Begin your response to **QUESTION 4** on this page.

4. Answer the following questions about the compounds NH_2Cl and NCl_3. The Lewis electron-dot diagrams of the two compounds are shown.

(a) Calculate the number of moles of NH_2Cl (molar mass 51.48 g/mol) present in 1.0 L of a solution in which the concentration of NH_2Cl is 0.0016 g/L.

(b) NH_2Cl is highly soluble in water, whereas NCl_3 is nearly insoluble. Explain this observation in terms of the types and relative strengths of the intermolecular forces between each of the solutes and water.

GO ON TO THE NEXT PAGE.

Continue your response to **QUESTION 4** on this page.

(c) The value of $\Delta H^{\circ}_{vaporization}$ for $NCl_3(l)$ is 32.9 kJ/mol. Calculate the amount of energy required to vaporize a 15.0 g sample of NCl_3 (molar mass 120.36 g/mol).

GO ON TO THE NEXT PAGE.

Question 4: Short Answer — 4 points

(a) For a correct calculated value: **1 point**

$$1\text{ L} \times \frac{0.0016\text{ g}}{1\text{ L}} \times \frac{1\text{ mol}}{51.48\text{ g}} = 3.1 \times 10^{-5}\text{ mol}$$

(b) For the correct identification of intermolecular forces between each substance and water: **1 point**

Accept one of the following:

- *Both* NH_2Cl *and* NCl_3 *can participate in hydrogen bonding with water.*
- *Both* NH_2Cl *and* NCl_3 *have dipole-dipole attractions to water.*

For a correct explanation: **1 point**

The intermolecular forces between NH_2Cl *molecules and water are stronger than those between* NCl_3 *molecules and water, which leads to the greater solubility of* NH_2Cl *in water.*

Total for part (b) 2 points

(c) For the correct calculated value: **1 point**

$$15.0\text{ g } NCl_3 \times \frac{1\text{ mol}}{120.36\text{ g}} \times \frac{32.9\text{ kJ}}{1\text{ mol}} = 4.10\text{ kJ}$$

Total for question 4 4 points