CHAPTER 19

THERMAL PROPERTIES

PROBLEM SOLUTIONS

Heat Capacity

19.1 The energy, E, required to raise the temperature of a given mass of material, m, is the product of the specific heat, the mass of material, and the temperature change, ΔT, as

$$E = c_p m \Delta T$$

The ΔT in this problem is equal to 150°C – 20°C = 130°C (= 130 K), while the mass is 5 kg, and the specific heats are presented in Table 19.1. Thus,

$$E(\text{aluminum}) = (900 \text{ J/kg - K})(5 \text{ kg})(130 \text{ K}) = 5.85 \times 10^5 \text{ J}$$

$$E(\text{brass}) = (375 \text{ J/kg - K})(5 \text{ kg})(130 \text{ K}) = 2.44 \times 10^5 \text{ J}$$

$$E(\text{alumina}) = (775 \text{ J/kg - K})(5 \text{ kg})(130 \text{ K}) = 5.04 \times 10^5 \text{ J}$$

$$E(\text{polypropylene}) = (1925 \text{ J/kg - K})(5 \text{ kg})(130 \text{ K}) = 1.25 \times 10^6 \text{ J}$$