

Chapter 17 Tutorial

Thermodynamics-I

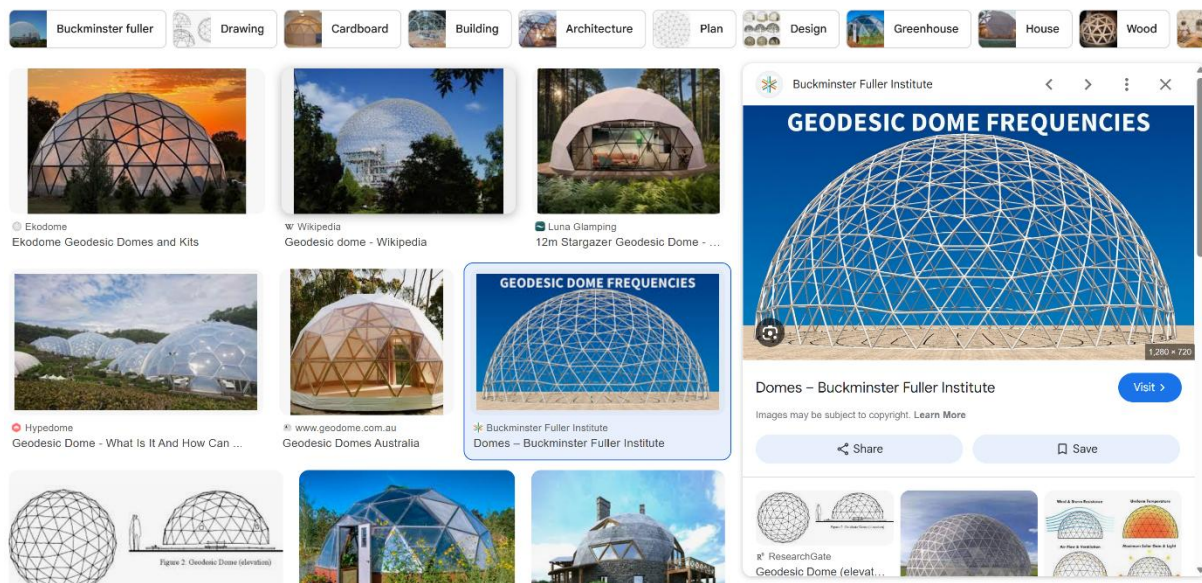
Chapter 17 : Temperature and Heat

Question 1:

- (a) Calculate the one temperature at which Fahrenheit and Celsius thermometers agree with each other.
- (b) Calculate the one temperature at which Fahrenheit and Kelvin thermometers agree with each other.

Question 2: One of the tallest buildings in the world is the Taipei 101 in Taiwan, at a height of 1671 feet. Assume that this height was measured on a cool spring day when the temperature was 15.5°C . You could use the building as a sort of giant thermometer on a hot summer day by carefully measuring its height. Suppose you do this and discover that the Taipei 101 is 0.471 foot taller than its official height. What is the temperature, assuming that the building is in thermal equilibrium with the air and that its entire frame is made of steel?

Question 3: A geodesic dome constructed with an aluminium frame work is a nearly perfect hemisphere; its diameter measures 55.0 m on a winter day at a temperature of -15°C . How much more interior space does the dome have in the summer, when the temperature is 35°C ?



Question 4: Steel train rails are laid in 12.0-m-long segments placed end to end. The rails are laid on a winter day when their temperature is -2.0°C .

- a) How much space must be left between adjacent rails if they are just to touch on a summer day when their temperature is 33°C ?
- b) If the rails are originally laid in contact, what is the stress in them on a summer day when their temperature is 33°C ?

Question 5: In an effort to stay awake for an all-night study session, a student makes a cup of coffee by first placing a 200-W electric immersion heater in 0.320 kg of water.

- (a) How much heat must be added to the water to raise its temperature from 20.0°C to 80°C ?
- (b) How much time is required? Assume that all of the heater's power goes into heating the water.

Question 6: While painting the top of an antenna 225 m in height, a worker accidentally lets a 1.00-L water bottle fall from his lunch box. The bottle lands in some bushes at ground level and does not break. If a quantity of heat equal to the magnitude of the change in mechanical energy of the water goes into the water, what is its increase in temperature?

Question 7: A 500.0-g chunk of an unknown metal, which has been in boiling water for several minutes, is quickly dropped into an insulating Styrofoam beaker containing 1.00 kg of water at room temperature 20.0°C . After waiting and gently stirring for 5.00 minutes, you observe that the water's temperature has reached a constant value of 22.0°C .

- (a) Assuming that the Styrofoam absorbs a negligibly small amount of heat and that no heat was lost to the surroundings, what is the specific heat of the metal?
- (b) Which is more useful for storing thermal energy: this metal or an equal weight of water? Explain.