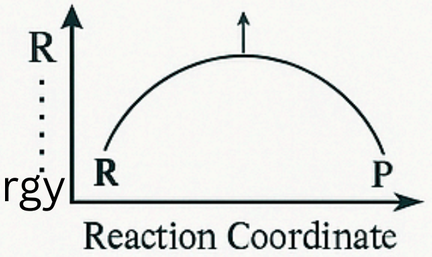
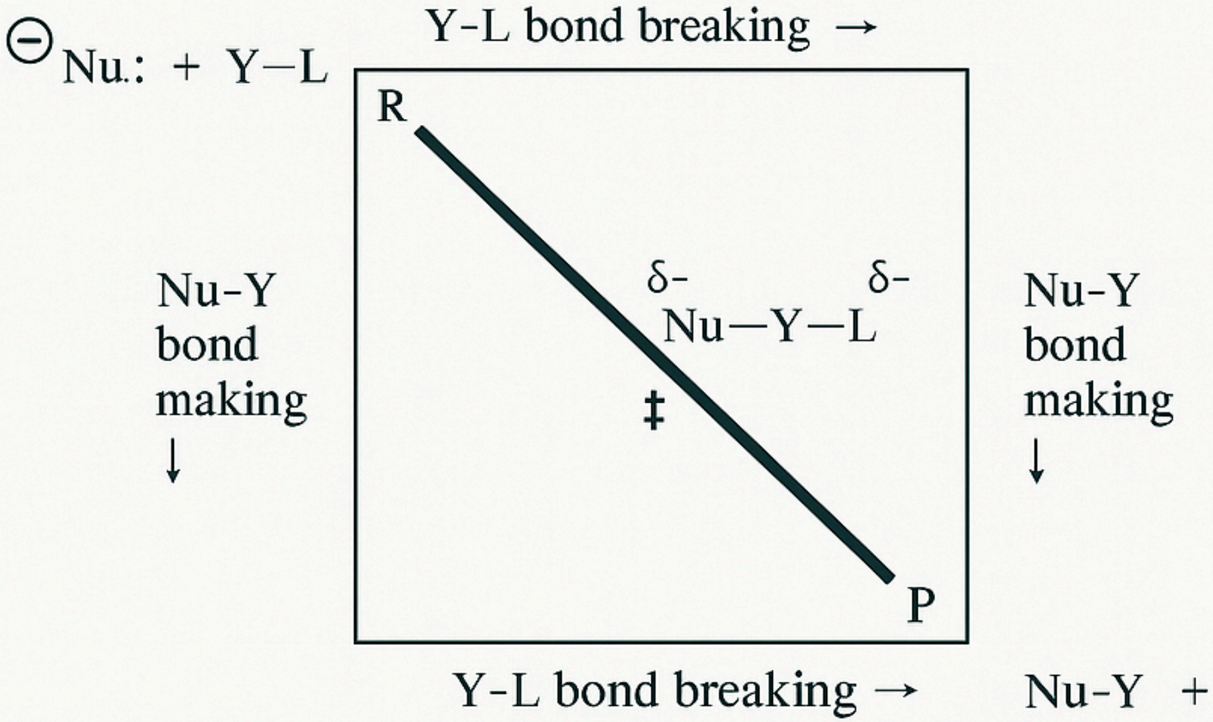
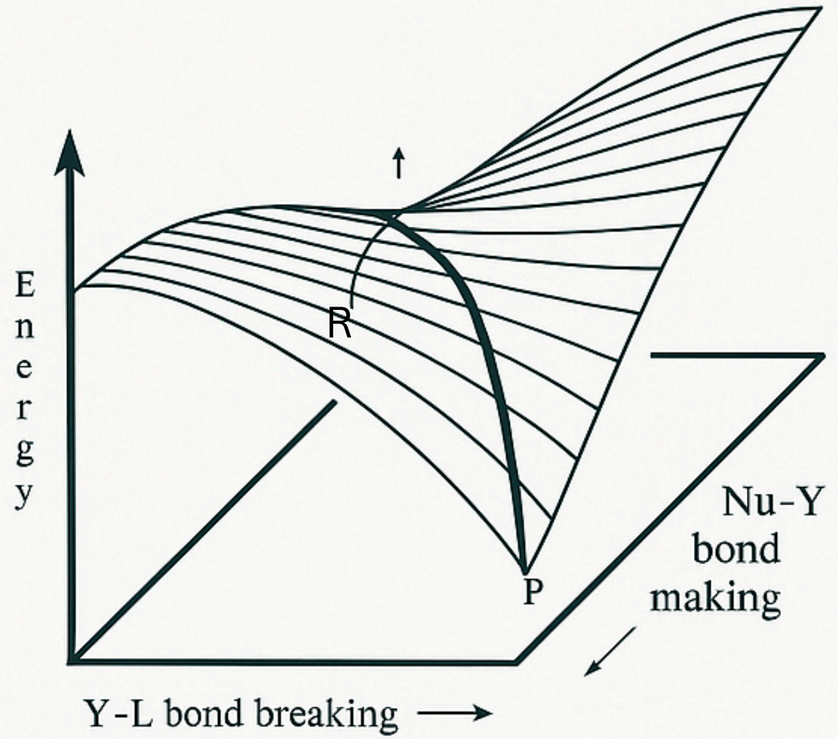
A simplified energy surface:

