F. What is the relationship between these molecules:

Cl \equiv Br \quad \text{and} \quad Cl \equiv Cl

(a) they're identical, damn it!  (b) they are enantiomers
(c) they are diastereomers  (d) they are structural isomers
(e) they have different molecular formulas

G. Which of the following statements about phases and states of matter is true?

(a) Increasing the temperature of a liquid decreases the percentage of molecules whose kinetic energy exceeds the enthalpy of vaporization of that liquid.

(b) Water will boil at a higher temperature in Saint Paul, Minnesota (barometric \( P = 740 \) Torr) than in Fresno, California (barometric \( P = 760 \) Torr).

(c) A solid sample of a substance cannot sublime at pressures below its triple point.

(d) The meniscus separating the liquid and vapor phases will disappear if a substance is heated and pressurized above its critical point.

(e) Diamond is an excellent conductor of electricity due to its \( sp^3 \)-hybridized atoms.

2. In the Fall of 1987, a freshman (not a first year—this was a politically less correct time) at Harvey Mudd College studied the phase transitions of \( Br_2 \). He recorded a set of enthalpy changes, but neglected (the fool!) to label which phase transitions they corresponded to.

(a) (6 points) Match the enthalpy change with the correct process.

\begin{align*}
\text{Condensation} & \quad +3 \quad \text{for} \quad \text{right} \quad \text{(i) -10.6 kJ/mol} \\
\text{Deposition} & \quad \text{iii} \quad \text{(ii) -29.5 kJ/mol} \\
\text{Freezing} & \quad \text{i} \quad \text{(iii) -40.1 kJ/mol}
\end{align*}

(b) (6 points) Briefly justify your assignments.

Deposition (g \rightarrow s) is the least dramatic change in the structure of the substance (from completely independent \( Br_2 \) molecules to \( Br_2 \)'s stuck together in a 3D lattice), and should \( \Rightarrow \) be the most exothermic process. Freezing (l \rightarrow s) involves the least dramatic change (the densities of liquids are very similar), and should \( \Rightarrow \) be the least exothermic process.