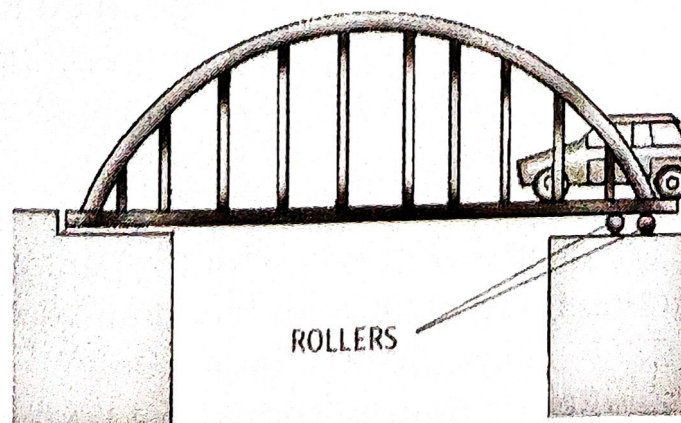
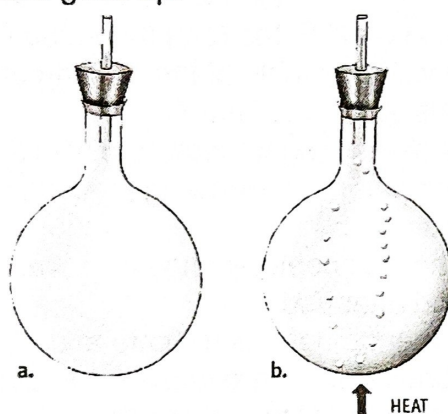


- C. 1. Four effects that heat produces are:
- increase in temperature
 - expansion
 - change of state
 - chemical changes
2. A bimetallic strip consists of two metal strips, one of iron and the other of brass.
3. In a steel bridge, one end is kept on rollers having enough space for expansion in summer.
4. Temperature and hotness of a body are related in a way that hotter the body is, the higher is its temperature.
5. Upper fixed point is the temperature (on a scale) at which pure water boils at sea level.
6. A clinical thermometer has a kink on its stem because when taken out of one's mouth, the liquid in the bulb contracts and the mercury column breaks at the kink. Thus the level of mercury in the stem remains the same and we get a correct reading.
- D. 1. When we heat a substance, the movements of its molecules increase. This increases the average distance between the molecules. Therefore, the space occupied by the molecules, i.e. the volume of the substance increases. Thus we say that heat causes expansion.
2. In steel bridges, one end is made to rest on rollers with enough space provided for expansion during summers. This is one example where expansion on heating is put to good use.



3. On heating a gas, the vibrations of its molecules increase. Since the molecules are not bound to each other at all, the average distance between the molecules increases considerably. Hence, the expansion will be more in case of gases than in liquids or solids.
4. Fill a flask up to the brim with water. Take a rubber cork with a hole in it and insert a narrow tube into the hole. Fix the cork firmly in the mouth of the flask. The liquid will rise a little in the tube. Note the level of the liquid. Now, heat the liquid. You will notice that the level of the liquid in the tube goes down a little and then starts rising. It goes down initially as the flask gets heated first and expands. When the heat reaches the liquid, it expands, and its level in the tube goes up.



5. Expansion on heating can cause some problems as explained below.
 - a. In summers, electric cables between two poles expand and sag. In winters, they contract and become taut. If cables are laid in summers, they must be left a little loose to allow for contraction during winters. If this is not done, they may break on contraction in winters.
 - b. The railway tracks over which trains run are made of iron. During summers, the iron expands. To allow this expansion, space has to be left between two sections of the rail tracks. If this is not done, expansion of the tracks can cause them to bend. This can cause serious accidents.
6. Convert 25°C to $^{\circ}\text{F}$

Solution:

$$\begin{aligned}
 F &= \left(\frac{9}{5} \times C \right) + 32 \\
 &= \frac{9}{5} \times 25 + 32 \\
 &= 45 + 32 \\
 &= 77^{\circ}\text{F}
 \end{aligned}$$

Convert 86°F to $^{\circ}\text{C}$

Solution:
$$C = \frac{5}{9} (F - 32)$$

$$= \frac{5}{9} \times (86 - 32)$$

$$= \frac{5}{9} \times 54 = 30^\circ\text{C}$$

7. Let us take $C = x$, thus $F = 2x$
According to the formula, we get

$$F = \left(\frac{9}{5} \times C \right) + 32$$

or
$$2x = \left(\frac{9}{5} \times x \right) + 32$$

or
$$2x = \frac{9x}{5} + 32$$

or
$$10x - 9x = 32 \times 5$$

$$\therefore x = 160^\circ\text{C}$$

$$\therefore 2x = 2 \times 160 = 320^\circ\text{F}$$

Thus, at 320°F , the reading on the Fahrenheit scale will be double of the reading on the Celsius scale, i.e. 160°C .

8. While measuring temperature with a laboratory thermometer, the following precautions should be observed:

- (i) The thermometer should be washed before and after use.
- (ii) A thermometer is delicate and should be handled with care to avoid breakage.
- (iii) It should not be held by the bulb while reading the temperature.
- (iv) It should be kept upright and not tilted.
- (v) The bulb should be completely surrounded by the substance whose temperature is being measured and the bulb should not touch the sides of the container.
- (vi) While reading the thermometer, the level of mercury should be at the same level as the eye.

The extra precautions to be taken while measuring body temperature with a clinical thermometer are:

- (i) Wash the clinical thermometer before use, preferably with an antiseptic solution.
- (ii) Hold it with the stem and give it a few jerks, to ensure that the level of mercury falls to its normal level.

HOTS Questions

1. In a cold place where the night temperature drops to -50°C , we must carry alcohol thermometer because alcohol freezes at -117°C whereas mercury freezes at -39°C .
2. 1° rise in the Celsius scale is greater than 1° rise in the Fahrenheit scale.
3. A clinical thermometer cannot be used to measure the temperature of boiling water because it has a range of 35°C to 42°C

whereas boiling water's temperature is 100°C . If inserted in boiling water, a clinical thermometer will crack as the mercury will expand beyond the stem.

4. A laboratory thermometer is not used to measure body temperature because its mercury level falls as soon as it is taken out of the mouth and the reading cannot be correctly taken.
5. The thick-walled glass tumbler is more likely to crack. There is greater temperature difference between the inner and the outer surfaces of a thick-walled tumbler when hot water is poured into it, as compared to a thin-walled tumbler. This causes greater difference in expansion between the inner and the outer surfaces. The resulting strain cracks the tumbler.

Be a Scientist

1. Gaps have to be longer since the greater the length of the rails, the greater will be the expansion in length.
2. Join all rails together and give a long expansion space at the end.