

## Gravitational Potential Energy

1. What is the gravitational potential energy of a satellite of mass 1000 kg at a radius of orbit of  $2 \times 10^7$  m relative to infinity? Relative to the surface of the Earth? ( $-1.99 \times 10^{10}$  J,  $4.26 \times 10^{10}$  J)
2. A satellite of mass 1500 kg is placed in orbit at a radius of  $4r_E$  ( $r_E$  is Earth's radius).
  - (a) How much potential energy does the satellite gain if launched from Earth's surface? ( $7.02 \times 10^{10}$  J)
  - (b) What kinetic energy does the satellite require to be in orbit at this height? ( $1.17 \times 10^{10}$  J)
  - (c) What is the total energy required to put the satellite in this orbit? ( $8.19 \times 10^{10}$  J)
3. What is the escape velocity of a rocket from the surface of the Earth? (11.2 km/s)
4. What velocity would the Earth have to obtain to escape the sun? (42.2 km/s)

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