CHEMICAL SPACE

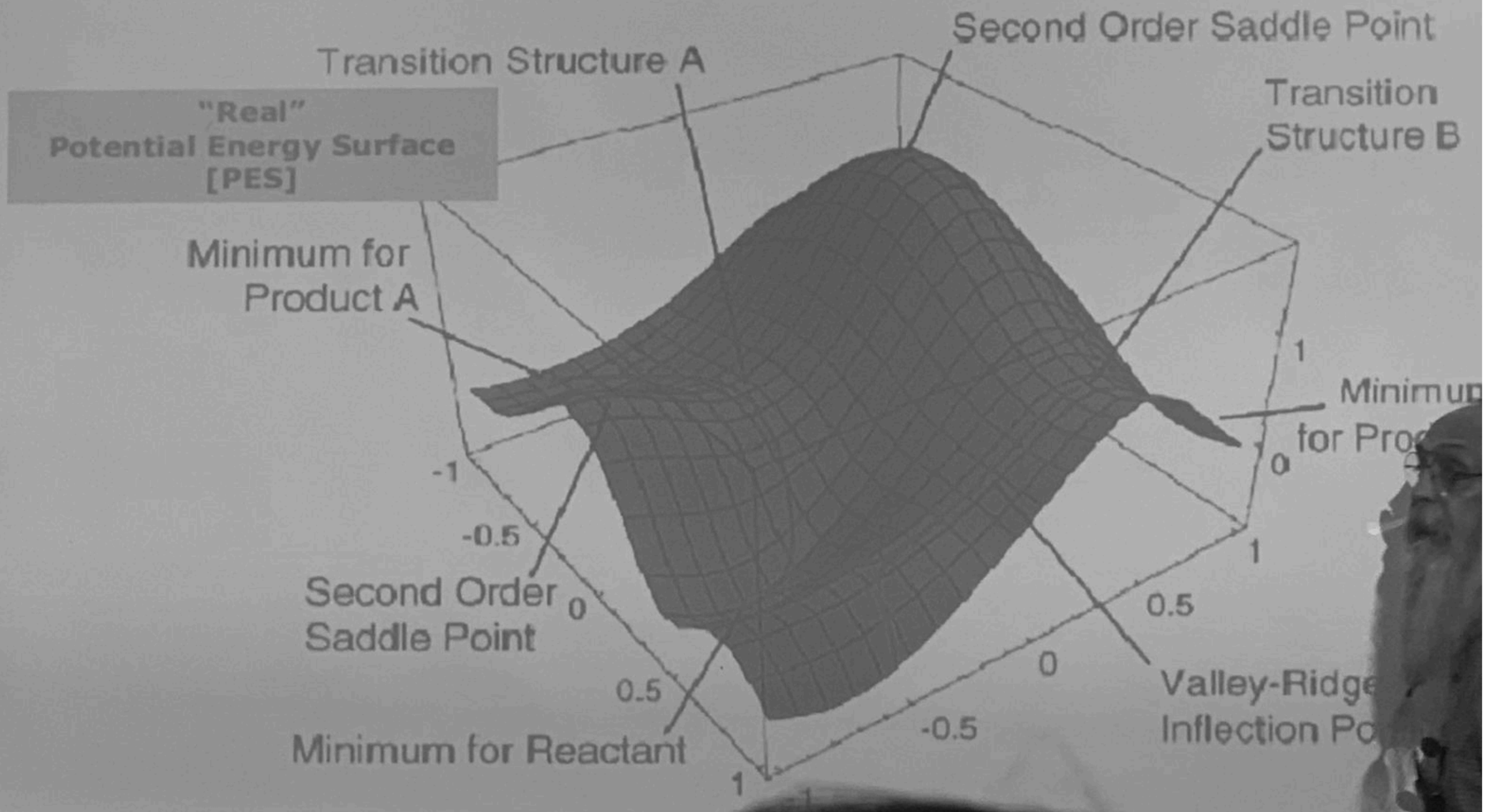


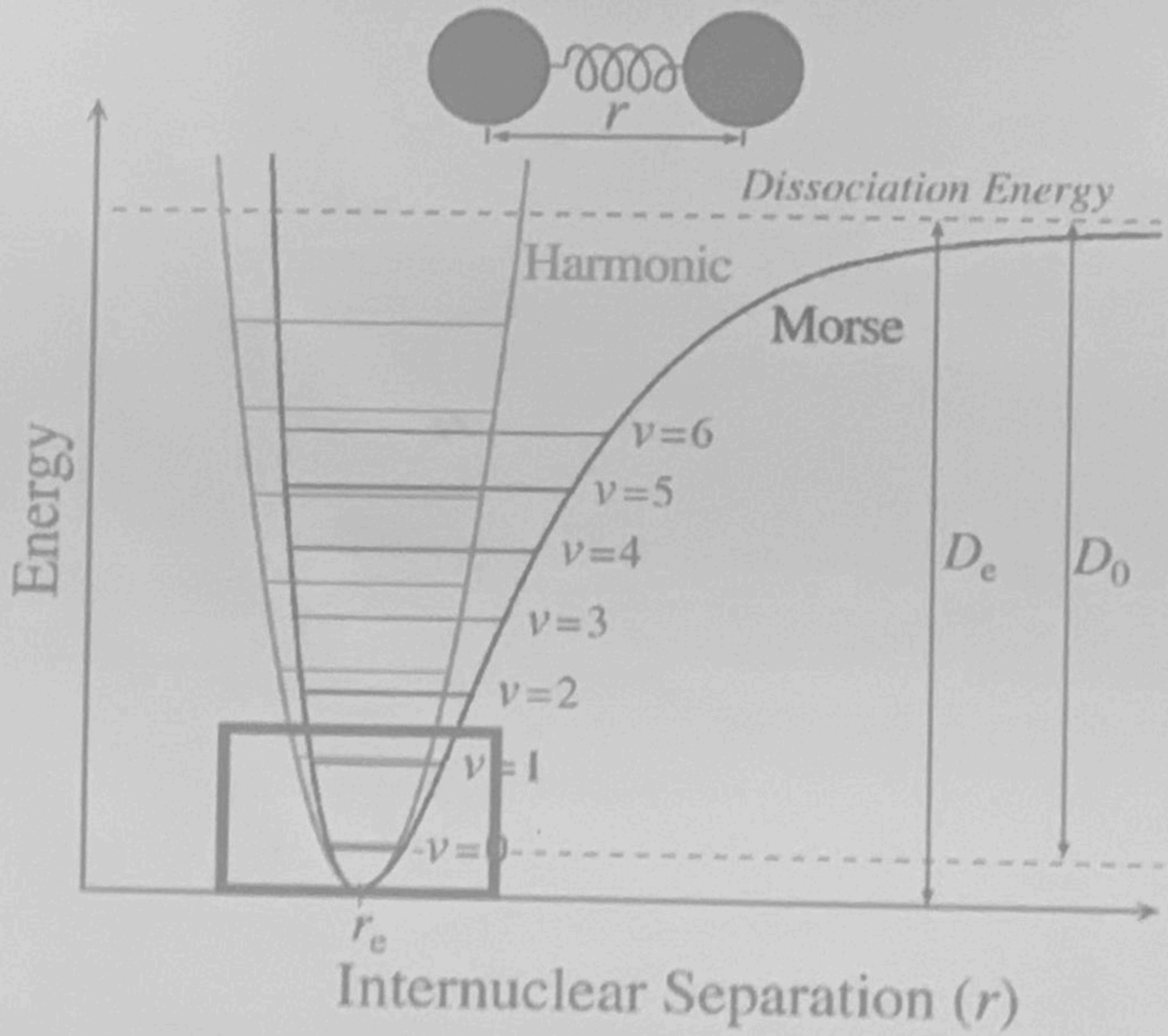


viewed from the top

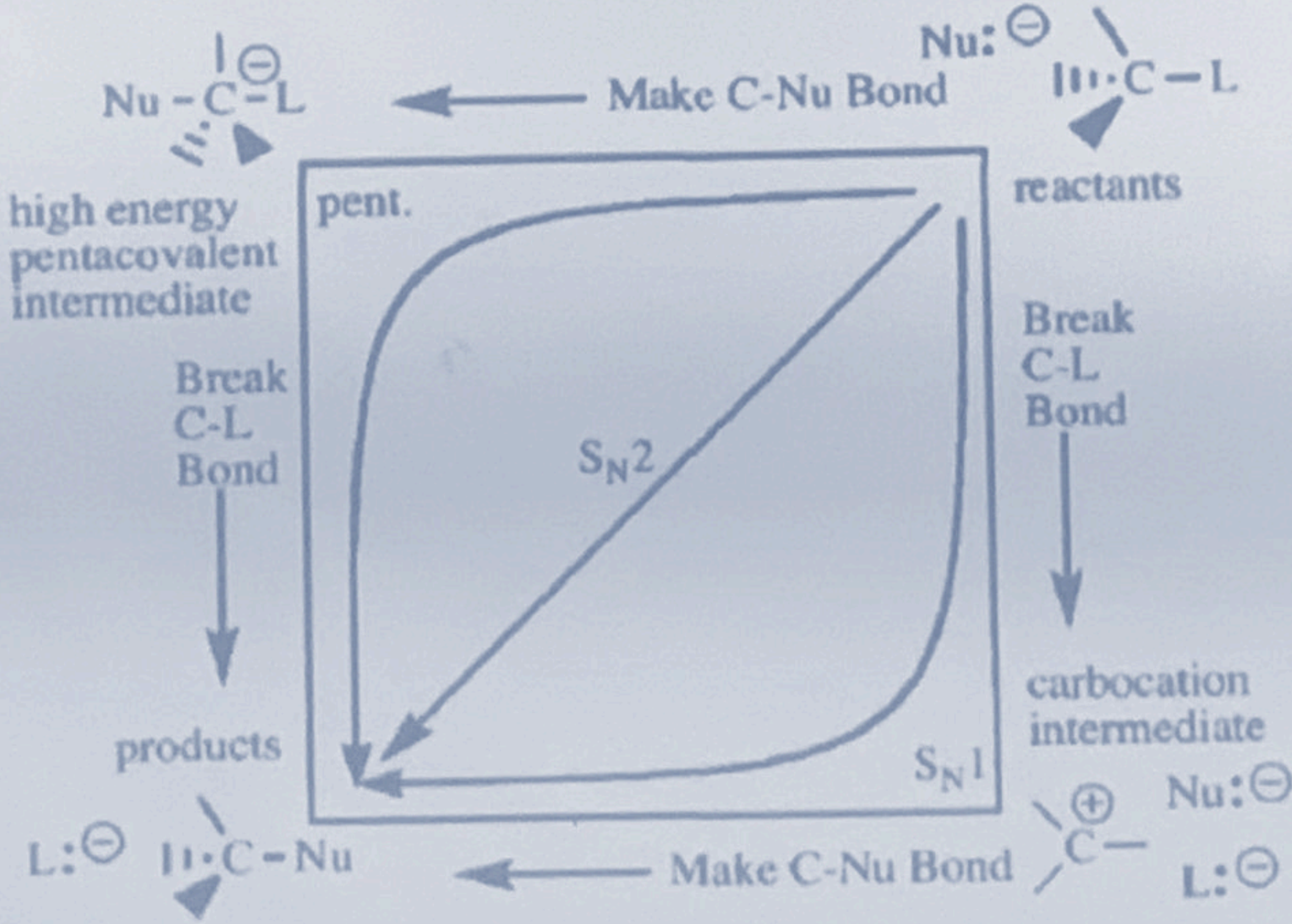


viewed from *4rside*



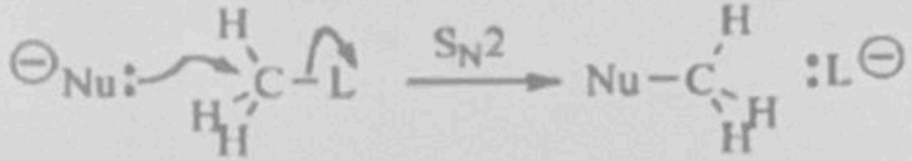

r
Dissociation Energy
Harmonic
Morse
Energy
v=6
v=5
v=4
v=3
v=2
v=1
v=0
D_e
D_0
r_e
Internuclear Separation (r)

