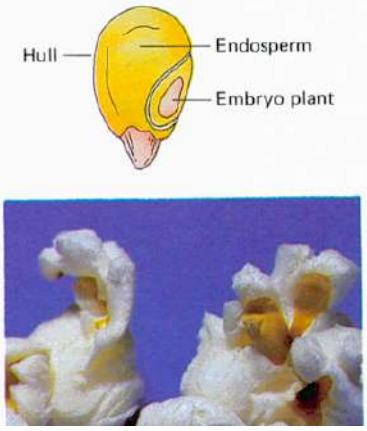
7-7 Application: Why Popcorn Pops

Almost everyone loves popcorn. Yet you may wonder: How does something as unappetizing as a kernel of corn become so delectable? Part of the answer lies in the starchy composition of corn and part in the physical behavior of gases.

A kernel of corn is composed mostly of carbohydrates and water. The kernel has three parts. The outer shell is called the hull (pericarp). The inside of the kernel is composed of starch (endosperm) and an embryo plant (see Figure 7-19). The endosperm acts as food for the embryo as it germinates.

When the kernels are placed into heated oil or a hot-air popper, the water inside the kernel becomes superheated, which means it is hot enough to vaporize but does not have the room to do so. The rapidly moving water molecules cause a tremendous increase in pressure on the hull (the kernel's container). The superheated water penetrates the starch structure under a pressure of about 900 kPa. Because the pressure is so great, the hull ruptures. The pressure surrounding the starch is then greatly reduced (to about 100 kPa, or atmospheric pressure). As the pressure drops, the water vaporizes and expands as described by Boyle's law. This change causes the starch to expand to about 30 times its original size. The expansion is so rapid that the kernel explodes, or pops.

Figure 7-19 Under proper conditions, a corn kernel produces a snack that so many people love to eat. The white fluff of the popcorn kernel is the expanded endosperm.



Results:

1. Mass of unpopped popcorn = _____ g
2. Mass of the popped popcorn = _____ g
3. Calculate the mass of lost by subtracting = _____ g (m)
4. Volume of the 17 kernels = .002L (V)
5. Molar mass of water(H_2O) = 18.02 g/mol (M)
6. Temperature of the boiling oil 273.15 K + 225°C = 498.15 K (T)
7. R = 8.31 (known)

Calculate the Pressure using

$PV = (m\ R\ T) / M$