1 Mark Questions

1. For a second order reaction, $2B \rightarrow$ products, if the initial concentration of the species B is $[B]_0$ and the rate constant is k, then $t_{1/2}$ can be expressed as
(a) $1/[B]_0 k$ (b) $1/k$
(c) $[B]_0/k$ (d) $1/2[B]_0 k$

2. If the heats of reaction of the following transformations

$$C + O_2(g) \longrightarrow CO_2(g),\ C + \frac{1}{2}O_2(g) \longrightarrow CO(g)$$

and $CO(g) + \frac{1}{2}O_2(g) \longrightarrow CO_2(g)$ are Q, 11.5 J and 10.5 J respectively, then Q in joules is equal to
(a) 120.75 (b) 1
(c) −1 (d) 22

3. The spontaneity of a reaction can be judged from the sign of the emf (E) and the free energy (G) of the cell. The criteria are
(a) $\Delta G = +ve, E = -ve$
(b) $\Delta G = 0,\ E = 0$
(c) $\Delta G = -ve, E = +ve$
(d) $\Delta G = -ve, E = -ve$

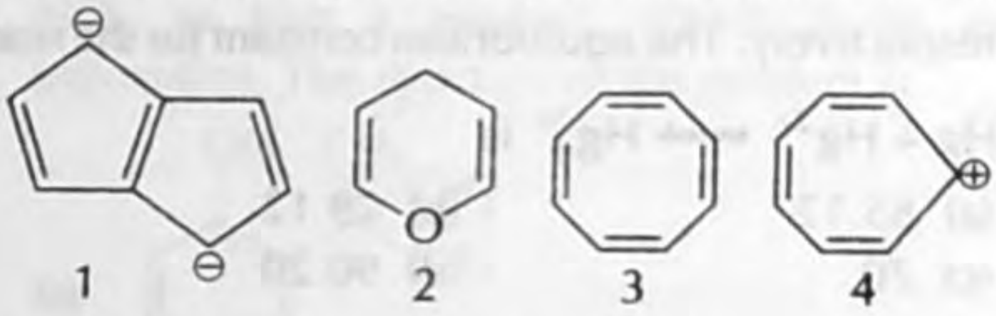
4. The function cos (ax) is an eigen function of $\frac{d^2}{dx^2}$ with an eigen value of
(a) $-a$ (b) $-a^2$
(c) a (d) $-a^{-2}$

5. The heteronuclear diatomic molecule that is isoelectronic to HCN is
(a) NO (b) CO
(c) BO (d) SO

6. The bond order in Be_2 molecule can be expected to be
(a) 0 (b) 1
(c) 2 (d) 3

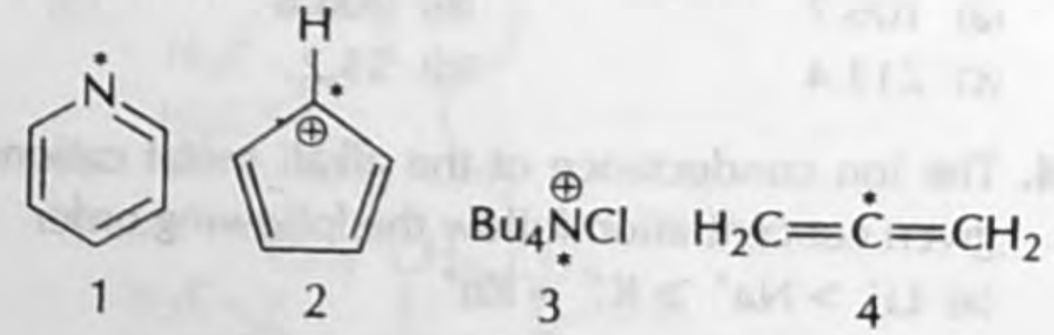
7. The intense colour of $KMnO_4$ is due to
(a) electronic transition from one energy level to another in Mn
(b) electronic transition from one energy level to another in O
(c) charge transfer from Mn to O
(d) charge transfer from O to Mn

