***Chemistry***

**10: Liquids and Solids**

**10.5: The Solid State of Matter**

65. At very low temperatures oxygen, O2, freezes and forms a crystalline solid. Which best describes these crystals?

(a) ionic

(b) covalent network

(c) metallic

(d) amorphous

(e) molecular crystals

Solution

(e) molecular crystals

67. Explain why ice, which is a crystalline solid, has a melting temperature of 0 °C, whereas butter, which is an amorphous solid, softens over a range of temperatures.

Solution

Ice has a crystalline structure stabilized by hydrogen bonding. These intermolecular forces are of comparable strength and thus require the same amount of energy to overcome. As a result, ice melts at a single temperature and not over a range of temperatures. The various, very large molecules that compose butter experience varied van der Waals attractions of various strengths that are overcome at various temperatures, and so the melting process occurs over a wide temperature range.

69. Identify the type of crystalline solid (metallic, network covalent, ionic, or molecular) formed by each of the following substances:

(a) CaCl2

(b) SiC

(c) N2

(d) Fe

(e) C (graphite)

(f) CH3CH2CH2CH3

(g) HCl

(h) NH4NO3

(i) K3PO4

Solution

(a) CaCl2, ionic; (b) SiC, covalent network; (c) N2, molecular; (d) Fe, metallic; (e) C (graphite), covalent network; (f) CH3CH2CH2CH3, molecular; (g) HCl, molecular; (h) NH4NO3, ionic; (i) K3PO4, ionic

71. Classify each substance in the table as either a metallic, ionic, molecular, or covalent network solid:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Substance | Appearance | Melting Point | Electrical Conductivity | Solubility in Water |
| X | brittle, white | 800 °C | only if melted/dissolved | soluble |
| Y | shiny, malleable | 1100 °C | high | insoluble |
| Z | hard, colorless | 3550 °C | none | insoluble |

Solution

X = ionic; Y = metallic; Z = covalent network

73. Substance A is shiny, conducts electricity well, and melts at 975 °C. Substance A is likely a(n):

(a) ionic solid

(b) metallic solid

(c) molecular solid

(d) covalent network solid

Solution

(b) metallic solid

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