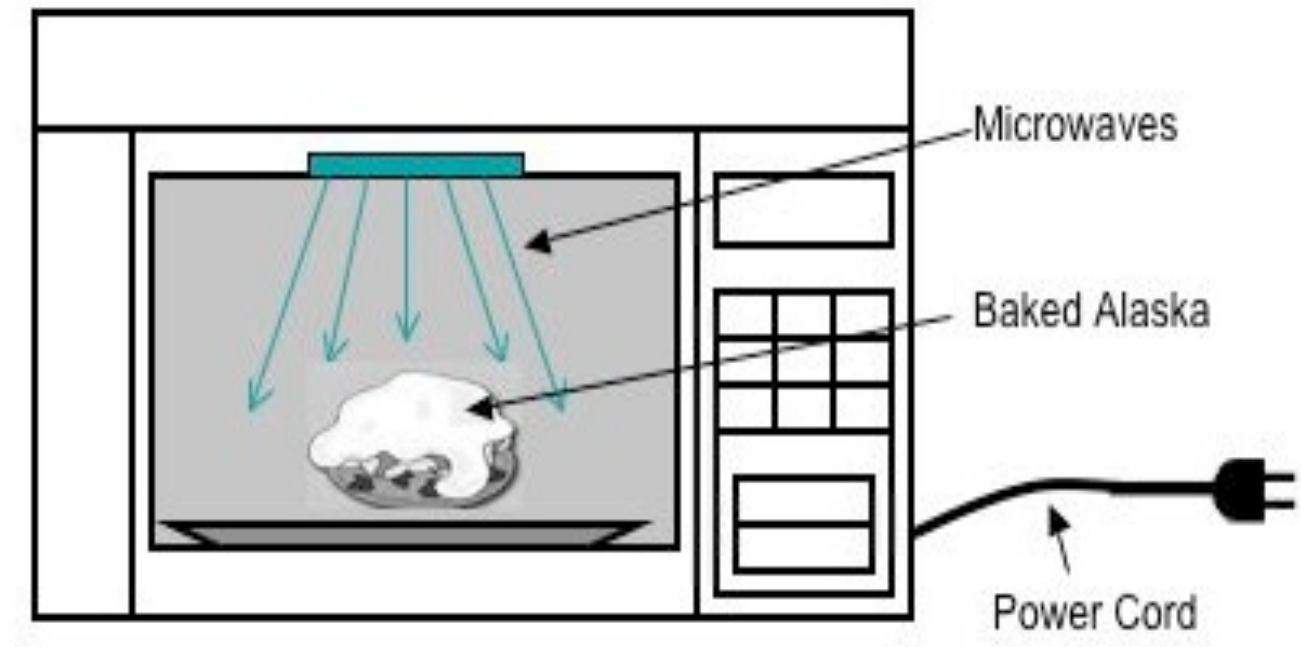
Typical Homework Question with Answers
Baked Alaska (659040
Microwave ovens allow for some interesting cooking and funny disasters.



a. Baked Alaska is a dessert in which a hot, baked meringue contains cold, frozen ice cream. The reverse is Frozen Florida, a dessert in which cold, frozen meringue contains a boiling hot liqueur. Frozen Florida is prepared by taking a frozen meringue ball (cooked egg whites) containing liquid liqueur (a water-alcohol mixture that remains liquid at low temperature) out of the freezer and putting it in a microwave oven briefly. Why does the liqueur get hot while the meringue remains frozen?

Key: The microwave operates by rapidly twisting polar molecules back and forth, and that kinetic energy is dissipated into heat. This process operates normally for the liquid liqueur, causing it to heat up. The frozen molecules in the meringue are locked in a crystal lattice and cannot vibrate, so they cannot absorb energy from the microwave's electric field, and therefore do not become heated.

b. If you try to cook an egg in a microwave oven, the egg may explode. Compare this result to the process of cooking popcorn in a microwave oven.

Key: These culinary incendiary devices are identical in principle. In each, water inside the shell (there is a trace amount of water even in a dried corn kernel) is rapidly heated by the microwave to the boiling point. The vaporization increases the pressure inside the shell enormously until it ruptures, forming either a tasty movie treat or Humpty Dumpty as imagined by Jerry Bruckheimer.

c. Some prepared foods come with browning sheets that contain very thin metallic layers. These sheets become hot in a microwave oven and help brown the surface of the food. Why does a thin metallic film become so hot?

Key: Free electrons in the metal are easily vibrated by the microwave's fluctuating field efficiently absorbing energy from the microwave's electric field. Much of it is dissipated into heat because the thin

metal layers have a very high electrical resistance, while thicker metal would reradiate the microwaves without much loss to heat.

d. If you wrap a piece of food in sturdy metal screening with holes about 2 millimeters on a side, the food won't cook in a microwave oven. Why can't the microwaves get through the screen's holes the way light can?

Key: The wavelength of visible light is in the range of several hundred nanometers, which will pass through the holes unobstructed. The wavelength of microwaves is a few centimeters, just the same as the holes. Such waves will be reflected by the metal screening.