Orbitting problems

1. The space shuttle ejects a 1200 kg booster tank so that the tank is momentarily at rest at an altitude of 2000 km (above Earth's surface). Neglecting atmospheric effects, determine:
   a) How much work is done on the booster by the force of gravity in returning it to the Earth's surface. Hint: W-E theorem. **[1.8×10^{10} J]**
   b) the velocity with which is strikes the surface of the Earth **[5.4×10^{3} m/s]**

2. A 500 kg satellite is in circular orbit 200 km above the Earth's surface. Calculate :
   a) the gravitational potential energy of the satellite **[-3.03×10^{10} J]**
   b) the kinetic energy of the satellite **[1.52×10^{10} J]**
   c) the escape velocity (from earth's surface) **[11,000 m/s]**

3. The moon.
   a) With what velocity must an object be projected from the moon's surface in order to rise to an altitude equal to twice the moon's radius? **[1.7×10^{3} m/s]**
   b) What is the escape velocity required from the moon's surface? **[2.4×10^{3} m/s]**

4. A rocketship, of mass 1.00×10^{4} kg is located 1.00×10^{10} m from the centre of the Earth?
   a) Determine its gravitational potential energy at this point **[-3.99×10^{8} J]**
   b) How much kinetic energy must it have, at this point, to be capable of escaping from the Earth's gravitational field? **[$\geq 3.99 \times 10^{8}$ J]**
   c) What is its escape velocity from Earth, at this point? **[2.82×10^{2} m/s]**