8. Of the following, the compounds that are aromatic are



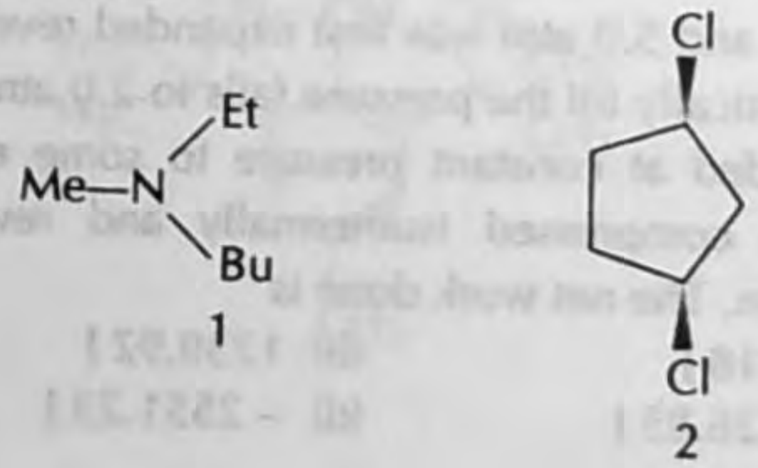
(a) 1, 4 (b) 1, 2, 4
(c) 2, 3, 4 (d) 2, 4

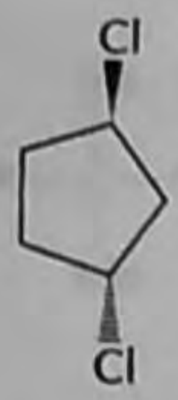
9. The hybridisation of the atoms indicated by an asterisk in the following compounds in a sequence (from 1 to 4) is given by



(a) sp^3, sp^2, sp^3, sp (b) sp^2, sp^2, sp^3, sp^2
(c) sp^2, sp^2, sp^3, sp (d) sp^2, sp^3, sp^3, sp

10. Which of the following compounds can have enantiomers?





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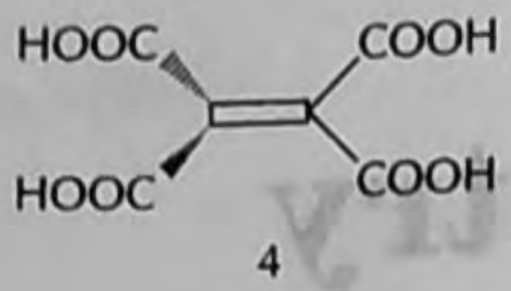


4

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

2 Marks Questions

11. The rate constant for a certain reaction is found to be doubled when the temperature is raised from 27°C to 37°C. The activation energy for this reaction in kJ is
(a) 26.8 (b) 107.2
(c) 53.6 (d) 50.0

12. The standard potential for the electrodes Hg/Hg_2^{2+} and Hg/Hg^{2+} are – 0.799 V and – 0.855 V at 25°C respectively. The equilibrium constant for the reaction

$Hg + Hg^{2+} \rightleftharpoons Hg_2^{2+}$ is
(a) 85.12 (b) 79.12
(c) 70 (d) 90.20

13. The freezing point of pure benzene is 5.44°C and that of a solution containing 2.092 g of *A* in 100 g of benzene is 4.44°C. The molal depression constant (k_f) for benzene is 5.1. From this data, the molecular weight of *A* can be calculated to be
(a) 106.7 (b) 206.6
(c) 213.4 (d) 53.2

14. The ion conductance of the alkali metal cations at a given concentration follow the following order
(a) $Li^+ > Na^+ > K^+ > Rb^+$
(b) $Li^+ < Na^+ < K^+ > Rb^+$
(c) $Li^+ < Na^+ < K^+ < Rb^+$
(d) $Li^+ \simeq Na^+ > K^+ > Rb^+$

15. 2.0 moles of an ideal monoatomic gas ($C_V = 1.5R$) at 500 K and 5.0 atm was first expanded reversibly and adiabatically till the pressure falls to 2.0 atm and then expanded at constant pressure to some extent and finally compressed isothermally and reversibly to 5.0 atm. The net work done is
(a) 7618 J (b) 1239.92 J
(c) 3826.85 J (d) – 2551.23 J

16. K_p is 10 atm for the reaction,

$CO_2(g) + C(s) \rightleftharpoons 2CO(g)$ at 82°C

The equilibrium composition of CO at a total pressure of 4.0 atm and at 820°C is
(a) 25% (b) 33%
(c) 48% (d) 99%

17. The order of increasing bond order for the diatomic species O_2, O_2^+, O_2^-, O_2^{2-} is
(a) $O_2^{2-} < O_2^- < O_2 < O_2^+$
(b) $O_2 < O_2^+ < O_2^- < O_2^{2-}$
(c) $O_2^+ < O_2 < O_2^- < O_2^{2-}$
(d) $O_2^- < O_2^{2-} < O_2^+ < O_2$

