Thermochemistry Review

Chapter 5

1

Before a pitcher throws a baseball to the batter, the ball has *kinetic energy.*

2

Before a pitcher throws a baseball to the batter, the ball has *kinetic energy.*

- False
  - If you assume the ball is stationary.
- True
  - if you are imagining the ball in the already moving arm of the pitcher.

3

A brand new battery has more potential energy than a used battery.

4

A brand new battery has more potential energy than a used battery of the same size.

- True
- The new battery has more chemical potential energy than a battery that has already been discharged.

5

The burning of coal is accompanied by the release of heat; thus it is an *endothermic process.*

6

The burning of coal is accompanied by the release of heat; thus it is an *endothermic process.*

- False
- It is an exothermic process because heat is released.
- An endothermic process involves the absorption of heat.

7

The universe can be considered to be composed of two parts when we do an experiment; the *system*, that which we focus our attention on, and the *surroundings*, the rest of the universe.

8

The universe can be considered to be composed of two parts when we do an experiment; the *system*, that which we focus our attention on, and the *surroundings*, the rest of the universe.

- True

9

The *energy* within a battery that enables it to power a fan is a form of *potential* energy.

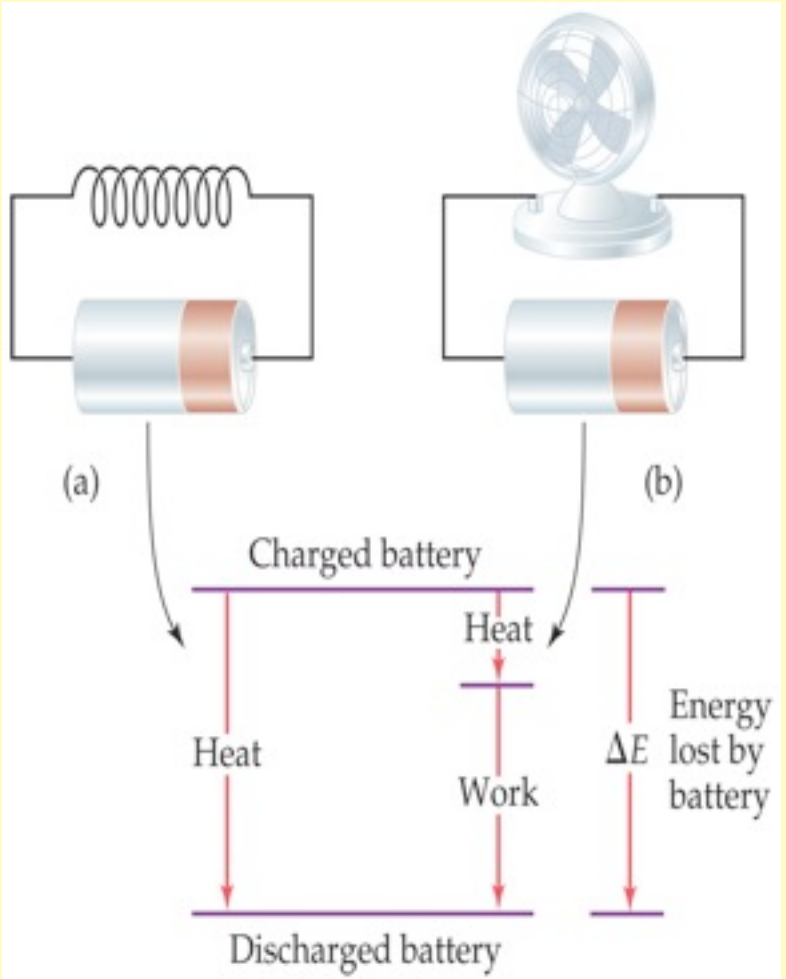
10

The *energy* within a battery that enables it to power a fan is a form of *potential* energy.

