

**JEE MAINS 2021, DATE – 20-07-2021 (SHIFT - 2) PAPER 1- CHEMISTRY**

1. 4 grams mixture  $NaOH$  and  $Na_2CO_3$  is Equimolar, if it contain x gram of  $NaOH$  and Y gram of  $Na_2CO_3$  then value of 'x' is

Ans: 1

Sol: Given (i)  $x + y = 4$

$$(ii) \frac{x}{4} = \frac{y}{106} [\text{Equimolar}]$$

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

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

$$x + 2.065x = 4$$

$$3.65x = 4$$

$$x = 1.096 \text{ gram}$$

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  $Fe^{2+}$  in high spin state what is the Magnetic moment (Spin only)

(1) 4.89 BM      (2) 1.73 BM      (3) 0 BM      (4) 3.87 BM

Ans: 1

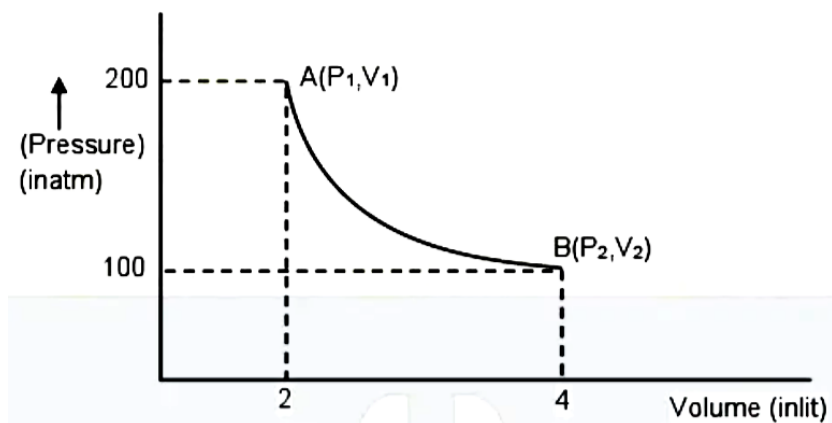
Sol:  $26^{Fe^{2+}} = 3d^6 4s^0 \Rightarrow t_{2g}^{2.1.1}, e_g^{1.1}$

Unpaired  $e^- [n = 4]$

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

$$= 4.89 \text{ BM}$$

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  $P_1V_1 = P_2V_2$  So reversible isothermal process

$$W = -nRT \ln \left( \frac{V_2}{V_1} \right) = -P_1V_1 \ln \left( \frac{V_2}{V_1} \right) = -200 \times 2 \ln \left( \frac{4}{2} \right)$$

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

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

Work done by gas = 2.8 KJ

5. An ideal solution is prepared by mixing of A ( $P_A^0 = 90 \text{ torr}$ ) and B ( $P_B^0 = 15 \text{ torr}$ ) 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:  $x_A + x_B = 1 \begin{cases} x_A = 0.6 \\ x_B = 0.4 \end{cases}$

$$P_{\text{Total}} = P_B^0 x_B$$

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

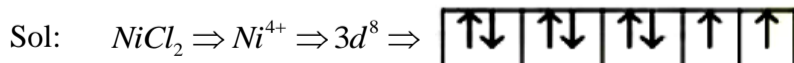
$$P_B = P_B^0 x_B = [P_{\text{TOTAL}}] Y_B$$

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

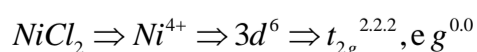
$$1 \times 10^{-1}$$

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

Ans: 2



Unpaired electron **n = 2**



Unpaired electron = 0

Difference in unpaired electron = 2

7. What is the major use of dihydrogen ( $H_2$ )

- (1) In formation of  $HNO_3$
- (2) In synthesis of ammonia ( $NH_3$ )
- (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

