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# JEE

## (Main)

PAPER-1 (B.E./B. TECH.)

# 2021

## COMPUTER BASED TEST (CBT) Memory Based Questions & Solutions

Date: 20 July, 2021 (SHIFT-2) | TIME : (3.00 p.m. to 6.00 p.m)

Duration: 3 Hours | Max. Marks: 300

**SUBJECT: CHEMISTRY**

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**RESULT:** JEE (Advanced),  
JEE (Main), NEET

== **HIGHEST** No. of Classroom Selections ==  
in JEE (Advanced) 2020 from any Institute of Kota

**5 AIRs in TOP-50 in JEE (Adv.) 2020 from Classroom**

AIR-2  
(GEN-EWS)  
**AIR-15**  
DHANANJAY  
KEJRIWAL  
With us Since Class 9<sup>th</sup>

Zonal Topper  
IIT-Kharagpur  
**AIR-25**  
SAMARTH  
AGARWAL  
With us Since Class 11<sup>th</sup>

2nd Rank in  
IIT-Kharagpur Zone  
**AIR-29**  
SANKALP  
PARASHAR  
With us Since Class 11<sup>th</sup>

**AIR-30**  
AARYAN K.  
GUPTA  
With us Since Class 9<sup>th</sup>

**AIR-41**  
UTKARSH P.  
SINGH  
With us Since Class 10<sup>th</sup>

Total Selections in JEE (Advanced) 2020

**4505**

Classroom: 3441 | Distance: 1064

Eligible for JEE (Advanced) Through JEE (Main) 2020

**14755**

Classroom: 11047 | Distance: 3708

NEET 2020

**2646**

Classroom: 1833 | Distance: 813

**ADMISSION OPEN for Session 2021-22**

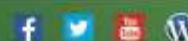
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Target: JEE (Main+Adv.) | JEE (Main) | NEET

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## PART : CHEMISTRY

1. 4 gram mixture of NaOH and Na<sub>2</sub>CO<sub>3</sub> is equimolar, if it contain X gram of NaOH and Y gram of Na<sub>2</sub>CO<sub>3</sub>, then value of 'X' is

Ans. (1)

Sol. Given (i)  $X + Y = 4$

$$(ii) \frac{X}{40} = \frac{Y}{106} \text{ [Equimolar]}$$

$$Y = \left[ \frac{106}{40} \right] X$$

So  $X + \frac{106}{40} X = 4$

$$X + 2.65X = 4$$

$$3.65X = 4$$

$$X = 1.096 \text{ gram.}$$

2. What is the correct relation between degree of freedom and  $\gamma$

(1)  $\left( 1 + \frac{2}{F} \right)$

(2)  $1 + \frac{F}{2}$

(3)  $\frac{F}{2}$

(4)  $\frac{2}{F}$

Ans. (1)

Sol.  $\frac{C_p}{C_v} = \gamma$

$$\frac{\left( \frac{F}{2} + 1 \right) R}{\left( \frac{F}{2} \right) R} = \gamma$$

$$\left( \frac{F}{2} + 1 \right) = \gamma \left[ \frac{F}{2} \right]$$

$$R = 1 + \frac{2}{F}$$

3. In a octahedral complex of Fe<sup>2+</sup> in high spin state what is the Magnetic moment (Spin only)

(1) 4.89 BM

(2) 1.73BM

(3) 0 BM

(4) 3.87BM

Ans. (1)

