Learning Guide for Lecture 2B – Physical, Chemical, and Nuclear Changes Chem 1010

<u>Review</u>

Which state of matter matches the following pictures?



What could the circles in these pictures represent?

How can you tell that the particles in a liquid or a gas are moving?

Which of the changes of state require energy, and which give off energy?

give off energy:

require energy:

Why does it require energy for a substance to melt?

Why does it require energy for a substance to evaporate?

Why is energy given off when a substance freezes?

What temperature will each of the following substances be in at the melting point of water?

carbon dioxide:	table sugar:	salt:
rubbing alcohol:	carbon monoxide:	

Why do different substances have different melting and boiling points?

Introduction

What was the definition of chemistry given at the beginning of this course?

chemistry =

in other words...

we've talked a lot about:

and now its time to talk about:

In this lecture, we will talk about how to recognize the three types of changes, and how to represent them with equations.

3 Types of Changes-

Let's begin by looking at three examples:

- ice melting
- hydrogen burning
- tritium decaying

Water melting:

What can we observe happening when ice melts?

What is happening to the water molecules?



How can we represent this change with an equation?

Hydrogen burning:

What do we observe when hydrogen burns?



How can we represent this change with an equation?

Tritium decaying:

What is tritium?

What do we observe when tritium decays?

What is happening to the atoms?



How can we represent this change with an equation?

In which of these three changes are...

the atoms different?

the atoms still the same but the molecules different?

the molecules still the same?

We call all changes in which the molecules remain the same:

We call all changes in which the molecules are different but the atoms are still the same:

We call all changes in which the atoms are different:

In physical changes:

- only the arrangement of molecules changes
- no chemical bonds are broken
- no new compounds or elements are formed

In chemical reactions:

- chemical bonds are broken and formed
- new compounds are formed
- the elements stay the same

In nuclear reactions:

- new elements are formed
- total number of protons and neutrons stays the same

What happens to the energy in each of these changes? How could we show this in the equations?

ice melting:

$$H_2O_{(s)} \longrightarrow H_2O_{(l)}$$

hydrogen burning:

$$2 \text{ H}_2 + \text{O}_2 \rightarrow 2 \text{ H}_2\text{O}$$

tritium decaying:

$$^{3}\text{H} \rightarrow ^{3}\text{He} + \text{e-}$$

How much energy is involved?

Other examples of these changes

1) What does this equation represent?

 $2 \text{ K} + 2 \text{ H}_2\text{O} \rightarrow 2 \text{ KOH} + \text{H}_2$

What kind of change is this? How can you tell?

2) What does this equation represent?

 $C_{11}H_{22}O_{11} + H_2O \rightarrow C_{11}H_{22}O_{11(aq)}$

What kind of change is this? How can you tell?

3) What does this equation represent?

 $n^{\circ} + {}^{235}U \rightarrow {}^{92}Kr + {}^{141}Ba + 3 n^{\circ}$

What kind of change is this? How can you tell?

4) What does this equation represent?

 $H_2O_{(g)} \to H_2O_{(l)}$

What kind of change is this? How can you tell?

5) What does this equation represent?

 $4 \ ^1\mathrm{H} \rightarrow {}^4\mathrm{He} + 2 \ e^{\scriptscriptstyle +}$

What kind of change is this? How can you tell?

6) What does this equation represent?

4 Fe + 3 $O_2 \rightarrow 2 Fe_2O_3$

What kind of change is this? How can you tell?

Write an equation to represent the following changes:

dry ice subliming:

charcoal burning:

fusion of plutonium-241 and neon-10:

Which type of changes are most common?

physical changes:

chemical changes:

nuclear changes: