NAME _____ DATE _____

Scenario

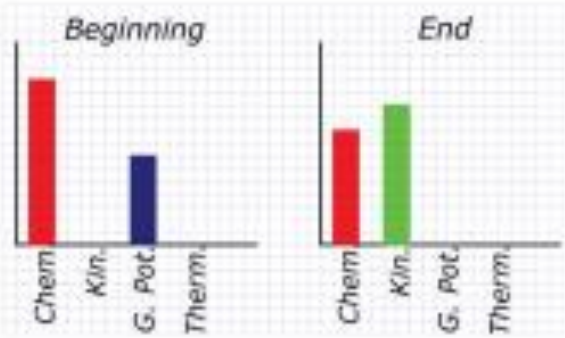
Consider a car that is initially moving on a straight roadway. The road may be an uphill road, a downhill road, or a flat road. The driver of the car may be pressing the gas pedal, the brake pedal, or neither pedal. The only energy transformations that can take place are chemical energy becoming mechanical energy (when the gas pedal is pressed) and mechanical energy becoming thermal energy (when the brake pedal is pressed). (Chemical energy levels may be thought about as the level of the gas gauge.)

Data Analysis

For each situation, fill in the sentence explaining how each system's mechanical energy is changing, create an energy bar chart representing the energy transformation, and use the blank space to explain how you formulated your answers.

PART A: The car is traveling downhill while the driver presses the gas pedal.

The mechanical energy of only the car is _____ while the mechanical energy of the car-Earth system is _____.
Increasing (increasing/decreasing/constant) — Increasing (increasing/decreasing/constant)



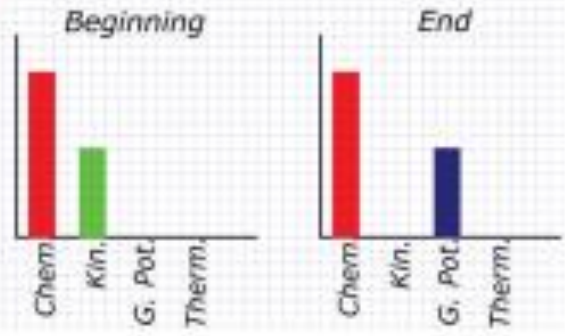
Complete the bar charts to show the energy of the car-gas-Earth system as the car travels from the top of the hill to the bottom of the hill while pressing the gas.

Explain how you formulated your answers.

Assuming the driver presses the gas during travel, we would see the potential energy transform into kinetic energy, while the gas tank level would decrease. While the ride occurred, chemical energy would transform into kinetic energy leaving more kinetic energy at the end than potential at the start.

PART B: The car is traveling uphill while the driver presses neither pedal.

The mechanical energy of only the car is _____ while the mechanical energy of only the car-Earth system is _____.
Decreasing (increasing/decreasing/constant) — Constant (increasing/decreasing/constant)

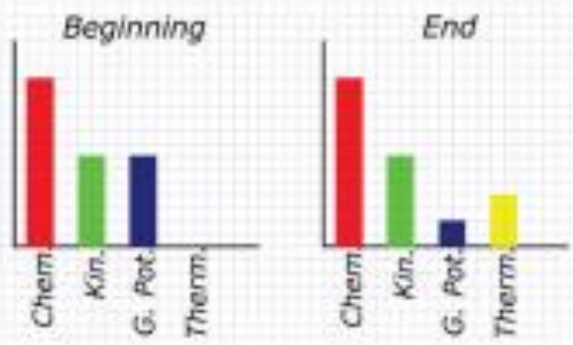


Complete the bar charts to show the energy of the car-gas-Earth system as the car travels from the bottom of the hill to the top of the hill.

Explain how you formulated your answers.

Since the driver is pushing neither pedal, the chemical energy and thermal energy remain the same from the bottom of the hill to the top of the hill. The transformation here is from kinetic energy of the car into gravitational potential energy of the car-Earth system.

PART C: The mechanical energy of only the car is constant and the mechanical energy of only the car-Earth system is decreasing. The car is traveling on a road that is Downhill (uphill/downhill/flat) and the driver is pressing on Brake (the gas/the brake/neither pedal).

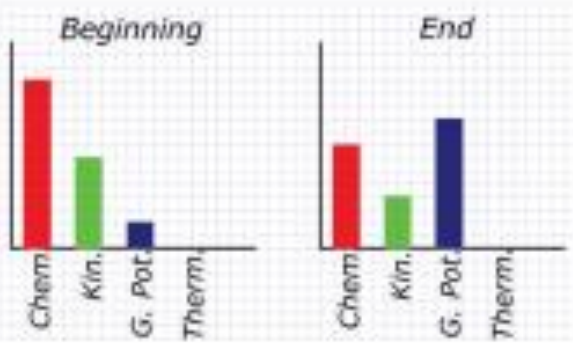


Complete the bar charts to show the energy of the car-gas-earth system for this scenario.

Explain how you formulated your answers.

To keep the mechanical energy of the car constant means to keep the kinetic energy and thus the speed of the car constant. Three options came to mind here: going uphill pressing the gas, going downhill pressing the brake, and flat road no pedals. If the car-Earth system will lose energy, but it cannot be from kinetic energy decreasing, then potential energy must decrease. So we must be moving downhill pressing the brake.

PART D: The mechanical energy of only the car is decreasing and the mechanical energy of only the car-Earth system is increasing. The car is traveling on a road that is Uphill (uphill/downhill/flat) and the driver is pressing on The Gas (the gas/the brake/neither pedal).



Complete the bar charts to show the energy of the car-gas-earth system for this scenario.

Explain how you formulated your answers.

The car must be slowing if its mechanical energy is decreasing. The car must be going uphill if the car-Earth system is going to increase in energy because the increase cannot come from kinetic energy. The speed of the car will decrease naturally. Therefore, with no pedals, the kinetic energy would turn into potential energy. BUT we need more energy than that, so the car-Earth system's energy can increase, not just remain constant. We will press the gas, but not to the point where we make the car go as fast as it did at the bottom of the hill.