Chem 11 Practice Questions for Ch. 10 (Truncated)

1. Which of the species below would you expect to show the least hydrogen bonding?
   A) NH_3
   B) H_2O
   C) HF
   D) CH_4
   E) all the same

2. The molecules in a sample of solid SO_2 are attracted to each other by a combination of
   A) London forces and H-bonding
   B) H-bonding and ionic bonding
   C) covalent bonding and dipole-dipole interactions
   D) London forces and dipole-dipole interactions
   E) none of these

3. The bonds between hydrogen and oxygen within a water molecule can be characterized as _____.
   A) hydrogen bonds
   B) London dispersion forces
   C) intermolecular forces
   D) intramolecular forces
   E) dispersion forces

4. When a nonpolar liquid displays a convex meniscus, which of the following explains this behavior?
   A) It has a low surface tension, and therefore clings to the glass.
   B) The cohesive forces are stronger than the adhesive forces to the glass.
   C) The adhesive forces to the glass are stronger than the cohesive forces.
   D) The liquid's viscosity is low.
   E) None of these.

12. Which of the compounds below is an example of a network solid?
   A) $S_8(s)$
   B) $SiO_2(s)$
   C) $MgO(s)$
   D) $NaCl(s)$
   E) $C_{25}H_{52}(s)$

13. Which of these statements is incorrect?
   A) Molecular solids have high melting points.
   B) The binding forces in a molecular solid include London dispersion forces.
   C) Ionic solids have high melting points.
   D) Ionic solids are insulators.
   E) All of the statements (A-D) are correct.

14. Which of the following is most likely to be a solid at room temperature?
    A) Na_2S
    B) HF
    C) NH_3
    D) N_2
    E) H_2O

15. On a relative basis, the weaker the intermolecular forces in a substance,
    A) the greater its heat of vaporization
    B) the more it deviates from ideal gas behavior
    C) the greater its vapor pressure at a particular temperature
    D) the higher its melting point
    E) none of these

16. Which of the following processes must exist in equilibrium with the evaporation process when a measurement of vapor pressure is made?
    A) fusion
    B) vaporization
    C) sublimation
    D) boiling
    E) condensation

18. In which of the following processes will energy be evolved as heat?
    A) sublimation
    B) crystallization
    C) vaporization
    D) melting
    E) none of these

20. The vapor pressure of water at 100.0°C is
    A) 85 torr
    B) 760 torr
    C) 175 torr
    D) 1 torr
    E) More information is needed.

26. For each of the following pairs of substances, select the one expected to have the lower melting point:

I. H_2O, H_2S II. HCl, NaCl III. CH_4, C_3H_8

A) H_2O, HCl, C_3H_8
B) H_2O, NaCl, C_3H_8
C) H_2O, HCl, CH_4
D) H_2S, HCl, CH_4
E) H_2S, NaCl, CH_4

27. The measure of resistance to flow of a liquid is
A) van der Waals forces
B) vapor pressure
C) London forces
D) surface tension
E) viscosity

28. Which of the following intermolecular forces exist in all solid substances?
A) Dispersion forces
B) Dipole-dipole forces
C) Covalent bonding
D) Hydrogen bonding
E) Ion-induced dipole forces

Chem 11 Practice Questions for Ch. 10
Answer Section

1. ANS: D PTS: 1 DIF: Moderate REF: 10.1
   KEY: Chemistry | general chemistry | phases | intermolecular forces | hydrogen bonds
   MSC: Conceptual
2. ANS: D PTS: 1 DIF: Easy REF: 10.1
   KEY: Chemistry | general chemistry | phases | intermolecular forces
   MSC: Conceptual
3. ANS: D PTS: 1 DIF: Easy REF: 10.1
   KEY: Chemistry | general chemistry | phases | intermolecular forces | hydrogen bonds
   MSC: Conceptual
4. ANS: B PTS: 1 DIF: Easy REF: 10.2
   KEY: Chemistry | general chemistry | phases | liquid | properties of liquids
   MSC: Conceptual

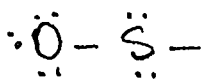
12. ANS: B PTS: 1 DIF: Easy REF: 10.5
    KEY: Chemistry | general chemistry | phases | solid | structures of crystalline solids | covalent network solid MSC: Conceptual
13. ANS: A PTS: 1 DIF: Easy REF: 10.7
    KEY: Chemistry | general chemistry | phases | solid | classification of solids
    MSC: Conceptual
14. ANS: A PTS: 1 DIF: Easy REF: 10.7
    KEY: Chemistry | general chemistry | phases | solid | classification of solids
    MSC: Conceptual
15. ANS: C PTS: 1 DIF: Easy REF: 10.8
    KEY: Chemistry | general chemistry | phases | liquid | intermolecular forces
    MSC: Conceptual
16. ANS: E PTS: 1 DIF: Easy REF: 10.8
    KEY: Chemistry | general chemistry | phases | phase transitions | vapor pressure
    MSC: Conceptual
18. ANS: B PTS: 1 DIF: Easy REF: 10.8
    KEY: Chemistry | general chemistry | phases | phase transitions MSC: Conceptual
20. ANS: B PTS: 1 DIF: Easy REF: 10.8
    KEY: Chemistry | general chemistry | phase | phase transitions | vapor pressure
    MSC: Conceptual
26. ANS: D PTS: 1 DIF: Moderate REF: 10.1
    KEY: Chemistry | general chemistry | phases | intermolecular forces
    MSC: Conceptual
27. ANS: E PTS: 1 DIF: Easy REF: 10.2
    KEY: Chemistry | general chemistry | phases | liquid | properties of liquids
    MSC: Conceptual
28. ANS: A PTS: 1 DIF: Easy REF: 10.1
    KEY: Chemistry | general chemistry | phases | intermolecular forces
    MSC: Conceptual
29. ANS: D PTS: 1 DIF: Easy REF: 10.9
    KEY: Chemistry | general chemistry | phases | phase transitions | phase diagram
    MSC: Conceptual

