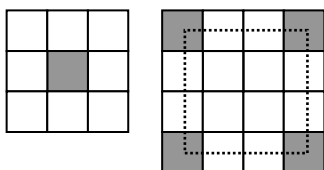


AP Chemistry Chapter 13 Answers - Kotz

Text Problems: 1, 3, 5, 7, 9, 11, 13, 19, 23, 26, 28, 29, 32, 33, 35, 37, 47, 49

- 13.1 (a) hydrogen bonding
(b) induced dipole/induced dipole
(c) hydrogen bonding
- 13.3 (a) induced dipole/induced dipole (c) dipole-dipole
(b) induced dipole/induced dipole (d) hydrogen bonding
- 13.5 Based on increasing molar mass: $\text{CH}_4 < \text{Ne} < \text{CO} < \text{CCl}_4$
—increasing intermolecular forces→
However, boiling points are in the order $\text{Ne} (-246\text{ }^\circ\text{C}) < \text{CO} (-192\text{ }^\circ\text{C}) < \text{CH}_4 (-162\text{ }^\circ\text{C}) < \text{CCl}_4 (77\text{ }^\circ\text{C})$
 CH_4 , Ne , and CO are gases at $25\text{ }^\circ\text{C}$ and 1 atm
- 13.7 (c) HF , (d) $\text{CH}_3\text{CO}_2\text{H}$, and (f) CH_3OH would be expected to form intermolecular hydrogen bonds in the liquid state
- 13.9 (a) LiCl Lithium ions are smaller than cesium ions
(b) $\text{Mg}(\text{NO}_3)_2$ Magnesium has a larger positive charge (+2) than sodium (+1)
(c) NiCl_2 Nickel has a larger positive charge (+2) than rubidium (+1) and it is a smaller ion
- 13.11 $125\text{ mL} \cdot \frac{0.7849\text{ g}}{1\text{ mL}} \cdot \frac{1\text{ mol CH}_3\text{CH}_2\text{OH}}{46.069\text{ g}} \cdot \frac{42.32\text{ kJ}}{1\text{ mol}} = 90.1\text{ kJ}$
- 13.13 (a) Approximately 150 mm Hg. Appendix G shows a value of 149.4 mm Hg
(b) $93\text{ }^\circ\text{C}$
(c) Ethanol (520 mm Hg) has a higher vapor pressure at $70\text{ }^\circ\text{C}$ than water (225 mm Hg)
- 13.19 (a) CS_2 : 620 mm Hg CH_3NO_2 : 80 mm Hg
(b) induced dipole/induced dipole dipole-dipole
(c) $46\text{ }^\circ\text{C}$ $100\text{ }^\circ\text{C}$
(d) $39\text{ }^\circ\text{C}$
(e) $34\text{ }^\circ\text{C}$

13.23 Two possible unit cells:



Each unit cell contains 1 A square and 8 B squares, so the simplest formula is AB_8

13.26	8 corner Ti $\times \frac{1}{8}$	= 1 Ti	4 face O $\times \frac{1}{2}$	= 2 O
	1 internal Ti	= 1 Ti	2 internal O	= 2 O
		<hr/>		
		= 2 Ti total		= 4 O total

There are two TiO_2 units per unit cell.

- 13.28 (a) face-centered cubic
 (b) tetrahedral holes
 (c) $(8 \text{ corner Ca}^{2+} \times \frac{1}{8}) + (6 \text{ face Ca}^{2+} \times \frac{1}{2}) = 4 \text{ Ca}^{2+}$ 8 internal $\text{F}^- = 8 \text{ F}^-$
 The formula is CaF_2

- 13.29 (a) $(8 \text{ corner C} \times \frac{1}{8}) + (6 \text{ face C} \times \frac{1}{2}) + (4 \text{ internal C}) = 8 \text{ C atoms/unit cell}$
 (b) face-centered cubic arrangement with carbon atoms in tetrahedral holes

- 13.32 The total heat required is the sum of the heat required to (1) heat the solid from 25°C to its melting point and (2) liquefy the solid at its melting point.

$$q_{\text{solid}} = (5.00 \text{ g Ag})(0.235 \text{ J/g}\cdot\text{K})(1235 \text{ K} - 298 \text{ K}) = 1.10 \times 10^3 \text{ J}$$

$$q_{\text{melting}} = 5.00 \text{ g} \cdot \frac{1 \text{ mol Ag}}{107.9 \text{ g}} \cdot \frac{11.3 \text{ kJ}}{1 \text{ mol}} \cdot \frac{10^3 \text{ J}}{1 \text{ kJ}} = 5.24 \times 10^2 \text{ J}$$

$$q_{\text{total}} = (1.10 \times 10^3 \text{ J}) + (5.24 \times 10^2 \text{ J}) = 1.62 \times 10^3 \text{ J}$$

- 13.33 (a) The positive slope of the solid/liquid equilibrium line indicates that liquid CO_2 is less dense than solid CO_2 .
 (b) gas phase
 (c) no

- 13.35 The total heat required is the sum of the heat required to (1) heat the liquid from -50.0°C to its boiling point, (2) vaporize the gas, and (3) heat the vapor to 0.0°C .

$$q_{\text{liquid}} = (12 \text{ kg} \cdot \frac{10^3 \text{ g}}{1 \text{ kg}})(4.7 \text{ J/g}\cdot\text{K})(239.9 \text{ K} - 223.2 \text{ K}) \cdot \frac{1 \text{ kJ}}{10^3 \text{ J}} = 9.4 \times 10^2 \text{ kJ}$$

$$q_{\text{evaporation}} = 12 \text{ kg} \cdot \frac{10^3 \text{ g}}{1 \text{ kg}} \cdot \frac{1 \text{ mol NH}_3}{17.0 \text{ g}} \cdot \frac{23.33 \text{ kJ}}{1 \text{ mol}} = 1.6 \times 10^4 \text{ kJ}$$

$$q_{\text{vapor}} = (12 \text{ kg} \cdot \frac{10^3 \text{ g}}{1 \text{ kg}})(2.2 \text{ J/g}\cdot\text{K})(273.2 \text{ K} - 239.9 \text{ K}) \cdot \frac{1 \text{ kJ}}{10^3 \text{ J}} = 8.8 \times 10^2 \text{ kJ}$$

$$q_{\text{total}} = 9.4 \times 10^2 \text{ kJ} + 1.6 \times 10^4 \text{ kJ} + 8.8 \times 10^2 \text{ kJ} = 1.8 \times 10^4 \text{ kJ}$$

- 13.37 Yes, the critical temperature is well above room temperature.

- 13.47 (a) 350 mm Hg
 (b) ethanol (lower vapor pressure at every temperature)
 (c) 84°C
 (d) CS_2 : 46°C $\text{C}_2\text{H}_2\text{OH}$: 78°C C_7H_{16} : 99°C
 (e) CS_2 : gas $\text{C}_2\text{H}_2\text{OH}$: gas C_7H_{16} : liquid

13.49 $(\text{face diagonal})^2 = (\text{edge length})^2 + (\text{edge length})^2$

$\text{face diagonal} = \sqrt{2} \cdot \text{edge length}$

$\text{face diagonal} = \sqrt{2} \cdot 409 \text{ pm}$

$\text{face diagonal} = 578 \text{ pm}$

$\text{radius} = \frac{578 \text{ pm}}{4} = 145 \text{ pm}$

