10.20 An electric kettle has a heat capacity of 450 J K^{-1} and an element whose power is 2.25 kW. Ignoring losses of energy to the surroundings, what is the rate of rise of temperature (in K min^{-1}) when the kettle contains 1.0 kg of water? [Use data.]

10.25 A car of mass 800 kg moving at 20 m s^{-1} is braked to rest 10 times. If 20% of the car's kinetic energy is retained by the steel brake discs, what is their rise in temperature, if each of the four has a mass of 1.5 kg?
[s.h.c. of steel = 420 J kg^{-1} K^{-1}.]

10.26 A squash ball of mass 46 g is struck so that it hits a wall at a speed of 40 m s^{-1}; it rebounds with a speed of 25 m s^{-1}.

(a) What is its rise in temperature? [s.h.c. of rubber = 1600 J kg^{-1} K^{-1}.]

(b) Why is it unnecessary to know its mass?

(c) What will happen to its temperature if the players continue to hit it against the wall?

10.29 1.0 kg of water at a temperature of 95°C is poured into a copper saucepan of mass 0.70 kg which is at a temperature of 20°C. The water transfers energy to the saucepan and they reach the same temperature before they start to lose energy to the surroundings.

(a) Suppose this temperature is θ. Write down expressions involving θ for **(i)** the temperature fall of the water **(ii)** the temperature rise of the saucepan.
[s.h.c. of copper = 385 J kg^{-1} K^{-1}.]

(b) The energy transferred from the water is equal to the energy transferred to the saucepan. Write down an equation involving your answers to **(a)** and hence find θ.
[Use data.]

(c) Explain why the final temperature of the water and saucepan is much closer to the original temperature of the water than it is to the original temperature of the copper.

3 In an inversion tube experiment, 0.50 kg of lead shot at an initial temperature of 18 °C was inverted fifty times in a tube of length 1.30 m. The final temperature of the lead shot was 23 °C. Calculate:

a the total gravitational potential energy released by the lead,

b the specific heat capacity of lead. Assume $g = 9.81\,m\,s^{-2}$.

4 An electric shower is capable of heating water from 10 °C to 40 °C when the flow rate is 0.025 $kg\,s^{-1}$. Calculate the minimum power of the heater.

Data: SHC Water = 4200 J kg^{-1} K^{-1}