18. The bond angle in I_3^- is
(a) 90° (b) 104°
(c) 120° (d) 180°

19. The number of ions present in the unit cell of cesium chloride (CsCl) is
(a) 6 (b) 4
(c) 2 (d) 8

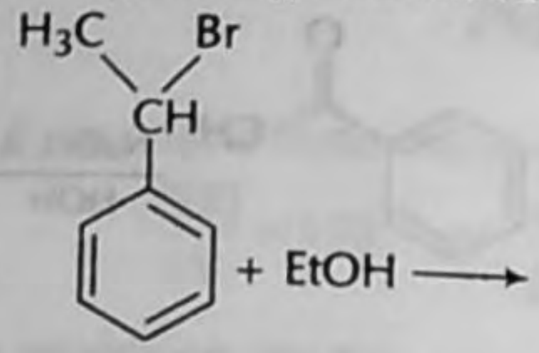
20. The crystal field stabilization energy and the spin-only magnetic moment of $[CoF_6]^{4-}$ are respectively
(a) 0.4 Δ_0 and 4.9 BM (b) 0.8 Δ_0 and 3.8 BM
(c) 1.8 Δ_0 and 1.7 BM (d) 2.4 Δ_0 and 0 BM

21. The reaction of H_3BO_3 with HF yields a product, which upon introduction into bunsen flame gives a characteristic green colouration. The product is
(a) BH_3 (b) B_2H_6
(c) B_2O_3 (d) BF_3

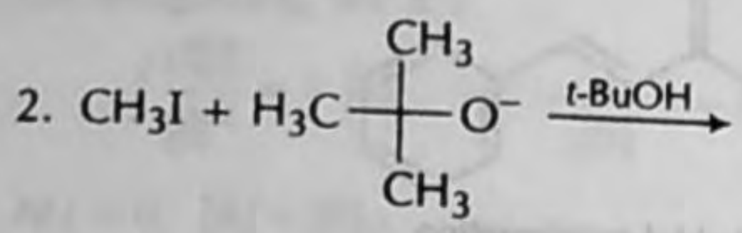
22. Graphite sublimes at a very high temperature (3700°C). This is due to
(a) weak covalent interactions in the solid and stronger or more covalent interactions in the gas phase
(b) strong covalent interactions in the solid and weaker or fewer covalent interactions in the gas phase
(c) strong covalent interactions in the solid and strong covalent interactions in the gas phase
(d) weak covalent interactions in the solid and stronger ionic interactions in the gas phase

23. The nickel (II) complex $[NiCl_2(PPh_3)_2]$ is paramagnetic. The analogous complex of palladium (II) is diamagnetic. The number of isomers that will exist for each of these formulations respectively are
(a) 1, 1 (b) 2, 2
(c) 1, 2 (d) 2, 1

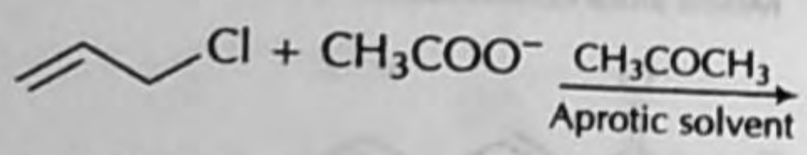
24. The order (from 1 to 3) in which the reactions below follow S_N1 and S_N2 mechanisms is



1. + EtOH ⟶



2. $CH_3I + H_3C-C(CH_3)_2-O^-$ $\xrightarrow{t\text{-BuOH}}$



3. Cl + CH_3COO^- $\xrightarrow[\text{Aprotic solvent}]{CH_3COCH_3}$

(a) S_N1, S_N2, S_N2 (b) S_N2, S_N1, S_N2
(c) S_N1, S_N2, S_N1 (d) S_N2, S_N2, S_N1

25. The products '*X*' and '*Y*' of the following reaction are

$CH_3CH_2COOEt \xrightarrow[2.\ H^+/H_2O]{1.\ 2PhMgBr,\ ether} X \xrightarrow{conc.\ H_2SO_4,\ \Delta} Y$

