WebAssign
CH06-HW05-SP12 (Homework)

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PHYS 172-SPRING 2012, Spring 2012
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Current Score : 25 / 25 **Due :** Tuesday, February 21 2012 11:59 PM EST

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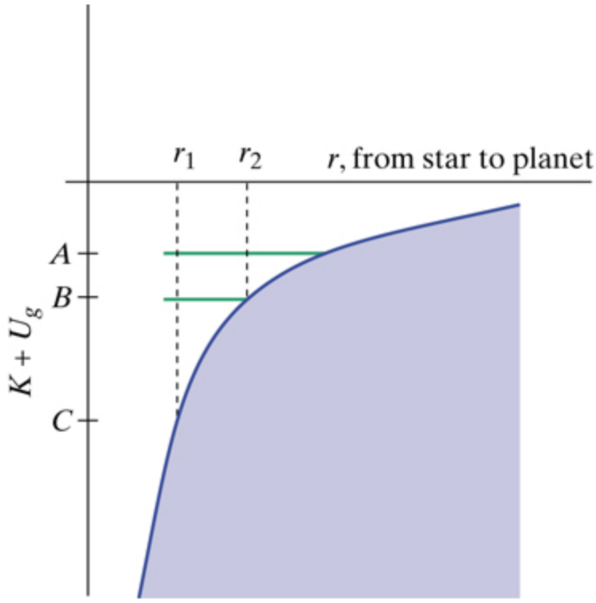
1. 6/6 points | Previous Answers MI3 6.11.X.078

The diagram below is a graph of the energy of a system of a planet interacting with a star. The gravitational potential energy U_g is shown as the thick curve, and plotted along the vertical axis are various values of $K+U_g$.



Suppose that $K+U_g$ of the system is A. Which of the following statements are true?

- [x] The kinetic energy of the system is greater when the distance between the star and planet is r_1 than when the distance between the two bodies is r_2.
- [ ] The planet will escape.
- [ ] The potential energy of the system decreases as the planet moves from r_1 to r_2.
- [ ] When the separation between the two bodies is r_2, the kinetic energy of the system is (B - C).
- [x] When the separation between the two bodies is r_2, the kinetic energy of the system is (A - B).
- [x] The system is a bound system; the planet can never escape.

Suppose instead that $K+U_g$ of the system is B. Which of the following statements are true?

- [x] The planet and star cannot get farther apart than r_2.
- [ ] This is not a bound system; the planet can escape.
- [x] When the separation between the planet and star is r_2, the kinetic energy of the system is zero.
- [ ] When the separation between the planet and star is r_2, the potential energy of the system is zero.

- *Read the eBook*
- Section 6.11

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2. 4/4 points | Previous Answers MI3 6.12.P.084

The escape speed from a very small asteroid is only 20 m/s. If you throw a rock away from the asteroid at a speed of 25 m/s, what will be its final speed?

v_f = 15 m/s

- *Read the eBook*
- Section 6.12

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3. 9/9 points | Previous Answers MI3 6.12.P.090

You stand on a spherical asteroid of uniform density whose mass is 1.0×10^{16} kg and whose radius is 8 km (8×10^{3} m). These are typical values for small asteroids, although some asteroids have been found to have much lower average density and are thought to be loose agglomerations of shattered rocks. You want to figure out how fast you have to throw the rock so that it never comes back to the asteroid and ends up traveling at a speed of 12 m/s when it is very far away.

What fundamental principle(s) will you use in your solution?

- [ ] No fundamental principles are applicable
- [x] The Energy Principle
- [ ] The Momentum Principle

What are useful choices for the initial and final states of the system?

- [ ] In the initial state the rock is at rest in your hand
- [ ] In the initial state the rock is in your hand, which is moving
- [ ] In the final state the rock is very far away, at rest
- [x] In the final state the rock is very far away moving at 12 m/s
- [x] In the initial state the rock has just left your hand
- [ ] In the final state the rock has just left your hand

Which of these quantities are important in your solution?

- [ ] The time it takes for the rock to get far away
- [ ] The rest energy mc^2 of the rock
- [x] The final kinetic energy of the rock
- [x] The final potential energy of the rock+asteroid system
- [x] The initial kinetic energy of the rock
- [ ] The rest energy $M_{asteroid}c^2$ of the asteroid
- [x] The initial potential energy of the rock+asteroid system
- [ ] The force exerted by your hand on the rock

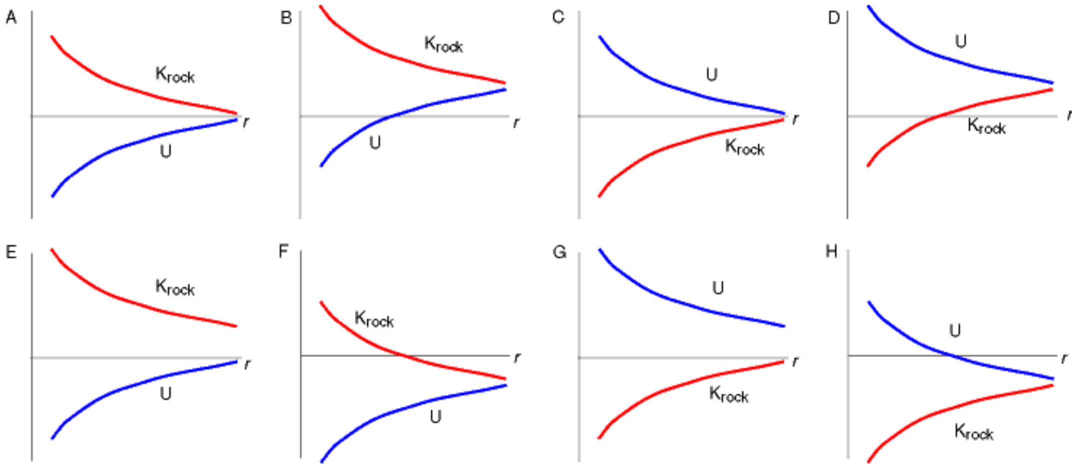
Which of the following are true in this problem?

- [ ] The final potential energy of the rock+asteroid system is less than the initial potential energy of the system
- [x] The change in the kinetic energy of the asteroid is negligible
- [ ] The final kinetic energy of the rock is 0
- [ ] The total energy of the rock+asteroid system is less in the final state than in the initial state
- [x] The final kinetic energy of the rock is less than its initial kinetic energy

How fast do you have to throw the rock so that it never comes back to the asteroid and ends up traveling at a speed of 12 m/s when it is very far away?

launch speed (relative to you) = 17.649 m/s

Which graph best describes the kinetic and potential energy of the rock+asteroid system as a function of distance between the rock and the asteroid?



- A
- D
- G
- H
- F
- B
- C
- E (selected)

- *Read the eBook*
- Section 6.12

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4. 6/6 points | Previous Answers MI3 6.12.P.087.alt01

You will need to use the Momentum Principle to do the first part of this problem, and the Energy Principle to do the second part.

A satellite of mass 6500 kg orbits the Earth in a circular orbit of radius of 9.3×10^6 m (this is above the Earth's atmosphere).The mass of the Earth is 6.0×10^{24} kg.

What is the speed of the satellite?

v = 6574.63 m/s

What is the minimum amount of energy required to move the satellite from this orbit to a location very far away from the Earth?

energy = 1.405e11 J

- *Read the eBook*
- Section 6.12