

**PHYSICS**  
**EXPANSION & CONTRACTION**  
**FORM 5**

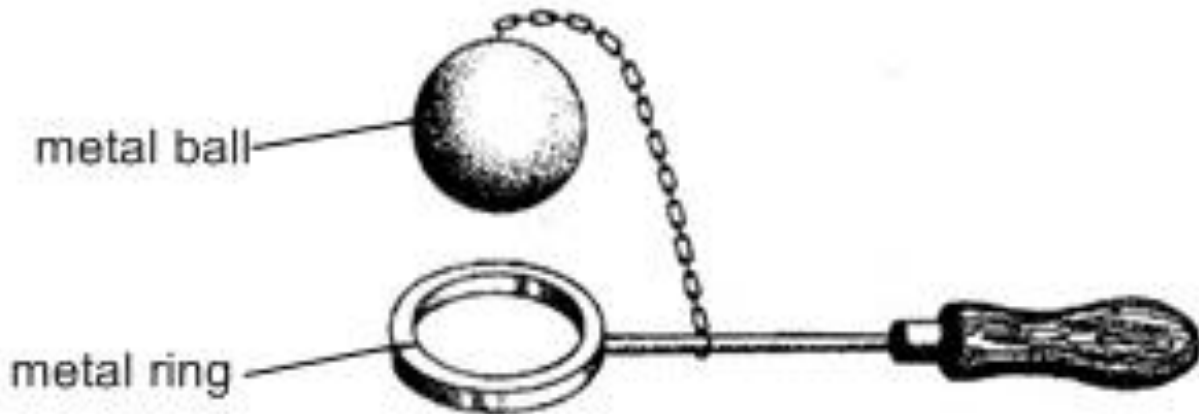
**Expansion**

Expansion occurs when substances are heated, the particles gain kinetic energy. (Kinetic energy is the energy an object possesses by virtue of its motion.)

The particles therefore move more rapidly, travelling longer distances (as in the case of gases). Since the motion is greater, the particles therefore occupy a greater volume. This explains why when substances are heated the volume of the substance increases.

**Ball and Ring Experiment**

<http://www.youtube.com/watch?v=MXk57NIM3w8>



Normally the ball is able to pass through the ring. However when the ball is heated it is unable to pass through the ring, the reason being the ball expands on heating. When allowed to cool, the metal ball can once fit through the ring.

**PHYSICS**  
**EXPANSION & CONTRACTION**  
**FORM 5**

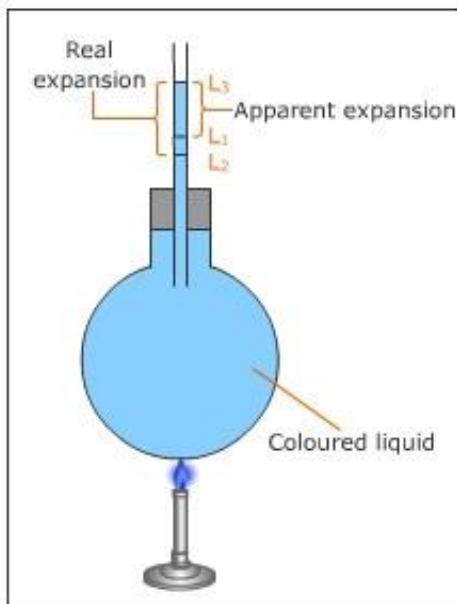
**Metal Bar and Gauge Experiment**

<http://www.youtube.com/watch?v=U0xLUyk7QDY>



In the cool state, the metal bar just fits into the gauge, however when heated it is unable to fit, the bar expands on heating.

**Expansion of Liquids** (<http://www.youtube.com/watch?v=IFacqEPB2nI>)



To demonstrate the expansion of liquids, the experiment is set up as shown above. A round bottom flask is attached to a straight delivery tube. The flask is then filled with a liquid to a level within the delivery tube. This liquid level is then marked. By simply holding the round bottom flask with both hands, enough heat is transferred to the liquid resulting in expansion. The water level rises.

**PHYSICS**  
**EXPANSION & CONTRACTION**  
**FORM 5**

**Expansion of Gases**

<http://www.youtube.com/watch?v=cq6d9RAcIAQ>



To demonstrate the expansion of gases, the experiment is set up as shown above. The round bottom flask and delivery tube containing air is inverted and the end of the delivery tube is placed within a beaker of water. Again by simply holding the round bottom flask, enough heat energy is transferred to the air within the flask causing the air to expand. The expansion of air is demonstrated by the bubbles seen.

