Begin your response to **QUESTION 6** on this page.

6. Answer the following questions related to $HBr(l)$ and $HF(l)$.

(a) In the following table, list all of the types of intermolecular forces present in pure samples of $HBr(l)$ and $HF(l)$.

Liquid	$HBr(l)$	$HF(l)$
Intermolecular forces present		

(b) The enthalpy of vaporization, ΔH°_{vap}, for each liquid is provided in the following table.

Liquid	$HBr(l)$	$HF(l)$
ΔH°_{vap}	17.3 kJ / mol	25.2 kJ / mol

(i) Based on the types and relative strengths of intermolecular forces, explain why ΔH°_{vap} of $HF(l)$ is greater than that of $HBr(l)$.

(ii) Calculate the amount of thermal energy, in kJ, required to vaporize 6.85 g of $HF(l)$.

GO ON TO THE NEXT PAGE.

Continue your response to **QUESTION 6** on this page.

(c) Based on the arrangement of electrons in the Br and F atoms, explain why the bond length in an HBr molecule is greater than that in an HF molecule.

GO ON TO THE NEXT PAGE.

Question 6: Short Answer — 4 points

(a) For the correct answer: **1 point**

$HBr(l)$: *London dispersion forces, dipole-dipole attractions*

$HF(l)$ *: London dispersion forces, dipole-dipole attractions, hydrogen bonding*

(b) (i) For a correct explanation: **1 point**

ΔH°_{vap} *is greater for* $HF(l)$ *than* $HBr(l)$ *because the overall intermolecular forces in* $HF(l)$ *are stronger than those in* $HBr(l)$ *due to hydrogen bonding attractions present in* $HF(l)$*, so more energy is required to separate the molecules in* $HF(l)$.

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

$$6.85 \text{ g HF} \times \frac{1 \text{ mol}}{20.01 \text{ g}} \times \frac{25.2 \text{ kJ}}{1 \text{ mol}} = 8.63 \text{ kJ}$$

Total for part (b) 2 points

(c) For a correct explanation: **1 point**

Br *has two additional occupied electron shells (n = 3 and n = 4) compared to* F *(n = 2). The extra electron shells increase the distance between the* H *and* Br *nuclei, giving* HBr *the greater bond length.*

Total for question 6 4 points