

# 16 Heat Transfer

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## Solutions to Chapter 16 Exercises

1. The metal doorknob conducts heat better than wood.
3. No, the coat is not a source of heat, but merely keeps the thermal energy of the wearer from leaving rapidly.
9. In touching the tongue to very cold metal, enough heat can be quickly conducted away from the tongue to bring the saliva to sub-zero temperature where it freezes, locking the tongue to the metal. In the case of relatively nonconducting wood, much less heat is conducted from the tongue and freezing does not take place fast enough for sudden sticking to occur.
15. The high conductivity of metal means a lot of heat transfer, hence the ouch. But the low conductivity of air results in less heat transfer and less pain.
20. It is thermal energy that flows—heat. It is therefore correct to say that thermal energy flows between the objects.
42. Radiation requires no medium for transfer.
44. A good emitter, by virtue of molecular-or-whatever design, is also a good absorber. A good absorber appears black because radiation that impinges upon it is absorbed; just the opposite of reflection. The blackness of materials is evidence for their absorption. By the same token the blackness is also evidence for their emission. The radiation that an object emits at normal temperatures is too low in frequency to be seen by the eye and too feeble to be felt. But it's there. A warm black pot will emit more energy in a given time than a warm silver pot of the same mass and material.

## Chapter 16 Problem Solutions

5. According to Newton's law of cooling, its rate of cooling is proportional to the temperature difference, so when the temperature difference is half as great, the rate of cooling will be half as great. After another eight hours, the coffee will lose 12.5 degrees, half as much as in the first eight hours, cooling from 50°C to **37.5°C**. (Newton's law of cooling leads to exponential behavior, in which the fractional change is the same in each equal increment of time.)