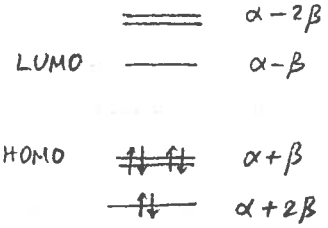
$E_k = \alpha + 2\beta \cos\frac{2k\pi}{N}$ N even, $k = 0, \pm 1, \ldots, \frac{N}{2}$ N odd, $k = 0, \pm 1, \ldots, \pm\frac{N-1}{2}$

(a) Benzene: $N = 6$

$k=0$	$E = \alpha+2\beta$	
± 1	$\alpha + 2\beta \cos\frac{2\pi}{6} = \alpha+\beta$	(2-fold degeneracy)
± 2	$\alpha-\beta$	(2-fold degeneracy)
3	$\alpha-2\beta$	

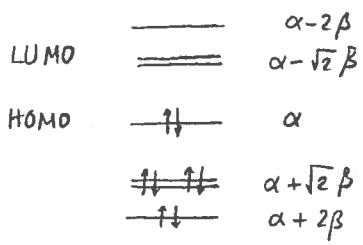


Binding energy: $2(\alpha+2\beta) + 4(\alpha+\beta) = 6\alpha + 8\beta$

Comparing to $6(\alpha+\beta)$, delocalization energy is 2β.

Cyclooctatetraene: $N = 8$

$k=0$	$E = \alpha+2\beta$	
± 1	$\alpha + 2\beta\cos\frac{2\pi}{8} = \alpha+\sqrt{2}\beta$	(2-fold degeneracy)
± 2	$\alpha + 2\beta\cos\frac{4\pi}{8} = \alpha$	" "
± 3	$\alpha + 2\beta\cos\frac{6\pi}{8} = \alpha-\sqrt{2}\beta$	" "
4	$\alpha-2\beta$	



Binding energy: $2(\alpha+2\beta) + 4(\alpha+\sqrt{2}\beta) + 2\alpha$
$= 8\alpha + 4(1+\sqrt{2})\beta$

Comparing to $8(\alpha+\beta)$, delocalization energy is $4(\sqrt{2}-1)\beta \simeq 1.64\beta$