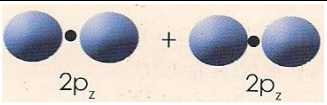
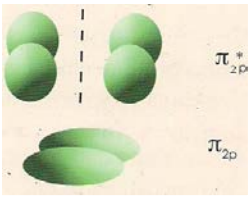
Table Appendix 1

The characteristics of the module Chemistry – From "the hole" to "the whole": From the nanoscale to Microelectronics

Topics	Key Concept	Applications	Visualizations
The electronic structure of atoms	Atomic orbitals, energy levels, emission spectrum	Pyrotechnic, the firework colors	
The electronic structure of molecules	Molecular orbitals: Bonding, anti-bonding, HOMO, LUMO	Why do organic pigments have colors? stick lights	
The electronic structure of solid state	Energy bands, N and P type semiconductors	Microelectronic of solid state apparatus, light emitting diode	
*Quantum size effect application	Observable size-dependent characteristics of nanoparticles	Tunable emission from CdSe based nanocrystals of different sizes,carbon nanotubes	

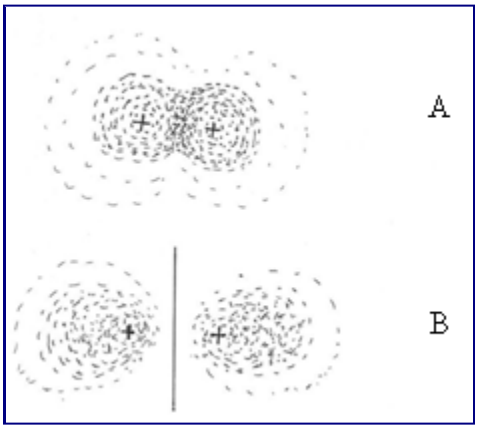
*The picture was taken by Dr. Roni Costi at Prof. Uri Banin's lab, the Institute of Chemistry and the Center for Nanoscience and Nanotechnology, The Hebrew University of Jerusalem, Jerusalem, Israel

Appendix 2 – Assignment C

The Figure below represents a two dimensional model of molecular orbitals. Illustration A and illustration B represents the orbitals of a di-atomic molecule. Each illustration refer to a different molecular orbital.

Please explain the illustration in the Figure by answering the following questions:

i. What do the "+" symbols represent?
ii. What does the vertical line in illustration B stand for?
iii. What does the density of the dots in the illustration represent?
iv. Assuming that the two orbitals are formed from the same two atomic orbitals, which one has a higher level of energy? Please explain.



A two dimension model of molecular orbitals

Appendix 3 – Assessment tool and rubric for assignments A, B, and C

Assignment	Representation type	Category	Explanation and corresponding score	Max score
Assignments A and B	Visual	Number of illustrations	No illustration – 0 One illustration – 1 Two illustrations – 2 Two illustrations that are connected to each other– 3	3
		Character of illustrations	A naïve illustration – 1 An illustration that focuses on the micro level – 2 An illustration that focuses on the quantum mechanical level– 3	3
		Correctness	An improper or erroneous illustration – 0 A partially correct illustration – 1 A correct illustration – 2	2
		Complexity	An illustration with one item – 1 An illustration with 2-3 items – 2 An illustration with 4 items or more – 3	3
	Textual	Correctness	No explanation , or a wrong one – 0 A very short or partially correct explanation – 1 A correct and detailed explanation – 2	2
		Chemistry understanding levels	The number of chemistry understanding levels out of the symbolic, macroscopic, microscopic, process, and quantum mechanical levels, (none of the answers included more than 3 levels)	3
	Match between the two mode	Coherence	There is no correct match between textual and visual representation – 0 There is a correct match between the two modes of representation –1	1

Assignment	Representations	Category	Explanation and corresponding score	Max score
AssignmentC	Textual	Correctness and detailed content	Each sub-question was scored between 0-2 with respect to its correctness and levels of details	4*2=8
		Chemistry understanding levels	The number of chemistry understanding levels out of the symbolic, macroscopic, microscopic, process, and quantum mechanical levels, (none of the answers included more than 3 levels)	3

* Only correct and relevant items were counted