Cornell Notes

Period 1

Name	Date
Ashley Martinez	10/10/11
Topic	Class/ Suject: Chem / Fragoso

7:55 am

Nuclear Reaction

Rxn's:
- Change the composition of an atoms nucleus.

Nuclear Stability →
- Protons + neutrons are found in nucleus.
  - Only some combinations of # protons and neutrons lead to radioactivity.

Strong Nuclear Force
- Force that holds nucleus together.
- Overcomes the repulsion between protons.
- Presence of neutrons adds a net attractive force to the inside of nucleus.
  - acting as glue.

In book Pg. 112
Copy figure 3-27

In book Pg 115
Figure 3-31 represents radium.

HOMEWORK: 3-4 Review + Reinforcement #1-20
Take home Quiz → due tomorrow.

Cornell Notes

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Radioactivity

- Spontaneous emission of radiation from an element.
- Uranium
- Marie + Pierre Curie discovered Radium + Polonium.

Changes in the nucleus

- chemical properties of radioactive elements change as it gives off radiation.

3 types of Radiation

differ on amount of energy they carry

- alpha (a)
- Beta (B)
- Gamma (Y)

Nuclear Stability continued.

Atoms $p > 20$ need $n > p$ for nuclei to be stable.

all nuclei $p > 83$ are radioactive

Cornell Notes

Period 1

Name: Ashley Martinez

Date: 10/6/11

Topic:

Class/Subject: Chem / Fraga50

Radioactive Decay

$^{226}_{88}Ra \xrightarrow{\alpha\text{-decay}} {}^{4}_{2}He + {}^{222}_{86}Rn$

Equation to describe α-decay

$^{131}_{53}I \xrightarrow{\beta\text{-decay}} {}^{0}_{-1}\beta + {}^{131}_{54}Xe$

Equation to describe β-decay

Unstable nuclei:
- Too many or few neutrons.

- Excess neutrons result in β− radiation.

Alpha radiation → copy figure 3-31 pg. 11
- the nucleus of Radium-226 has too many protons = unstable
- As a result, element is radioactive and undergoes α-decay.
  - α particle = 2 protons + 2 neutrons ⇒ $^{4}_{2}He$

Beta Radiation → copy figure 3-32 pg. 116
- the nucleus of Iodine-131 has too many neutrons = unstable nucleus.
- In β radiation, one neutron splits into a proton and a high energy electron.
- the high energy electron is excited as radiation + the proton remains in the nucleus of the new nucleus

Gamma Radiation aka → non-particle radiation
- Rays (similar to light, UV rays, x-rays)
- Strongest type of radiation

8:35 am

IN class – Start working on 3-4 Practice Problems
1-4 in class
5-10 on own.

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3-4 Practice Prob.

1-4

*Note :

For a → you subtract

EX: 231-4

$^{231}_{91}Pa \rightarrow {}^{4}_{2}He + {}^{227}_{89}Ac$

91-2

For B → you add

223+0

$^{223}_{87}Fr \rightarrow {}^{0}_{-1}B + {}^{223}_{88}Ra$

87+1

Mass

(1) $^{231}_{91}Pa \xrightarrow{\alpha\text{-decay}} {}^{4}_{2}He + {}^{227}_{89}Ac$

Protons

(2) $^{223}_{87}Fr \xrightarrow{\beta\text{-decay}} {}^{0}_{-1}B + {}^{223}_{88}Ra$

(3) $^{149}_{62}Sm \xrightarrow{\alpha\text{-decay}} {}^{4}_{2}He + {}^{145}_{60}Nd$

(4) $^{165}_{61}Pm \xrightarrow{\beta\text{-decay}} {}^{0}_{-1}B + {}^{165}_{62}Sm$

Name_____ Date_____ Class _____

3–4 Explore

The Nuclear Dropout

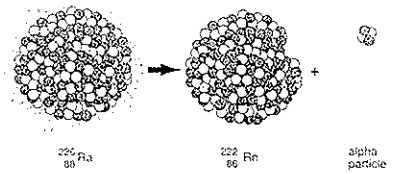
In this activity you will explore the nature of alpha particles.

Materials (per person)

pencil
periodic table

Procedure

1. Examine the diagram of a radium atom undergoing alpha nuclear decay.
2. Use a periodic table to answer each of the questions below.



Alpha Decay

Questions

1. What is the new chemical identity of the radium atom after it has emitted an alpha particle?

   _____

2. When the radium atom undergoes nuclear decay, how does the number of protons in the nucleus change? How does the number of neutrons in the nucleus change?

   _____

   _____

   _____

3. Based on your answer to question 2, describe the composition of an alpha particle.

   _____

   _____

4. An alpha particle is identical to the nucleus of another element in the periodic table. Identify this element. _____
5. Create an appropriate symbol for an alpha particle that incorporates your answers to questions 3 and 4 above. _____
6. Can you explain why alpha particles are deflected away from a positively charged plate?