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

- (1)  $CuI$
- (2)  $Cu_2I_3$
- (3)  $Cu(I_3)_2$
- (4) Does not react

Ans: 1

Sol:  $2Cu^{2+} + 4KI \rightarrow 2CuI_{(s)} + I_2 + 4K^+$

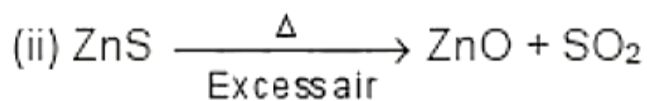
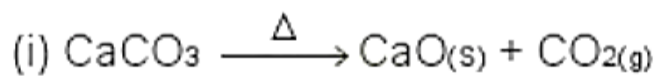
9. Which of the following species does not have magnetic moment (Spin only) 1.73 BM

- (1)  $O_2^-$
- (2)  $O_2^+$
- (3)  $CuI$
- (4)  $[Cu(NH_3)_4]Cl_2$

Ans: 3

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

Species	Unpaired electron
$O_2^-$	1
$O_2^+$	1
$Cu^+$	0
$Cu^{2+}$	1



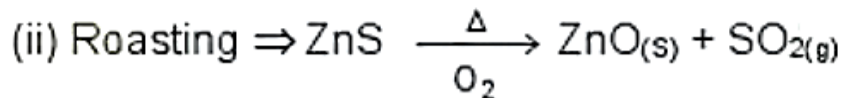
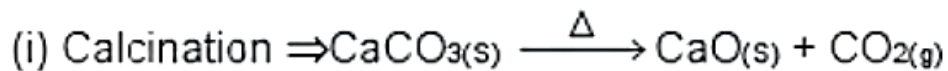
10.

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

Sol:



11. For a reaction  $\Delta G^0 = -51.4 \text{ KJ/mol}$  and  $\Delta H^0 = 49.4 \text{ KJ/mol}$  at 300K, then value of  $\Delta S^0$  in J/K is

Ans: (336)

Sol:  $\Delta G^0 = \Delta H^0 - T\Delta S^0$

$-51.4 = 49.4 - T\Delta S^0$

$\Delta S^0 = \left[ \frac{49.4 + 51.4}{300} \right]$

$= 0.336 \text{ KJ/K} = 336 \text{ J/K}$

12. In 13<sup>th</sup> group from 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

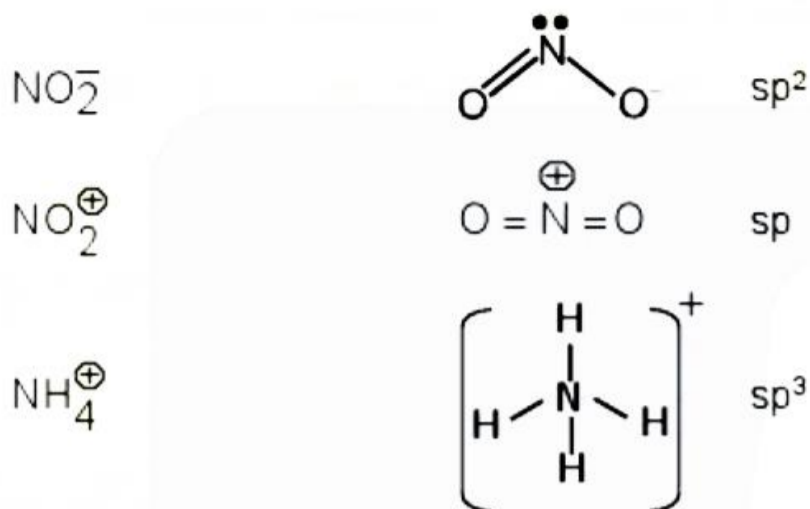
That element is  $\text{Sn} \Rightarrow [\text{Kr}] 4d^{10} 5s^2 5p^2$

13. Identify the correct hybridization of  $\text{NO}_2^-$ ,  $\text{NO}_2^+$ ,  $\text{NH}_4^+$

- (1)  $sp^2, sp, sp^3$       (2)  $sp, sp^2, sp^3$       (3)  $sp^3, sp^2, sp$       (4)  $sp^2, sp^3, sp$