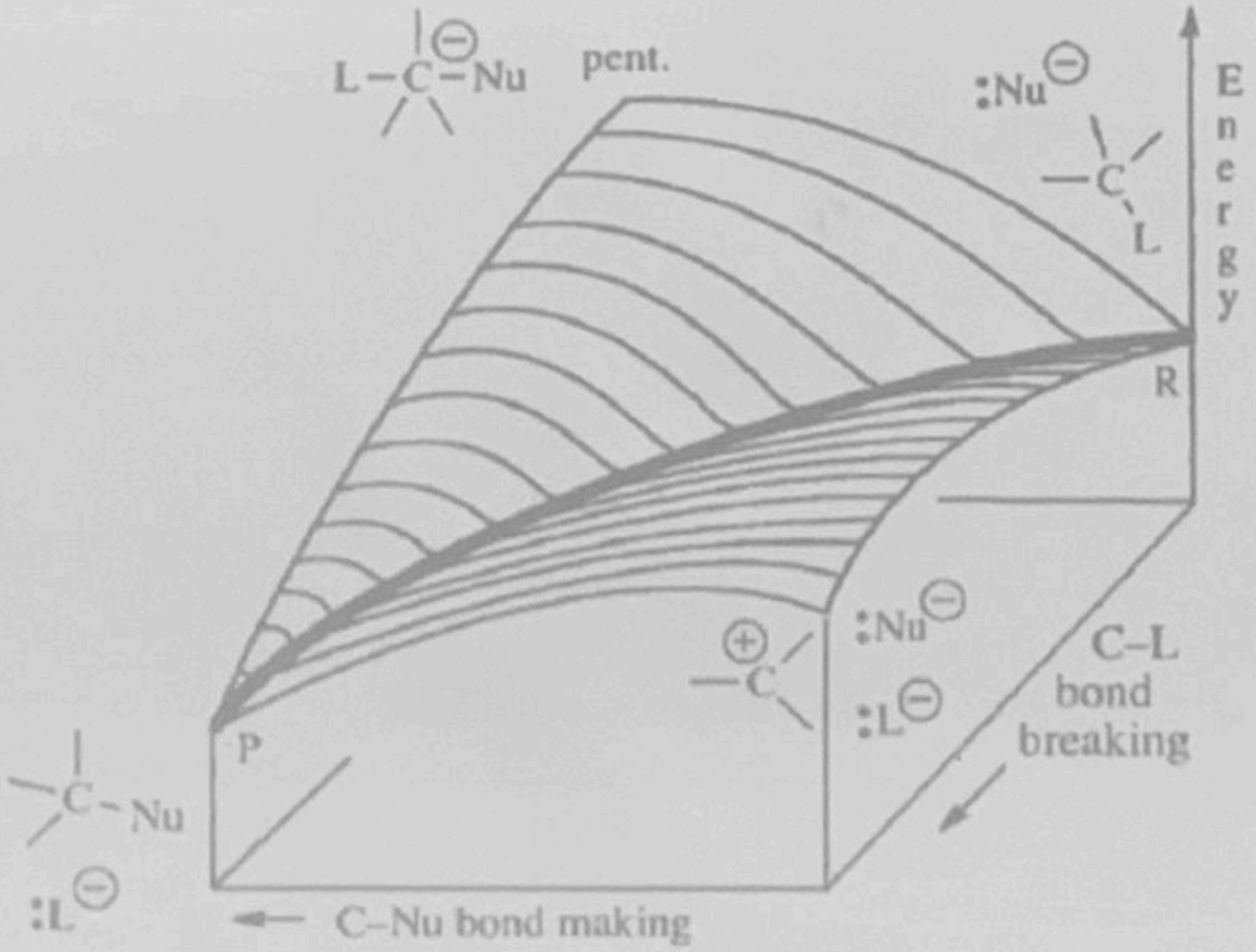
simplified energy surface for substitution at a tetrahedral center