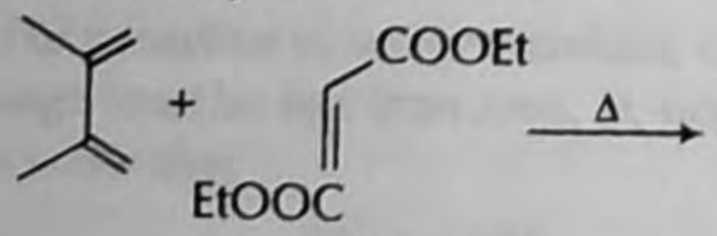
(a) $CH_3CH_2-C(OH)Ph_2$ and $H_3CHC=CPh_2$

(b) $CH_3CH_2-C(=O)-Ph$ and $CH_3CH_2-CH(OH)-Ph$

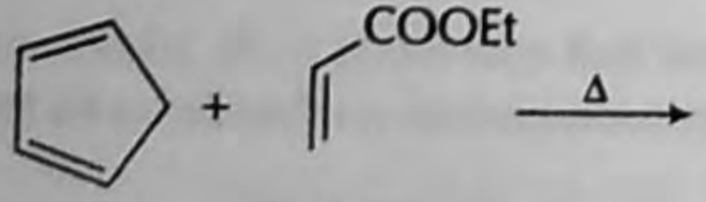
(c) $CH_3CH_2-CH(OH)-Ph$ and $CH_3CH_2-CPh_2(OH)$

(d) $CH_3CH_2-CPh_2(OH)$ and $CH_2=C=CPh_2$

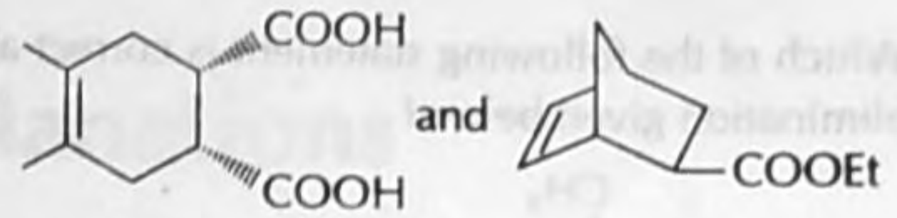
26. The major products of the following Diels-Alder cycloaddition reaction 1 and 2 with the correct stereochemistry are

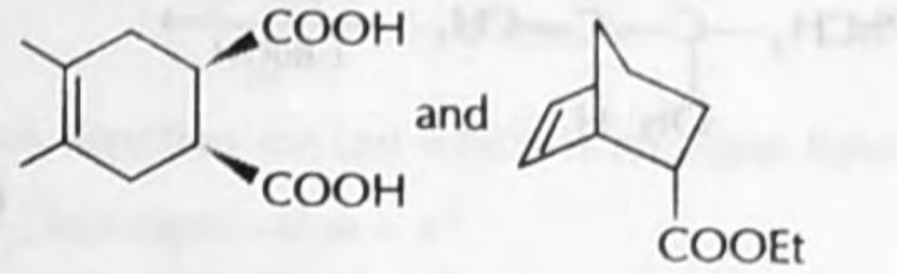


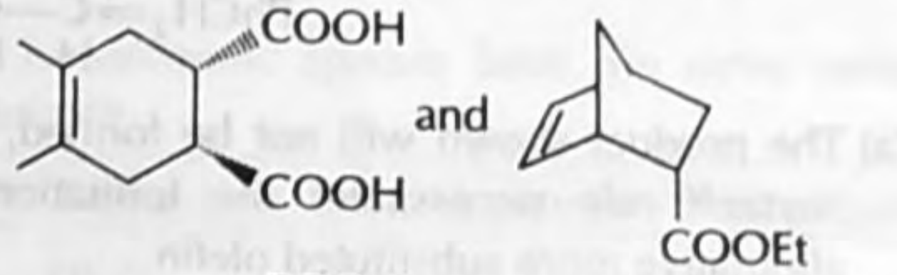
1. + $\xrightarrow{\Delta}$

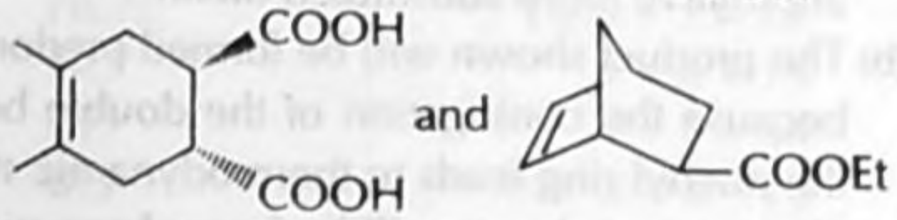


2. + $\xrightarrow{\Delta}$

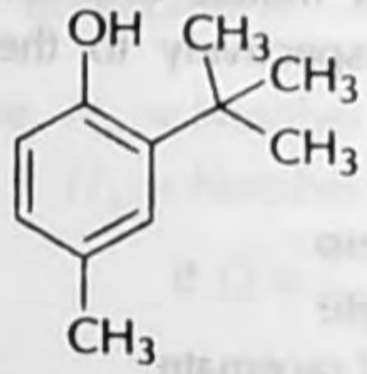
(a) 