Ans: 1

Sol:



14. Which of the following statement is incorrect 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 crystallize in fcc unit cell Effective No of Atoms = 4 [FCC] + 8 [TV]  $\frac{1}{2}$

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

Sol:  $\text{PCl}_5(\text{g}) \rightarrow \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$

$t = 0$                       50 moles

$t = 120$  minutes 10 mole

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

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

$$= \frac{2.303 \times 0.639}{120} = 0.0133 \text{ minutes}$$

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

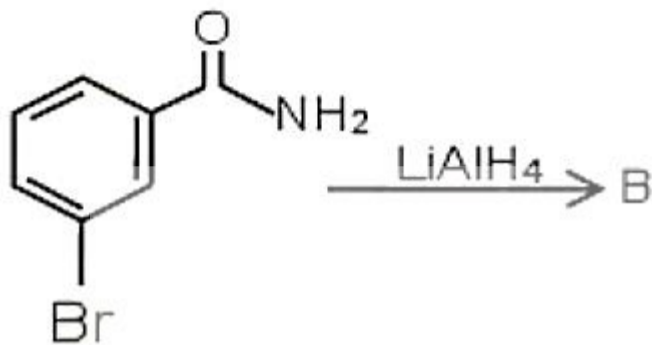
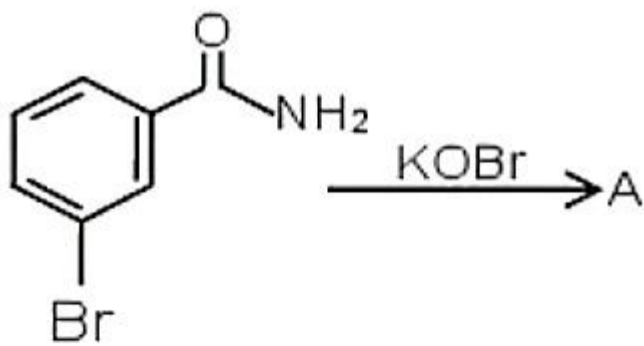
17. Among  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$ , which act as acid and base respectively during nitration ?

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

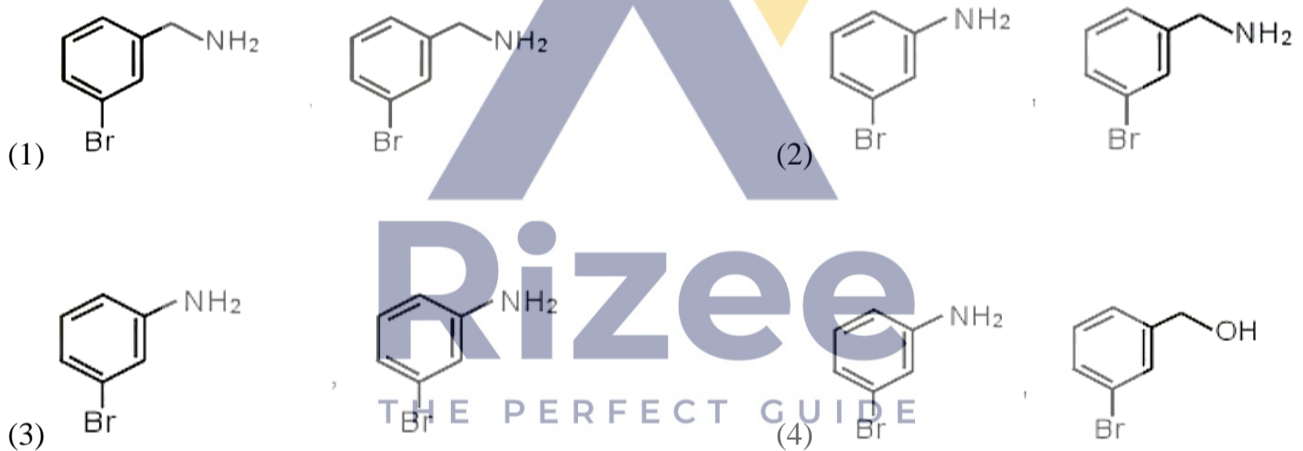
Ans: 1

Sol:

18.

