

Physics 008: The Quantum World Around Us

Spring 2007

Homework Assignment #8

Due Thursday 04/19/2007

Name:

1. Using the water-bottle analogy, introduced by Wannier in his Scientific American article, describe the differences between metals, insulators and semiconductors. How are electrons and holes in semiconductors represented in this analogy?

2. In class we discussed a naive rule for determining whether a particular solid would be an insulator or metal based on how many valence electrons each constituent atom has. For atoms with an odd number of valence electrons this rule always works: they form metallic solids. However, the rule sometimes fails for atoms with an even number of electrons. An example is Beryllium, which has 2 valence electrons and yet is metallic in solid form. Explain how this is possible. Sketch a possible energy level diagram for solid Be that is consistent with the observation that it is a metal.