1. An small object of mass $m$ moves from point $r_A$ to point $r_B$ along some given path under the action of an external force $F(r)$. Find the relation between the work done by the force and the change of the kinetic energy of the object.

2. A uniform density sphere has initially a mass $M$ and radius $R$. A spherical hollow is then made in the sphere such that its surface touches the surface of the sphere and passes through its center. A small sphere of mass $m$ is placed outside the sphere a distance $d$ from its center on the straight line which passes through both the center of the sphere and the center of the hollow. Find the force acting on the mass $m$.

3. A damped harmonic oscillator consists of a block of mass $m = 2.00$ kg attached to a spring with the harmonic constant $k = 10$ N/m (another end of the spring is fixed). The oscillator is in a medium providing a damping force $F = -bv$ at velocity $v$, where $b$ is a constant. At zero time, the system oscillates with an amplitude of 25.0 cm. After the completion of four periods $T$, the amplitude falls to 20.0 cm.

   (a) Explain the notion of the amplitude for a damped oscillator.

   (b) Find the value of $b$.  

   (c) Find the value of $T$. 

   (d) Find the value of $b$. 

   (e) Find the value of $k$. 

   (f) Find the value of $M$. 

   (g) Find the value of $R$. 

   (h) Find the value of $d$.