

# Enthalpy Game

1. For each of the following, label with a + or a - where a + indicated an endothermic reaction (i.e.  $\Delta H = +$ ) and a - indicates an exothermic reaction (i.e.  $\Delta H = -$ ). Do not guess, wrong will be subtracted from right.

- (12)
- a) \_\_\_ a rotting onion is slowly consumed by special rotting onion bacteria
  - b) \_\_\_ formation of dew overnight
  - c) \_\_\_ formation of hydrogen cyanide from the elements hydrogen, carbon and nitrogen in their natural state at 25 °C and 1 atm pressure
  - d) \_\_\_ boiling water produces water vapour
  - e) \_\_\_ spontaneous levitation of an entire class of chemistry students
  - f) \_\_\_ zinc and oxygen combine in a combustion reaction to form a common oxide of zinc
  - g) \_\_\_ mixing ammonium nitrate and water is a common reaction used in cold packs (reduces temperature in case of injury)
  - h) \_\_\_ irradiation of stable atoms produces unstable isotopes capable of spontaneous radiative decay processes
  - i) \_\_\_ electricity can be used to separate water molecules into its component elements through electrolysis
  - j) \_\_\_ slow steady growth of a tree is a result of metabolic processes within the tree

1. For each of the following, decide if the situation represents an increase in potential energy or a decrease in potential energy. Label the increases in potential energy with a "+" sign and the decreases in potential energy with a "-" sign. Proceed carefully. Wrong subtracted from right.

- (8)
- a) \_\_\_ the combustion of methane gas
  - b) \_\_\_ the formation of diamond from coal or graphite deep within the earth's crust
  - c) \_\_\_ formation of ice on a window pane through a sublimation process
  - d) \_\_\_ formation of toluene from its constituent elements (l)
  - e) \_\_\_ a reaction in which the reactants have greater forces of attraction than the products
  - f) \_\_\_ evaporation of isopropyl alcohol
  - g) \_\_\_ formation of an onion from all necessary raw materials
  - h) \_\_\_ the conversion of ethyl alcohol to dimethyl ether
  - i) \_\_\_ physical exertion
  - f) \_\_\_ a tree grows in the forest

1. For each of the following, label with a + for an increase in potential energy or a - for a decrease in potential energy. Be careful. One-half mark will be deducted for each incorrect response.

- 9
- a) \_\_\_ The formation of ethyne from its component elements.
  - b) \_\_\_ Sand is used to make glass.
  - c) \_\_\_ Calcium carbonate is formed by the addition of carbon dioxide to calcium oxide.
  - d) \_\_\_ Growth of a Western Red Cedar (i.e. humongous tree).
  - e) \_\_\_ Cellular respiration.
  - f) \_\_\_ Formation of a cloud.
  - g) \_\_\_ Sublimation of  $H_2O(g)$  to  $H_2O(s)$ .
  - h) \_\_\_ Reaction of propane with oxygen.
  - i) \_\_\_ Reduction of tin (IV) oxide to tin (II) oxide.
  - j) \_\_\_ Conversion of glucose to hexane.

1. For each of the following, label with a + for an increase in potential energy or a - for a decrease in potential energy:

- 4
- a) \_\_\_ the combustion of methane gas
  - b) \_\_\_ the formation of diamond deep within the earth's crust
  - c) \_\_\_ formation of ice on a window through a sublimation process
  - d) \_\_\_ formation of toluene (l)
  - e) \_\_\_ a reaction in which the reactants have greater forces or attraction than the products
  - f) \_\_\_ heat energy is absorbed by the water jacket in a bomb calorimeter (consider reactant and product compounds only)
  - g) \_\_\_ formation of an onion from all necessary raw materials
  - h) \_\_\_ the conversion of ethyl alcohol to dimethyl ether
  - i) \_\_\_ deflation of a balloon
  - f) \_\_\_ build up of electrostatic charge in a thunderhead

1. For each of the following situations, determine if the process represents an increase or a decrease in potential energy. If the process is an increase in potential energy, label it with a "+" sign. If the process is a decrease, label it with a "-" sign. Do not guess. One half mark will be deducted for each incorrect response.

+ / -	situations
	cold water droplets form on a window
	cellular respiration (i.e. the process in which your body converts glucose to useable energy)
	a piece of bread slowly becomes dry and hard
	in a thermonuclear process, mass is converted to heat energy
	photosynthesis (i.e. the process in which plants convert carbon dioxide and water to glucose and oxygen gas)
	the heat of formation of benzene
	the heat of combustion of benzene
	the heat of formation of ethanol
	the formation of snow
	a light fluffy cloud slowly dissipates leaving clear sunny skies

1. For each of the following, label with a + for an increase in potential energy or a - for a decrease in potential energy. Be careful. One-half mark will be deducted for each incorrect response.

- a) \_\_\_ the combustion of methane gas
- b) \_\_\_ the formation of diamond deep within the earth's crust
- c) \_\_\_ formation of frost on a window through a sublimation process
- d) \_\_\_ formation of benzene (l)
- e) \_\_\_ a reaction in which the reactants have greater forces of attraction than the products
- f) \_\_\_ heat energy is absorbed by the water jacket in a bomb calorimeter (consider the change in enthalpy of the reaction only)
- g) \_\_\_ formation of an onion from all necessary raw materials
- h) \_\_\_ the conversion of ethyl alcohol to dimethyl ether
- i) \_\_\_ deflation of a balloon
- f) \_\_\_ build up of electrostatic charge in a thunderhead

1. Each of the following examples involve a change in enthalpy. If the change in enthalpy is positive, label with an A. If the change in enthalpy is negative, label with a B. Do not guess! For every two wrong answers, one mark will be subtracted.