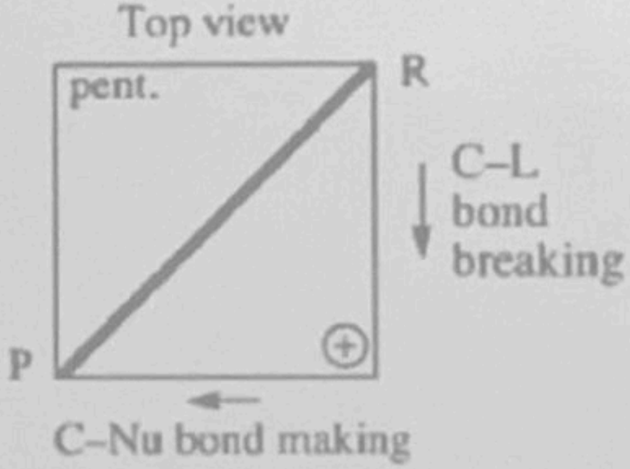


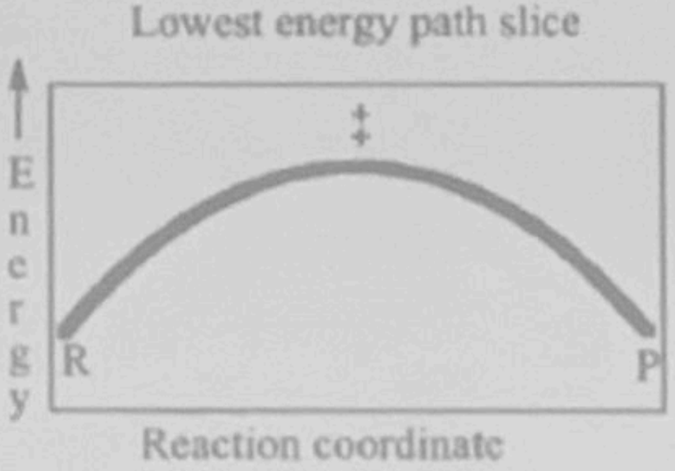
viewed from the top

The S_N2 energy surface; C–L bond breaking and C–Nu bond making are concerted

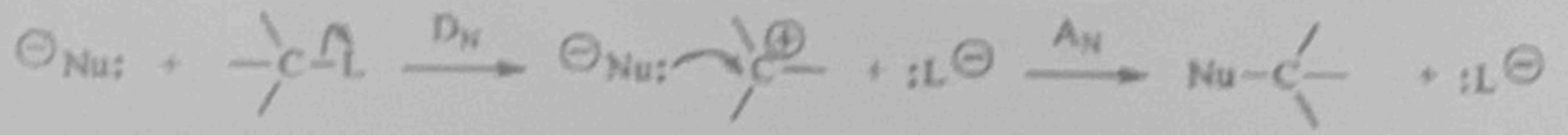


