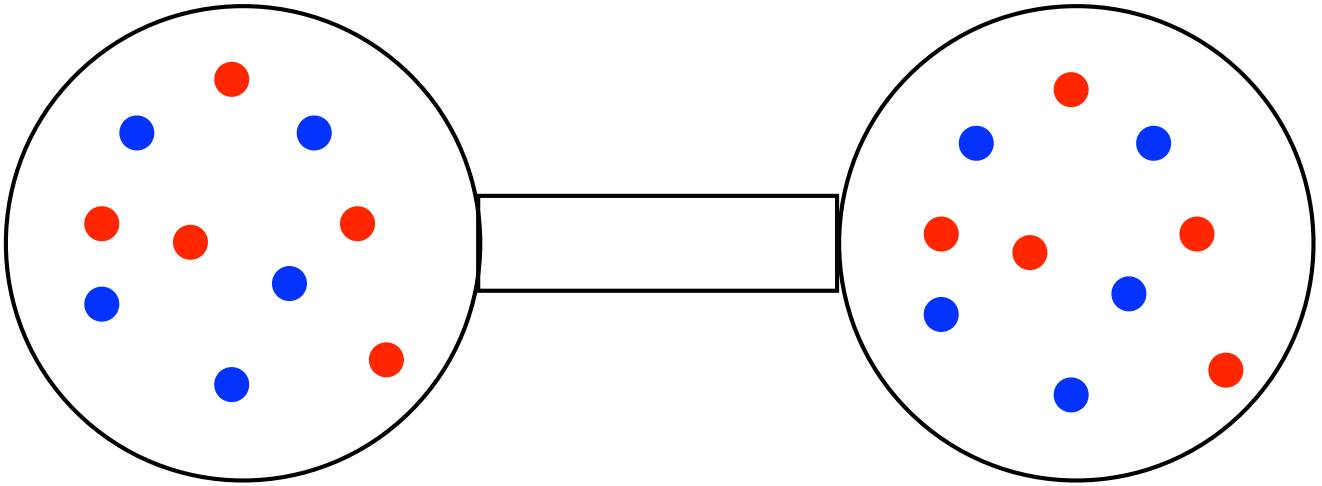
19.1a)



19.1b) ΔS is positive because the gases become more random as they spread out to fill the containers. ΔH is zero, assuming the gases do not exchange heat with the surroundings.

c) This process is not reversible

d) As established in (b), gases do not exchange heat with the surrounds. Therefore, the entropy of the surroundings does not change.

19.3

a) The diagram represents a solid turning into a gas. Because gases are more disordered than solids, ΔS is positive. ΔH is also positive because melting and boiling are endothermic processes.

19.4

Both reactants and products are gases. However, there are twice as many moles of product, indicating that entropy increases. As such, ΔS will be positive.

19.6a) Since isomers have the same chemical formulas, the balanced equations representing their combustions will be identical. As such, we would expect the bonds being broken and formed to be equal for both isomers, suggesting very similar ΔH's.

b) We would expect n-pentane to have great molar entropy because the elongated molecule is more likely to vibrate and rotate.

19.11a) Ripening banana - spontaneous

b)Dissolving sugar in coffee - spontaneous

c)Nitrogen atoms forming N_2 - spontaneous

d)Lightning - spontaneous

e)Formation of CH_4 and O_2 from CO_2 and H_2O - nonspontaneous

19.15

a) This process is endothermic
b) This process is spontaneous at $T \geq 100°C$
c) This process is nonspontaneous at $T < 100°C$
d) This process is at equilibrium at $T = 100°C$

19.19

a) Ice melting at a temperature of 20°C is spontaneous
b) This process is irreversible
c) The sign for ΔH is positive
d) The sign for ΔS is positive

19.23a) When Br_2 boiling it creates a gas with greater entropy. As such entropy increases.

19.27a) Whenever a gas expands isothermally we expect the entropy to increase, making ΔS positive.
c) The temperature change is not needed as long as the change is isothermal.