

## Module 09-Lesson 6

### Potential Energy and Force

**Question 1:** If the potential energy of an object is zero at a point, does that mean that the force acting on that object must be zero, too? Explain your answer.

**Question 2:** A particle moves under a force described by the potential energy illustrated in Fig. 1. At which position(s) (a) is the particle at equilibrium so that the force is zero?, (b) does the force have maximum magnitude while directed to the left?

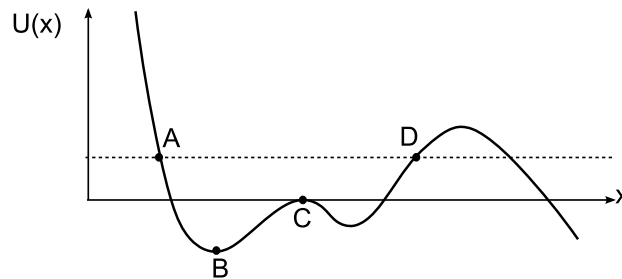


FIG. 1: Electron under varying potential.

**Problem:** In solids, there are attractive forces pulling the atoms together and also repulsive forces that prevent the atoms from getting too close. If the repulsive force were not present then solids would collapse in on themselves. We model the forces between atoms through a potential energy that includes attractive and repulsive terms given by:  $U(r) = \frac{A}{r^{12}} - \frac{B}{r^6}$ , where  $r$  is the separation between the atoms, and  $A$  and  $B$  are constants that determine the strength of the attractive and repulsive potential respectively.

(a) Using this potential, determine an expression for the attractive and repulsive forces acting between the atoms.

(b) Determine the separation distance  $r_0$  for which the atom is at equilibrium.