \begin{array}{l} \diagup \\ \diagdown \end{array} \text{NH} + \text{KMnO}_4$ mixture if heated	(c)	generates acetonitrile
4.	Aqueous solution of ethylamine gives white ppt. with	(d)	LiAlH <sub>4</sub>

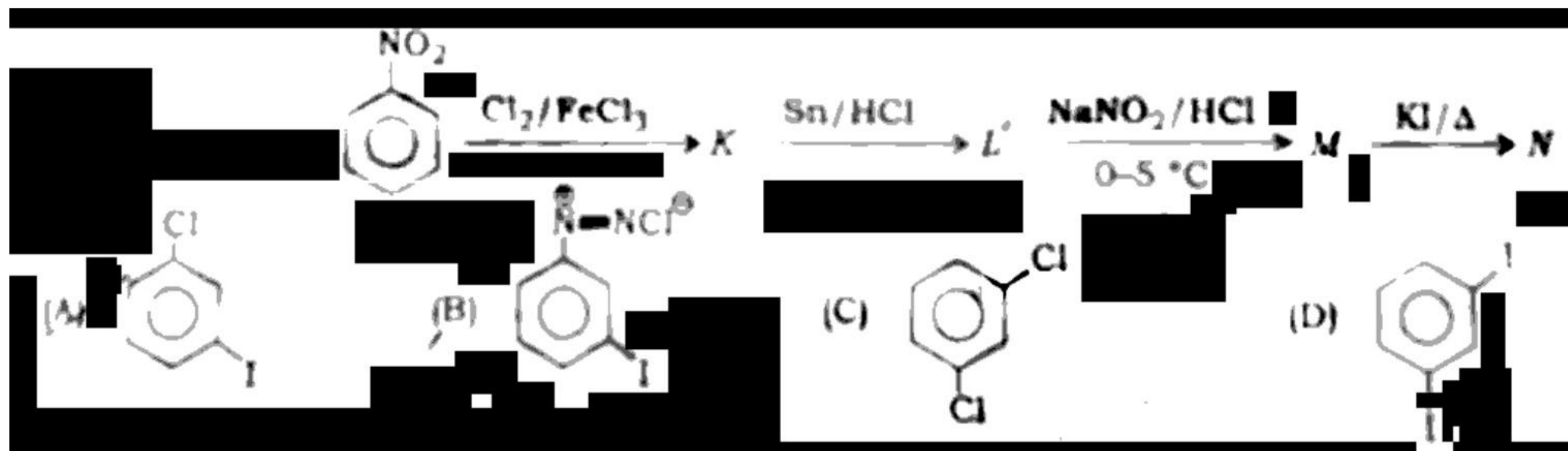
(a) 1 (a), 2 (b), 3 (c), 4 (d)

(b) 1 (d), 2 (c), 3 (b), 4 (a)

(c) 1 (d), 2 (b), 3 (a), 4 (c)

(d) 1 (a), 2 (c), 3 (b), 4 (d)

45. Write the final product (N) of the following reactions:



46. Glucose when treated with  $\text{CH}_3\text{OH}$  in the presence of dry  $\text{HCl}$  gives  $\alpha$  - and  $\beta$  - methyl glucosides because it contains

(a) a  $-\text{CHO}$  group

(b) a  $-\text{CH}_2-\text{OH}$  group

(c) a ring structure

(d) five  $-\text{OH}$  groups

47. Match the following matrix:

Column X		Column Y	
1.	Water soluble vitamin is	(a)	Glucose
2.	Hydrolysis of starch leads to	(b)	ascorbic acid
3.	Protein can be identified by	(c)	inversion
4.	Hydrolysis of sucrose is	(d)	Benedict's test

(a) 1 (a), 2 (b), 3 (c), 4 (d)

(b) 1 (b), 2 (a), 3 (d), 4 (c)

(c) 1 (b), 2 (a), 3 (c), 4 (d)

(d) 1 (a), 2 (c), 3 (b), 4 (d)

