RESONANCE

Q.1 Which of the following statements are correct :
Delocalization of electrons increases molecular stability because.
(a) electrons – nuclei attraction increases.
(b) electron – electron repulsion decreases.
(c) potential energy of the molecule increases.
(d) potential energy of the molecule decreases.

Q.2 Which of the following statements is (are) true about resonance.
(a) Resonance is an intramolecular process.
(b) Resonance involves delocalization of both σ and π electrons.
(c) Resonance involves delocalization of π electrons only.
(d) Resonance decreases potential energy of a molecule.
(e) Resonance has no effect on the potential energy of a molecule.
(f) Resonance is the only way to increase molecular stability.
(g) Resonance is not the only way to increase molecular stability.
(h) Any resonating molecule is always more stable than any nonresonating molecule.
(i) The canonical structure explains all features of a molecule.
(j) The resonance hybrid explains all features of a molecule.
(k) Resonating structures are real and resonance hybrid is imaginary.
(l) Resonance hybrid is real and resonating structures are imaginary.
(m) Resonance hybrid is always more stable than all canonical structures.

Q.3 Which of the following statements are correct about canonical structures
All canonical structures of a molecule :
(a) must have same number of unpaired electrons.
(b) must have different numbers of paired electrons.
(c) need not be always equivalent but they should not differ much in stability.
(d) should be always equivalent.
(e) must have π electrons in same orbital.
(f) must have π electrons in different orbitals.

Q.4 Which of the following statements are correct about Resonance energy
Resonance energy is
(a) equal to the energy of resonance hybrid.
(b) equal to the energy of most stable canonical structure.
(c) equal to the energy of least stable canonical structure.
(d) equal to the difference in energies of the most stable canonical structure & resonance hybrid.
(e) equal to the potential energy of molecule.

Q.5 Mark the correct statements
Resonance energy is
(a) stored by the molecule
(b) released by the molecule
(c) neither stored nor released by the molecule
(d) sometimes stored and somtimes released by the molecules.

Q.6 Resonance energy will be more if
(a) canonical structures are equivalent than if canonical structures are non-equivalent.
(b) canonical structures have charge separation than if canonical structure have no charge separation.
(c) canonical structures have more charge separation tha if canonical structures have less charge separation.
(d) molecule is aromatic than if molecule is not aromatic.

Q.7 A canonical structure will be more stable if

(a) it has more number of π bonds than if it has less number of π bonds.

(b) the octets of all atoms are complete than if octets of all atoms are not complete.

(c) it has charge separation than if it has no charge separation.

(d) it involves cyclic delocalization of (4n + 2) π – electrons than if it involves acyclic delocalization of (4n + 2) π – electrons.

(e) it involves cyclic delocalization (4n) π – electrons than if it involves acyclic delocalizationof (4n) π – electrons.

(f) +ve charge is on more electronegative atom than if +ve charge is on less electronegative atoms.

(g) –ve charge is on more electronegative atom than if –ve

Q.8 Which of the following statements is (are) true about the contribution of a canonical structure in resonance hybrid :

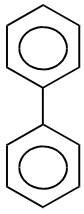
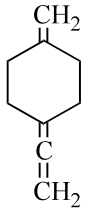
(a) More stable canonical structure will have more contribution than less stable canonical structure.

(b) A cahrge separated canonical structure will have more contribution than a canonical structure without charge separation.

(c) A canonical structure with –ve charge on more electronegative atom and +ve charge on less electronegative atom will have more contribution than a canonical structure with +ve charge on more electronegative atom and –ve charge on less electronegative atom.

(d) A canonical structure with more number of π – bonds will have more contribution than a canonical structure with less number of π bonds.