- 6
- a) \_\_\_ The lake thaws slowly in the spring.
  - b) \_\_\_ When two particular solutions are mixed together the average temperature increases
  - c) \_\_\_ In a fission reaction , the total mass of the products is significantly less than the total mass of the reactants.
  - d) \_\_\_ Sulphuric acid is dissolved in water.
  - e) \_\_\_ The products of a reaction have greater attractive forces than the reactants.
  - f) \_\_\_ After a reaction, the forces of attraction between the atoms involved has undergone a net increase.
  - g) \_\_\_ The condensation of any liquid.
  - h) \_\_\_  $\text{H}_2\text{O}(\text{g}) + \text{C}(\text{s}) = \text{CO}(\text{g}) + \text{H}_2(\text{g}) \quad H = 31.4 \text{ kcal}$
  - i) \_\_\_ Photosynthesis
  - j) \_\_\_ The formation of water from its elements at 25 C and 1 atmosphere pressure.

The following questions will be graded according to presentation for a total of ten marks!!!! You should have adequate time to consider your approach to presentation.

1. Each of the following examples involve a change in enthalpy. If the change in enthalpy is positive, label with an A. If the change in enthalpy is negative, label with a B. Do not guess! Wrong subtracted from right!

- 7
- a) \_\_\_ The lake thaws slowly in the spring.
  - b) \_\_\_ When two particular solutions are mixed together the average temperature increases
  - c) \_\_\_ In a nuclear fission reaction , the total mass of the products is significantly less than the total mass of the reactants.
  - d) \_\_\_ Sulphuric acid is dissolved in water.
  - e) \_\_\_ The products of a reaction have greater attractive forces than the reactants.
  - f) \_\_\_ After a reaction, the forces of attraction between the atoms involved has undergone a net increase.
  - g) \_\_\_ The condensation of any liquid.
  - h) \_\_\_  $\text{H}_2\text{O}(\text{g}) + \text{C}(\text{s}) = \text{CO}(\text{g}) + \text{H}_2(\text{g}) \quad \Delta H = 31.4 \text{ kcal}$
  - i) \_\_\_ Photosynthesis
  - j) \_\_\_ The formation of water from its elements at 25 °C and 1 atmosphere pressure.

1. Each of the following examples involve a change in enthalpy. Label as + for an increase in potential energy and - for a decrease in potential energy Do not guess! One half mark deducted for each wrong answer!

- 5
- a)  The lake thaws slowly in the spring.
  - b)  When two particular solutions are mixed together the average temperature increases
  - c)  In a fission reaction , the total mass of the products is significantly less than the total mass of the reactants.
  - d)  Sulphuric acid is dissolved in water.
  - e)  The products of a reaction have greater attractive forces than the reactants.
  - f)  After a reaction, the forces of attraction between the atoms involved has undergone a net increase.
  - g)  The condensation of any liquid.
  - h)   $\text{H}_2\text{O}(\text{g}) + \text{C}(\text{s}) = \text{CO}(\text{g}) + \text{H}_2(\text{g}) \Delta\text{H} = 31.4 \text{ kcal}$
  - i)  Photosynthesis
  - j)  The formation of water from its elements at 25 C and 1 atmosphere pressure.

1. Each of the following examples involve a change in enthalpy. If the change in enthalpy is positive, label with an A. If the change in enthalpy is negative, label with a B. Do not guess! One mark for a correct response, minus one half mark for an incorrect response!

- 3
- a)  water in a puddle gradually evaporates
  - b)  when two particular solutions are mixed together the average temperature decreases
  - c)  the sublimation of dry ice i.e  $\text{CO}_2(\text{s}) \Rightarrow \text{CO}_2(\text{g})$
  - d)   $\text{COCl}_2(\text{g}) \Rightarrow \text{CO}(\text{g}) + \text{Cl}_2(\text{g})$
  - e)  the reactants of a reaction have stronger bonds than the products
  - f)  after a reaction, the forces of attraction between the atoms involved has undergone a net increase
  - g)  the condensation of any liquid
  - h)  the formation of benzene from its elements at 25 °C and 1 atmosphere pressure
  - i)  photosynthesis
  - j)  the fermentation of glucose to ethyl alcohol plus carbon dioxide i.e.  $\text{C}_6\text{H}_{12}\text{O}_6 \Rightarrow 2\text{C}_2\text{H}_6\text{O} + \text{CO}_2$

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1. Determine whether the following circumstances are endothermic or exothermic and label as endo or exo. Do not guess, one half mark deducted for each incorrect response.

- a) \_\_\_\_\_ ice-cream slowly melts
- b) \_\_\_\_\_ protein molecules from a medium rare steak are digested to form amino acids
- c) \_\_\_\_\_ the smell of frying mushrooms fills a room
- d) \_\_\_\_\_ in the nuclear power reaction used to generate the energy needed to cook the frying mushrooms the mass of uranium fuel becomes less during the reaction
- e) \_\_\_\_\_ vegetables such as potatoes and corn are produced through the process known as photosynthesis
- f) \_\_\_\_\_ the energy one gets after digesting a good meal is due to the abundance of glucose available for the process known as cellular respiration
- g) \_\_\_\_\_ the beautiful smell associated with garlic is thought to form through the rapid combination of two separate molecules once the garlic cells are disturbed
- h) \_\_\_\_\_ the condensation of steam to form water droplets when pasta is cooking is a sure sign that dinner is almost ready
- i) \_\_\_\_\_ the freshness of many different vegetables such as peas and corn can be preserve through rapid freezing
- j) \_\_\_\_\_ when baking a cake sodium bicarbonate (baking soda) is frequently used to cause the cake to rise due to its spontaneous decomposition in the presence of an acid to form carbon dioxide gas thus making the cake light and fluffy!
- MMMMMMMM!