

AP Physics 1
4.2 – The Work-Energy Theorem and Kinetic Energy
Assessment

“My theory is that you should move quickly to complete this!”

Name: _____

Period: _____

Concepts

- 1) A sailboat is moving with a constant velocity. Is work being done by a net external force acting on the sailboat?
- 2) A ball has a speed of 15 m/s. Only one external force acts on the ball. After the force acts, the speed of the ball is 7 m/s. What type of work was done on the ball (Positive, Negative, Zero)? Justify your answer.
- 3) A rocket is at rest on a launch pad. When the rocket is launched, its kinetic energy increases. Consider all of the forces acting on the rocket during the launch and decide whether the following statement is true or false: The amount by which the kinetic energy of the rocket increases during the launch is equal to the work done by the force generated by the rocket's engine. Justify your answer.
- 4) A net external force acts on a particle that is moving along a straight line. This net force is not zero. Select the correct statement from the choice below and explain why each is right or wrong.
 - a. The velocity, but not the kinetic energy, of the particle is changing.
 - b. The kinetic energy, but not the velocity, of the particle is changing.
 - c. Both the velocity and the kinetic energy of the particle are changing.

Problems

- 5) A water skier is being towed by a tow rope attached to a boat. As the driver pushes the throttle forward, the skier accelerates. A 70.3 kg water skier has an initial speed of 6.10 m/s. Later, the speed increases to 11.3 m/s. Determine the work done by the net external force on the water skier.
- 6) A 75 g arrow is fired horizontally. The bowstring exerts an average force of 65 N on the arrow over a distance of 0.90 m. With what speed does the arrow leave the bow?
- 7) A fighter jet is launched from an aircraft carrier with the aid of its own engines and a steam-powered catapult. The thrust of its engines is 2.3×10^5 N. In being launched from rest it moves through a distance of 87 m and has a kinetic energy of 4.5×10^7 J at lift-off. What is the work done on the jet by the catapult?

- 8) A 7420 kg satellite has an elliptical orbit. The point on the orbit that is the farthest from Earth is called the apogee and the point that is closest is called the perigee. Suppose that the speed of the satellite is 2820 m/s at the apogee and 8450 m/s at the perigee. Find the work done by the gravitational force when the satellite moves from
- the apogee to the perigee, and
 - the perigee to the apogee.
- 9) A sled is being pulled across a horizontal patch of snow. Friction is negligible. The pulling force points in the same direction as the sled's displacement, which is along the +x axis. As a result, the kinetic energy of the sled increases by 38%. By what percentage would the sled's kinetic energy have increased if this force had pointed 62° above the +x axis?
- 10) Under the influence of its drive force, a snowmobile is moving at a constant velocity along a horizontal patch of snow. When the drive force is shut off, the snowmobile coasts to a halt. The snowmobile and its rider have a mass of 136 kg. Under the influence of a drive force of 205 N, it is moving at a constant velocity whose magnitude is 5.50 m/s. The drive force is then shut off. Find
- the distance in which the snowmobile coasts to a halt, and
 - the time required to do so.
- 11) An extreme skier, starting from rest, coasts down a mountain slope that makes an angle of 25.0° with the horizontal. The coefficient of kinetic friction between the skis and the snow is 0.200. She coasts down a distance of 10.4 m before coming to the edge of a cliff. Without slowing down, she skis off the cliff and lands downhill at a point whose vertical distance is 3.50 m below the edge.
- Sketch the system.
 - How fast is she going just before she lands?

FOX TROT