Sol.  $_{26}\text{Fe}^{2+} = 3d^6 4s^0 \Rightarrow t_{2g}^{2,1,1}, e_g^{1,1}$

Unpaired e<sup>-</sup> [n = 4]

$$\mu = \sqrt{n(n+2)} = \sqrt{24}$$






$$= 4.89 \text{ BM}$$

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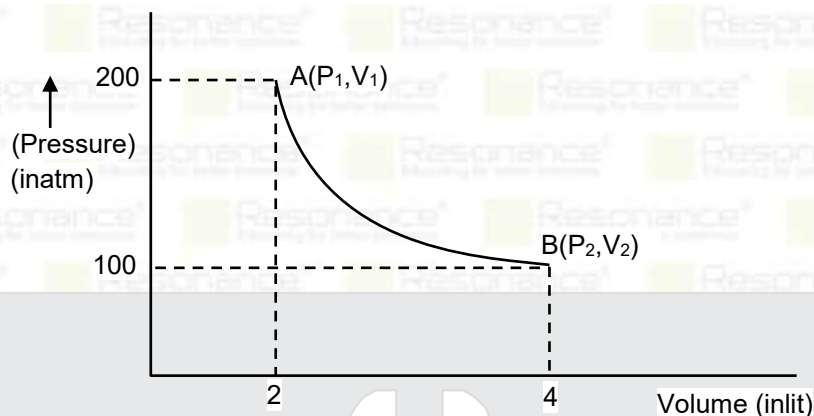
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4. An ideal gas change state from A to state B. Find work done by gas (in KJ) using following P-V diagram



Ans. (2.8)

Sol. As  $P_1 V_1 = P_2 V_2$  So reversible isothermal process

$$W = -nRT \ln \left( \frac{V_2}{V_1} \right) = -P_1 V_1 \ln \left( \frac{V_2}{V_1} \right) = -200 \times 2 \ln \left( \frac{4}{2} \right)$$

$$= -2.303 \times 400 \log 2 = -2.303 \times 400 \times 0.3$$

$$= -276.36 \text{ atm} \times \text{lit} = -28002 \text{ J} = -2.8 \text{ KJ}$$

Work done by gas = 2.8 KJ

5. An ideal solution is prepared by mixing of A ( $P_A^0 = 90$  torr) and B ( $P_B^0 = 15$  torr) in which mole fraction of A in liquid phase is 0.6, Then mole fraction of B in vapour phase is  $[X] \times 10^{-1}$ . Then Volume of X is

Ans. (1)

Sol.  $X_A + X_B = 1 \quad \begin{cases} X_A = 0.6 \\ X_B = 0.4 \end{cases}$

$$P_{\text{Total}} = P_A^0 X_A + P_B^0 X_B$$

$$= [90] 0.6 + [15] 0.4 = 54 + 6 = 60 \text{ torr}$$

$$P_B = P_B^0 X_B = [P_{\text{TOTAL}}] Y_B$$

$$Y_B = \frac{15 \times 0.4}{60} = 0.1$$

Ans.  $1 \times 10^{-1}$

6. What is the difference in number of unpaired electron when  $\text{NiCl}_2$  change into  $[\text{Ni}(\text{CN})_6]^{2-}$

Ans. (2)

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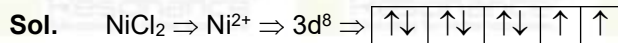
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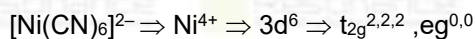
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Unpaired electron  $n=2$



unpaired electron = 0

difference in unpaired electron = 2

**7.** What is the major use of dihydrogen ( $\text{H}_2$ )

- (1) In formation of  $\text{HNO}_3$
- (2) In synthesis of ammonia ( $\text{NH}_3$ )
- (3) In fuel cell for generating electrical energy
- (4) To reduce heavy metal oxides to metal

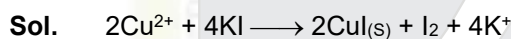
**Ans.** (2)

**Sol.** The largest single use of dihydrogen is in the synthesis of ammonia [NCERT page 287]

**8.**  $\text{Cu}^{2+}$  salt on reaction with KI forms

- (1)  $\text{CuI}$
- (2)  $\text{Cu}_2\text{I}_2$
- (3)  $\text{Cu}(\text{I}_3)_2$
- (4) Does not react

**Ans.** (1)



**9.** Which of the following species does not have magnetic moment (spin only) 1.73 BM

- (1)  $\text{O}_2^-$
- (2)  $\text{O}_2^+$
- (3)  $\text{Cu}$
- (4)  $[\text{Cu}(\text{NH}_3)_4]\text{Cl}_2$