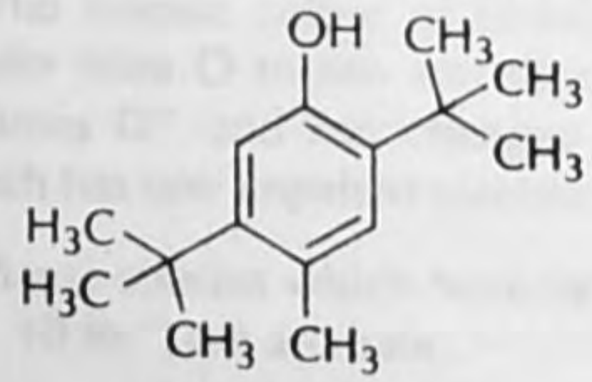
(b) 

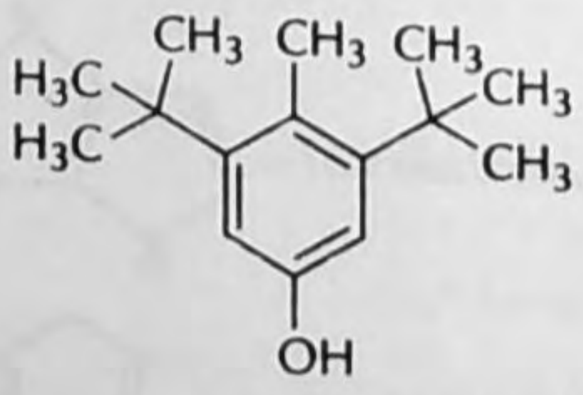
(c) 

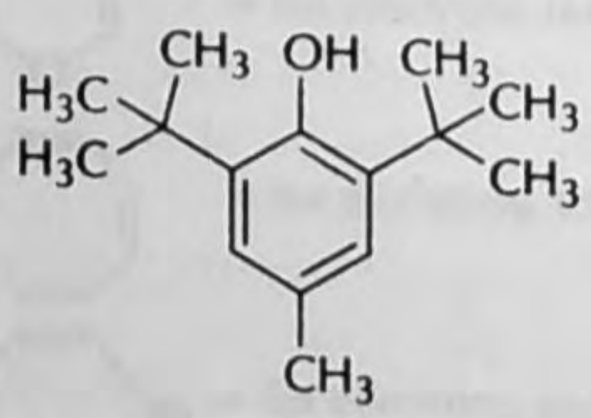
(d) 

27. *p*-cresol (4-methylphenol) reacts with two molar equivalents of isobutylene in the presence of HCl and $AlCl_3$ to give a product, which is an excellent antioxidant. The structure of the product is

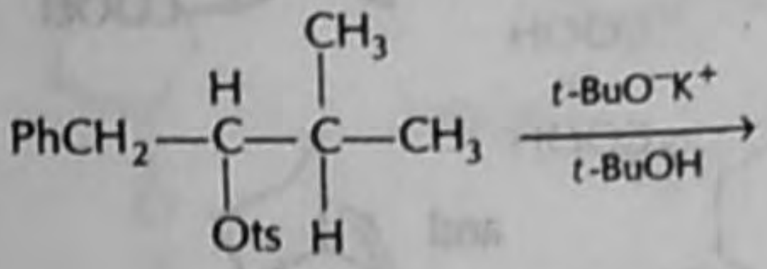
(a) 

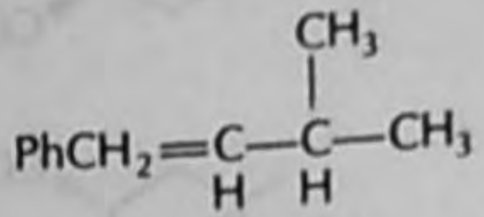
(b) 

(c) 

(d) 

