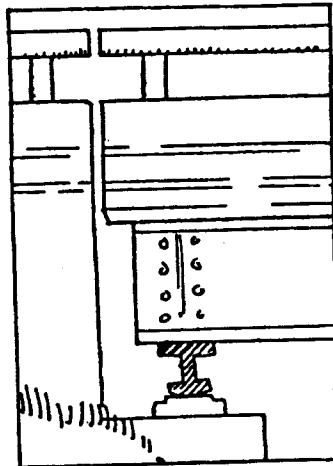


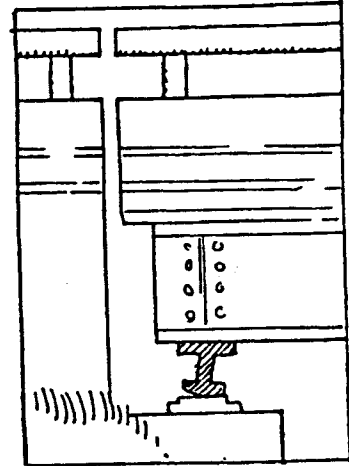
**Concept-Development
Practice Page** 21-2

Thermal Expansion

1. Long steel bridges often have one end fixed while the other end rests on rockers, as shown. Each sketch shows the bridge at a different season of the year. Mark the sketches winter (W) or summer (S). Briefly defend your answer.

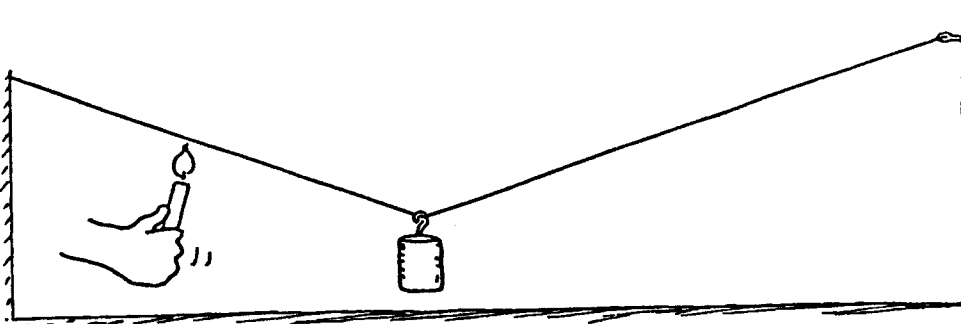


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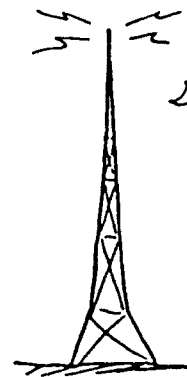
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2. The weight hangs above the floor from the copper wire. When a candle is moved along the wire and heats it, what happens to the height of the weight above the floor? Why?

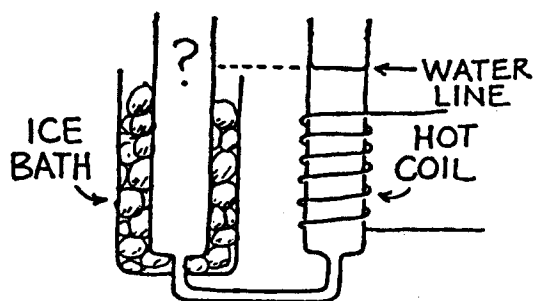


3. A steel television broadcasting tower is taller in the daytime than it is in the cooler nighttime. This is because steel expands (or contracts) about 1 part in 100 000 for each degree Celsius change. By this we mean that a piece of steel 100 000 units long will be 100 001 units long when its temperature increases by 1°C. What is the change in height for a 500-m steel tower when its temperature changes 20°C from day to night?