**Ans.** (3)

**Sol.**  $\mu = 1.73 \text{ BM}$  It means number of unpaired electron = 1

Species	Unpaired electron
$\text{O}_2^-$	1
$\text{O}_2^+$	1
$\text{Cu}^+$	0
$\text{Cu}^{2+}$	1

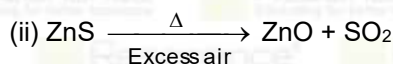
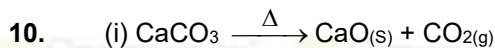
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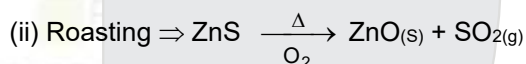
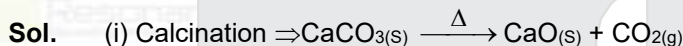
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Identify the calcination and roasting reaction from above

- (1) Both reaction are roasting  
(2) Both reaction are calcination  
(3) 1<sup>st</sup> reaction is calcination and 2<sup>nd</sup> reaction is roasting  
(4) 1<sup>st</sup> reaction is roasting and 2<sup>nd</sup> reaction is calcination.

Ans. (3)



11. For a reaction  $\Delta G^\circ = -51.4 \text{ KJ/mol}$  and  $\Delta H^\circ = 49.4 \text{ KJ/mol}$  at 300K, then value of  $\Delta S^\circ$  in J/K is

Ans (336)

Sol.  $\Delta G^\circ = \Delta H^\circ - T \Delta S^\circ$

$-51.4 = 49.4 - T \Delta S^\circ$

$$\Delta S^\circ = \left[ \frac{49.4 + 51.4}{300} \right]$$
  
 $= 0.336 \text{ KJ/K} = 336 \text{ J/K}$

12. In 13<sup>th</sup> group from the element with electronic configuration  $4s^2 4p^1$  if we move diagonally then the electronic configuration of 5<sup>th</sup> period element is:

- (1)  $5s^2 5p^3$       (2)  $4s^2 4p^1$       (3)  $4s^2 4p^2$       (4)  $5s^2 5p^2$

Ans (4)

Sol.

		13 <sup>th</sup>	14 <sup>th</sup>	15 <sup>th</sup>
2 <sup>nd</sup> period	$2s^2 2p^1$	B	C	N
3 <sup>rd</sup> period	$3s^2 3p^1$	Al	Si	P
4 <sup>th</sup> period	$4s^2 4p^1$	Ga	Ge	As
5 <sup>th</sup> period	$5s^2 5p^1$	In	Sn	Sb

That element is  ${}_{50}\text{Sn} \Rightarrow [\text{Kr}] 4d^{10} 5s^2 5p^2$

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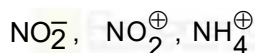
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13. Identify the correct hybridisation of



(1)  $\text{sp}^2, \text{sp}, \text{sp}^3$

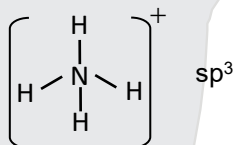
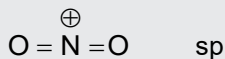
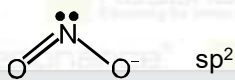
(2)  $\text{sp}, \text{sp}^2, \text{sp}^3$

(3)  $\text{sp}^3, \text{sp}^2, \text{sp}$

(4)  $\text{sp}^2, \text{sp}^3, \text{sp}$

Ans (1)

Sol.  $\text{NO}_2^-$



14. Which of the following statement is incorrect about Enzymes

(1) Enzymes are non-specific

(2) Enzymes are temperature and pH specific

(3) Almost all enzymes are proteins

(4) Enzymes act as catalyst.

Ans. (1)

Sol. Enzymes are highly specific in nature

15. A metal crystallize in FCC lattice in addition to 50% occupancy of tetrahedral voids, find the effective number of atoms of metal per unit cell.

