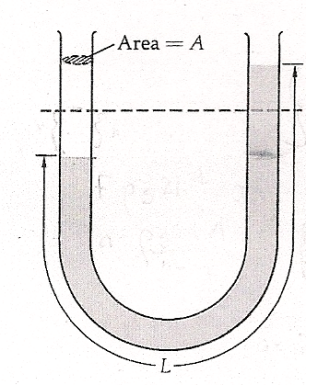
Problems of the Week 4

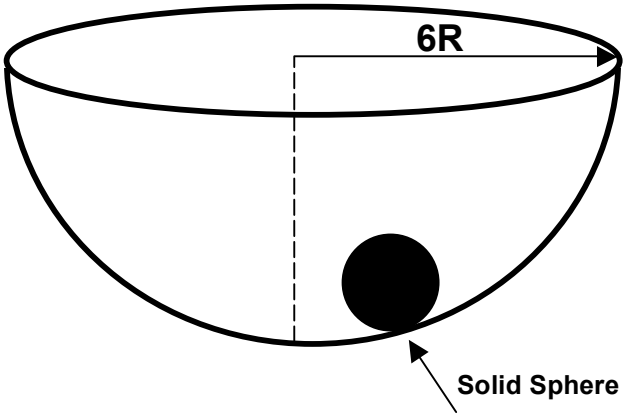
Always show your work to receive credit (NO WORK=NO CREDIT)

1. A U-tube (shown below) of constant cross section **A** is open to the atmosphere. It is filled with an incompressible liquid that flows through the U-tube with negligible friction. The total length of the liquid in the U-tube is **L=78.4cm**. Prove that if the liquid is depressed on one side and released, it will exhibit simple harmonic motion about its equilibrium position. Furthermore its period of oscillation is (**1 point**)



   A. 1.26s
   B. 1.78s
   C. 2.52s
   D. 3.44s
   E. 5.05s

2. A solid sphere of radius **R** rolls without slipping in a fixed spherical bowl of radius **6R**. Prove that for small displacements from equilibrium, the solid sphere exhibits simple harmonic motion with period (**1 point**)



   A. $2\pi\sqrt{\frac{2R}{25g}}$
   B. $2\pi\sqrt{\frac{2R}{5g}}$
   C. $2\pi\sqrt{\frac{7R}{5g}}$
   D. $2\pi\sqrt{\frac{7R}{g}}$
   E. $2\pi\sqrt{\frac{42R}{5g}}$