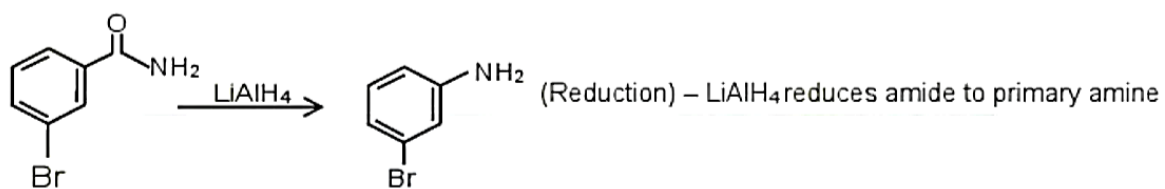
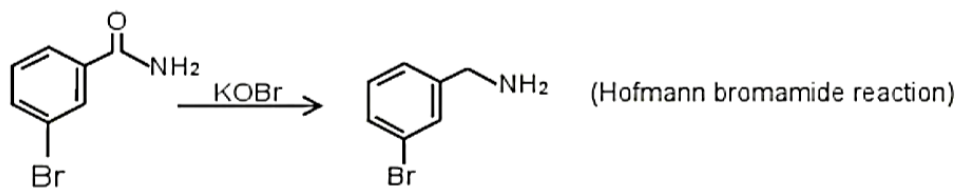


A and B are respectively:



Ans: 2

Sol:



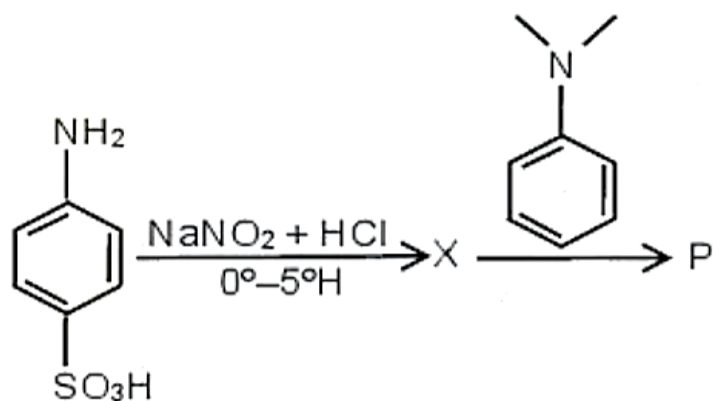
19. Which gas retards photosynthesis?

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

Ans: 4

Sol: Reason:  $NO_2$  damage the leaves of plants and retard the photosynthesis.

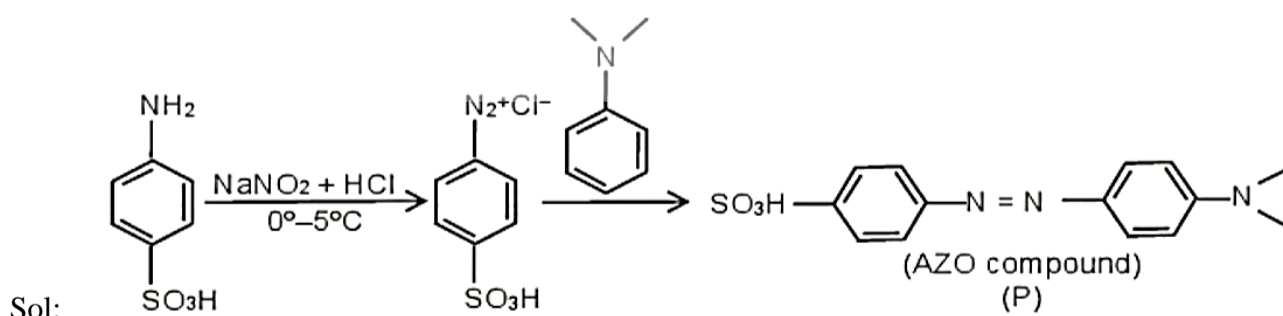
20.