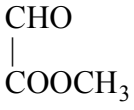
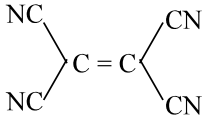
Q.9 In which of the following molecules all atoms are coplanar :

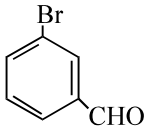
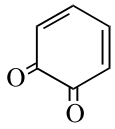
(a)  (b)  (c)  (d) HCOCl

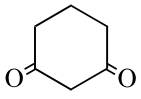
(e) C_3H_8 (f) $C(CN)_4$ (g) $CH_3 - CH = CH_2$ (h) 

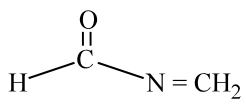
(i)  (j) $CH_2 = C = CH_2$

Q.10 In which of the following molecules all atoms are not coplanar :

(a) $CH_2 = C = C = CH_2$ (b)  (c) 

(d)  (e) $HCOOCH_3$ (f) 

(g) $CH_2 = CH - CH = CH_2$ (h) $CH_2 = CH - C \equiv CH$ (i) 

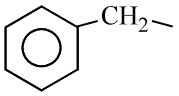
(j) 

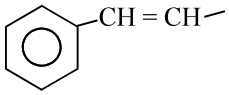
Q.11 Which of the following groups cannot participate in resonance with other suitable group :

(a) – COOH (b) $-CO\overline{O}$ (c) – COCl (d) $-\overset{\oplus}{N}H_3$

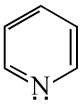
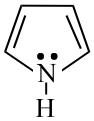
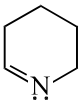
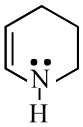
(e) $-\overset{\oplus}{C}H_2$ (f) $-\dot{C}H_2$ (g) $CH_2=\overset{\oplus}{N}-$ with CH_3 below N

Q.12 Which of the following group can participate in resonance with other suitable group :

(a) $CH_2=\overset{\oplus}{O}-$ (b) $-CH_2-\overline{C}H_2$ (c) $-CH_2-\overset{\oplus}{C}H_2$ (d) 

(e)  (f) $-BH_2$ (g) $-\overset{\oplus}{P}Ph_3$

Q.13 In which of the following lone-pair indicated is involved in resonance :

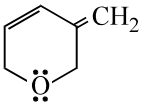
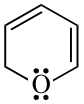
(a)  (b)  (c)  (d) 

(e) $CH_2=CH-\overset{\ominus}{C}H_2$ (f) $CH_2=CH-CH=\ddot{N}H$

Q.14 In which of the following lone-pair indicated is not involved in resonance :

(a) $CH_2=CH-\ddot{N}H-CH_3$ (b) $CH_2=CH-CH=\ddot{O}$

(c) $CH_2=CH-\ddot{O}-CH=CH_2$ (d) $CH_2=CH-C\equiv N:$

(e)  (f) 

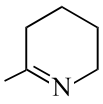
Q.15 Identify electron – donating groups in resonance among the following :

(a) $-CONH_2$ (b) $-NO_2$ (c) $-OCOCH_3$ (d) $-COOCH_3$

(e) – CHO (f) $-NHCOCH_3$

Q.16 Identify electron – withdrawing groups in resonance among the following :

(a) – COOH (b) $-CONHCH_3$ (c) – COCl (d) – CN

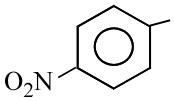
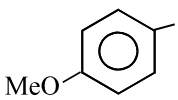
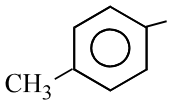
(e) $-O-CH=CH_2$ (f) 

Q.17 Which of the following groups can either donate or withdraw a pair of electrons in resonance depending upon situation :

(a) $-NO_2$ (b) – NO (c) – CH = CH (d) – CHO

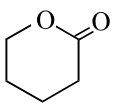
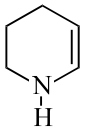
(e) $-NH_2$ (f) – N = NH

Q.18 Which of the following groups can only withdraw a pair of electrons in resonance depending upon situation :

(a) – Ph (b)  (c)  (d) 