   _____

   _____

For α → you subtract
β → you add

Name_____ Date_____ Class _____

3–4 Practice Problems

1. Write a nuclear equation for the alpha decay of $^{231}_{91}$Pa.

   $^{231}_{91}Pa \xrightarrow{\alpha\text{-decay}} {}^{4}_{2}He + {}^{227}_{89}Ac$

2. Write a nuclear equation for the beta decay of $^{223}_{87}$Fr.

   $^{223}_{87}Fr \rightarrow {}^{0}_{-1}B + {}^{223}_{88}Ra$

3. Write a nuclear equation for the alpha decay of $^{149}_{62}$Sm.

   $^{149}_{62}Sm \rightarrow {}^{4}_{2}He + {}^{145}_{60}Nd$

4. Write a nuclear equation for the beta decay of $^{165}_{61}$Pm.

   $^{165}_{61}Pm \rightarrow {}^{0}_{-1}B + {}^{165}_{62}Sm$

5. Write a nuclear equation for the alpha decay of $^{249}_{101}$Md.

   $^{249}_{101}Md \rightarrow {}^{4}_{2}He + {}^{245}_{99}Es$

6. Write a nuclear equation for the alpha decay of $^{146}_{62}$Sm.

   $^{146}_{62}Sm \rightarrow {}^{4}_{2}He + {}^{142}_{60}Nd$

7. Write a nuclear equation for the beta decay of $^{198}_{85}$At.

   $^{198}_{85}At \rightarrow {}^{0}_{-1}B + {}^{198}_{86}Rn$

8. Write a nuclear equation for the alpha decay of $^{150}_{64}$Gd.

   $^{150}_{64}Gd \rightarrow {}^{4}_{2}He + {}^{146}_{62}Sm$

9. Write a nuclear equation for the beta decay of $^{152}_{54}$Xe.

   $^{152}_{54}Xe \rightarrow {}^{0}_{-1}B + {}^{152}_{55}$ _____

10. Write a nuclear equation for the beta decay of $^{120}_{55}$Cs.

    $^{120}_{55}Cs \rightarrow {}^{0}_{-1}B + {}^{120}_{56}$ _____

Name _____ Date _____ Class _____

3–4 Apply

The Carbon-Nitrogen Cycle

Hydrogen nuclei are involved in a process known as the carbon-nitrogen cycle. The six reactions in this decay series are presented below. The net result of the carbon-nitrogen cycle is that four hydrogen atoms are combined to produce one helium atom. Reactions 2 and 5 involve decay particles called positrons ($^{0}_{+1}e$). Positrons are essentially positively charged beta particles

Reaction 1: $^{1}_{1}H + ^{12}_{6}C \rightarrow$ ☐ $+ ^{0}_{0}\gamma$

Reaction 2: $^{13}_{7}N \rightarrow$ ☐ $+ ^{0}_{+1}e$

Reaction 3: $^{1}_{1}H +$ ☐ $\rightarrow ^{13}_{7}N + ^{0}_{0}\gamma$

Reaction 4: $^{1}_{1}H +$ ☐ $\rightarrow ^{15}_{8}O + ^{0}_{0}\gamma$

Reaction 5: $^{15}_{8}O \rightarrow$ ☐ $+ ^{0}_{+1}e$

Reaction 6: $^{1}_{1}H + ^{15}_{7}N \rightarrow$ ☐ $+ ^{4}_{2}He + ^{0}_{0}\gamma$

1. Use your knowledge of radioactive decay to fill in the missing parts of each nuclear equation above.
2. Which type of radioactive particle was emitted by the following isotopes?
   a. $^{13}_{7}N$ _____
   b. $^{15}_{7}N$ _____
3. In the cycle, what happens to the nitrogen-13 nuclei produced in the first reaction?
   _____
   _____
   _____
4. What happens to the atom produced in the sixth reaction?
   _____
   _____
   _____
5. Why is the process called a cycle?
   _____
   _____

Name _____ Date _____ Class _____

3–4 Review and Reinforcement

Changes in the Nucleus

Complete each of the sentences below.

1. Nuclear reactions change the composition of an atom's _____.
2. The attractive force that overcomes the electric repulsion between protons is the _____ force.
3. Almost all the atoms you encounter have _____ nuclei.
4. All nuclei with atomic numbers greater than 83 are _____.
5. Alpha, beta, and gamma radiation are distinguished by their charge, _____, and penetrating power.
6. When an atom emits alpha, beta, or gamma radiation, it is undergoing _____ decay.

Answer each of the following questions in the space provided.

7. Why is carbon dating not useful for artifacts made entirely of metal?
   _____
   _____
   _____
8. Compare the penetrating power of alpha, beta, and gamma radiation.
   _____
   _____
   _____
   _____
9. Why do nuclei need neutrons to be stable?
   _____
   _____
   _____
10. Describe two types of nuclear reactions other than radioactive decay.
    _____
    _____
    _____
    _____

Name _____ Date _____ Class _____

3–4 *Review and Reinforcement (continued)*

Complete each of the following nuclear reactions by filling in the blank with the correct particle.

11. $^{226}_{88}\text{Ra} \rightarrow {}^{222}_{86}\text{Rn} +$ _____

12. $^{14}_{6}\text{C} \rightarrow {}^{14}_{7}\text{N} +$ _____

13. $^{238}_{92}\text{U} \rightarrow {}^{234}_{90}\text{Th} +$ _____

Write the nuclear equations for the following reactions.

14. alpha decay of polonium-210 $\left(^{210}_{84}\text{Po}\right)$ _____

15. beta decay of tritium $\left(^{3}_{1}\text{H}\right)$ _____

16. alpha decay of thorium-230 $\left(^{230}_{90}\text{Th}\right)$ _____

On the line at the left, write the letter of the answer that best completes each statement.

_____ 17. In any radioactive decay, the sum of the mass numbers and atomic numbers must be _____ before and after the reaction.
   a. greater
   b. the same
   c. less
   d. unpredictable

_____ 18. The most dangerous form of radiation to the human body is
   a. beta radiation.
   b. gamma radiation.
   c. alpha radiation.
   d. They are all equally dangerous.

_____ 19. To be stable, atoms with more than 20 protons need increasingly more
   a. neutrons than protons.
   b. electrons than protons.
   c. electrons than neutrons.
   d. protons than neutrons.

_____ 20. The sun produces energy by means of
   a. gamma radiation.
   b. beta decay.
   c. alpha decay.
   d. nuclear fusion