1a) standard formation means forming 1 mole of NF_3

so $\Delta H_f^\circ = \frac{-264}{2} = -132 \frac{kJ}{mol}$

1b) Products $\Delta H = B.E._{react} - B.E._{prod}$, since ΔH is negative the bond energy of products must be larger

1c) $10.5g\ NF_3 \cdot \frac{1\ mol\ NF_3}{71.01g\ NF_3} \cdot \frac{132kJ}{1\ mol\ NF_3} = 19.5kJ$ released

2ai) $q = m \cdot c \cdot \Delta T$

$= 150g \cdot 4.18 \frac{J}{g^\circ C} \cdot (60.0 - 25.0) = 21945J$ or $21.9kJ$ absorbed

2aii) $21.9kJ \cdot \frac{1\ mol\ CaO}{63.7kJ} \cdot \frac{56.08g\ CaO}{1\ mol\ CaO} = 19.3g\ CaO$

3a) Sucrose would be more soluble. Sucrose has many polar -OH groups whereas lauric acid has a very long non-polar carbon chain. Water is polar and will dissolve the polar sucrose better than the much less polar lauric acid.

3b) First find energy released.

$1.5\,g\ C_{12}H_{14}O_2 \cdot \frac{37\ kJ}{1\,g\ C_{12}H_{14}O_2} = 55.5\ kJ$ released

now find ΔT

$q = m \cdot c \cdot \Delta T$

$55.5 \cdot 10^3\ J = 325\,g \cdot 4.18 \frac{J}{g^\circ C} \cdot \Delta T \quad \Delta T = 40.8^\circ C$

So $T_f = 25 + 40.8 = 66^\circ C$

3ci) The temperature will be higher. The Al can will absorbe more energy than the Cu can. This means there is more energy going into the water with the Cu can.

3cii) If the student is not measuring the energy absorbed by the can then the calculated energy of the reaction will be too low because of the energy lost to the can.