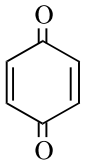
(e) $-\overset{\oplus}{N}Me_3$ (f) $-CONH_2$

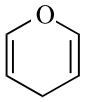
Q.19 Write the canonical structures of each of the following :

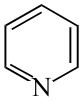
(a) CH_3NO_2 (b) $CH_2 = CH - \overset{CH_3}{\underset{CH_3}{N}}$ (c)  (d) 

(e) $CH_3O - CH = CH - \overset{\oplus}{N}Me_3$

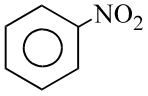
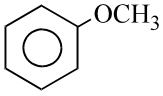
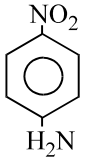
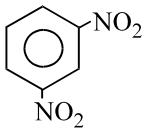
Q.20 Write the canonical structures of each of the following :

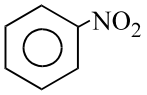
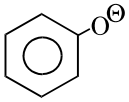
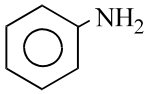
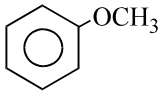
(a)  (b) $CH_2 = \overset{\oplus}{N} = \overline{N}$

(c) $CH_2 = C = O$ (d) 

(e) 

Q.21 Give the decreasing order of π e^- density in the ring.

(i) (A)  (B)  (C)  (D) 

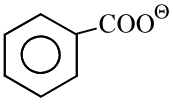
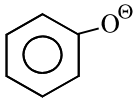
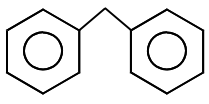
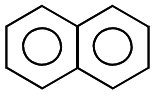
(ii) (A)  (B)  (C)  (D) 

Q.22 $CH_2 = CH - CH = CH - CH_3$ is more stable than $CH_3 - CH = C = CH - CH_3$ because
(I) (II)

(A) there is resonance in I but not in II
(B) there is tautomerism in I but not in II
(C) there is hyperconjugation in I but not in II
(D) II has more cononical structures than I.

Q.23 Which of the following pairs has higher resonance energy :

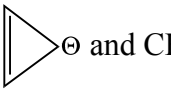
(a) CH_3COOH and CH_3COONa (b) $CH_2 = CH - \overset{\ominus}{O}$ and $CH_2 = CH - OH$

(c)  and  (d)  and 

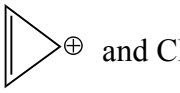
(e)  and $CH_2 = CH - CH = CH - CH = CH_2$

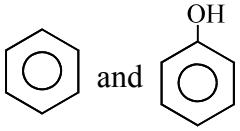
Q.24 Which of the following pairs has less resonance energy :

(a) CO_3^{2-} and $HCOO^-$

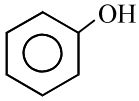
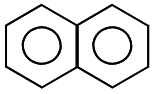
(b)  and $CH_2 = CH - \overset{\ominus}{C}H_2$

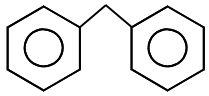
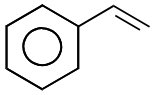
(c)  and $CH_2 = CH - CH = CH_2$

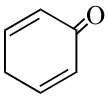
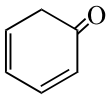
(d)  and $CH_2 = CH - \overset{\oplus}{C}H_2$

(e)  and

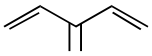
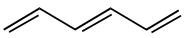
Q.25 Which of the following pairs has higher resonance energy :

(a)  and 

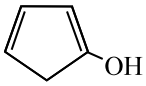
(b)  and 

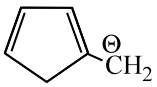
(c)  and 

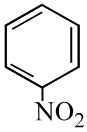
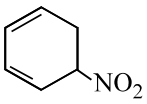
(d) $CH_2 = CH - OH$ and $CH_2 = CH - CH = CH - OH$

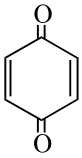
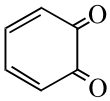
(e)  and 

