

Enthalpy Review

*cellular respiration & photosynthesis rxns!

- Q = ΔH

Potential energy
Chemical System (ΔH)

Thermal / Kinetic energy
Calorimetry (Q)

Ways to communicate enthalpy change

Potential Energy Diagrams

Reactants
Ep
"-"ΔH
Products

Rxn. Coord.

step down
∴ exothermic

Reactants
Ep
"+"ΔH
Products

Rxn Coord.

step up
∴ endothermic

ΔH Notation / Molar Enthalpies

- exothermic: "-" ΔH
- endothermic: "+" ΔH
- ΔH = n Δr H

Specific amount n = rxn ΔH =	balanced rxn n = ΔH ΔrH
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Important Notes

- Q = mcΔt where Q needs to be in joules
- know meaning of specific heat capacity (c)
- use Q = mcΔt when there is a transfer of heat (ie. a temp. change)
- know the difference b/w calorimetry questions with a styrofoam vs. a metal calorimetry

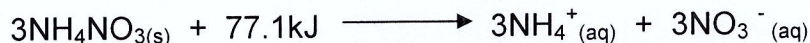
$$Q_{total} = Q_{water} + Q_{metal}$$

Thermochemical Equations

- ΔH is specific and only applies to the moles in the balanced rxn
- aA + bB + 79.0 kJ → cC + dD endothermic!
- xX + yY → zZ + 96.0 J exothermic!

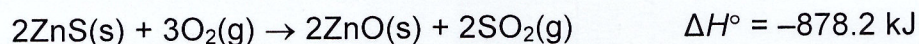
A Few Review Questions

1. A sample of NH_4NO_3 having a mass of 30.5g is dissolved in water in an insulated cup to make 500.0mL of solution.

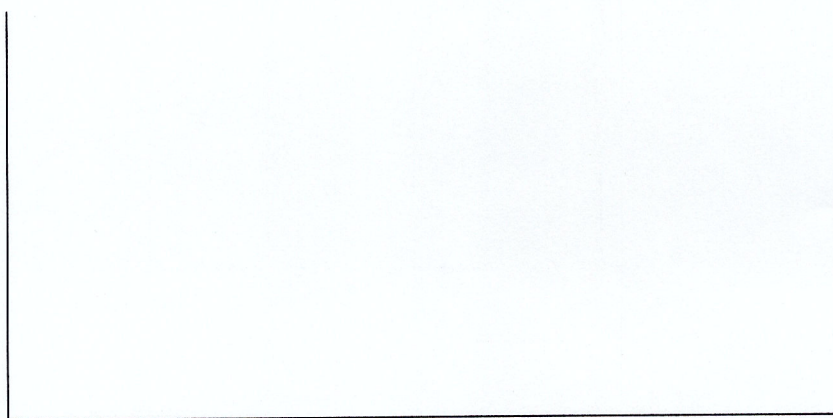


If the initial temperature of the water is 21.5°C , determine the final temperature of the solution after the dissolving is complete. **[16.8°C]**

2. Consider the following thermochemical equation:



- a. Draw a potential energy diagram for this reaction.



- b. How much heat is released when 3.0 mol $\text{ZnS}(s)$ reacts in excess oxygen?
[-1.3x10³ kJ]

3. Which of the following reactions corresponds to the equation for the formation of solid sodium chlorate, NaClO_3 ?

- $\text{NaCl}(s) + \text{O}_2(g) \rightarrow \text{NaClO}_2(s)$
- $2\text{NaCl}(s) + 3\text{O}_2(g) \rightarrow 2\text{NaClO}_2(s)$
- $\text{Na}(s) + \text{Cl}(g) + 3\text{O}(g) \rightarrow \text{NaClO}_3(s)$
- $2\text{Na}(s) + \text{Cl}_2(g) + 3\text{O}_2(g) \rightarrow 2\text{NaClO}_3(s)$

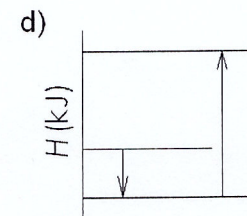
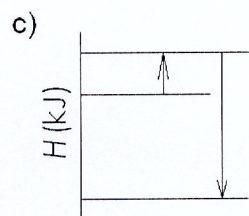
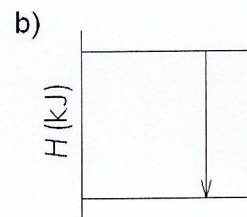
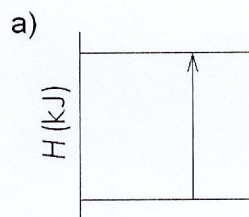
4. Given the reaction, $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) + 68 \text{ kJ} \rightarrow 2\text{NO}_2(\text{g})$, what is the change in enthalpy, ΔH , for the reaction $\text{NO}(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{NO}_2(\text{g})$?

- a) 68 kJ
- b) -68 kJ
- c) 34 kJ
- d) -34 kJ

5. Given the reaction, $\text{Ca}(\text{s}) + \text{C}(\text{s}) + \frac{3}{2} \text{O}_2(\text{g}) \rightarrow \text{CaCO}_3(\text{s}) \Delta H = -1205.8 \text{ kJ}$, how much heat is released when 3.750 g of calcium is allowed to react with excess oxygen and carbon?

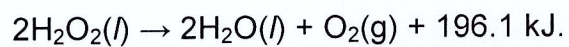
- a) $1.29 \times 10^4 \text{ kJ}$
- b) $4.22 \times 10^3 \text{ kJ}$
- c) $1.21 \times 10^3 \text{ kJ}$
- d) $1.13 \times 10^2 \text{ kJ}$

6. Which of the following potential energy diagrams most accurately represents the combustion of ethane?



7. The specific heat capacity of nickel is $0.444 \text{ J/g}\cdot^\circ\text{C}$. How much energy is required to raise the temperature of 3.57g of nickel by 7.00°C ? **[11.1 J]**

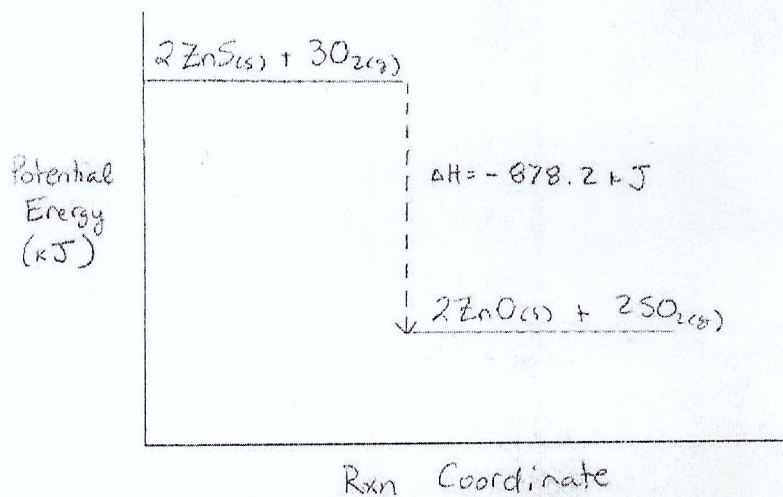
8. Liquid hydrogen peroxide is an oxidizing agent in many rocket fuel mixtures because it releases oxygen gas on decomposition:



How much heat is released when 6.50 g $\text{H}_2\text{O}_2(l)$ decomposes? [18.7 kJ]

Answers

2a.



- 3. D
- 4. C
- 5. D
- 6. B & C