**COMPLETION**

*For numbers 1-12, use the following terms to complete the statements.*

|  |  |  |
| --- | --- | --- |
| thermochemical equation | enthalpy of combustion | released |
| molar enthalpy of vaporization | molar enthalpy of fusion | absorbs |
| cool  law of conservation of energy | heat  specific heat | Calorimeter  Thermochemistry |

1. A(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a balanced chemical equation that includes the physical states of all reactants and products and the energy change that accompanies the reaction.

2. The enthalpy change for the complete burning of one mole of a substance is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the heat required to vaporize one mole of a liquid.

4. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the heat required to melt one mole of a solid substance.

5. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an insulated device used to measure heat absorbed or released during a chemical or physical process.

6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the study of heat changes from chemical reactions.

7. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the heat required to raise the temperature of one gram of a substance by one degree Celsius.

8. When a gas condenses to a liquid, heat is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the surroundings.

9. Sweating makes you feel cooler because, as it evaporates, the water on your skin \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ heat from your body.

10. If you put an ice cube in a glass of soda pop, the heat absorbed by the ice will cause the ice to melt, and the soda pop will become \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

11. According to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy is neither created nor destroyed in a chemical reaction.

12. In the equation H2O(s)  H2O(l) H = 600 kJ, the positive value for H means that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is absorbed in the reaction.

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13. Energy exits in two basic forms, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy.

14. The energy stored in a substance due to its composition is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ potential energy.

15. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is defined as the system along with the surroundings.

16. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_is defined as the change in enthalpy that accompanies the formation of one mole of the compound in its standard state from its constituent elements in their standard states.

17. The molar enthalpies of condensation and vaporization have the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ numerical value, but different signs.

18. If the temperature at which a reaction occurs increases, the number of collisions \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

*Use each of the terms below just once to complete the passage.*

|  |  |  |
| --- | --- | --- |
| collision theory | activated complex | transition state |
| activation energy | catalyst | inhibitor |

According to the (19)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, atoms, ions, and molecules must collide in order to react. Once formed, the (20) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a temporary, unstable arrangement of atoms that may then form products or may break apart to reform the reactants. This physical arrangement is known as a (21) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Every chemical reaction requires energy, and the minimum amount of energy that reacting particles must have to form the activated complex is the (22) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This value can be lowered by the addition of a (23) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which reacts, but remains unchanged by the end of the reaction. A(n) (24) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has the opposite effect, it slows down a reaction.

25. 2H2(g) + O2(g)  2H2O(g) + 572 kJ.

Is this reaction endothermic or exothermic and is H positive or negative? Why?

**PROBLEMS – show all work!**

26. A medium banana contains 105 Calories. Convert this energy value to J, calories, and kilocalories.

27. Copper metal has a specific heat of 0.385 J/g·°C and a melting point of 1083°C. Calculate the amount of heat (in kJ) required to raise the temperature of 22.8 g of copper from 20.0°C to 875°C.

28. Calculate the amount of heat released in the complete combustion of 8.17 g of Al at 25°C and 1 atm. Hcomb for Al(s) = –1680 kJ/mol.

29. Given the Hf of the following substances, calculate H° at 25°C for the reaction below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 2ZnS(s) + 3O2(g)  2ZnO(s) + 2SO2(g) | | | | |
| –206.0 | 0 | –350.5 | –296.8 | =Hf°(kJ/mol) |

30. Using the following data, calculate H at 25°C for the reaction:4HCl(g) + O2(g)  2Cl2(g) + 2H2O(g)

H2(g) + Cl2(g)  2HCl(g) H = –185 kJ

2H2(g) + O2(g)  2H2O(g) H = –483.7 kJ

**COMPLETION**

1. thermochemical equation

2. enthalpy of combustion

3. molar enthalpy of vaporization

4. molar enthalpy of fusion

5. calorimeter

6. thermochemical equation

7. specific heat

8. released

9. absorbs

10. cool

11. law of conservation of energy

12. heat

13. potential, kinetic *or* kinetic, potential

14. chemical

15. universe

16. standard

17. same

18. increases

19. collision theory

20. activated complex *or* transition sate

21. activated complex *or* transition sate

22. activation energy

23. catalyst

24. inhibitor

**PROBLEMS**

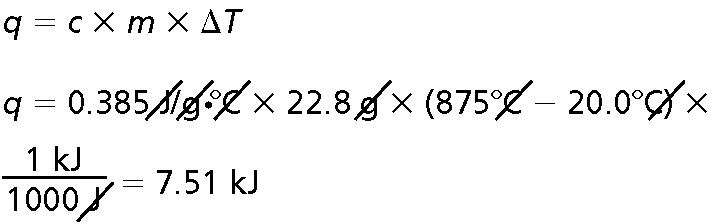
25. Exothermic and H is negative because heat is a product and is being released.

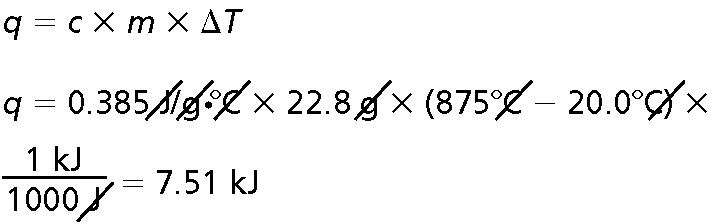
26.