Ans (8)

Sol. Metal crystalize in fcc unit cell

$$\text{Effective No. of Atoms} = 4 [\text{FCC}] + 8 [\text{TV}] \frac{1}{2}$$

$$\text{Ans} = 8$$

16.  $\text{PCl}_5$  decompose according to 1<sup>st</sup> order reaction as  $\text{PCl}_5(\text{g}) \longrightarrow \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$ .

Initially we take 50 moles of  $\text{PCl}_5$  and after 120 minutes final moles of  $\text{PCl}_5$  is 10 then the value of rate constant of reaction is  $[x] \times 10^{-4}$  minutes, then value of 'x' is:

Ans (133)

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Sol.  $\text{PCl}_5(\text{g}) \longrightarrow \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$

$t = 0$  50 moles

$t = 120$  minutes 10 mole

$$K = \frac{1}{t} \ln \left( \frac{a}{a-x} \right)$$

$$= \frac{2.303}{120} \log \left( \frac{50}{10} \right)$$

$$= \frac{2.303 \times 0.693}{120} = 0.0133 \text{ minutes}$$

$$= 133 \times 10^{-4} \text{ minutes}$$

17. Among  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$ , which act as acid and base respectively during nitration ?

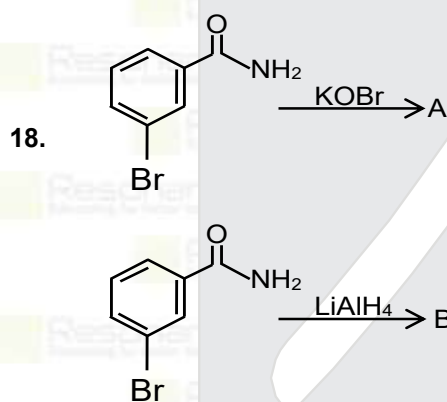
(1)  $\text{H}_2\text{SO}_4$ ,  $\text{HNO}_3$

(2)  $\text{HNO}_3$ ,  $\text{H}_2\text{SO}_4$

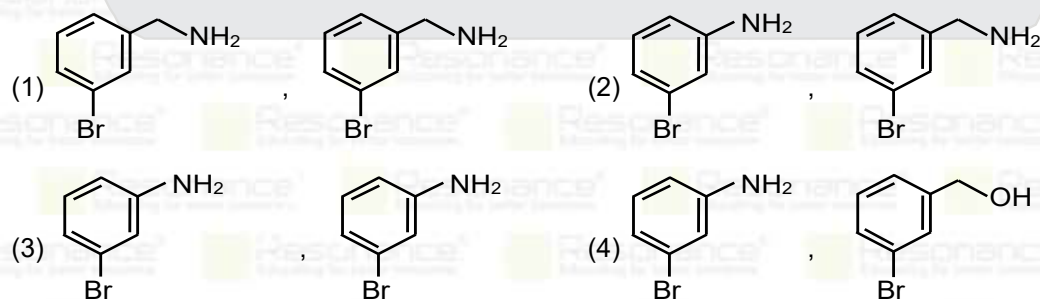
(3)  $\text{HNO}_3$ ,  $\text{HNO}_3$

(4)  $\text{H}_2\text{SO}_4$ ,  $\text{H}_2\text{SO}_4$

Ans. (1)



A and B are respectively:








Ans. (2)

