# You Are Here Gravitational potential energy in space

1a. What is the gravitational potential energy when a 7500kg alien spaceship is 3.0x103 km above the surface of the earth?

1b. How much work must the spaceship do to escape the Earth’s gravity?

2a. How much work must be done to lift a 5800kg satellite from the surface to a point 2600km above the Earth?

2b. How much additional work must be done to lift the satellite beyond Earth’s gravity?

3. What is the Ug when a 250kg spacecraft on the surface of the moon, relative to 0J at ∞? (Mmoon=7.35x1022kg, rmoon=1.74x106m)

4. Determine the escape velocities for: (Google search planetary data, or use a book.)

a) the Moon b) Mars c) Venus d) the Sun

5. How fast must you shoot an object straight up for it to reach a height of 2500 km above Earth?

6. A satellite is in stable circular orbit about planet Gliqwllkhjsdg-7. The satellite has -6.9x1012J of gravitational potential energy in this orbit.

a. How much work will the force of gravity do to the satellite in one revolution?

b. How much gravitational energy will a second identical satellite have in orbit around Gliqwllkhjsdg-7

if it has one half the orbital radius?

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7. A 38700kg satellite is in circular orbit above the Earth. The satellite has -1.96x1012J of gravitational potential energy in this orbit.

a. How high is the satellite above the surface of the Earth?

b. What is the satellite’s kinetic energy in this orbit?

8. A giant meteor (m0=1.25x1010kg) hurtles toward Earth (Oh my!). When the satellite is 19000km above earth it has a speed of 18km/s.

a. Find the speed of the satellite at the point it enters the atmosphere (120km above the surface).

As the meteor careens through the atmosphere it “burns up”, losing mass and releasing large amounts of heat, sound and light. If the meteor loses 70.0% of its mass through this process as well as losing 8.95x1017J of energy before it reaches the surface of the Earth.

b. Find the speed on impact.

Consider the diagram below:

A B

X X

9. At which point will a mass have more EPg?

10. If the EPg of a mass at A is -26000J, what is the EPg of the same mass at B (exactly)?

11. How much work would it take to move the mass in Q10 from A to beyond the planet’s gravitational pull?

12. How much work would it take to move the mass from Q10 from A to B?

13. How much kinetic energy would the mass in Q10 gain as it falls from B to A?

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