Find product (P) is:



Ans: 2



Sol:

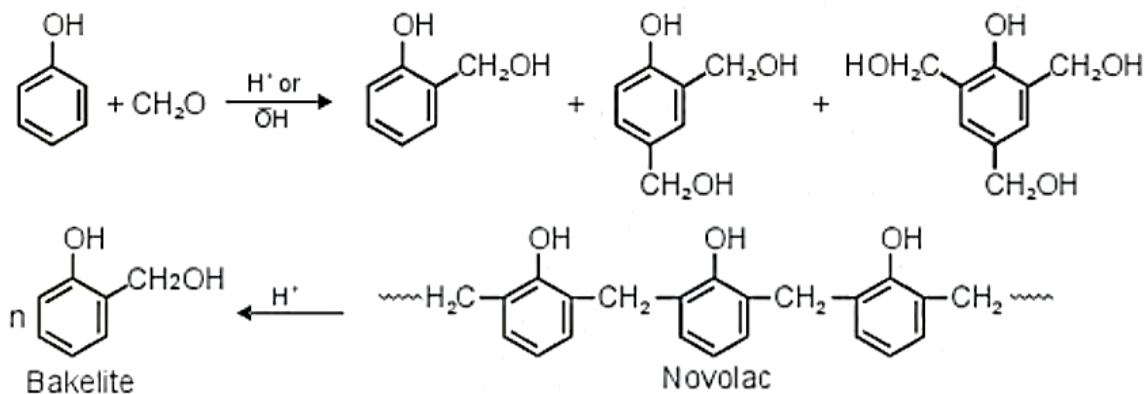
Diazotisation reaction

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

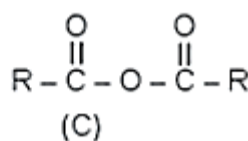
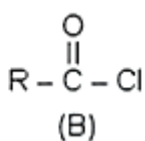
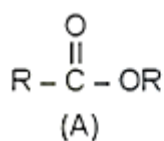
- (1) Novalac      (2) Buna-S      (3) Buna-N      (4) Adipic acid

Ans: 1

Sol:



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



(1)  $\text{B} > \text{A} > \text{C}$

(2)  $\text{B} > \text{C} > \text{A}$

(3)  $\text{A} > \text{B} > \text{C}$

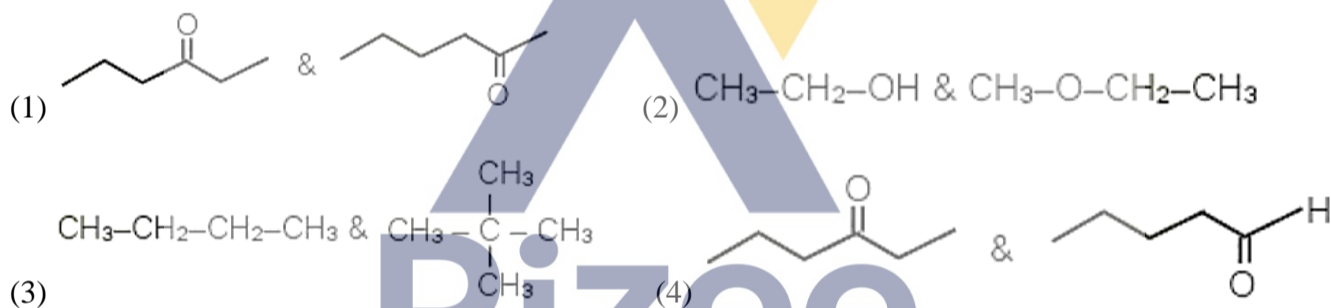
(4)  $\text{C} > \text{A} > \text{B}$

Ans: 2

Sol: Rate of hydrolysis is directly proportional to  $\delta$  positive charged present on carbon of  $\text{C}=\text{O}$  group.