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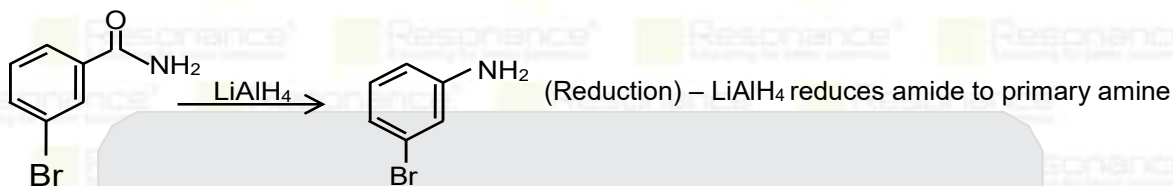
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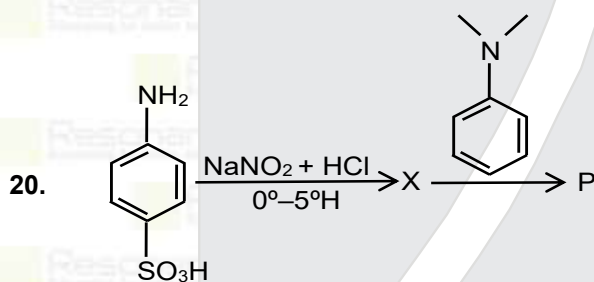


19. Which gas retards photosynthesis?

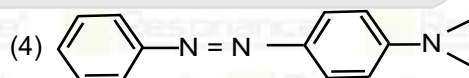
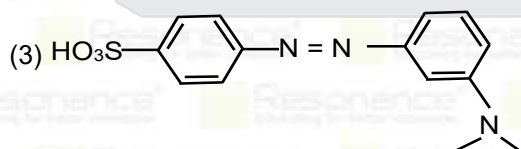
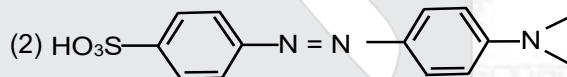
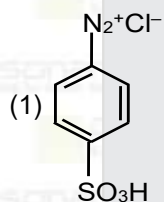
- (1) CO (2) CFC (3)  $\text{CO}_2$  (4)  $\text{NO}_2$

Ans. (4)

Sol. Reason:  $\text{NO}_2$  damage the leaves of plants and retard the photosynthesis.



Find product (P) is:



Ans. (2)

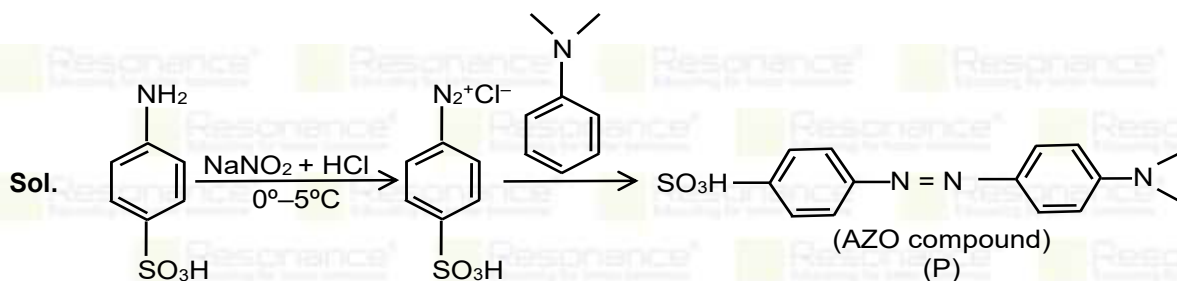
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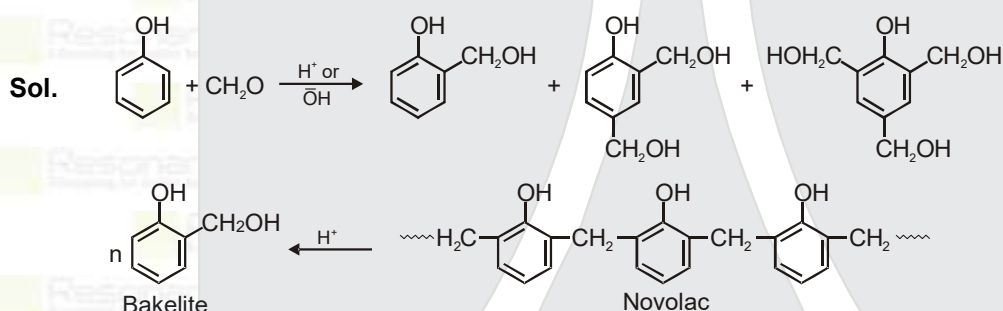


Diazotisation reaction

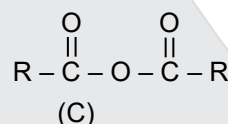
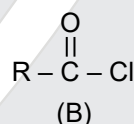
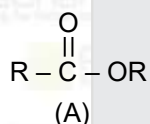
**21.** Which one is form as intermediate during the formation of Bakelite.