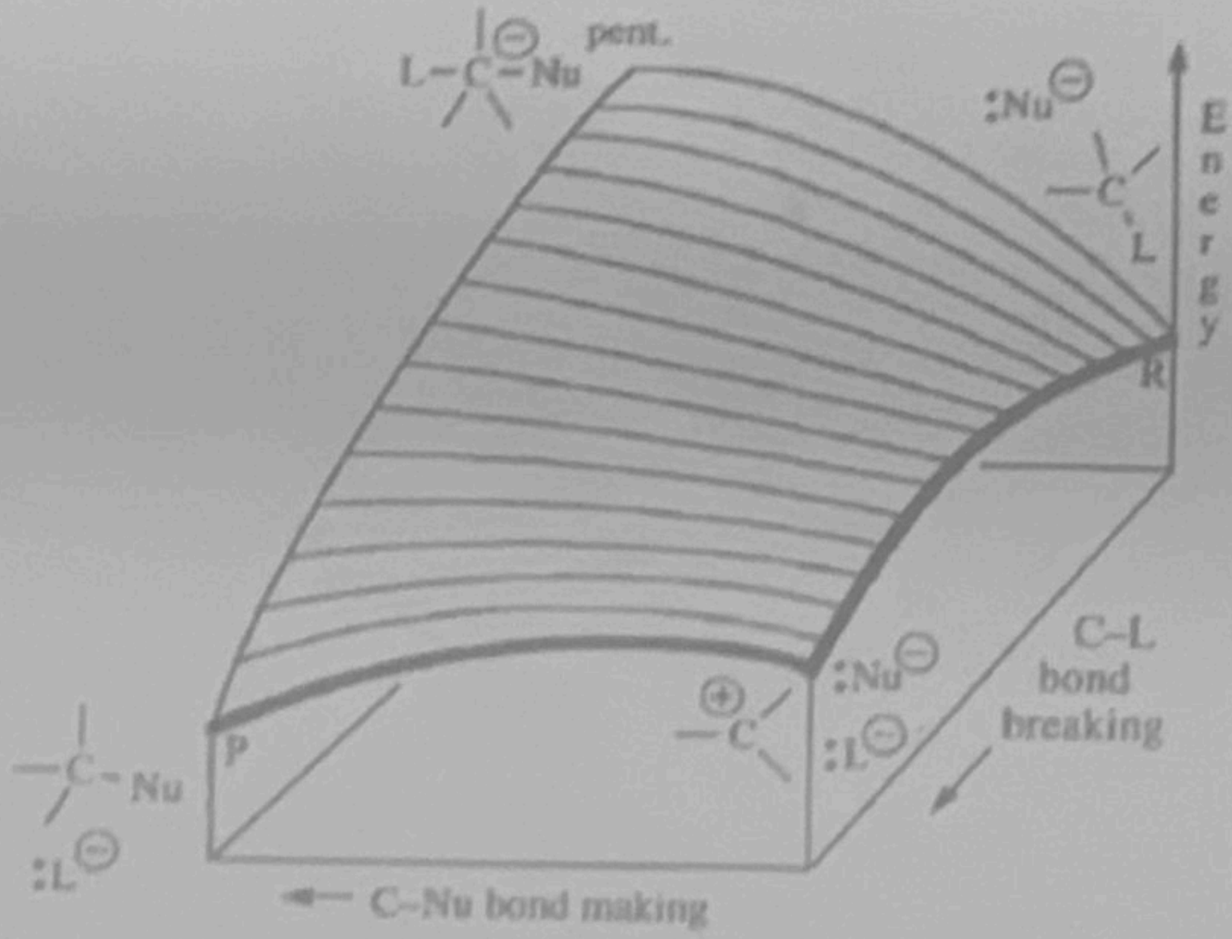


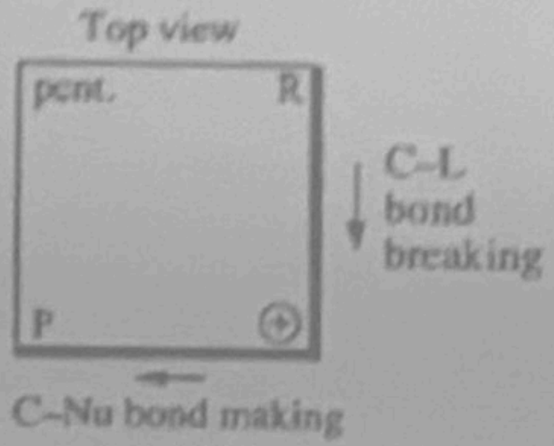


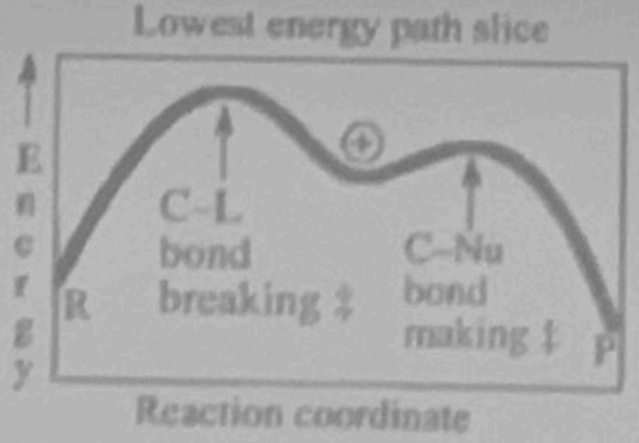


The S_N1 energy surface. The C–L bond breaking occurs first to form a carbocation and then the C–Nu bond is made.

