Work, Energy, and Power Homework

Instructions:
Complete the following exercises and questions to reinforce your understanding of the concepts related to work, energy, and power. Show all your work and include units in your final answers.

1. Conceptual Questions:
a. Define work and explain its relationship to energy.
b. Differentiate between kinetic and potential energy, providing examples of each.
c. When mechanical energy is conserved?

2. Real-world Applications:
a. Research and write a short paragraph about a real-world application of work, energy, or power (e.g., renewable energy sources, energy-efficient technologies, etc.).

3. Work Calculations:
a. A force of 50 N is applied to push a crate 10 m along a horizontal surface. Calculate the work done.
b. If the angle between the force and the direction of motion is 30 degrees, recalculate the work done.

4. Kinetic and Potential Energy:
a. A 500 kg roller coaster is at the top of a 30 m hill. Calculate its potential energy.
b. If the roller coaster is moving at 10 m/s at the bottom of the hill, calculate its kinetic energy.
c. Determine the total mechanical energy of the roller coaster at the top and bottom of the hill.

5. Power:
b. If a machine does 5000 J of work in 20 seconds, calculate the power output.
c. Explain the difference between work and power.