06/26/24

Which substance has the higher boiling point: butane (C_4H_{10}) or hexane (C_6H_{14})? Explain.

Both nonpolar so only have ID/ID interactions

C_6H_{14} – more atoms, more e^-, more ID/ID

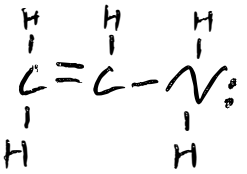
Which substance has the higher boiling point: Br_2 or ICl? Explain.

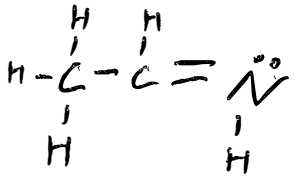
ICl and Br_2 pretty similar in size
but Br_2 non polar and ICl is polar
so it has stronger D/D interactions

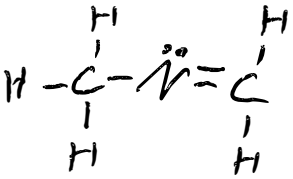
Rank the following substances from lowest to highest boiling point: C_5H_{12}, Ne, CCl_4, C_2H_6

Ne C_2H_6 C_5H_{12} CCl_4

Draw 3 Lewis structures for C_2H_5N and explain which one has the lowest boiling point.







↑
lowest BP
No hydrogen bonding

How many hydrogen bonding interactions are there in a beaker that contains 250 mL of water?

$250\,g \times \frac{1\,mol\ H_2O}{18\,g} = 13.9\ mol\ H_2O$ Each H-bond requires 1 H + 1 lp

13.9 mol H_2O has 27.8 mol H, 27.8 mol lp → 27.8 mol H-bonds
or 1.67×10^{25}

What is the ΔH_{vap} of water if the temperature of boiling water atop Mt Whitney is 85.1 °C. The summit of Mt. Whitney is 14505 feet above sea level and the atmospheric pressure at the summit is 0.58 atm.

$$\ln\left(\frac{0.58\ atm}{1\ atm}\right) = -\frac{\Delta H_{vap}}{R}\left(\frac{1}{358.25\ K} - \frac{1}{373.15\ K}\right)$$

$$-0.545 = -\frac{\Delta H_{vap}}{R}\left(1.115\times10^{-4}\ T^{-1}\right)$$

$$R = 8.314\ \frac{J}{mol\ K}$$

$$\Delta H_{vap} = 40638\ J/mol$$

What is the boiling point of water on the top of Mt. Everest where the atmospheric pressure is 250 mmHg?

$$\ln\left(\frac{250\ mmHg}{760\ mmHg}\right) = \frac{-40638\ \frac{J}{mol}}{8.314\ \frac{J}{mol\ K}}\left(\frac{1}{T_b} - \frac{1}{373.15}\right)$$

$$2.77\times10^{-4} = \frac{1}{T_b} - \frac{1}{373.15}$$

$$\frac{1}{T_b} = 2.907\times10^{-3}\ T^{-1}$$

$$T_b = 343.95\ K \quad or \quad 70.8\ °C$$