

## Gravitational Potential Energy Worksheet

1. What is the value of the gravitational potential energy of a 1.00 kg mass on the surface of the earth if the zero of potential energy is taken to be at infinity? ( $-6.25 \times 10^7 \text{ J}$ )
2. What is the gravitational potential energy of the moon with respect to the earth if the zero of potential energy is taken to be at infinity? ( $-7.7 \times 10^{28} \text{ J}$ )
3. What is the change in gravitational potential energy of a 1.00 kg mass that is carried from the surface of the earth to a distance of one earth radius above the surface? ( $3.13 \times 10^7 \text{ J}$ )
4. What is the change in gravitational potential energy of a 5.00 kg mass that is carried from the surface of the earth to a distance of 0.25 earth's radius above the surface? ( $6.26 \times 10^7 \text{ J}$ )
5. A metal slug is dropped from a height of  $0.05r_m$  above the moon's surface. Find the speed with which the slug strikes the moon's surface. ( $518 \text{ m/s}$ )
6. With what initial velocity must an object be projected vertically upward from the surface of Earth, in order to rise to a height equal to Earth's radius? ( $7.9 \times 10^3 \text{ m/s}$ )
7. Calculate the change in gravitational potential energy for a 1 kg mass lifted 100 km above Earth's surface. What percentage error would have been made by using the equation  $E_g = mgh$  and the value of  $g$  at Earth's surface? What does this tell you about the need for the more exact treatment in most normal Earth-bound problems? ( $1.0 \times 10^6 \text{ J}$ , 2%)
8. The distance from the sun to Earth varies from  $1.47 \times 10^{11} \text{ m}$ , at perihelion (closest approach), to  $1.52 \times 10^{11} \text{ m}$  at aphelion (farthest distance away).
  - a. What is the maximum change in Earth's gravitational potential energy during one orbit of the sun? ( $1.8 \times 10^{32} \text{ J}$ )
  - b. At what point in its orbit is Earth moving the fastest, and what is its maximum change in kinetic energy? (perihelion,  $1.8 \times 10^{32} \text{ J}$ )