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3. a) 1 and 3
b) 2
c) 1 and 2 because reaction 2 has a lower activation energy of 25 kJ, which is needed for the reaction to run backwards
d) reaction 2 is the fastest; it has the lowest activation energy.
e)

reaction	ΔH	Ae
1	75 kJ	100 kJ
2	-75 kJ	25 kJ
3	25 kJ	100 kJ
4	-25 kJ	75 kJ

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14. The heat –producing reaction used to warm up the soup involves NaOH dissolving in water. Consult the appendix on page 420 in the textbook to get the ΔH of -42 kJ/mole for $\text{NaOH}_{(s)} \rightarrow \text{NaOH}_{(aq)}$

Environment (soup):

$$\begin{aligned} Q &= mc\Delta T \\ &= 300 \text{ g}(0.90 \cdot 4.19 \text{ J/g}^\circ\text{C})(60-40)^\circ\text{C} \\ &= 22626 \text{ J} \end{aligned}$$

Reaction: $\Delta H = -22626 \text{ J} = -22.626 \text{ kJ}$
 $-22.626 \text{ kJ}(\text{mole of NaOH}/-42 \text{ kJ J}) = 0.5387142857 \text{ moles NaOH}$
 $0.5387142857 \text{ moles NaOH} (40\text{g}/\text{mole}) = 22 \text{ g}$