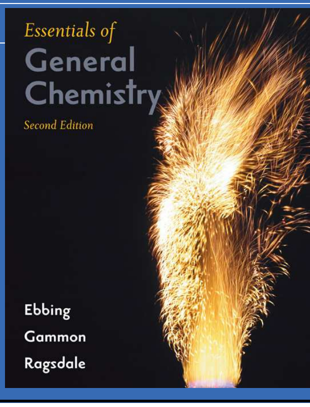


Chapter 11
CRS Questions

States of Matter; Liquids and Solids

Question

The vapor pressure of a liquid increases with an increase in temperature. Which of the following statements best explains this increase?

 CRS Question, 11–2

Question (continued)

1) A larger fraction of the molecules in the liquid have sufficient energy to overcome the intermolecular attractions within the liquid; thus, a correspondingly larger number of molecules can escape to the vapor phase.
2) The number of gaseous molecules above the liquid remains constant, but these molecules have greater average kinetic energy.
3) The faster-moving molecules in the liquid exert a greater pressure.
4) All the molecules have greater kinetic energies.
5) The intermolecular forces between the molecules decrease at higher temperatures.

 CRS Question, 11–3

Answer

1) A larger fraction of the molecules in the liquid have sufficient energy to overcome the intermolecular attractions within the liquid; thus, a correspondingly larger number of molecules can escape to the vapor phase.

Section 11.2 Phase Transitions (pp. 325–326)

In order to “escape” the liquid, a molecule must possess enough kinetic energy to overcome its attraction to its neighbors in the liquid. An increased temperature places a larger fraction of the molecules above this escape limit. The increased vapor pressure is caused mostly by the *larger number* of particles that find their way to the gas phase, although the increased kinetic energy per particle does play a minor role as well.

 CRS Question, 11–4

Question

Which of the following indicates the existence of strong intermolecular forces of attraction in a liquid?
1) a very low boiling point
2) a very low vapor pressure
3) a very low freezing point
4) a very low viscosity
5) a very low heat of vaporization

 CRS Question, 11–5

Answer

2) a very low vapor pressure

Section 11.4 Intermolecular Forces; Explaining Liquid Properties (p. 336)

All the other answer choices imply the *absence* of strong intermolecular forces.

 CRS Question, 11–6

Question

Which of the following compounds is expected to have the lowest vapor pressure?

1) $CH_3CH_2CH_3$
2) $CH_3CH_2CH_2CH_3$
3) CH_3OCH_3
4) CH_3CH_2OH
5) CH_3CH_2F

 CRS Question, 11–7

Answer

4) CH_3CH_2OH

Section 11.4 Intermolecular Forces; Explaining Liquid Properties (pp. 332–340)

The molecule with the lowest vapor pressure will be the one with the strongest intermolecular forces. Since the molecules have roughly the same mass and number of electrons, the London forces are expected to be comparable. But, CH_3CH_2OH alone exhibits hydrogen bonding, which is much stronger than the intermolecular forces that are active in the other choices.

 CRS Question, 11–8

Question

The boiling points of the hydrogen halides are listed below.

HF	19°C
HCl	–85°C
HBr	–67°C
HI	–35°C

Which of the following accounts for the relatively high boiling point of HF?

 CRS Question, 11–9

Question (continued)

a. HF has the strongest H—X bond.
b. HF molecules form hydrogen bonds.
c. HF molecules have the strongest van der Waals forces.

1) a only
2) b only
3) c only
4) a and b only
5) b and c only

 CRS Question, 11–10

Answer

2) b only

Section 11.4 Intermolecular Forces; Explaining Liquid Properties (pp. 337–339)

Of these choices, HF alone exhibits hydrogen bonding. Although the London and dipole-dipole forces are significant in HCl, HBr and HI, these forces are not comparable to the strength of the hydrogen bonding interactions in HF.

 CRS Question, 11–11

Question

The forces of attraction between molecules of I_2 are

1) induced dipole–dipole attractions.
2) dipole–dipole attractions.
3) covalent bonds.
4) London dispersion forces.
5) dipole-induced dipole attractions.

 CRS Question, 11–12

Answer

4) London forces.

Section 11.4 Intermolecular Forces; Explaining Liquid Properties (pp. 335–336)

Iodine is a non-polar molecule. Its intermolecular interaction is dominated by the London force.

 CRS Question, 11–13

Question

If heat is added to a mixture of ice and water in a closed container at equilibrium and after the addition of the heat, ice and water remain at equilibrium,

1) the vapor pressure of the water will decrease.
2) the temperature will increase somewhat.
3) the temperature will decrease somewhat.
4) the vapor pressure of the water will rise.
5) the vapor pressure of the water will remain constant.

 CRS Question, 11–14

Answer

5) the vapor pressure of the water will remain constant.

