Extended Response

9.1 Work, Power, and the Work–Energy Theorem 46.

Work can be negative as well as positive because an object or system can do work on its surroundings as well as have work done on it. Which of the following statements describes:
a situation in which an object does work on its surroundings by decreasing its velocity and
a situation in which an object can do work on its surroundings by decreasing its altitude?

a. A gasoline engine burns less fuel at a slower speed.
   Solar cells capture sunlight to generate electricity.
b. A hybrid car charges its batteries as it decelerates.
   Falling water turns a turbine to generate electricity.
c. Airplane flaps use air resistance to slow down for landing.
   Rising steam turns a turbine to generate electricity.
d. An electric train requires less electrical energy as it decelerates.
   A parachute captures air to slow a skydiver's fall.

47.

A boy is pulling a girl in a child's wagon at a constant speed. He begins to pull harder, which increases the speed of the wagon. Which of the following describes two ways you could calculate the change in energy of the wagon and girl if you had all the information you needed?

a. Calculate work done from the force and the velocity.
   Calculate work done from the change in the potential energy of the system.
b. Calculate work done from the force and the displacement.
   Calculate work done from the change in the potential energy of the system.
c. Calculate work done from the force and the velocity.
   Calculate work done from the change in the kinetic energy of the system.
d. Calculate work done from the force and the displacement.
   Calculate work done from the change in the kinetic energy of the system.

9.2 Mechanical Energy and Conservation of Energy 48.

Acceleration due to gravity on the moon is 1.6 m/s^2 or about 16% of the value of g on Earth.
If an astronaut on the moon threw a moon rock to a height of 7.8 m, what would be its velocity as it struck the moon's surface?
How would the fact that the moon has no atmosphere affect the velocity of the falling moon rock? Explain your answer.

a. The velocity of the rock as it hits the ground would be 5.0 m/s. Due to the lack of air friction, there would be complete transformation of the potential energy into the kinetic energy as the rock hits the moon's surface.

b. The velocity of the rock as it hits the ground would be 5.0 m/s. Due to the lack of air friction, there would be incomplete transformation of the potential energy into the kinetic energy as the rock hits the moon's surface.
c. The velocity of the rock as it hits the ground would be 12 m/s. Due to the lack of air friction, there would be complete transformation of the potential energy into the kinetic energy as the rock hits the moon's surface.
d. The velocity of the rock as it hits the ground would be 12 m/s. Due to the lack of air friction, there would be incomplete transformation of the potential energy into the kinetic energy as the rock hits the moon's surface.

49.

A boulder rolls from the top of a mountain, travels across a valley below, and rolls part way up the ridge on the opposite side. Describe all the energy transformations taking place during these events and identify when they happen.

a. As the boulder rolls down the mountainside, KE is converted to PE. As the boulder rolls up the opposite slope, PE is converted to KE. The boulder rolls only partway up the ridge because some of the PE has been converted to thermal energy due to friction.
b. As the boulder rolls down the mountainside, KE is converted to PE. As the boulder rolls up the opposite slope, KE is converted to PE. The boulder rolls only partway up the ridge because some of the PE has been converted to thermal energy due to friction.
c. As the boulder rolls down the mountainside, PE is converted to KE. As the boulder rolls up the opposite slope, PE is converted to KE. The boulder rolls only partway up the ridge because some of the PE has been converted to thermal energy due to friction.
d. As the boulder rolls down the mountainside, PE is converted to KE. As the boulder rolls up the opposite slope, KE is converted to PE. The boulder rolls only partway up the ridge because some of the PE has been converted to thermal energy due to friction.

9.3 Simple Machines 50.

To dig a hole, one holds the handles together and thrusts the blades of a posthole digger, like the one in the image, into the ground. Next, the handles are pulled apart, which squeezes the dirt between them, making it possible to remove the dirt from the hole. This complex machine is composed of two pairs of two different simple machines. Identify and describe the parts that are simple machines and explain how you would find the IMA of each type of simple machine.

a. Each handle and its attached blade is a lever with the fulcrum at the hinge.

Each blade is a wedge.
The IMA of a lever would be the length of the handle divided by the length of the blade. The IMA of the wedges would be the length of the blade divided by its width.

b. Each handle and its attached to blade is a lever with the fulcrum at the end. Each blade is a wedge.
The IMA of a lever would be the length of the handle divided by the length of the blade. The IMA of the wedges would be the length of the blade divided by its width.

c. Each handle and its attached blade is a lever with the fulcrum at the hinge. Each blade is a wedge.
The IMA of a lever would be the length of the handle multiplied by the length of the blade. The IMA of the wedges would be the length of the blade multiplied by its width.

d. Each handle and its attached blade is a lever with the fulcrum at the end. Each blade is a wedge.
The IMA of a lever would be the length of the handle multiplied by the length of the blade. The IMA of the wedges would be the length of the blade multiplied by its width.

51.

A wooden crate is pulled up a ramp that is 1.0 m high and 6.0 m long. The crate is attached to a rope that is wound around an axle with a radius of 0.020 m . The axle is turned by a 0.20 m long handle. What is the overall IMA of the complex machine?

A. 6
B. 10
C. 16
D. 60