THE ROYAL SOCIETY OF CHEMISTRY

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Part 1 Pre-16 – Conducting plastics and shape changing polymers

Teacher's notes

These worksheets consist of comprehension exercises that revise many basic ideas from chemistry and approach them from a novel perspective. They could be used for homework or self-study.

Answers to questions on conducting plastics

1. A polymer is a large molecule made up of many linked repeating units (monomers) of smaller molecules.
2. Any suitable use – *eg* electric plugs, sheathing for wire, bodies for hair driers, handles for kettles, irons.
3. Any metal or graphite (most forms of carbon conduct to some extent).
4. More carbon could be added to improve its conductivity.
5. It could melt or catch fire if overheated.
6. a) A liquid becomes more viscous as it cools.
   b) A typical liquid freezes.
   c) Water pipes will crack if the water freezes. Pipes carrying a viscous liquid – *eg* chocolate, sulfur, oil – may block if the liquid cools.
   d) Coil a self-regulating heating wire round the pipe to keep the contents warm.
7. A polymer – which is an insulator.

   Carbon – which conducts electricity.
8. Only the parts of the pipe that were cold would be heated, therefore it is more efficient and cheaper to run. The cable cannot overheat.
9. The particles have more energy and therefore vibrate (solid) or move (liquids and gases) further apart from each other. The material thus expands.
10. The material consists of thousands of independent parallel circuits each of which responds to its ambient temperature.

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Answers to questions on shape changing polymers (or molecules with a memory)

1. Thermosoftening plastics can be recycled because these plastics can be melted down and remoulded.
2. To *melt easily* means to turn into a liquid at a low temperature.
3. A rigid, brittle material is hard to bend and breaks rather than bends.
4. Typical properties of plastics:
   - ▼ poor conductor;
   - ▼ water resistant; and
   - ▼ low density.
5. A loose sleeve is fitted round the wires and then heated to make it shrink to form a tight seal.
6. Any suitable ideas – *eg* to protect junctions in cables for phones, electricity.
7. a) It softens when heated and its shape can be changed.

   b) It has a fundamental shape.
8. This is the property of returning to a given shape when heated.