19.3 (a) This problem asks that we determine the room-temperature heat capacities at constant pressure, C_p, for copper, iron, gold, and nickel. All we need do is multiply the c_p values in Table 19.1 by the atomic weights (values are found inside the front cover), taking into account the conversion from grams to kilograms (for the atomic weights). Thus, for Cu

$$C_p = (386 \text{ J/kg - K})(1 \text{ kg}/1000 \text{ g})(63.55 \text{ g/mol}) = 24.5 \text{ J/mol - K}$$

For Fe

$$C_p = (448 \text{ J/kg - K})(1 \text{ kg}/1000 \text{ g})(55.85 \text{ g/mol}) = 25.0 \text{ J/mol - K}$$

For Au

$$C_p = (128 \text{ J/kg - K})(1 \text{ kg}/1000 \text{ g})(196.97 \text{ g/mol}) = 25.2 \text{ J/mol - K}$$

For Ni

$$C_p = (443 \text{ J/kg - K})(1 \text{ kg}/1000 \text{ g})(58.69 \text{ g/mol}) = 26.0 \text{ J/mol - K}$$

(b) These values of C_p are very close to one another because room temperature is considerably above the Debye temperature for these metals; therefore, the values of C_p should be about equal to $3R$ [(3)(8.31 J/mol-K) = 24.9 J/mol-K], which is indeed the case for all four of these metals.

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