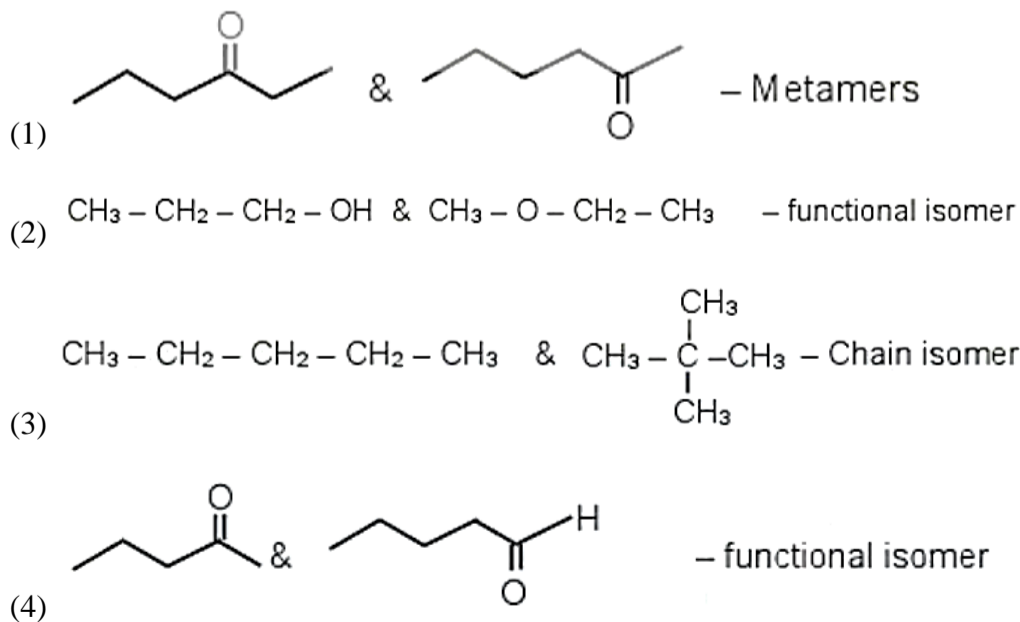
Rate of hydrolysis – Acid chloride > Acid anhydride > ester

23. Which of following compounds are metamers?



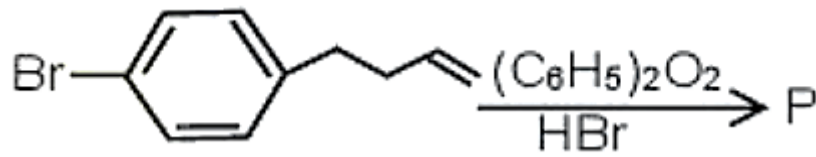
Ans: 1

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

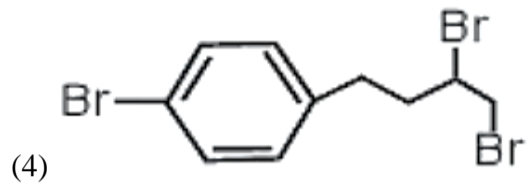
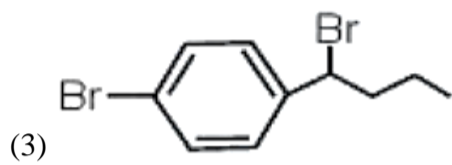
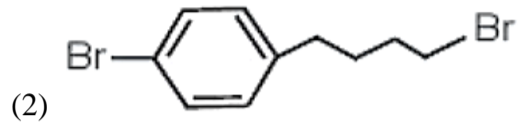
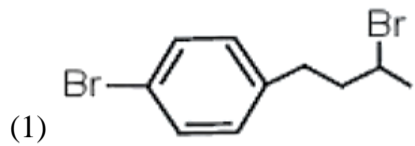




24.



Product (P) is:



Ans: 2

Sol: Here addition of  $HBr$  in presence of peroxide takes place according to antimarkovnikov rule