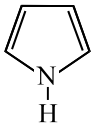
Q.26 Which of the following pairs has less resonance energy :

(a)  and 

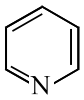
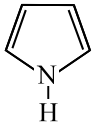
(b)  and 

(c)  and 

(d)  and 

(e)  and 

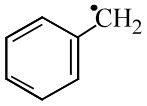
Q.27 Which of the following pairs has higher resonance energy :

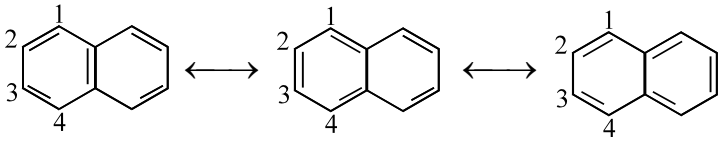
(a)  and 

(b) $CH_2 = CH - O - CH = CH_2$ and $CH_2 = CH - NH - CH = CH_2$

(c) $CH_2 = CH - \overset{\ominus}{N}H$ and $HN = CH - \overset{\ominus}{N}H$

(d) $CH_2 = CH - F$ and $CH_2 = CH - Br$

(e)  and $CH_2 = CH - \dot{C}H_2$

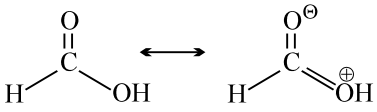
Q.28 

These are three canonical structures of naphthalene. Examine them and find correct statement among the following :

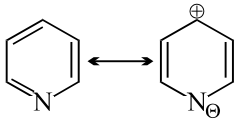
(A) All C – C bonds are of same length (B) CI – C2 bond is shorter than C2 – C3 bond.

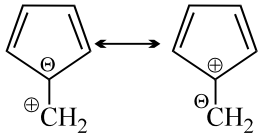
(C) C1 – C2 bond is longer than C2 – C3 bond (D) none.

Q.29 Identify more stable canonical structure in each of the following pairs :

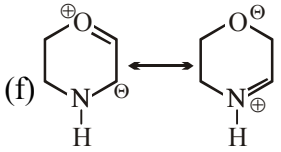
(a) 

(b) $\overset{\ominus}{C}H_2 - C \equiv CH \longleftrightarrow CH_2 = C = \overset{\ominus}{C}H$

(c) 

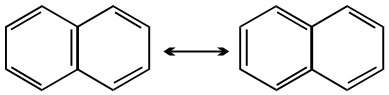
(d) 

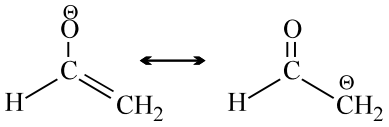
(e) $\overset{\oplus}{C}H_2 - CH = CH - \overset{\ominus}{O} \longleftrightarrow CH_2 = CH - CH = O$

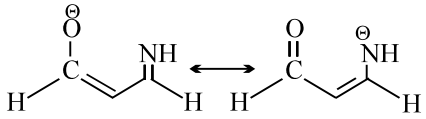
(f) 

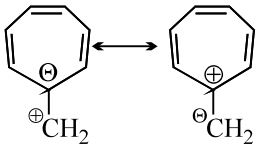
Q.30 Identify less stable canonical structure in each of the following pairs :

(a) $\overset{\oplus}{C}H_2 - O - CH_3 \longleftrightarrow CH_2 = \overset{\oplus}{O} - CH_3$

(b) 

(c) 

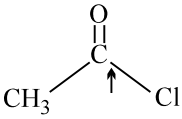
(d) 

(e) 

Q.31 In which of the following pairs, indicated bond is of greater strength :

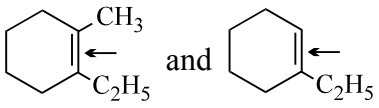
(a) $CH_3 - CH_2 \underset{\uparrow}{-} Br$ and $CH_3 - CH_2 \underset{\uparrow}{-} Cl$

