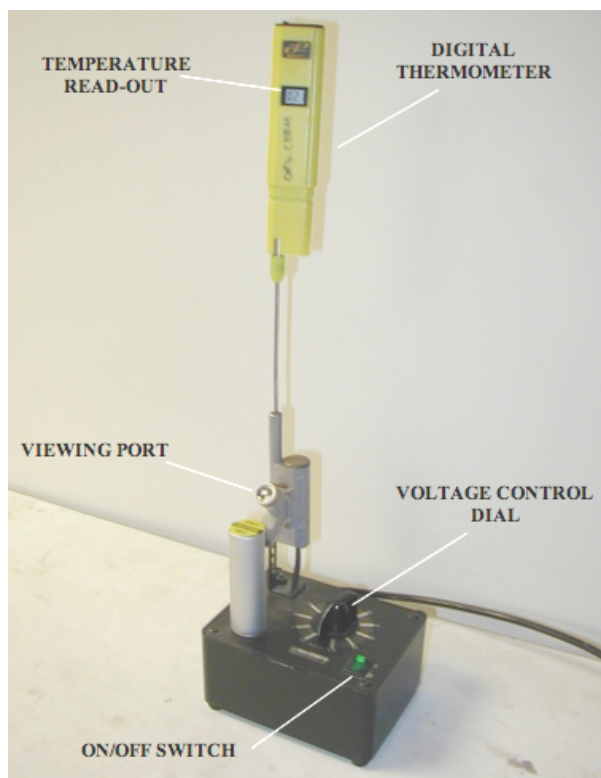


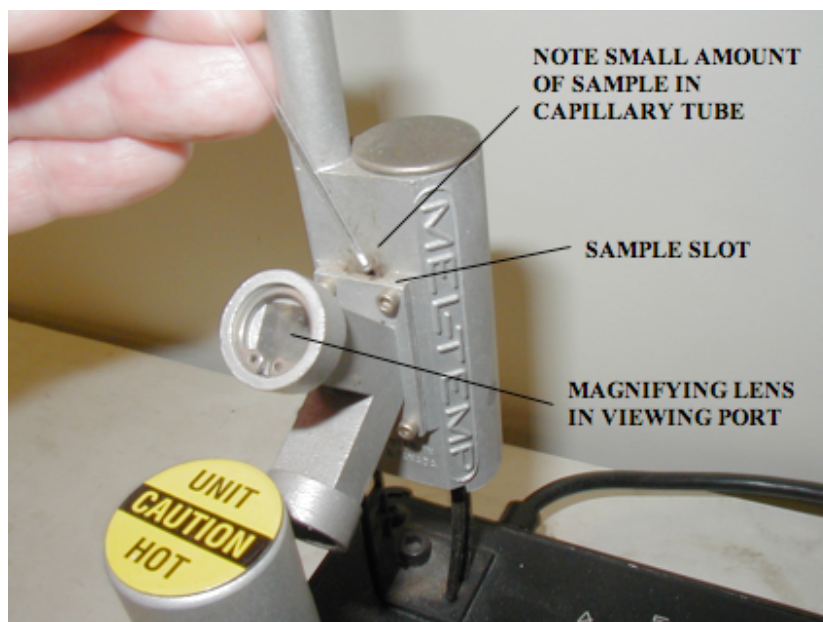
Melting Points.

The temperature at which a solid melts is known as the melting point (MP) of that substance. The melting point is a physical property of a solid and can be used to help identify a substance. In practice, a solid usually melts over a range of temperatures rather than at one specific temperature. For this reason it is more useful to speak of a melting point range. Although the term "melting point" is usually used, what is meant is "melting point range". If the compound melts over a very narrow range, it can usually be assumed that the compound is relatively pure. Conversely, compounds that melt over a wide range are assumed to be relatively impure.

Besides melting over a wide range, impure solids also melt at a temperature lower than that for the pure compound. For our purposes a range greater than 2° is considered to be wide. For example, if an unknown solid melts at $102\text{-}106^{\circ}\text{C}$, the 4° range suggests that the sample is impure. If the unknown is one of four possible compounds which melt at 102 , 104 , 106 , and 108°C , it is most likely that which melts at 108°C . To summarize, an impure solid melts over a wide range and at a temperature lower than that of the pure solid. It should be noted that "insoluble" impurities such as bits of filter paper or dust have no effect on the MP of a substance. To affect the MP the impurity must be soluble in the solid.

Several devices are available for measuring melting points. A Mel-Temp device is used in this lab. Below is a photo of a Mel-Temp device along with a close-up.





Sample is added to a small glass capillary tube, which is closed at one end. It is important to use as small amount of sample as possible so that sufficient heat is present to melt the sample rapidly. The temperature of the sample is measured with a digital thermometer. The sample is heated slowly as the temperature approaches the MP, while the sample is carefully observed. The temperature at which the first drop of liquid is observed is recorded as the beginning of the melting point range. The temperature at which all solid has melted is recorded as the end of the melting point range. Upon heating, the solid may expand and move slightly in the tube. This movement should not be interpreted as the beginning of the MP range. The melting point (MP) is recorded in the lab notebook as, for example, MP (compound A) 102.5-104.0° C.

To determine the MP of an unknown solid, to save time, an approximate MP is first determined by heating the sample fairly rapidly. Once the approximate MP is known, a more careful determination is made on a fresh sample. Note that once a sample has been melted, it may have decomposed slightly. Contamination with decomposition product will change the MP of the sample, so a fresh sample must always be used for each determination.

The effect of impurities on the MP can actually be used to help identify a compound. For example if an unknown solid is known to be one of two possible known compounds, both having the same MP, the unknown can be mixed with one of the known compounds and a MP taken of the mixture. If the MP range is lowered and widened, it means that the two are different compounds. If the MP stays the same it means that the two compounds are likely identical. This technique is known as a mixed melting point determination.

To summarize, melting points can provide information about the identity and the purity of a solid sample.