Name: _____

Date: _____

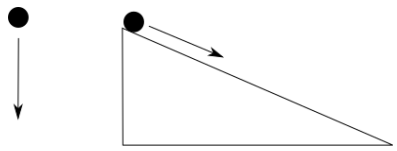
Cornell University
Prison Education Program

Conceptual Physics
Class 6 Questions
March 16, 2018

1. When an object moves, the force of friction does work on it. Where does this energy go?

2. Can kinetic energy ever be less than zero? Why or why not? (From *Light and Matter*, Chapter 11 Question 2)

3. Two balls are released from a certain height. One is dropped straight down, the other rolls down an incline.



   (a) Assuming no friction, which one has the greatest speed when it reaches the ground?

   (b) Assuming no friction, which one reaches the ground first?

   (c) Assuming there is friction, which one has the greatest speed when it reaches the ground?

4. You throw a steel ball up in the air. How can you prove based on the conservation of energy that it has the same speed when in falls back into your hand? What if you throw up a feather - is energy not conserved in that case? (From *Light and Matter*, Chapter 12 Discussion Question A)

5. Anya and Ivan lean over a balcony side by side. Anya throws a penny downward with an initial speed of 2 m/s. Ivan throws a penny upward with the same speed. Both pennies end up on the ground below. Compare their kinetic energies and velocities on impact (as in, which is bigger, smaller, pointing up/pointing down, etc.)

6. If you hold a 2 kg object at a steady height of 1.5 m, and walk forward at a constant speed of 5 m/s for 2 seconds, how much work do you do on the object?

7. Hydroelectric power (water flowing over a dam to spin turbines) appears to be completely free. Does this violate conservation of energy? If not, what is the ultimate source of the electrical energy produced by a hydroelectric plant? (From *Light and Matter*, Chapter 11 discussion question A)

8. Two runners, each of mass m, are running with speed v in opposite directions. What is their total kinetic energy?

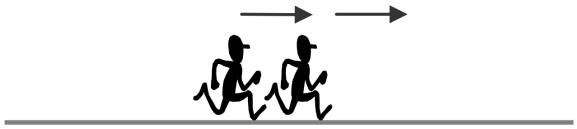
(a) 0

(b) $\frac{1}{2}mv^2$

(c) mv^2

(d) $2mv^2$

9. The two runners, each of mass m, are running are now running in the same direction with speed v. What is their total kinetic energy now?



(a) 0

(b) $\frac{1}{2}mv^2$

(c) mv^2

(d) $2mv^2$

10. Consider 3 moving cars:

    1. Car 1 moves at a constant speed and in a constant direction.
    2. Car 2 moves at a constant speed but *changes* direction.
    3. Car 3 moves in a constant direction but changes its *speed*.

    Which of the following cars has (have) constant kinetic energy?