- True
- chemical potential energy

11

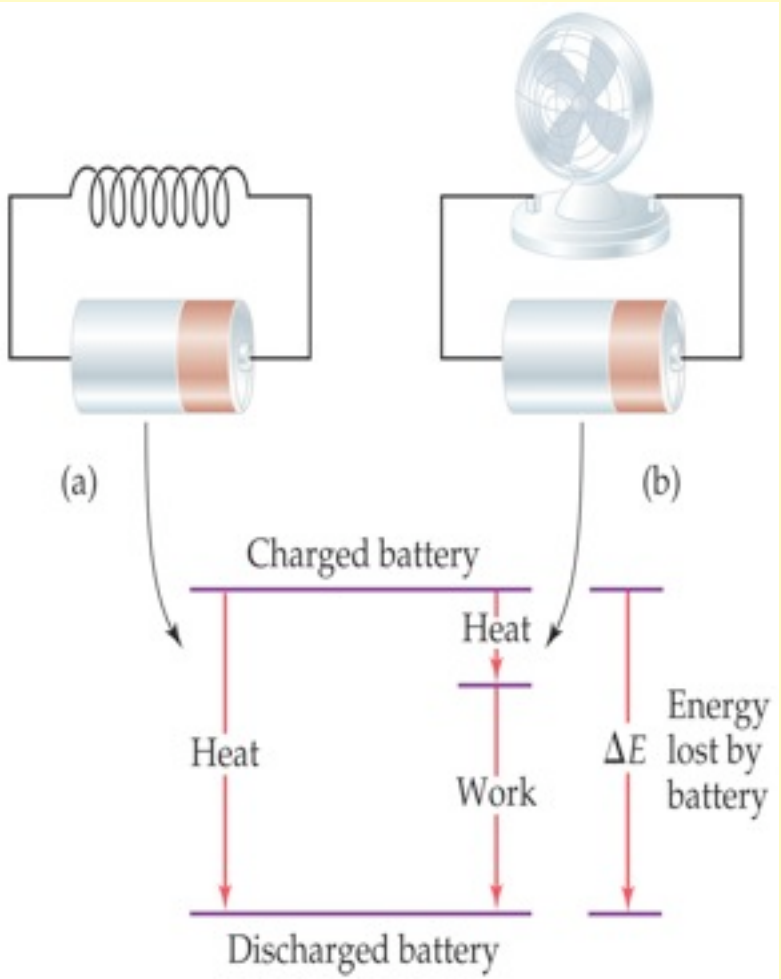
This diagram shows that heat and work are not state functions, yet energy is a state function.



12

This diagram shows that heat and work are not state functions, yet energy is a state function.

- True
- Since both batteries are discharged, and must have lost the same amount of energy to get there.
- Yet the amount of heat and work done by the two systems is different.