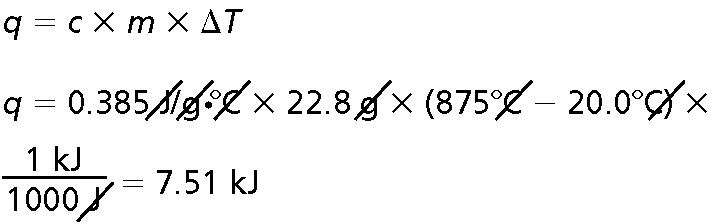
|  |  |  |  |
| --- | --- | --- | --- |
| 105 Cal | 1000 cal | 4.184 J | = **4.4x105 J** |
|  | 1Cal | 1 cal |
|  |  |  |  |
| 105 Cal | 1000 cal | = **1.1x105 cal** | |
|  | 1 Cal |

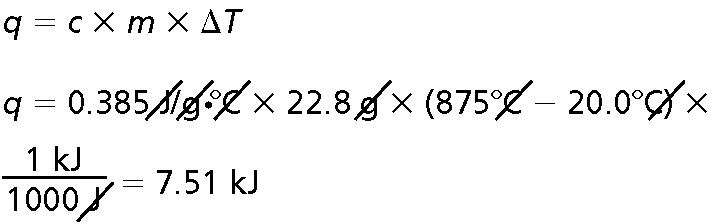
105 Cal = **105 kcal**

27.

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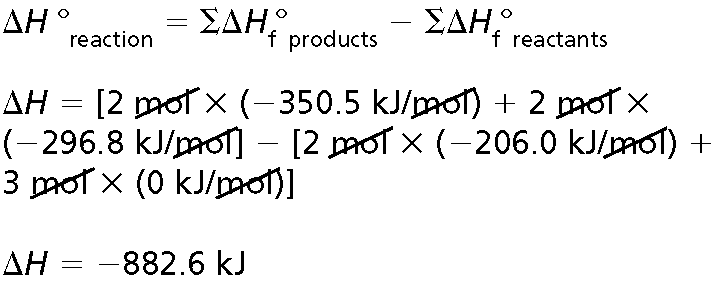
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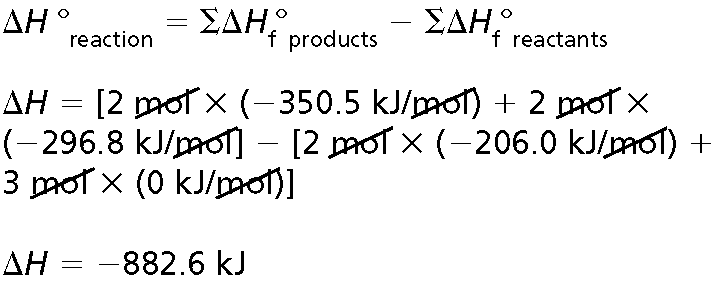
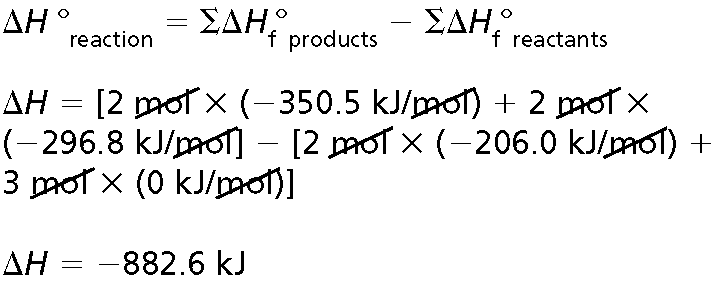
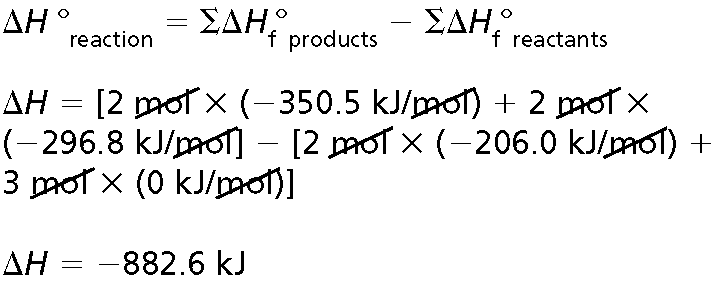
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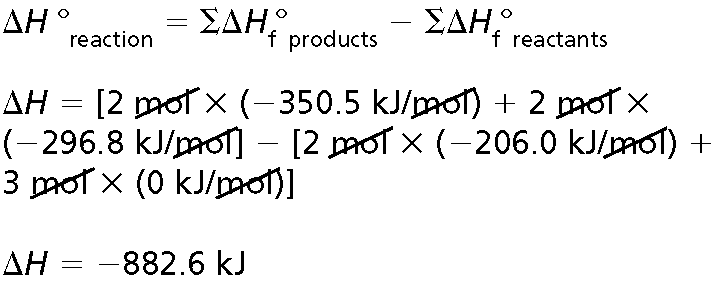
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28.

|  |  |  |  |
| --- | --- | --- | --- |
| 8.17 g Al | 1 mol Al | (-) 1680 kJ | = **508 kJ** |
|  | 27.0 g Al | 1 mol Al |

**** 29.

****

****

30.

4HCl  2H2 + 2Cl2 H = 185 kJ x 2

2H2 + O2   2H2O H = –483.7 kJ

370 kJ + (-483.7 kJ) = **-114 kJ**