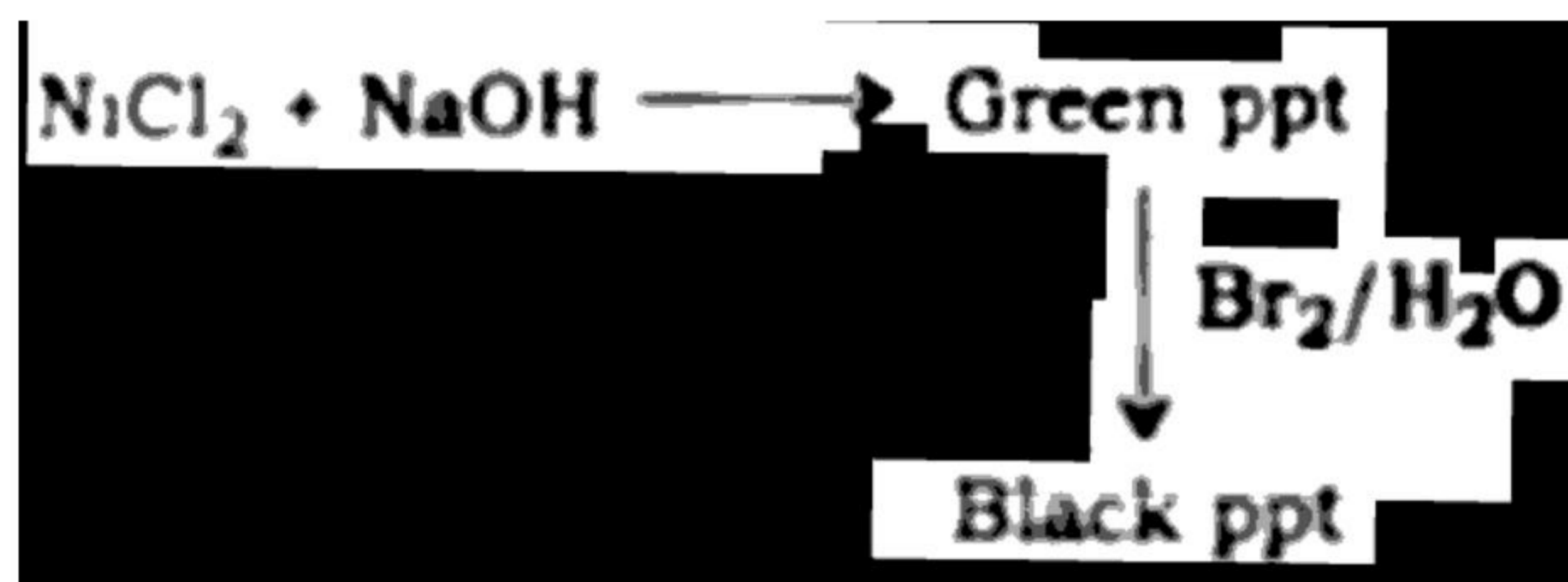
48. Drug Luminal is

- (a) Analgesic (b) Antipyretic  
(c) Hypnotic tranquillizer (d) Non-hypnotic tranquillizer

49. An aqueous solution of sodium sulfide is treated with few drops of sodium nitroprusside solution, a violet coloration results which confirms the generation of a complex salt having structure.

- (a)  $\text{Na}_2 [\text{Fe}(\text{NO})_5\text{CN}]$  (b)  $\text{Na}_2 [\text{Fe}(\text{NO})_5\text{CNS}]$   
(c)  $\text{Na}_5 [\text{Fe}(\text{CN})_5 \text{NOS}]$  (d)  $\text{Na}_4 [\text{Fe}(\text{CN})_5 \text{NOS}]$

50. Follow the chemical reactions:



Identify the structures of green and black ppt.

- (a)  $\text{Ni}(\text{OH})_2, \text{Ni}(\text{OH})_3$  (b)  $\text{Ni}(\text{OH})_2, \text{NiBr}_2$   
(c)  $\text{Ni}(\text{OH})_2, \text{Ni}(\text{OBr})_3$  (d)  $\text{Ni}(\text{OH})_2, \text{O} = \text{Ni}-\text{OH}$