13

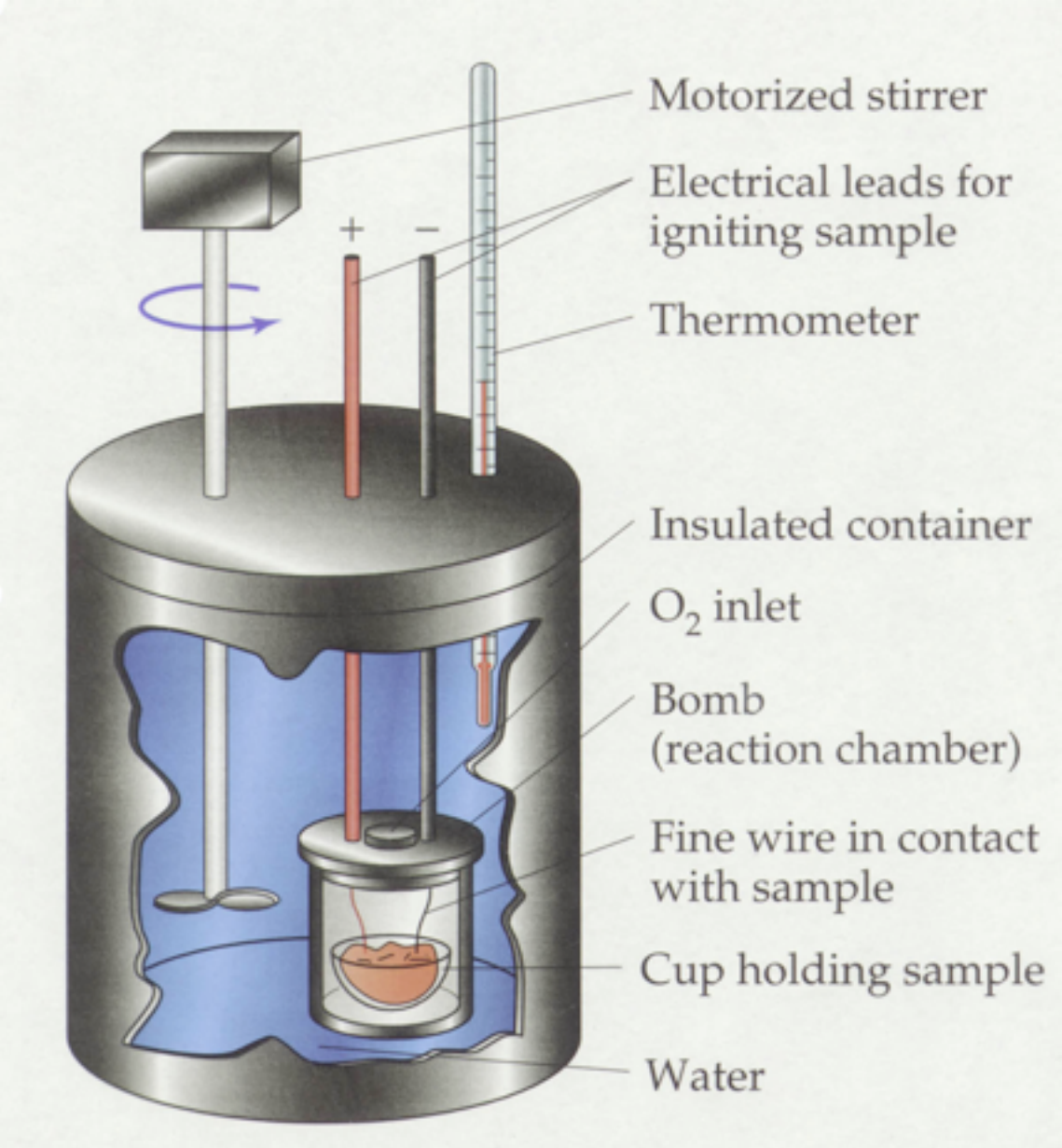
The *SI* unit of heat is the *joule.*

14

The *SI* unit of heat is the *joule.*

- True
- and the joule is defined as 2 $kg*m^2/s^2$
- Although this is not as useful for chemists to know.
- What you should know is that 4.184 J changes 1 g water 1ºC.

15



The heat measured in a *bomb calorimeter* is termed *enthalpy.*

16

The heat measured in a *bomb calorimeter* is termed *enthalpy.*

- False
- Enthalpy is the heat change measured only under constant pressure conditions.
- The Bomb calorimeter is under constant volume conditions and the pressure will change during a reaction. It is truly a measure of changes in internal energy and is not called enthalpy.
- In our class we use an open topped foam calorimeter which does operate at constant pressure because it is open to the constant pressure of the atmosphere.

17

When the *standard enthalpy of formation* of a substance is measured, both the elements and substances must be at 25ºC and at the standard atmospheric pressure of 1 atm.

18

When the *standard enthalpy of formation* of a substance is measured, both the elements and substances must be at 25ºC and at the standard atmospheric pressure of 1 atm.

- True
- ΔH^{o}_{f}

19

The *first law of thermodynamics* requires that energy be conserved in all processes.

20

The *first law of thermodynamics* requires that energy be conserved in all processes.

- True

21

The heat measured in a “coffee cup” calorimeter is ΔE.

22

The heat measured in a “coffee cup” calorimeter is ΔE.

- False
- It is actually ΔH which includes the P-V work.
- However, you might have said true.
- Since most coffee cup calorimeter reactions occur in solution, there is virtually no volume change making ΔH essentially equal to ΔE.

23

ΔE, ΔH, and q are all *state functions.*

24

ΔE, ΔH, and q are all *state functions.*

- False
- ΔE and ΔH are state functions.
- q (and w) is not a state function.

25

Heat capacity is an *intensive* property.

26

Heat capacity is an *intensive* property.