28. Which of the following statement is correct about the elimination given below?





(a) The product shown will not be formed, because Saytzeff rule necessitates the formation of the alternative more substituted olefin

(b) The product shown will be formed predominantly, because the conjugation of the double bond with the phenyl ring leads to thermodynamic stability

(c) The product shown will be formed as a minor one. This follows from Saytzeff rule

(d) The product shown is correct and it follows from Saytzeff rule

29. The perhydroxylation of maleic and fumaric acids using $KMnO_4$ leads respectively to the following tartaric acids

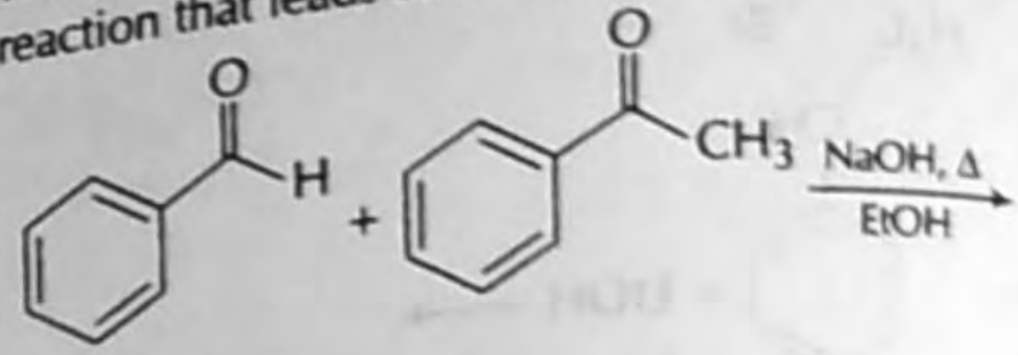
(a) *meso* and *meso*

(b) *d, l* racemate and *meso*

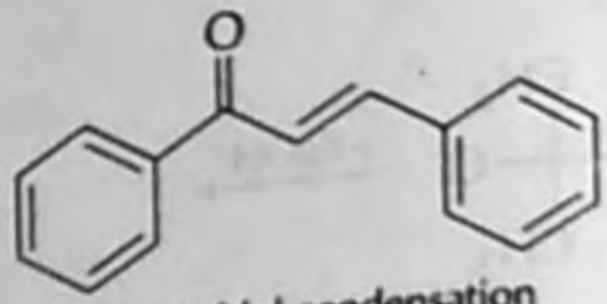
(c) *meso* and *d, l* racemate

(d) *d, l* racemate and *d, l* racemate

30. The product of the following reaction and the name reaction that leads to its formation are

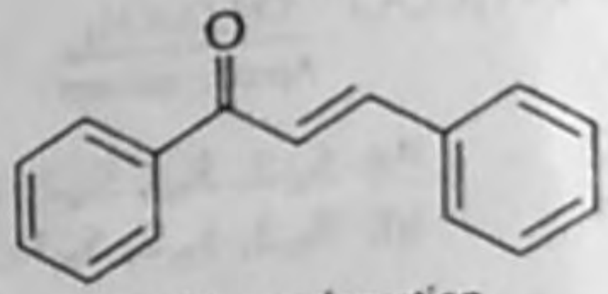


(a)



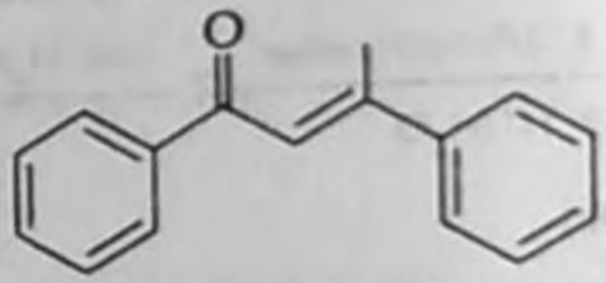
Mixed aldol condensation

(b)



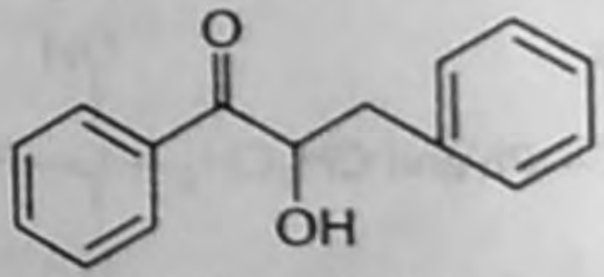
Perkin condensation

(c)



Claisen condensation

(d)



Benzoin condensation