Section 11.2 Phase Transitions (pp. 324–325)

Since the system consists of ice and water at equilibrium throughout the heating process, the temperature of the system must have remained constant. The vapor pressure, which depends on temperature, must also have remained constant.

 CRS Question, 11–15

Question

Which of the following substances is most likely to exist as a solid at room temperature?

1) NH_3
2) PH_3
3) AlH_3
4) CH_4
5) SiH_4

 CRS Question, 11–16

Answer

3) AlH_3

Section 11.5 Classifications of Solids by Type of Attraction of Units (pp. 341–342)

AlH_3 is an ionic material whereas the others are molecular.

 CRS Question, 11–17

Question

A solid has a very high melting point, is hard, and in the molten state it is a non-conductor. The solid is

1) a molecular solid.
2) a metallic solid.
3) a covalent network solid.
4) an ionic solid.
5) an amorphous solid.

 CRS Question, 11–18

Answer

3) a covalent network solid.

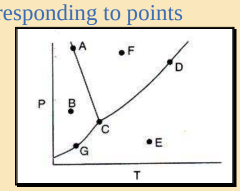
Section 11.5 Classification of Solids by Type of Attraction of Units (pp. 342–343)

The high melting point and hardness imply either an ionic substance or a covalent-network material. Of these two, the covalent network material is expected to be non-conducting when molten.

 CRS Question, 11–19

Question

In the accompanying phase diagram, a **LIQUID** can be present at combinations of temperature and pressure corresponding to points



1) A, B, C, and G.
2) A, C, G, and D.
3) G, C, D, and E.
4) A and C only.
5) A, C, D, and F.

 CRS Question, 11–20

Answer

5) A, C, D, and F.

Section 11.3 Phase Diagrams (pp. 330–331)

Liquids can exist anywhere between or on the solid-liquid and the liquid-gas coexistence curves, including the triple point.

 CRS Question, 11–21

Question

Consider the molecules

CH_3CH_2OH $CH_3CH_2CH_2OH$ $CH_3CH_2OCH_3$

We expect the boiling point to increase as

1) lowest $CH_3CH_2OCH_3$, CH_3CH_2OH, $CH_3CH_2CH_2OH$ highest.
2) lowest CH_3CH_2OH, $CH_3CH_2OCH_3$, $CH_3CH_2CH_2OH$ highest.
3) lowest $CH_3CH_2CH_2OH$, $CH_3CH_2OCH_3$, CH_3CH_2OH highest.
4) lowest $CH_3CH_2CH_2OH$, CH_3CH_2OH, $CH_3CH_2OCH_3$ highest.
5) lowest $CH_3CH_2OCH_3$, $CH_3CH_2CH_2OH$, CH_3CH_2OH highest.

 CRS Question, 11–22

Answer

1) lowest $CH_3CH_2OCH_3$, CH_3CH_2OH, $CH_3CH_2CH_2OH$ highest.

Section 11.4 Intermolecular Forces; Explaining Liquid Properties (pp. 332–336)

The hydrogen bonding in CH_3CH_2OH and $CH_3CH_2CH_2OH$ give these molecules a higher boiling point. Of the two, $CH_3CH_2CH_2OH$ has more electrons and thus stronger London forces, so it is the higher-boiling compound.

 CRS Question, 11–23

Question

In an experiment, 40.0 mmol of helium gas is collected over water. The volume of gas collected is 0.224 L. Under similar conditions, the gas is collected over two other liquids, A and B. The volume of gas collected over A and B are 0.222 L and 0.227 L, respectively. Which of the following statements is false?

 CRS Question, 11–24

Question (continued)

1) Liquid A boils at a higher temperature than water.
2) Liquid A boils at a temperature higher than B.
3) Liquid B boils at a higher temperature than water.
4) The vapor pressure of B is higher than that of A.
5) The vapor pressure of B is higher than that of water.

CRS Question, 11–25

Answer

3) Liquid B boils at a higher temperature than water.

Section 11.2 Phase Transitions (pp. 328–330)

The gas volume collected over liquid A was less than that for water, indicating that liquid A has a lower vapor pressure than water and boils at a higher temperature. The opposite situation occurs for liquid B compared to water.

CRS Question, 11–26

Question

An unknown white solid melts at a low temperature. The solid is a nonelectrolyte. The solid is most likely a:

1) ionic solid.
2) covalent network solid.
3) metallic solid.
4) molecular solid.
5) weak base.

CRS Question, 11–27

Answer

4) molecular solid.

Section 11.5 Classification of Solids by Type of Attraction of Units (pp. 342–343)

As it is a nonelectrolye, it cannot be either ionic or a weak base. Of the remaining choices, only a molecular solid is low-melting.

CRS Question, 11–28