- False
- Heat capacity is mass dependent. A larger substance will have a larger heat capacity. (J/ºC)
- Specific Heat Capacity is intensive (J/gºC)

27

If q is + and w is +, ΔE is always +

28

If q is + and w is +, ΔE is always +

- True
- Since $\Delta E = q + w$. ΔE can only be positive in sign if both q and w are positive.

29

Heat determined by *calorimetry* experiments involve calculations that assume the specific heat capacity of a substance does not vary with temperature.

30

Heat determined by *calorimetry* experiments involve calculations that assume the specific heat capacity of a substance does not vary with temperature.

- True
- We make this assumption. And although it is not a perfect assumption, it is close enough.

31

To perform *heat capacity* calculations no *assumptions* are made.

32

To perform *heat capacity* calculations no *assumptions* are made.

- False
- It must be assumed that heat lost equals heat gained or not calculations could be made.

33

The direction of *heat flow* between substances depends on which substance has less heat.

34

The direction of *heat flow* between substances depends on which substance has less heat.

- False:
- The direction only depends on the temperature of the two substance.
- The hot substance always loses heat to the cold substance. This is a part of the Second Law of Thermodynamics

35

The *quantity of heat* flow between substances of different temperatures depends only on their individual temperatures.

36

The *quantity of heat* flow between substances of different temperatures depends only on their individual temperatures.

- False
- The quantity of heat that flows depends on the temperatures *and* the mass of each substance.

37

At 25ºC and 1 atm pressure, the *standard state* of carbon dioxide is a solid.

38

At 25ºC and 1 atm pressure, the *standard state* of carbon dioxide is a solid.

- False
- The standard state of CO_2 at 25ºC and 1 atm pressure is a gas.

39

Hess' Law "works" because enthalpy is a *state function*.

40

Hess' Law "works" because enthalpy is a *state function*.

- True
- It does not matter what steps are used to arrive at a particular state of reactants and products.

41

The *specific heat capacity* of water, 4.18 J/gºC can be converted to a *molar specific heat* capacity by dividing by the molar mass of water.

42

The *specific heat capacity* of water, 4.18 J/gºC can be converted to a *molar specific heat* capacity by dividing by the molar mass of water.

- False
- To convert to the molar specific heat capacity multiply by the molar mass.
- (4.18 J/gºC)*(18.0 g/mole) = 75 J/ºCmole

43

One *Calorie* is the same as one kilocalorie.

44

One *Calorie* is the same as one kilocalorie.

- True
- 1 Calorie (the nutritional unit of energy) is equal to 1000 calories which equal 1 kilocalorie.
- I suspect that you would not need to have this memorized for the AP exam, thought you just might like to know.

45

Enthalpies of formation are generally exothermic.

46

Enthalpies of formation are generally exothermic.

- True
- Since more bonds are usually formed suring a formation reaction.
- Most are exothermic, since bond forming is an exothermic process.
- Bond breaking is an endothermic process.

47

Write a formation equation for ethanol, $C_2H_5OH_{(g)}$ for which ΔH^o_f = -235.1 kJ/mole

48

Write a formation equation for ethanol, $C_2H_5OH_{(g)}$ for which ΔH^o_f = -235.1 kJ/mole

- $C_{(s,graphite)} + H_{2(g)} + O_{2(g)} \rightarrow C_2H_5OH_{(g)}$

49

Heat capacity is a positive number.

50

Heat capacity is a positive number.

- True
- It is a measure of the heat needed to raise the temperature of some substance one degree.
- You might have said false if you wanted to think of it as the capacity to lose heat and lower the temp by 1 degree. It would be true that it is the same amount of energy, but it is simply not the actual definition of the term, *heat capacity*.

51

Fossil fuels are always solid like coal.

52

Fossil fuels are always solid like coal.

- False
- Fossil fuels include all hydrocarbons (C_xH_y) that result from the decomposition of plants and animals.
- Many of them are liquids and gases

53

The standard state of all the halogens is gas and the $\Delta H_f^o = 0$.

54

The standard state of all the halogens is gas and the $\Delta H_f^o = 0$.

- False
- Fluorine and chlorine are gas, but the standard state of bromine is liquid and the standard state of iodine is solid.
- The ΔH_f^o of the standard state is always zero for the halogens in their elemental form.

55