_____ cm

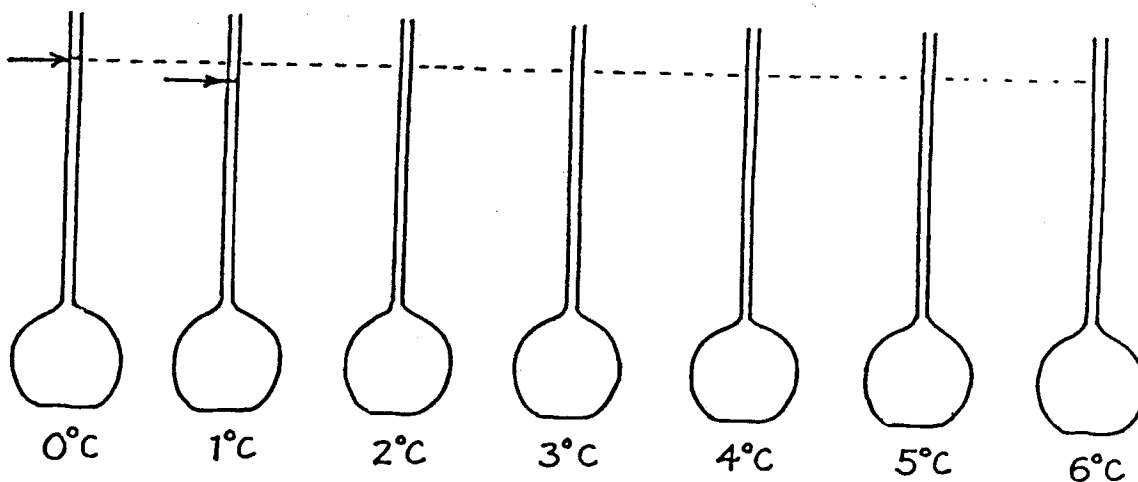


4. A common saying is "water seeks its own level," and usually it does. Here we see a container of water that is cooled on the left and warmed on the right. Consider the effect of temperature on density. Compared to the water level in the right tube, the water level in the left tube is

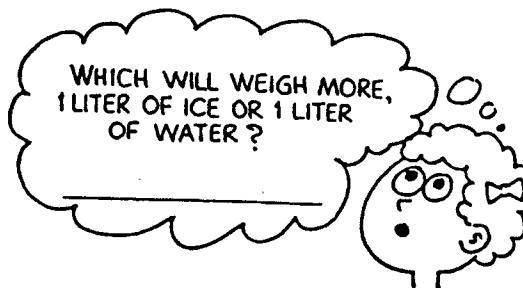
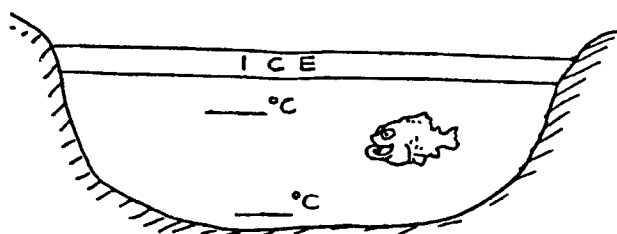


(slightly higher) (slightly lower) (the same)

5. The levels of water at 0°C and 1°C are shown below in the first two flasks. At these temperatures there is microscopic slush in the water. There is slightly more slush at 0°C than at 1°C . As the water is heated, some of the slush collapses as it melts, and the level of the water falls in the tube. That's why the level of water is slightly lower in the 1°C -tube. Make rough estimates and sketch in the appropriate levels of water at the other temperatures shown. What is important about the level when the water reaches 4°C ?



6. The diagram at right shows an ice-covered pond. Mark the probable temperatures of water at the top and bottom of the pond.



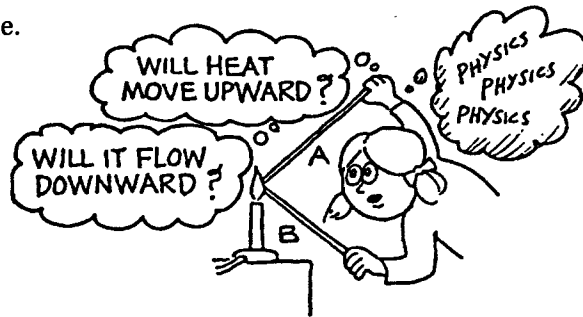
**Concept-Development
Practice Page**


22-1

Transmission of Heat

1. The tips of both brass rods are held in the gas flame.
Mark the following true (T) or false (F).

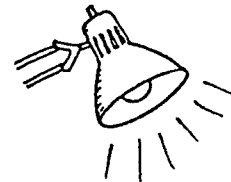
- a. Heat is conducted only along Rod A. _____
- b. Heat is conducted only along Rod B. _____
- c. Heat is conducted equally along both Rod A and Rod B. _____
- d. The idea that "heat rises" applies to heat transfer by *convection*, not by *conduction*.



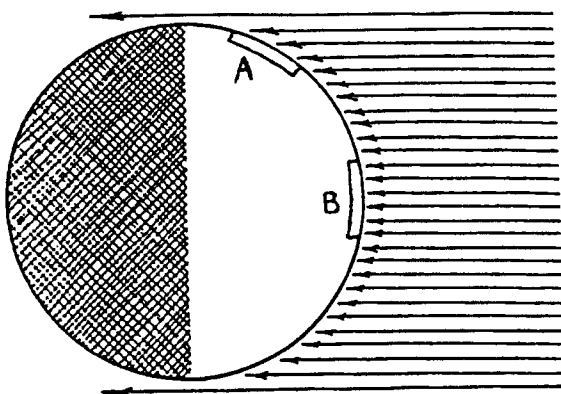
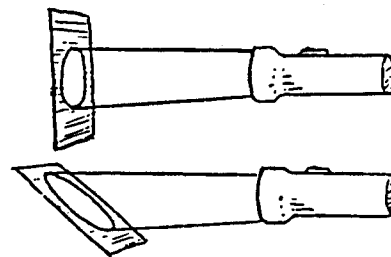
2.  Why does a bird fluff its feathers to keep warm on a cold day?

