

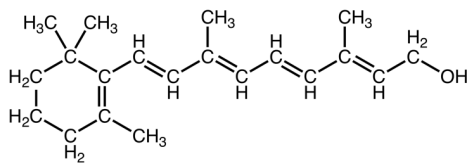
1. The following compounds contain a central C=O functional group.



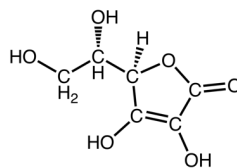
- (a) If you have pure solutions of each, arrange the compounds in order of increasing boiling points. Explain your answer.

- (b) Why might FCOF have a lower boiling point than the three compounds above?

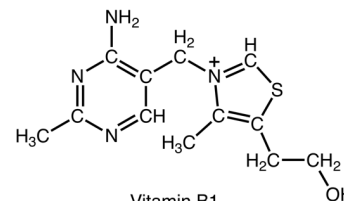
2. Which vitamins would be more soluble in water and which more soluble in oil?



Vitamin A

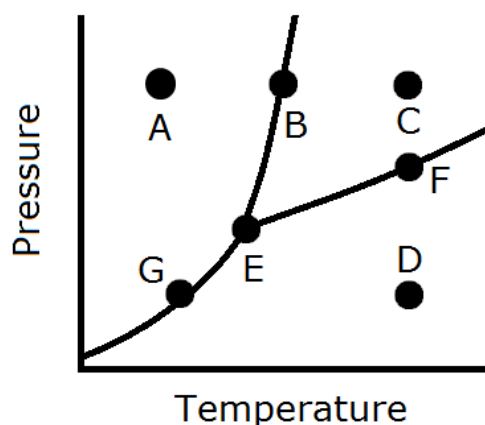


Vitamin C



Vitamin B1

3. Consider the following phase diagram for an unknown substance.



- (a) Which of the following points on the phase diagrams above represents a ...

(i) Solid (ii) Gas (iii) Triple point (iv) Melting Point

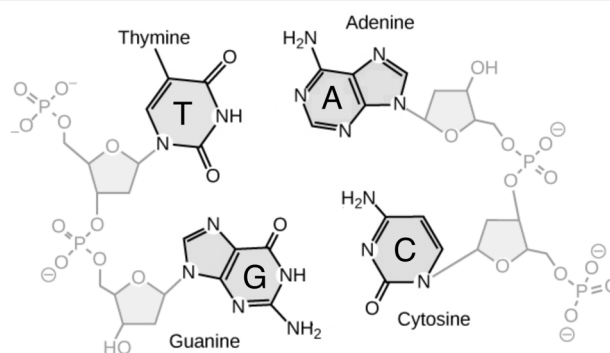
- (b) On the diagram, connect the points that would correspond to the following transformations.

(i) Vaporization (ii) Freezing (iii) Condensation

4. Sketch a phase diagram for element X, which has a triple point at 152 K and 0.371 atm, a boiling point of 166 K at 1.00 atm, and a melting point of 161 K at 1.00 atm. Mark the coordinates of key points on your graph.

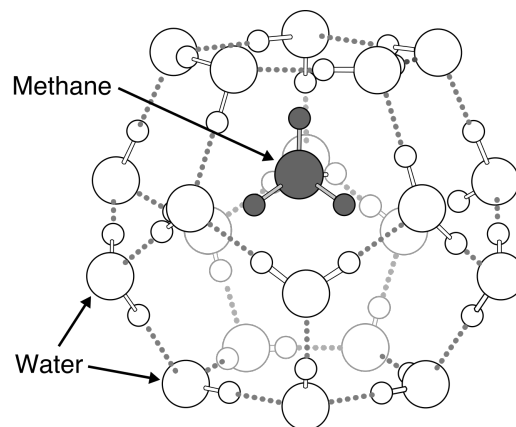
Will this element sublime at 1.00 atm?

5. Deoxyribonucleic acid (DNA) is a class of vital biological macromolecules comprised of two helical strands held together by hydrogen bonds between base pairs Adenine-Thymine (A-T) or Cytosine-Guanine (C-G) as shown to the right.



- (a) Draw in the missing hydrogen bonds for the A-T and C-G base pairs.
- (b) Which of the two hydrogen-bonded pairs would be harder to break? Explain your answer.
6. Methane gas (CH_4) is not soluble in water (its solubility is 22.7 mg/L). However, methane water clathrates, which are commonly found in polar ice caps and sometimes called “fire ice,” trap up to 120 g of CH_4 in 1 L of ice.

- (a) The structure of the methane water clathrate is shown to the right. What is the main intermolecular interaction between methane and the water molecules?



- (b) How do these interactions differ in liquid water and methane?