These problems are intended to ***supplement*** the problems in the textbook, not ***replace*** them.

Questions

Identify the major interparticle forces present in the following:

1. PBr_3
2. Ca
3. Ne
4. CH_2F_2
5. $CaCl_2$
6. NH_3
7. SiO_2
8. Cl_2
9. $Pb(NO_3)_2$
10. HF
11. Cu
12. K_3PO_4
13. SO_3
14. OF_2
15. MgO

Which member of each pair of solids should have the higher melting point ? Briefly explain why.

16. PF_3 or AlF_3
17. H_2S or I_2
18. SO_2 or SiO_2
19. NaBr or NaCl
20. Na or Al
21. SiO_2 or PbO_2
22. $MgSO_4$ or K_2SO_4
23. PCl_3 or SCl_2
24. H_2O or H_2S
25. CaO or KNO_3

Which member of each pair should be more volatile at a given temperature ? Briefly explain why.

26. I_2 or NaI
27. MgS or KBr
28. PbO_2 or SiO_2
29. CCl_4 or CI_4
30. H_2O or KCl
31. C_8H_{18} or $C_8H_{17}OH$
32. NaCl or KBr
33. PF_3 or AlF_3

Answers

If you cannot figure out how to get the correct answer, go to your instructor, the Science Tutoring Center, SI, etc.

1. London dispersion and dipole-dipole forces
2. metallic bonds
3. London dispersion forces
4. London dispersion and dipole-dipole forces
5. ionic bonds
6. hydrogen bonds
7. covalent bonds
8. London dispersion forces
9. ionic bonds
10. hydrogen bonds
11. metallic bonds
12. ionic bonds
13. London dispersion forces
14. London dispersion and dipole-dipole forces
15. ionic bonds

The stronger the interparticle forces, the more energy will be needed to separate the particles, so the HIGHER the melting point.

16. AlF_3 ionic bonds are stronger than dipole-dipole forces or London dispersion forces

17. I_2 both are nonpolar molecules, London dispersion forces are stronger for larger molecules

18. SiO_2 covalent bonds are stronger than dipole-dipole forces or London dispersion forces

19. NaCl both are ionic with same ionic charges, ionic bonds are stronger for smaller ions (Cl^{1-} vs Br^{1-})

20. Al both are metallic, metallic bonds are stronger for higher cation charges (Al^{3+} vs Na^{1+})

21. SiO_2 covalent bonds are generally stronger than ionic bonds

22. $MgSO_4$ both are ionic, ionic bonds are stronger for higher ionic charges (Mg^{2+} vs K^{1+})

23. PCl_3 dipole-dipole forces are stronger for higher electronegativity differences between atoms in the bonds, and London dispersion forces are stronger for larger molecules

24. H_2O hydrogen bonds are stronger than London dispersion forces

25. CaO both are ionic, ionic bonds are stronger for higher ion charges (Ca^{2+} and O^{2-} vs K^{1+} and NO_3^{1-})

The WEAKER the interparticle forces, the less energy will be required for the particles to escape into the vapor phase, so the HIGHER the volatility.

26. I_2 London dispersion forces are weaker than ionic bonds

27. KBr both are ionic, ionic bonds are weaker for smaller ionic charges (K^{1+} and Br^{1-} vs Mg^{2+} and S^{2-})

28. PbO_2 ionic bonds are weaker than covalent bonds

29. CCl_4 both are nonpolar molecules, London dispersion forces are weaker for smaller molecules

30. H_2O hydrogen bonds are weaker than ionic bonds

31. C_8H_{18} London dispersion forces are weaker for smaller molecules, plus $C_8H_{17}OH$ is a little bit polar

32. KBr both are ionic, same ion charges, ionic bonds weaker for larger ions (K^{1+} vs Na^{1+} and Br^{1-} vs Cl^{1-})

33. PF_3 dipole-dipole forces and London dispersion forces are both weaker than ionic bonds

Some Actual Melting Points (°C)							
PF_3	–152	$C_8H_{17}OH$	-17	Al	660	K_2SO_4	1069
PCl_3	–112	H_2O	0	NaI	661	$MgSO_4$	1124*
H_2S	–86	Na	98	KBr	734	AlF_3	1291
SCl_2	–78	I_2	114	NaBr	747	SiO_2	1723
SO_2	–73	CI_4	171*	KCl	770	MgS	2000*
C_8H_{18}	–57	PbO_2	290*	NaCl	801	CaO	2614
CCl_4	–23	KNO_3	334				

*decomposes

data from CRC Handbook of Chemistry and Physics, 74th ed.