(b) $CH_3 - CH = CH \underset{\uparrow}{-} Br$ and $CH_3 - \underset{\rightarrow}{CH} - CH_3$ (Br)

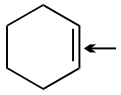
(c)  and $CH_3 - CH_2 \underset{\uparrow}{-} Cl$

(d) $CH_2 = CH \underset{\uparrow}{-} CH = CH_2$ and $CH_2 = CH_2 \underset{\uparrow}{-} CH_2 - CH_3$

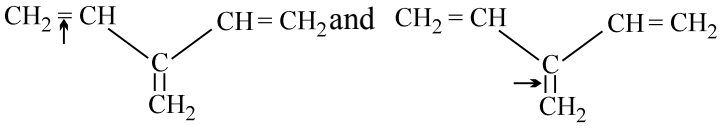
(e) $CH_2 = CH \underset{\uparrow}{-} CH = CH_2$ and $CH_2 = CH \underset{\uparrow}{-} NO_2$

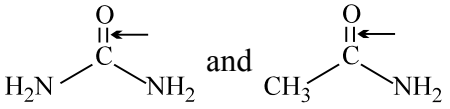
(f) 

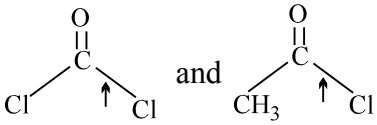
Q.32 In which of the following pairs, indicated bond having less bond dissociation energy :

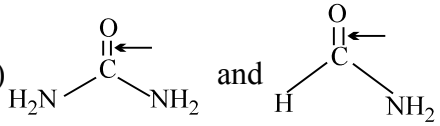
(a)  and $CH_2 \overset{\uparrow}{=} CH_2$

(b) $CH_3 - C \overset{\uparrow}{\equiv} CH$ and $HC \overset{\uparrow}{\equiv} CH$

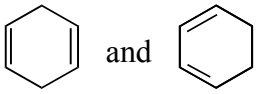
(c) 

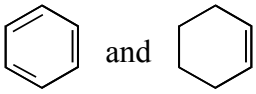
(d) 

(e) 

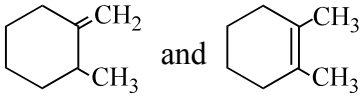
(f) 

Q.33 Among the following pairs identify the one which gives higher heat of hydrogenation :

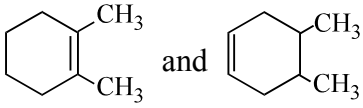
(a) 

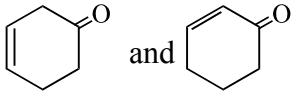
(b) 

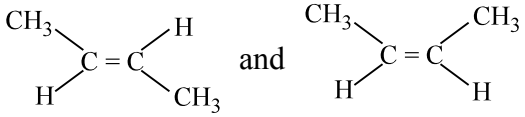
(c) $CH_3 - CH = CH - CH_3$ and $CH_3 - CH_2 - CH = CH_2$

(d) 

Q.34 Among the following pairs identify the one which gives less heat of hydrogenation :

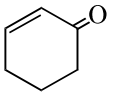
(a) 

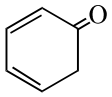
(b) 

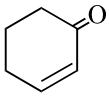
(c) 

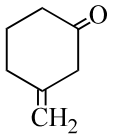
(d) $CH_2 = CH - CH \begin{matrix} CH_3 \\ CH_3 \end{matrix}$ and $CH_2 = C \begin{matrix} CH_3 \\ CH_2 - CH_3 \end{matrix}$

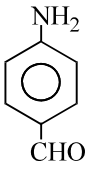
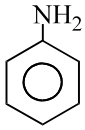
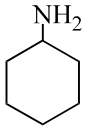
Q.35 Which of the following has longest C – O bond :

(A) 

(B) 

(C) 

(D) 

