

The Effect of Ionic and Covalent Bonds on the Melting Times of Substances

Problem: How do the attractive forces between ions compare to the attractive forces between molecules?

Hypothesis: The attractive force in ions is stronger than the attractive force in molecules, therefore, salt will resist melting and sugar and water will readily melt.

Materials:

three test tubes	goggles	test tube tongs	test tube holder
bunsen burner	table salt	sugar	crushed ice
timer	lighter		

Procedure:

1. Obtain goggles and put them on.
2. Retrieve three test tubes and place them in the test tube holder.
3. Measure out 2 mL of salt, sugar and crushed ice, putting each of the samples into a test tube.
4. Take the test tubes, tongs, and lighter back to the lab table.
5. Attach bunsen burner to gas and turn it on. Adjust flame so it is small and mainly blue.
6. Using tongs to hold test tube, take one of the tubes and hold it over the flame so the bottom part containing the sample is in the blue part of the flame and the opening is facing away from everyone around.
7. Time how long it takes for the sample to start to melt. Do NOT keep the sample in the flame for more than five minutes.
8. Return the test tube to the holder and repeat step seven with the two other samples.
9. Record time and observations.
10. Clean out test tubes and leave them upside down on test tube holder.
11. Return all materials to front table.
 - Constants: test tube size, amount of material used, heat from flame
 - IV: type of material used
 - DV: time to melt

Safety: 21, 47, 48, 51

Data and Observations:

Sample	Time to melt	Observations
Crushed ice	0:30	Became water, started to boil
Table salt	5:00+	Clumped together, but didn't seem to melt
Sugar	1:34	Turned brown quickly, smelled like something burning

Data table on attached graph paper.

Conclusion:

The data supported the hypothesis. The two covalently bonded compounds-water and sugar-melted in 35 seconds. The ionic compound-table salt-took longer to melt. In fact, it seemed as though the salt wouldn't melt at all. It did clump together and was different than when first added to the test tube, but that might have been because of humidity in the air or water molecules in the test tube prior to the experiment. This corresponds with what is known about compounds because ionic compounds do have a higher melting point than covalent compounds.

The results from other experiments seem to also support the hypothesis. In other experiments, the water melted first, anywhere from 2 seconds to 40 seconds. Second to melt was the sugar, taking on average 45 seconds to being to melt. If left too long over the flame, the sugar would turn brown and being to boil and steam. In one experiment, the salt did seem to bubble and melt together after 4:30 minutes, but in the majority of experiments, the salt had not changed, except to clump, in the 5 minutes it was held over the flame.

Polarity might affect the melting point of molecules because it gives the compound a slightly more ionic feel. Polar compounds are compounds with an unequal sharing of electrons. Water is a good example. The oxygen atom has more protons and therefore a stronger attraction for the electrons it shares with the hydrogen atoms. The electrons tend to spend more time around the oxygen atom, giving it a slightly positive charge to it. The hydrogen atoms are left with a slightly negative charge to them. These slight charges on the molecule makes the molecule more like ionic compounds than non-polar covalent compounds, making its melting point higher.