Name:

Physics 12
M. Lam

Gravitational Potential Energy

Block:

1. How much work is required to lift a 1 200 kg object from the surface of Earth to an altitude of 9.6×10^5 m?

2. A 2.0×10^3 kg satellite travels in a stable circular orbit around the Earth. The orbital radius is 4.2×10^7 m.
   a) What is the satellite's potential energy?
   b) What is the satellite's kinetic energy?
   c) What is total energy of the satellite?

3. A 1 500 kg satellite is in a stable circular orbit at an altitude of 4.0×10^5 m. What is the satellite's total energy in this orbit?

4. A 3 500 kg object is at rest on the surface of Earth.
   a) How much work is required to lift it to an altitude of 4.0×10^5 m?
   b) How much work is required to lift it to infinity?
   c) What is the escape velocity?

5. Show that $E_T = \frac{1}{2}E_p$ for a body in a circular orbit around a planet where E_T is the total mechanical energy of the orbiting body.

6. A ball is thrown vertically upwards from the surface of an asteroid of mass 4.60×10^{15} kg and radius of 8.30 km.
   a) What height above the surface of the asteroid does the ball reach if it has an initial velocity of 5.0 m/s?
   b) At what speed must the ball be thrown to escape the gravitational field of the asteroid?

7. A 6 540 kg satellite travels in a stable circular orbit around the earth. The orbital radius is 1.23×10^7 m. How much work is required to increase the orbital radius to 4.56×10^7 m?

8. Two planets, *X* and *Y*, are separated by a distance of 4.3×10^{11} m. Planet *X* has a mass of 6.6×10^{22} kg and Planet *Y* has a mass of 1.3×10^{23} kg.
   a) At what point between the two planets would an astronaut have to be in order to feel no net force?
   b) What is the gravitational potential energy of a 75 kg astronaut at this point?