50 Why are metals good conductors of heat and electricity? Why does the ability of a metal to conduct electricity decrease with increasing temperature?
Metals are good conductors of heat and electricity because the delocalized electrons are mobile. As the temperature increases, electrical conductivity decreases because the metal atoms vibrate more, causing them to collide more with the electrons.

51 A solid is hard, brittle, and electrically nonconducting. Its melt and an aqueous solution containing the substance conduct electricity. Classify the solid & explain your choice.
A solid that is hard and brittle could be either an ionic crystal or a covalent network solid. Both types are also nonconducting in the solid state (with the exception of certain metalloids that are semiconductors). However, of the types of crystals available (ionic, covalent, molecular, metallic), only an ionic solid can dissolve in water and conduct electricity in both the aqueous and liquid states. See Table 11.4 in text.

52 A solid is soft and has a low melting point (below 100°C). The solid, its melt, and an aqueous solution containing the substance are all nonconductors of electricity. Classify the solid & explain your choice.
A soft solid could be molecular or a soft metal, but metals generally have higher melting points and would be conductive in the solid & liquid states (and not soluble in H₂O). The properties listed are those of a molecular solid and further would have to be a polar substance to dissolve in H₂O.

53 A solid is very hard and has a high melting point. Neither the solid nor its melt conducts electricity. Classify the solid & explain your choice.
A hard solid with a high melting point could be any type of solid except molecular. However, a metal would be conductive and an ionic solid would conduct as a liquid. The properties listed are those of a covalent solid.

55 Classify the solid state of the following substances as ionic crystals, covalent crystals, molecular crystals, molecular crystals, or metallic crystals:
(a) CO₂ (carbon dioxide) forms molecular crystals; it is a molecular compound and can only exert weak dispersion type intermolecular attractions because of its lack of polarity.
(b) B₁₂ (boron) is a nonmetal with an extremely high melting point. It forms covalent crystals like carbon (diamond).
(c) S₈ (sulfur) forms molecular crystals; it is a molecular substance (S₈) and can only exert weak dispersion type intermolecular attractions because of its lack of polarity.
(d) KBr (potassium bromide) forms ionic crystals because it is an ionic compound.
(e) Mg (magnesium) is a metal; it forms metallic crystals.
(f) SiO₂ (silica or quartz) is a hard, high melting nonmetallic compound; it forms covalent crystals like boron and C (diamond).
(g) LiCl (lithium chloride) is an ionic compound; it forms ionic crystals.
(h) Cr (chromium) is a metal and forms metallic crystals.

56 Explain why diamond is harder than graphite. Why is graphite an electrical conductor but diamond is not?
In diamond, each carbon atom is covalently bonded to four other carbon atoms. Because these bonds are strong and uniform, diamond is a very hard substance. In graphite, the carbon atoms in each layer are linked by strong bonds, but the layers are bound by weak dispersion forces. As a result, graphite may be cleaved easily between layers and is not hard. Graphite conducts electricity because its sheet of sp² hybridized carbons contains an extended π-system in which electrons are delocalized over the entire structure, hence free to move.
57 What is an amorphous solid? How does it differ from crystalline solid?
An amorphous solid lacks long-range order in its atoms/molecules while a crystalline solid has a long-range order in the repeating pattern of its particles.

58 What is the structure and main component of glass?
Glass is amorphous silica, SiO₂.

92 Explain the phase changes that occur when a weighted wire cuts through a block of ice (called regelation; see image at right):
Initially, the ice melts because of the increase in pressure. As the wire sinks into the ice, the water above the wire refreezes. Eventually the wire actually moves completely through the ice block without cutting it in half.

94 A phase diagram of water is shown below. Label the regions. Predict what would happen as a result of the following changes:
Region labels: The region containing point A is the solid region. The region containing point B is the liquid region. The region containing point C is the gas region.

(a) Raising the temperature at constant pressure beginning at A implies starting with solid ice and warming until melting occurs. If the warming continued, the liquid water would eventually boil and change to steam. Further warming would increase the temperature of the steam.

(b) Lowering the temperature at constant pressure from C: At point C water is in the gas phase. Cooling without changing the pressure would eventually result in the formation of solid ice. Liquid water would never form.

(c) Lowering the pressure at constant temperature from point B: At B the water is in the liquid phase. Lowering the pressure without changing the temperature would eventually result in boiling and conversion to water in the gas phase.

99 Referring to Figure 11.41 (at right), determine the phase of CO₂ at:
(a) 4 atm and −60°C: solid
(b) 0.5 atm and −20°C: vapor
(c) 6 atm and −20°C: liquid

106 Which has a higher density, crystalline SiO₂ or amorphous SiO₂? Why?
Crystalline SiO₂. Its regular structure results in a more efficient packing.

134 Use the phase diagram of carbon (at right) to answer the questions:
(a) How many triple points are there and what are the phases that can coexist at each?
Two triple points: Diamond/graphite/liquid and graphite/liquid/vapor.

(b) Which has a higher density, graphite or diamond?
Diamond has higher density.

(c) Synthetic diamond can be made from graphite. Using the phase diagram, how would you go about making diamond?
To synthesize diamond from graphite, apply high pressure at high temperature.