Answers to AP solutions.

1. D 2. A 3. B. (actually 163) 4. C 5. B 6. D

7. D* * = not on this year's test. 8 A * 9. B 10. A 11. B 12. A

13. C* 14. B 15. A 16. E 17.C 18. C 19. A or B

20. 0.225 g (Henry's Law) 21. B 22. C *

I. NW = 46, and the solute is volatile, since the boiling point went down

II. 1000 grams of the solution would contain 280 grams of NH_3 , and would have a volume of 1111 mL. the molarity is 14.8 molar.

The moles of NH_3 are 16.47, while tha mass of the water is 1000 g - 280, which is 720 g. The molality is 16.47mole/.720 kg = 22.9 m

There are 720/18 = 40 moles of water, and 16.47 moles of NH_3 . The mole fraction of water is 0.708. (Or, since a kg of water is 55.56 moles, and the molality was 22.9,

55.56/ (55.56 + 22.9) = 0.708

The freezing point depression is the molality times 1.86, so the answer is −42.6°

III. Dissolving salt lowers the vapor pressure of the water, as predicted by Raoult's Law. Since the concentration of water decreases as salt is added, its vapor pressure decreases. Dissolving alcohol also lowers the vapor pressure of the water. However, alcohol has a higher vapor pressure than water, so adding alcohol RAISES the vapor pressure of the mixture, and so lowers the boiling point.

IV. * The freezing point decrease depends on the particle concentration. Sucrose does not form ions, so 0.010 molal sucrose contains 0.010 mole of particles. Sodium formate is ionic, so 0.010 mole of sodium formate contains 0.010 mole of each ion, or 0.020 moles of particles all together . That should lower the freezing point twice as much. Formic acid is a weak acid. It forms some ion, so it lowers the freezing point more than sucrose does, but less than the completely ionized sodium formate.

V. MM = 147. The actual formula is $C_6H_4Cl_2$

c) 0.937 d) 141 mm

VI. Less soluble in Denver, since the pressure is lower there.