Q.36    $CH_2 = NH$

I II III IV

Among these compounds, the correct order of C – N bond lengths is :

(A) IV > I > II > III (B) III > I > II > IV (C) III > II > I > IV (D) III > I > IV > II

Q.37 Among the following molecules, the correct order of C – C bond lenght is

(A) $C_2H_6 > C_2H_4 > C_6H_6 > C_2H_2$ (B) $C_2H_6 > C_6H_6 > C_2H_4 > C_2H_2$($C_6H_6$ is benzene)

(C) $C_2H_4 > C_2H_6 > C_2H_2 > C_6H_6$ (D) $C_2H_6 > C_2H_4 > C_2H_2 > C_6H_6$

Q.38 $CH_3O - CH = CH - NO_2$ I

$CH_2 = CH - NO_2$ II

$CH_2 = CH - Cl$ III

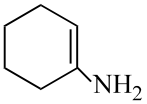
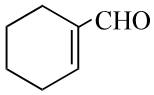
$CH_2 = CH_2$ IV

Which of the following is the correct order of C – C bond lengths among these compounds :

(A) I > II > III > IV (B) IV > III > II > I (C) I > III > II > IV (D) II > III > I > IV

Q.39 In which of the following molecules resonance is equivalent :

(A) $HCOO^{\ominus}$ (B) $CH_2 = CH - CH = CH_2$

(C)  (D) 

Q.40 $CH_2 = CH - CH = CH - CH_3$ is more stable than $CH_3 - CH = C = CH - CH_3$ because

(I) (II)

(A) there is resonance in I but not in II (B) there is tautomerism in I but not in II

(C) there is hyperconjugation in I but not in II (D) II has more cononical structures than I.

Q.41 $CH_2 = CH - CH = CH - CH = CH_2$ I

$CH_2 = CH - \overset{\oplus}{C}H - CH = CH - \overset{\ominus}{C}H_2$ II

$\overset{\oplus}{C}H_2 - CH = CH - CH = CH - \overset{\ominus}{C}H_2$ III

Among these three canonical structures (through more are possible) what would be their relative contribution in the hybrid :

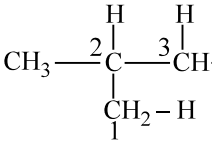
(A) I > II > III (B) III > II > I (C) I > III > II (D) III > I > II

Q.42 Which of the following is (are) the correct order of bond lengths :

(A) C – C > C = C > C ≡ C > C ≡ N (B) C = N > C = O > C = C

(C) C = C > C = N > C = O (D) C – C > C = C > C ≡ C > C – H

(E) C – C > C – H > C = C > C ≡ C

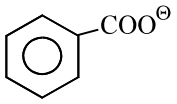
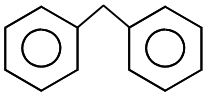
Q.43  ; Cl – H, C2 – H, C3 – H and C4 – H homolytic bond dissociation energy is in the order:

(A) C2 – H > C3 – H > C4 – H > C1 – H (B) C1 – H > C4 – H > C2 – H > C3 – H

(C) C2 – H > C3 – H > C1 – H > C4 – H (D) C1 – H > C4 – H > C3 – H > C2 – H

ANSWER

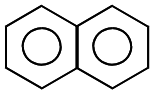
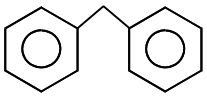
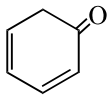
Q.1	a, b, d	Q.2	a, c, d, g, j, l, m	Q.3	a, c	Q.4	d
Q.5	b	Q.6	a, d	Q.7	a, b, d, g	Q.8	a, c, d
Q.9	a, b, d	Q.10	b, e, i	Q.11	b, d	Q.12	a, e, f, g
Q.13	b, d, e	Q.14	b, d, e	Q.15	c, f	Q.16	a, b, c, d, f
Q.17	b, c, f	Q.18	b, f	Q.21	(i) d, a, c, b	(ii) b, c, d, a	Q.22 A

