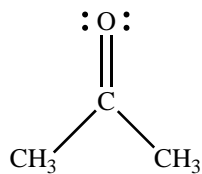
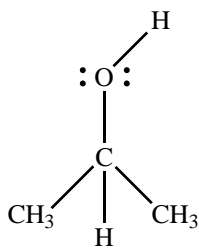


**Problem of the Day 9**      **CHEM 1252**

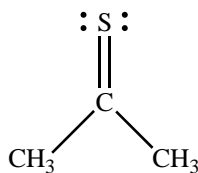
1. At room temperature, predict which of the following molecules would have the **lowest** vapor pressure. You must rationalize your answer.



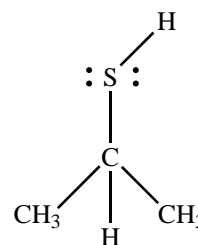
a



b



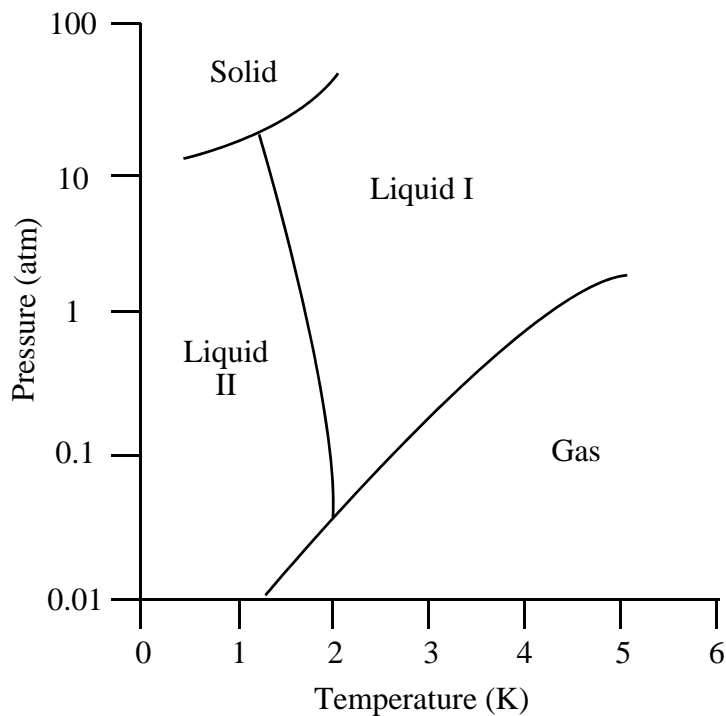
c



d

6

2. Shown at right is the phase diagram for helium. It is distinct in two interesting ways: (1) the solid and gas phases are never at equilibrium no matter how low the temperature and (2) it is the only substance known to have two liquid phases. Answer the following questions about helium.



(a) What is the normal boiling point of helium?

3

(b) How many triple points does helium have?

3

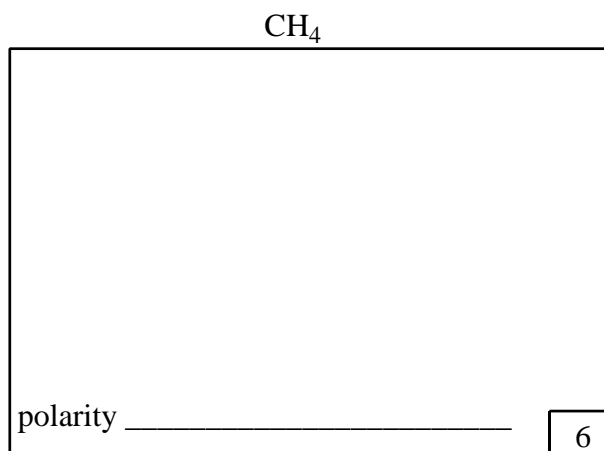
(c) What is the critical temperature?

3

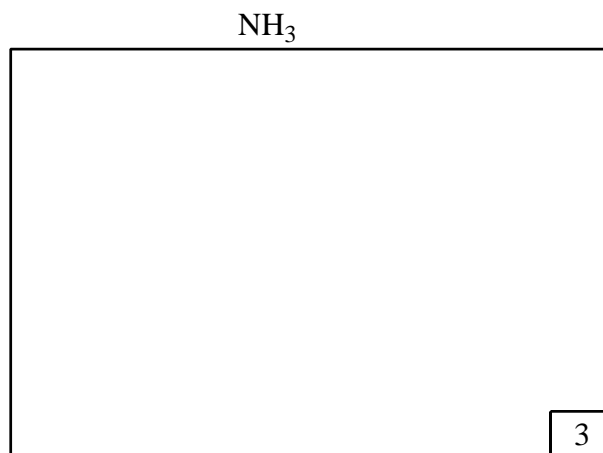
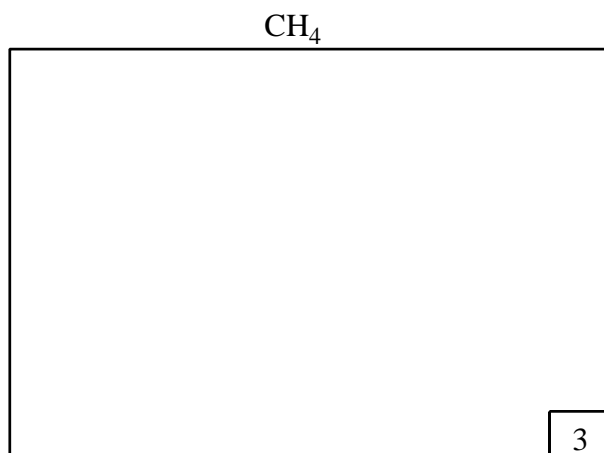
(d) List each phase that would be observed as the pressure changed from 0.01 atm to 100 atm at a constant temperature of 1.5 K.

3

3. (a) Draw a reasonable Lewis structure for methane,  $\text{CH}_4$ , and ammonia,  $\text{NH}_3$  and determine the polarity of each molecule.



(b) List the intermolecular forces present for each molecule.



(c) The molar mass of  $\text{CH}_4$  and  $\text{NH}_3$  are nearly identical. Rationalize why the melting points and boiling points of  $\text{NH}_3$  (mp =  $-77.7^\circ\text{C}$  and bp  $-33.3^\circ\text{C}$ ) are higher than those of  $\text{CH}_4$  (mp =  $-184^\circ\text{C}$  and bp  $-161.5^\circ\text{C}$ ).

6