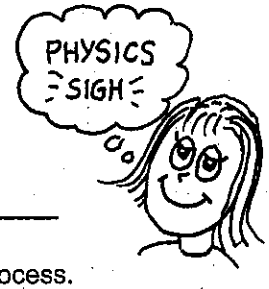
Name ____________________ Date __________

CONCEPTUAL Physics PRACTICE PAGE

Chapter 17 Change of Phase
Evaporation



1. Why do you feel colder when you swim in a pool on a windy day?

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2. Why does your skin feel cold when a little rubbing alcohol is applied to it?

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3. Briefly explain from a molecular point of view why evaporation is a cooling process.

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4. When hot water rapidly evaporates, the result can be dramatic. Consider 4 g of boiling water spread over a large surface so that 1 g rapidly evaporates. Suppose further that the surface and surroundings are very cold so that all 540 calories for evaporation come from the remaining 3 g of water.

a. How many calories are taken from each gram of water that remains?

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b. How many calories are released when 1 g of 100°C water cools to 0°C?

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c. How many calories are released when 1 g of 0°C water changes to 0°C ice?

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d. What happens in this case to the remaining 3 g of boiling water when 1 g rapidly evaporates?

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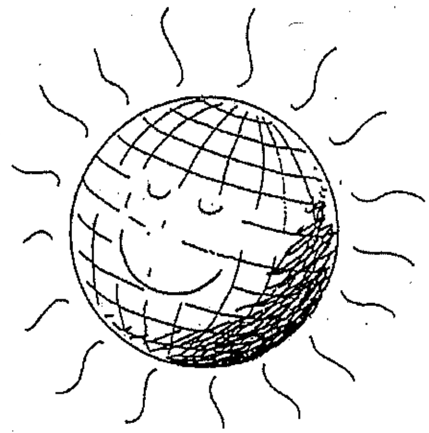
Hewitt Drew it!

Chapter 17 Change of Phase
Our Earth's Hot Interior

A major puzzle faced scientists in the 19th century. Volcanoes showed that Earth is molten beneath its crust. Penetration into the crust by bore holes and mines showed that Earth's temperature increases with depth. Scientists found that heat flows from the interior to the surface. They assumed that the source of Earth's internal heat was primordial, the afterglow of its fiery birth. Measurements of cooling rates indicated a relatively young Earth—some 25 to 30 millions years in age. But geological evidence indicated an older Earth. This puzzle wasn't solved until the discovery of radioactivity. Then it was learned that the interior is kept hot by the energy of radioactive decay. We now know the age of Earth is some 4.5 billion years—a much older Earth.



All rock contains trace amounts of radioactive minerals. Those in common granite release energy at the rate of 0.03 joule/kilogram·year. Granite at Earth's surface transfers this energy to the surroundings as fast as it is generated, so we don't find granite warm to the touch. But what if a sample of granite were thermally insulated? That is, suppose the increase of internal energy due to radioactivity were contained. Then it would get hotter. How much? Let's figure it out, using 790 joule/kilogram·kelvin as the specific heat of granite.

Calculations:

1. How many joules are required to increase the temperature of 1 kg of granite by 1000 K?

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2. How many years would it take radioactive decay in a kilogram of granite to produce this many joules?

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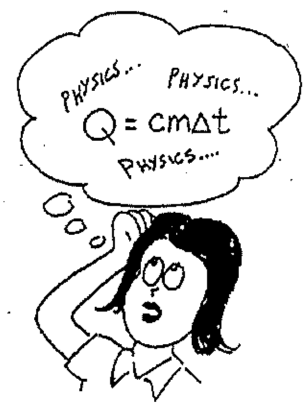

Questions:

1. How many years would it take a thermally insulated 1-kg chunk of granite to undergo a 1000 K increase in temperature?

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2. How many years would it take a thermally insulated one-million-kilogram chunk of granite to undergo a 1000 K increase in temperature?

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3. Why are your answers to the above the same (or different)?

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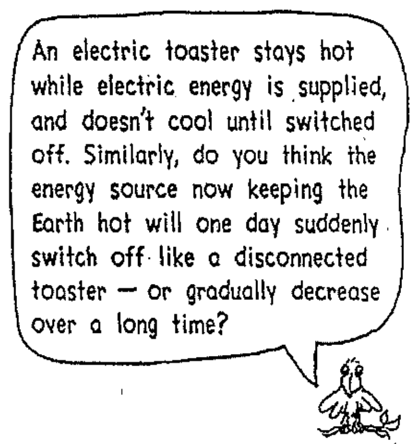

4. [True] [False] Energy produced by Earth radioactivity ultimately becomes terrestrial radiation.