    (a) Car 1

    (b) Car 1 and Car 2

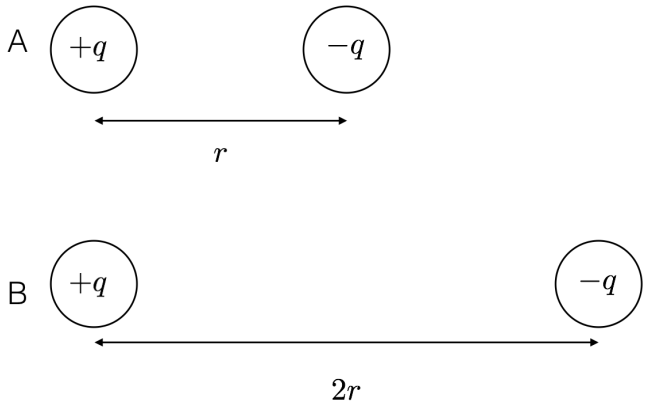
    (c) Car 2 and Car 3

    (d) Car 1 and Car 3

    (e) Car 1, Car 2, and Car 3

    (f) None of the above: they all have changing kinetic energy

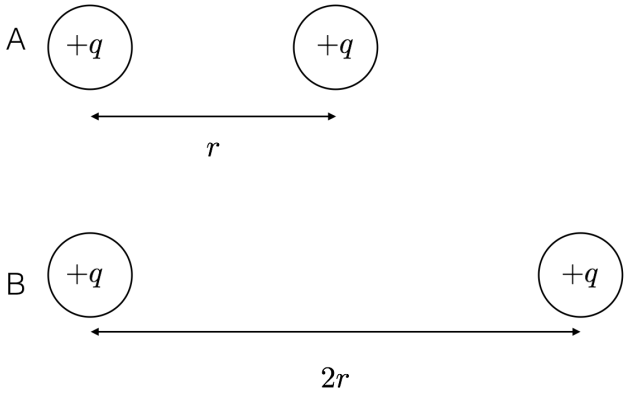
11. Consider the following point charges, with equal and opposite electrical charge, being held apart at distances r and $2r$.



(a) In which configuration, A or B, do the charges feel a greater magnitude of electrical force (*i.e.*, more attracted or more repelled)?

(b) In which configuration, A or B, do the charges have a greater potential energy?

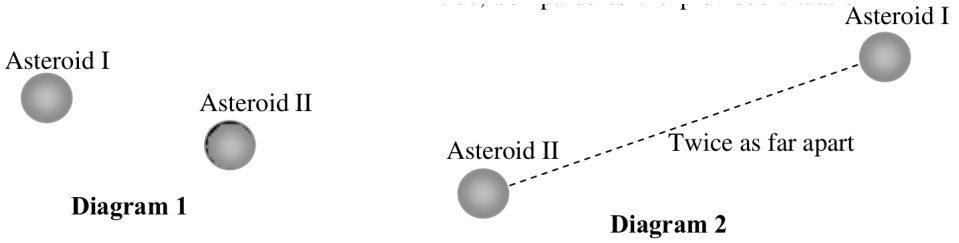
12. Now consider the following point charges, with equal electrical charge of the same sign, being held apart at distances r and $2r$.



(a) In which configuration, A or B, do the charges feel a greater magnitude of electrical force (*i.e.*, more attracted or more repelled)?

(b) In which configuration, A or B, do the charges have a greater potential energy?

13. At a location in space far from any other objects, two moving asteroids (asteroid I and asteroid II) pass each other. Diagram 1 shows the two asteroids at one point in time, and diagram 2 shows them some time later.



Which of the following statements are correct?

(a) The potential energy increased, the kinetic energy increased

(b) The potential energy increased, the kinetic energy decreased

(c) The potential energy increased, the kinetic energy remained constant

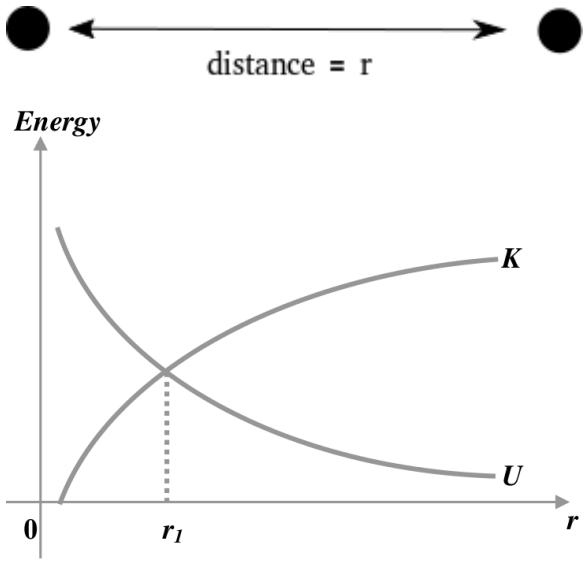
(d) The potential energy decreased, the kinetic energy increased

(e) The potential energy decreased, the kinetic energy decreased

(f) The potential energy decreased, the kinetic energy remained constant

(g) Energy is conserved, therefore both the kinetic and potential energy remained constant

14. BONUS QUESTION: The following figure plots kinetic energy K and potential energy U of a two-particle system versus the distance r between the two particles. From these curves we can conclude that the interaction between the two particles is:



(a) Repulsion

(b) Attraction

(c) Repulsion when $r < r_1$ and attraction when $r > r_1$

(d) Attraction when $r < r_1$ and repulsion when $r > r_1$

(e) Not enough information to determine