3. Why does a down-filled sleeping bag keep you warm on a cold night? Why is it useless if the down is wet?

4. What does *convection* have to do with the holes in the shade of the desk lamp?



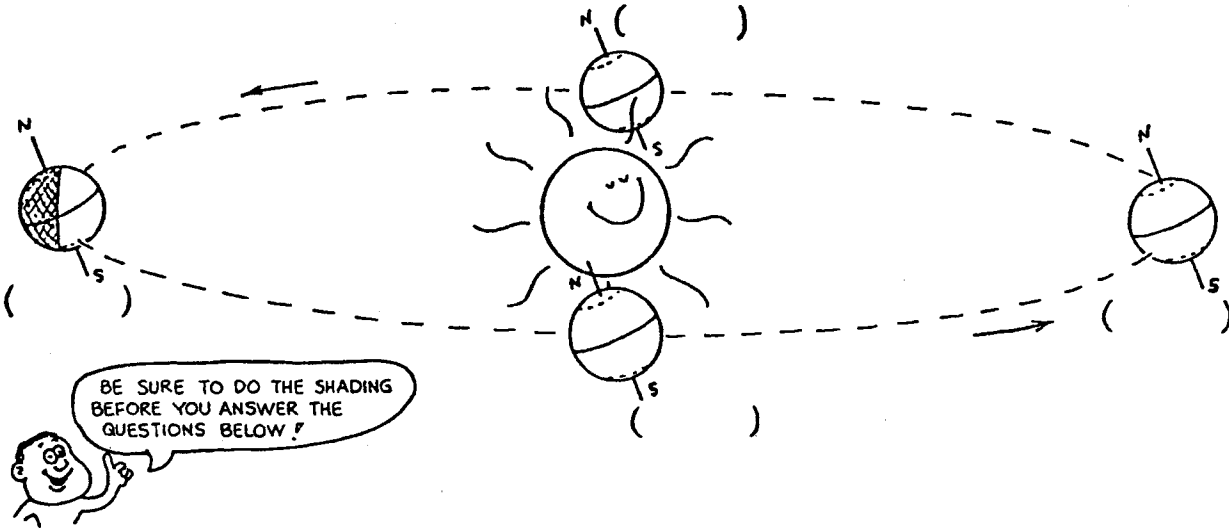
5. The warmth of equatorial regions and coldness of polar regions on the earth can be understood by considering light from a flashlight striking a surface. If it strikes perpendicularly, light energy is more concentrated as it covers a smaller area; if it strikes at an angle, the energy spreads over a larger area. So the energy per unit area is less.



The arrows represent rays of light from the distant sun incident upon the earth. Two areas of equal size are shown, Area A near the north pole and Area B near the equator. Count the rays that reach each area, and explain why B is warmer than A.

6. The earth's seasons result from the 23.5-degree tilt of the earth's daily spin axis as it orbits the sun. When the earth is at the point shown on the right in the sketch below (not to scale), the Northern Hemisphere tilts toward the sun, and sunlight striking it is strong (more rays per area). Sunlight striking the Southern Hemisphere is weak (fewer rays per area). Days in the north are warmer, and daylight is longer. You can see this by imagining the earth making its complete daily 24-hour spin.

Do two things on the sketch: (1) Shade the part of the earth in nighttime darkness for all positions, as is already done in the left position. (2) Label each position with the proper month — March, June, September, or December.



- a. When the earth is in any of the four positions shown, during one 24-hour spin a location at the equator receives sunlight half the time and is in darkness the other half the time.

This means that regions at the equator always get about _____ hours of sunlight and _____ hours of darkness.

- b. Can you see that in the June position regions farther north have longer daylight hours and shorter nights? Locations north of the Arctic Circle (dotted line in Northern Hemisphere) always face toward the sun as the earth spins, so they get daylight _____ hours a day.

- c. How many hours of light and darkness are there in June at regions south of the Antarctic Circle (dotted line in Southern Hemisphere)?

- d. Six months later, when the earth is at the December position, is the situation in the Antarctic the same or is it the reverse?

- e. Why do South America and Australia enjoy warm weather in December instead of June?
