

## Objectives for Work, Energy, and Power

<b>C.1 Work and the work-energy theorem</b>	<b>textbook section</b>	<b>Review problems</b>	<b>Key formula or idea</b>
C.1.a Students should understand the definition of work, including when it is positive, negative or zero, so they can:			
C.1.a.1 Calculate the work done by a specified constant force on an object that undergoes a specified displacement.			
C.1.a.2 Relate the work done by a force to the area under a graph of force as a function of position, and calculate this work in the case where the force is a linear function of position.			
C.1.a.3 Use integration to calculate the work performed by a force $F(x)$ on an object that undergoes a specified displacement in one dimension.			
C.1.a.4 Use the scalar product operation to calculate the work performed by a specified constant force $F$ on an object that undergoes a displacement in a plane.			
C.1.b Students should understand and be able to apply the work-energy theorem, so they can:			
C.1.b.1 Calculate the change in kinetic energy or speed that results from performing a specified amount of work on an object.			
C.1.b.2 Calculate the work performed by the net force, or by each of the forces that make up the net force, on an object that undergoes a specified change in speed or kinetic energy.			
C.1.b.3 Apply the theorem to determine the change in an object's kinetic energy and speed that results from the application of specified forces, or to determine the force that is required in order to bring an object to rest in a specified distance.			
<b>C.2 Forces and potential energy</b>			
C.2.a Students should understand the concept of a conservative force, so they can:			
C.2.a.1 State alternative definitions of "conservative force" and explain why these definitions are equivalent.			
C.2.a.2 Describe examples of conservative forces and non-conservative forces.			

C.2.b Students should understand the concept of potential energy, so they can:			
C.2.b.1 State the general relation between force and potential energy, and explain why potential energy can be associated only with conservative forces.			
C.2.b.2 Calculate a potential energy function associated with a specified one dimensional force $F(x)$ .			
C.2.b.3 Calculate the magnitude and direction of a one-dimensional force when given the potential energy function $U(x)$ for the force.			
C.2.b.4 Write an expression for the force exerted by an ideal spring and for the potential energy of a stretched or compressed spring.			
C.2.b.5 Calculate the potential energy of one or more objects in a uniform gravitational field.			
<b>C.3 Conservation of energy</b>			
C.3.a Students should understand the concepts of mechanical energy and of total energy, so they can:			
C.3.a.1 State and apply the relation between the work performed on an object by nonconservative forces and the change in an object's mechanical energy.			
C.3.a.2 Describe and identify situations in which mechanical energy is converted to other forms of energy.			
C.3.a.3 Analyze situations in which an object's mechanical energy is changed by friction or by a specified externally applied force.			
C.3.b Students should understand conservation of energy, so they can:			
C.3.b.1 Identify situations in which mechanical energy is or is not conserved.			
C.3.b.2 Apply conservation of energy in analyzing the motion of systems of connected objects, such as an Atwood's machine.			
C.3.b.3 Apply conservation of energy in analyzing the motion of objects that move under the influence of springs.			
C.3.b.4 Apply conservation of energy in analyzing the motion of objects that move under the influence of other non-constant one-dimensional forces.			

C.3.c Students should be able to recognize and solve problems that call for application both of conservation of energy and Newton's Laws.			
<b>C.4 Power</b>			
Students should understand the definition of power, so they can:			
C.4.a Calculate the power required to maintain the motion of an object with constant acceleration (e.g., to move an object along a level surface, to raise an object at a constant rate, or to overcome friction for an object that is moving at a constant speed).			
C.4.b Calculate the work performed by a force that supplies constant power, or the average power supplied by a force that performs a specified amount of work.			