- (1) Novolac (2) Buna-S (3) Buna-N (4) Adipic acid

**Ans.** (1)



**22.** Rate of hydrolysis of given compounds ester, acid chloride, acid anhydride is:

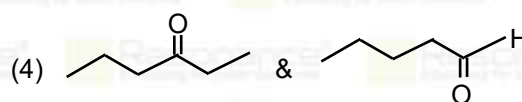
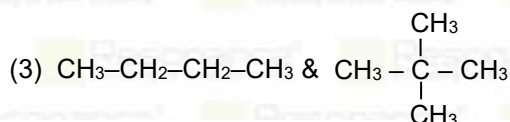
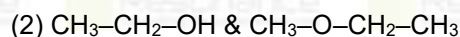
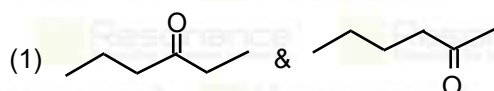


- (1) B > A > C (2) B > C > A (3) A > B > C (4) C > A > B

**Ans.** (2)

**Sol.** Rate of hydrolysis is directly proportional to  $\delta$  positive charged present on carbon of C=O group.  
Rate of hydrolysis – Acid chloride > Acid anhydride > ester

**23.** Which of following compounds are metamers?



**Ans.** (1)

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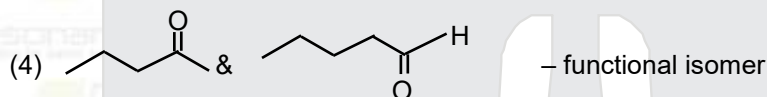
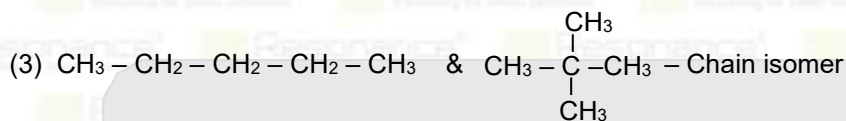
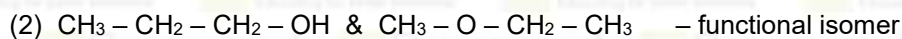
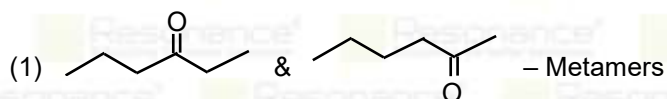
Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

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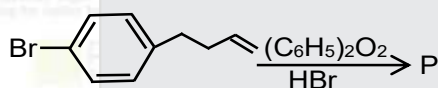
To Know more : sms RESO at 56677 | Website : [www.resonance.ac.in](http://www.resonance.ac.in) | E-mail : [contact@resonance.ac.in](mailto:contact@resonance.ac.in) | CIN : U80302RJ2007PLC024029

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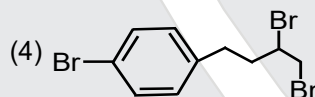
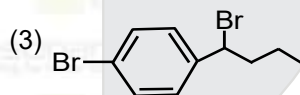
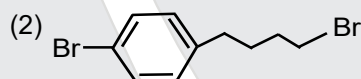
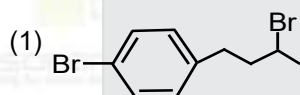
**Sol.** Metamers are compounds which have different alkyl groups present along both side of polyvalent functional group.



24.



Product (P) is :



**Ans.** (2)






**Sol.** Here addition of HBr in presence of peroxide takes place according to antimarkovnikov rule.

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