A 100 g aluminum calorimeter contains 250 g of water. The two substances are in thermal equilibrium at 10°C. Two metallic blocks are placed in the water. One is a 50 g piece of copper at 66°C. The other sample has a mass of 78 g and is originally at a temperature of 100°C. The entire system stabilizes at a final temperature of 20°C. Determine the specific heat of the unknown second sample

Specific heat of aluminum = 0.897 J / g degC.
Heat gained by calorimeter = 100 * 10 * 0.897 J = 897 J

Specific heat of water = 4.18 J / g degC.
Heat gained by water = 250 * 10 * 4.18 J = 10450 J

Specific heat of copper = 0.385 J / g degC.
Heat loss by copper block = 50 * (66-10) * 0.385 J = 1078 J

Let specific heat of unknown block be x J / g degC.
Heat loss by unknown block = 78 * (100-10) * x J = 7020x J

Heat gain = Heat loss
897 + 10450 = 1078 + 7020x
7020x = 10269
x =~ 1.463

Specific heat of unknown substance is 1.463 J / g degC.