Solutions to Ch. 10 Practice Questions

(1) H bonded to N, O, or F form hydrogen bonds.
Hydrogens in CH_4 don't.

(2) London forces are always present, so we need to figure out if SO_2 has a dipole moment. If SO_2 is linear, the S-O bond dipoles will cancel and the net dipole will be zero. If it is bent, then it will have a net dipole, and therefore dipole-dipole forces.
To know the geometry of SO_2, we first find its Lewis structure:

no. of valence e^- = 6 + (2)(6) = 18



no. of e^- used = (B+2)(2) = 20 We need to make a double bond

S is sp^2 hybridized because it has 3 electron groups (2 bonds and one lone pair) ⇒

Bent geometry ⇒ net dipole ⇒ dipole-dipole forces

Obviously SO_2 does not have hydrogen bonding possibility
SO_2 is a molecular compound, not ionic. It doesn't have ionic bonding.

⇒ London dispersion and dipole-dipole forces

(3) This can be viewed as a "trick question". It says "bonds between hydrogen and oxygen <u>within</u> a molecule". Remember that hydrogen bonding is <u>between</u> molecules. So it's an <u>intramolecular</u> force.

(4) Convex ⇒ 

The liquid is minimizing contact with the walls of the glass tube
⇒ <u>cohesive</u> forces stronger than <u>adhesive</u> forces
(cohesive: within the liquid; adhesive: between the liquid and the glass)

(11) Si has 4 valence e^-. To produce a p-type semiconductor, it needs to be doped with atoms with one less e^- (Group 3A), such as P or As.

Charge carriers are electron "holes", and not protons.

Doping a metalloid like Si, leads to higher conductivity, not lower.

(12) $S_8(s)$ is a molecular solid, where lattice positions are occupied by S_8 molecules.

* SiO_2 is a tetrahedral network solid, where lattice positions are occupied by Si or O atoms.

MgO and NaCl are ionic solids

$C_{25}H_{52}$ is a molecular solid where lattice positions are occupied by $C_{25}H_{52}$ molecules

(13) Molecular solids are held together by intermolecular forces, which are not strong enough to require high temperatures for melting. *

Binding forces in a molecular solid indeed does include London dispersion forces

Ionic solids have (usually) high melting points because they are held together by ionic bonds (chemical bond type of strength)

Only metals and graphite are conductors. Other solids are insulators, including ionic solids.

(14) Na_2S is the only ionic solid among the choices. The others have various intermolecular forces which are much weaker than ionic bonds. So Na_2S melting point is the highest and is a solid at room temperature.

(15) The weaker the intermolecular forces, the greater the vapor pressure because it's easier for molecules to break free from their neighbors and escape into the gas phase.

(16) Condensation and evaporation must be in equilibrium for a valid vapor pressure to be measured

(18) Energy is evolved (released) as heat in processes where the system goes from a less ordered state to a more ordered state. Sublimation, vaporization, and melting all involve going in the opposite direction, from a more ordered state to a less ordered state (solid → gas ; liq → gas, solid → liq). Question bank's answer is "crystallization", but actually the question is not quite valid. Crystallization is the process of precipitating crystals out of a solution. It is the opposite of dissolving a substance, which can be endothermic or exothermic depending on the substance. Therefore crystallization can be exothermic or endothermic, depending on the substance.
The true answer is "none of these".

(20) Normally we would need more information, such as ΔH_{vap} to calculate the vapor pressure. However, 100.0°C is the "normal" boiling point of water, which by definition corresponds to 1 atm, which is equal to 760 torr.

(26) H_2S has a lower melting point than H_2O because it lacks hydrogen bonding (extra electrons of S gives it a bit more London dispersion forces, but not nearly enough to compensate for lack of H-bonding).

HCl has a lower melting point than NaCl because the latter is an ionic solid whereas HCl is a polar covalent compound. Ionic bonds are much stronger than any intermolecular forces.

CH_4 has a lower melting point than C_3H_8. Both are nonpolar hydrocarbons, but C_3H_8 has more atoms, and therefore more electrons producing more London dispersion forces.

The substance with weaker forces between its particles has the lower melting point.

(27) The measure of resistance to flow is viscosity

(28) Dispersion forces exist in all solid (or liquid or gas) substances. They are produced by the quantum fluctuations of electron clouds in atoms and molecules, which make up all solids.