

1. Rank the following gases in order of increasing van der Waals “*a*” and van der Waals “*b*” values: Cl<sub>2</sub>, HCl, H<sub>2</sub>

(a) van der Waals *a*:

\_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_

(b) van der Waals *b*:

\_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_

(c) Sketch a Z vs P diagram for Cl<sub>2</sub>, HCl, H<sub>2</sub>

2. Rank the following gases in order of increasing van der Waals “*a*” and van der Waals “*b*” values: Kr, N<sub>2</sub>O, C<sub>2</sub>H<sub>6</sub>

(a) van der Waals *a*:

\_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_

(b) van der Waals *b*:

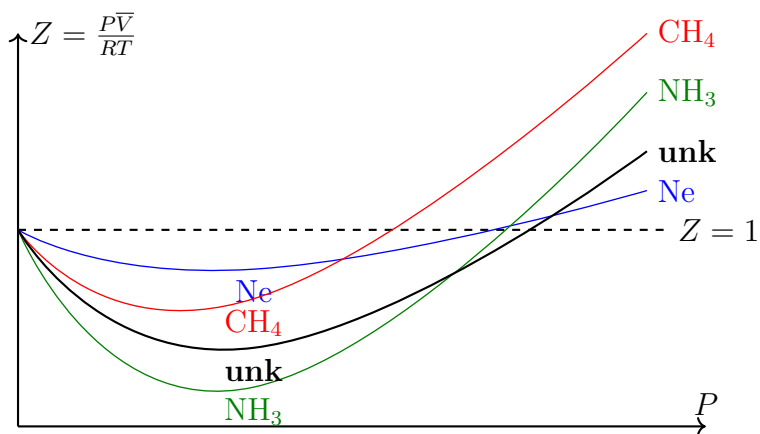
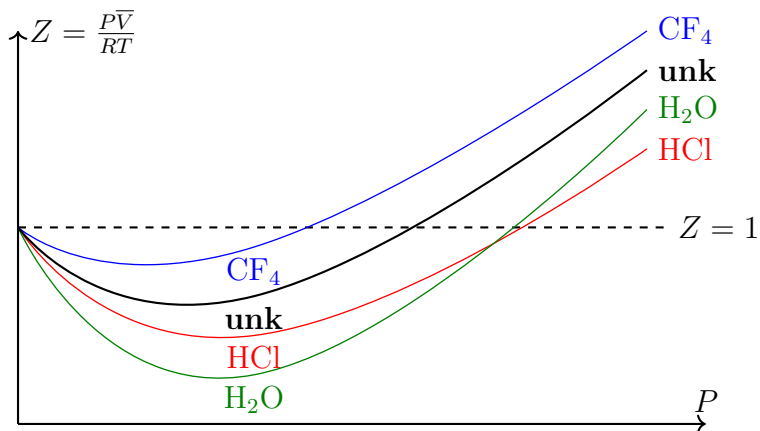
\_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_

(c) Sketch a Z vs P diagram for Kr, N<sub>2</sub>O, and C<sub>2</sub>H<sub>6</sub>

3. Write  $<$ ,  $>$ , X for “cannot be determined”. Treat X as  $=$  for the purpose of drawing compressibility diagrams.

- (a) van der Waals “ $a$ ” for  $\text{SF}_4$  \_\_\_\_\_ van der Waals “ $a$ ” for  $\text{SF}_6$   
 (b) van der Waals “ $b$ ” for  $\text{SF}_4$  \_\_\_\_\_ van der Waals “ $b$ ” for  $\text{SF}_6$   
 (c) actual volume at low  $P$  for  $\text{SF}_4$  \_\_\_\_\_ actual volume at low  $P$  for  $\text{SF}_6$   
 (d) actual volume at high  $P$  for  $\text{SF}_4$  \_\_\_\_\_ actual volume at high  $P$  for  $\text{SF}_6$   
 (e) Sketch a  $Z$  vs  $P$  diagram for  $\text{SF}_4$  and  $\text{SF}_6$

4. Below we have a  $Z$  vs  $P$  diagram for 3 gases and one unknown gas. Determine 2 possible identities for each of the unknowns, with different molecular geometries.



5. System A: 10.0 g  $\text{CO}_2(\text{g})$  in a 0.75 L rigid container with a pressure of 1.00 atm.  
System B: 10.0 g  $\text{N}_2\text{O}(\text{g})$  in a volume of 1.50 L and a pressure of 2.00 atm.

Write  $<$ ,  $>$ , X for "cannot be determined". Treat X as  $=$  for the purpose of drawing compressibility diagrams. Round MW to one decimal place.

- (a) particle density in System A \_\_\_\_\_ particle density in System B
- (b) van der Waals " $a$ " for  $\text{CO}_2$  \_\_\_\_\_ van der Waals " $a$ " for  $\text{N}_2\text{O}$
- (c) van der Waals " $b$ " for  $\text{CO}_2$  \_\_\_\_\_ van der Waals " $b$ " for  $\text{N}_2\text{O}$
- (d) Sketch a Z vs P diagram for  $\text{CO}_2$  and  $\text{N}_2\text{O}$

### Homework Problem 10

1. Sketch a Z vs P diagram for  $\text{NH}_3$ ,  $\text{PH}_3$ ,  $\text{PCl}_3$ ,  $\text{PCl}_5$