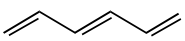
Q.23 (a) CH_3COONa (b) $CH_2 = CH - \overset{\ominus}{O}$ (c)  (d) 

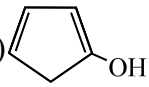
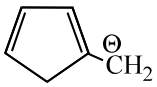
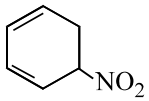
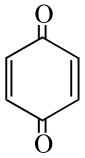
(e) 

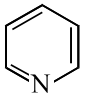
Q.24 (a) $HCOO^-$ (b)  (c)  (d) $CH_2 = CH - \overset{\oplus}{C}H_2$

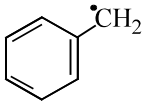
(e) 

Q.25 (a)  (b)  (c)  (d) $CH_2 = CH - CH = CH - OH$

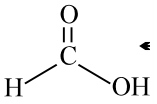
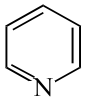
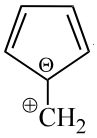
(e) 

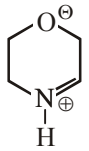
Q.26 (a)  (b)  (c)  (d)  (e) 

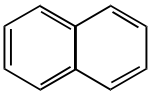
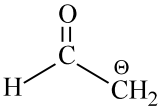
Q.27 (a)  (b) $CH_2 = CH - NH - CH = CH_2$

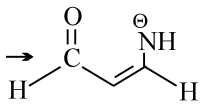
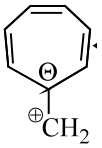
(c) $HN = CH - \overset{\ominus}{N}H$ (d) $CH_2 = CH - F$ (e) 

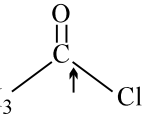
Q.28 B

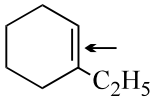
Q.29 (a)  (b) $\overset{\ominus}{C}H_2 - C \equiv CH$ (c)  (d) 

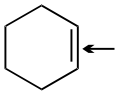
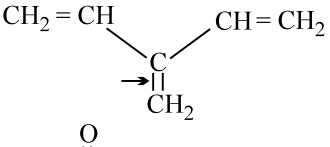
(e) $CH_2 = CH - CH = O$ (f) 

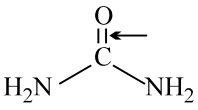
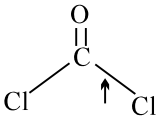
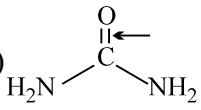
Q.30 (a) $\overset{\oplus}{C}H_2 - O - CH_3$ (b)  (c) 

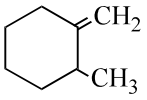
(d)  (e) 

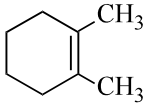
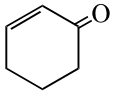
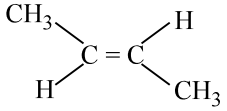
Q.31 (a) $CH_3 - \underset{\uparrow}{CH_2} - Cl$ (b) $CH_3 - CH = CH - \underset{\uparrow}{Br}$ (c)  (d) $CH_2 = CH - \underset{\uparrow}{CH} = CH_2$

(e) $CH_2 = CH - \underset{\uparrow}{NO_2}$ (f) 

Q.32 (a)  (b) $CH_3 - C \equiv \underset{\uparrow}{C}H$ (c) 

(d)  (e)  (f) 

Q.33 (a)  (b)  (c) $CH_3 - CH_2 - CH = CH_2$ (d) 

Q.34 (a)  (b)  (c)  (d) $CH_2 = C \begin{matrix} \nearrow CH_3 \\ \searrow CH_2 - CH_3 \end{matrix}$

Q.35	B	Q.36	C	Q.37	B	Q.38	A
Q.39	A	Q.40	A	Q.41	A	Q.42	A, C, E
Q.43	D						