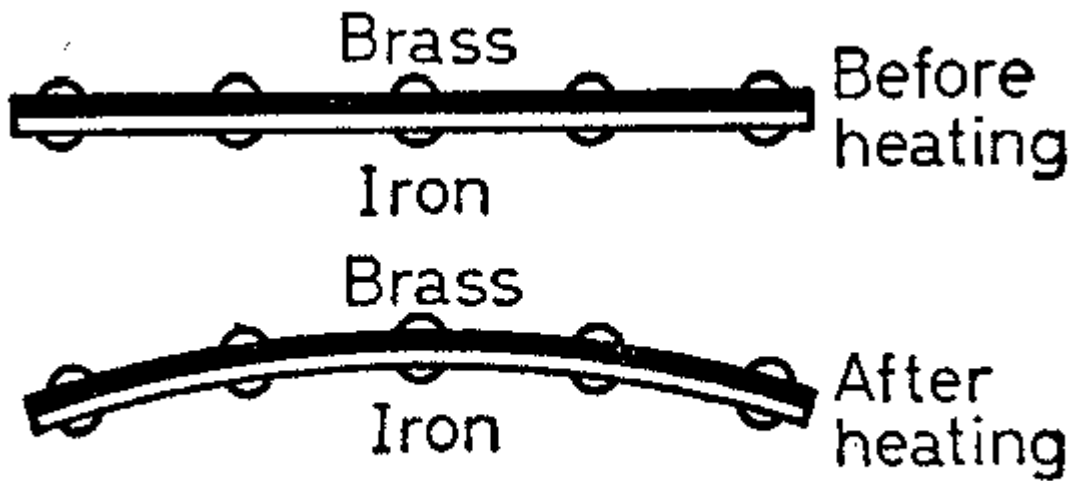
R. Mondal

**PHYSICS**  
**EXPANSION & CONTRACTION**  
**FORM 5**

**Bimetallic Strip**

A bimetallic strip is made using two strips of different metal that are either welded or riveted. When heated the different metal expands by various amounts.

When the bimetallic strip is cold, it is straight. When it is heated, the bimetallic strip is curved. The curvature is brought about by the difference in expansion of metals.



**Bimetallic strip**

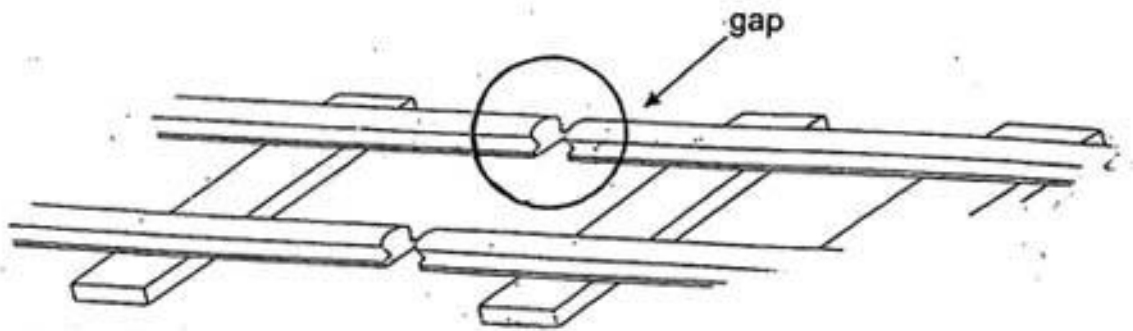
In the above diagram the brass expands more than the iron, the bimetallic strip curves downwards. In this way, the length of the brass strip is greater than that of the iron strip.

*Metals that expand more on heating, contracts more than when cooled.*

**PHYSICS**  
**EXPANSION & CONTRACTION**  
**FORM 5**

**Applications of Thermal Expansion**

1. Opening a jar with a metal cover – by pouring hot water onto the jar, the metal cover expands making it easier to open.
2. Telephone Wires – On a hot day, the metal wires expand, ie. the lengthened wires therefore hang more. On a cold day metal wires will contract. The wires will be taut (pulled straight). This means therefore, the wires will break during the contraction and if it hangs to much, then on a hot day, they will be too close to the ground.
3. Railway Track – If the tracks are continuous metal, then when heated the tracks will bend. To overcome this problem, small gaps are placed along the tracks.



4. In paving long concrete driveways or walkways, strips of wood are placed at regular intervals. On a hot day when the concrete expands, the strips of wood allow for the expansion to occur. If the concrete pavement is paved continuously, then the concrete will begin to crack.