$$HCN + NaOH \rightarrow H_2O + NaCN$$
$$1\,HCN : 1\,NaOH$$

Multiple Choice Practice FTW! Questions 3 – 5 refer to the following.

<u>excess</u>

Inside a calorimeter, 100.0 mL of 1.0 M hydrocyanic acid (HCN), a weak acid, and 100.0 mL of 0.50 M sodium hydroxide are mixed. The temperature of the mixture rises from 21.5°C to 28.5°C. The specific heat of the mixture is approximately 4.2 J/g °C, and the density is identical to that of water.

limiting! ← NaOH

100 mL + 100 mL

4. What is the approximate amount of heat released during the reaction?

   c.   1.5 kJ   b.   2.9 kJ   (c.) 5.9 kJ   d.   11.8 kJ

$$q_{rxn} = -q_{cal} = -(200.0\,g)(4.2\tfrac{J}{g°C})(28.5-21.5)$$
$$= -(200)(4.2)(7) = (-840)(7) \approx (-800)(7)$$
$$= -5600\,J = -5.6\,kJ$$

5. If the experiment is repeated with 100.0 mL of 2.0 M HCN and 100.0 mL of 0.50 M NaOH, what would happen to the values for ΔT and ΔH$_{rxn}$?

limiting doesn't change ⟹ q same!

	ΔT	ΔH$_{rxn}$
(A)	Increase	Increase
(B)	Stay the same	Stay the same
(C)	Decrease	Stay the same
(D)	Stay the same	Increase

more mol excess, but same volume ⟹ same mass

Same m, Same q ⟹ Same ΔT !

Same as original

6. If the experiment is repeated for a third time with 100.0 mL of 1.0 M HCN and 100.0 mL of 1.0 M NaOH, what would happen to the values for ΔT and ΔH$_{rxn}$ (relative to the original experimental results)?

	ΔT	ΔH$_{rxn}$
(A)	Increase	Stay the same
(B)	Stay the same	Stay the same
(C)	Decrease	Stay the same
(D)	Stay the same	Increase

→ more mol limiting
⟹ higher q
(more heat released)

– Same volume (as original) ⟹ Same mass
– more heat (↑q), Same mass ⟹ ↑ΔT
✱But ΔH$_{rxn}$ is per mole, so it will always stay the same! (except for lab error ☺)