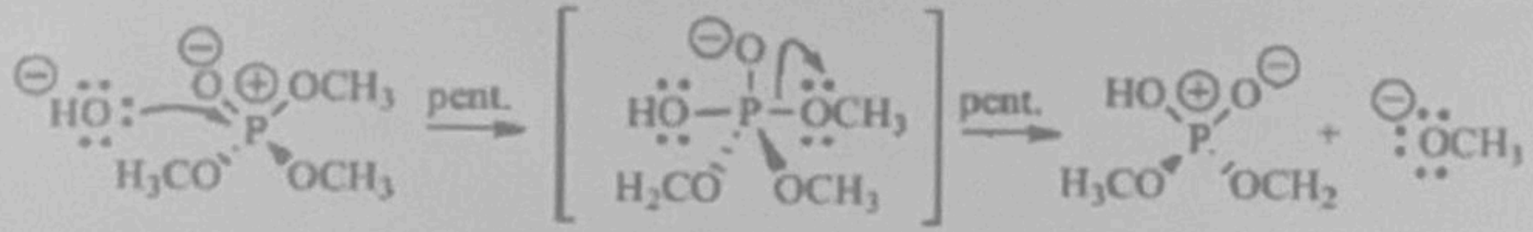


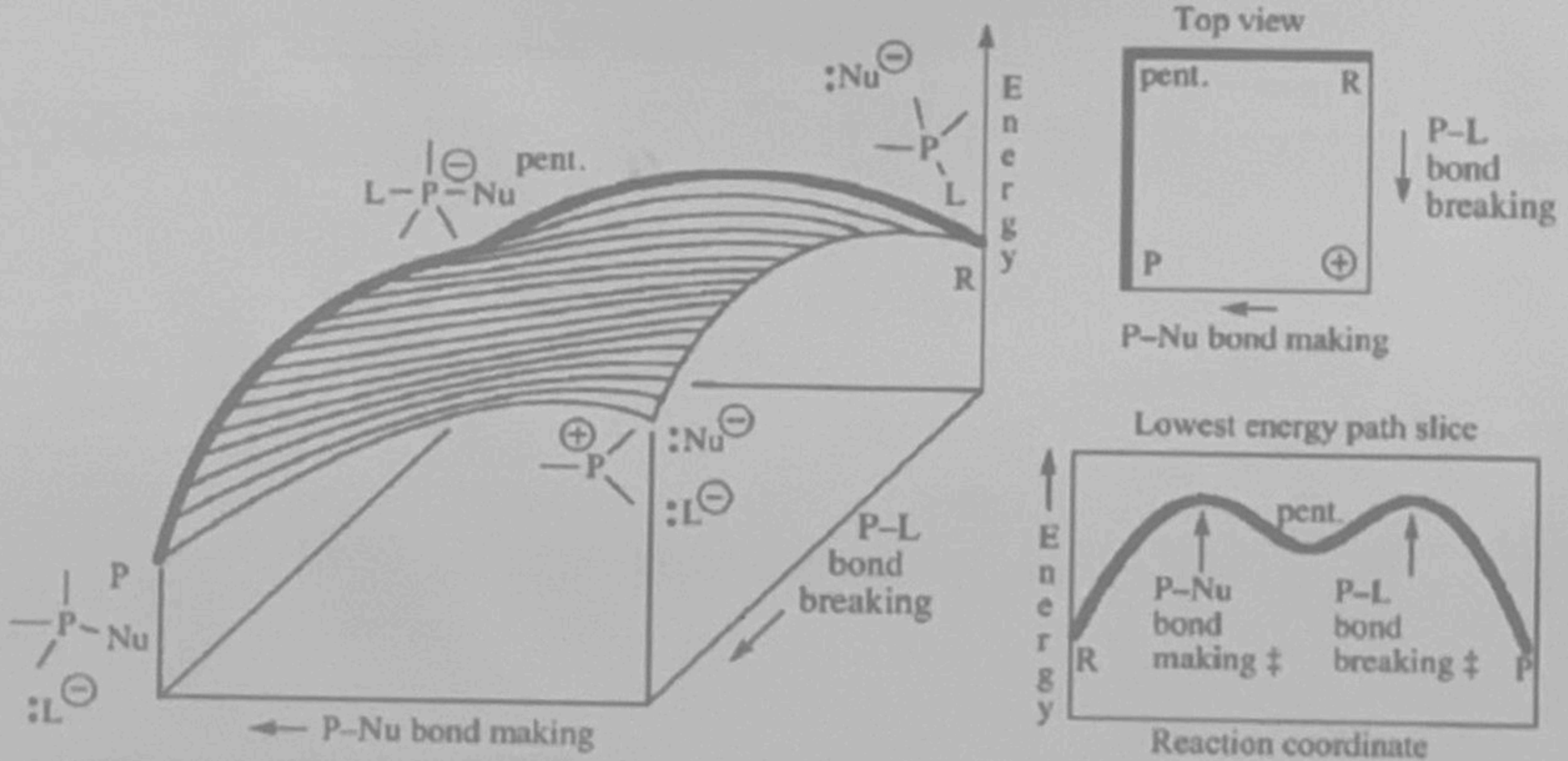




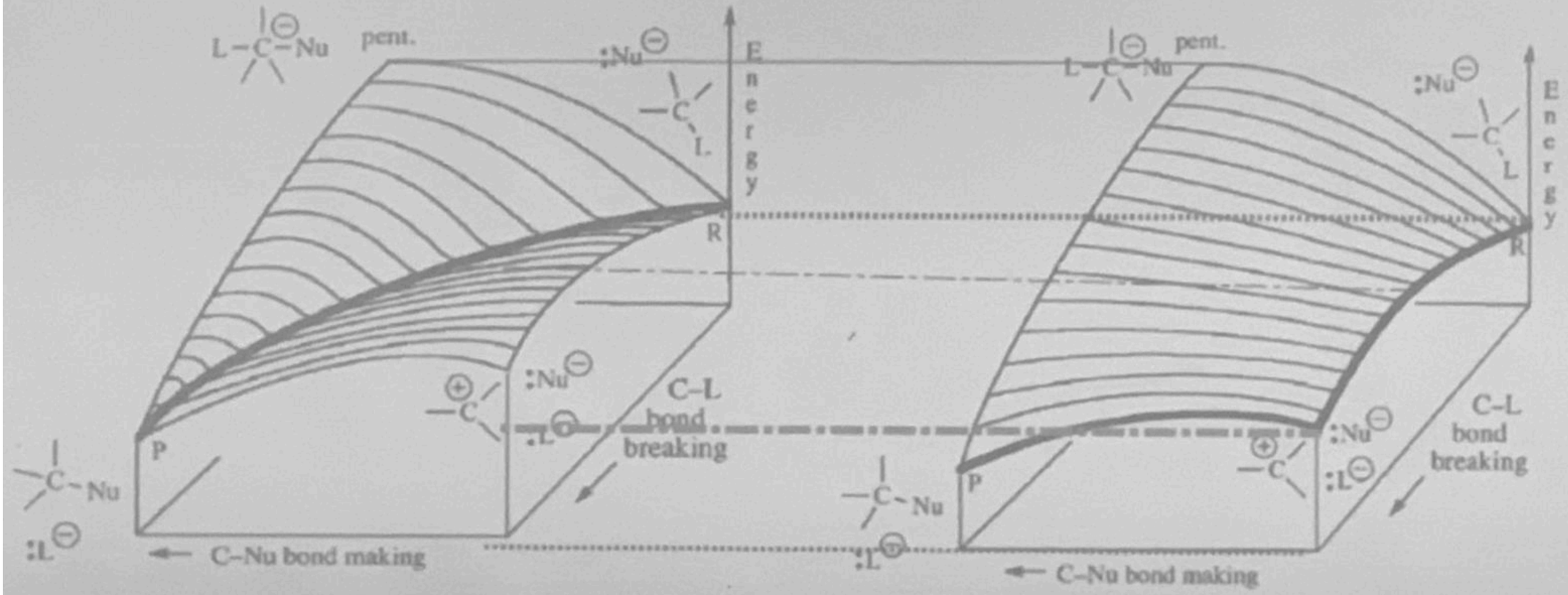


Substitution via a Pentacovalent Intermediate





The energy surface for substitution via a pentacovalent intermediate.



Comparison of S_N2 and S_N1 PES's

THE UNIVERSE OF CHEMICAL TRANSFORMATIONS

(Different "TYPES" of reactions)
(***Changes*** to the ***valence*** of the atom ***where BB/BM is taking place***)

1) **SUBSTITUTION:** One valence group is ***replaced*** by another.
Original valence unchanged, often MW changes

2) **ADDITION/ELIMINATION:** Groups are added of removed.
Original valence changes, MW change certain.

3) **REARRANGEMENTS:** ***Original valence unchanged!***
MW may or may not change.

4) **REDOX:** Most of the time, ***original valence changes***.
There are exceptions.