Name _____ Date _____ Class _____

CHAPTER 5 REVIEW

The Periodic Law

SECTION 1

SHORT ANSWER **Answer the following questions in the space provided.**

1. __c__ In the modern periodic table, elements are ordered

(a) according to decreasing atomic mass.
(b) according to Mendeleev's original design.
(c) according to increasing atomic number.
(d) based on when they were discovered.

2. __d__ Mendeleev noticed that certain similarities in the chemical properties of elements appeared at regular intervals when the elements were arranged in order of increasing

(a) density.
(b) reactivity.
(c) atomic number.
(d) atomic mass.

3. __b__ The modern periodic law states that

(a) no two electrons with the same spin can be found in the same place in an atom.
(b) the physical and chemical properties of an element are functions of its atomic number.
(c) electrons exhibit properties of both particles and waves.
(d) the chemical properties of elements can be grouped according to periodicity, but physical properties cannot.

4. __c__ The discovery of the noble gases changed Mendeleev's periodic table by adding a new

(a) period.
(b) series.
(c) group.
(d) level.

5. __d__ The most distinctive property of the noble gases is that they are

(a) metallic.
(b) radioactive.
(c) metalloid.
(d) largely unreactive.

6. __c__ Lithium, the first element in Group 1, has an atomic number of 3. The second element in this group has an atomic number of

(a) 4.
(b) 10.
(c) 11.
(d) 18.

7. An isotope of fluorine has a mass number of 19 and an atomic number of 9.

__9__ **a.** How many protons are in this atom?

__10__ **b.** How many neutrons are in this atom?

__$^{19}_{9}F$__ **c.** What is the nuclear symbol of this fluorine atom, including its mass number and atomic number?

Name _____ Date _____ Class _____

SECTION 1 continued

8. Samarium, Sm, is a member of the lanthanide series.

Pu, plutonium **a.** Identify the element just below samarium in the periodic table.

32 units **b.** By how many units do the atomic numbers of these two elements differ?

9. A certain isotope contains 53 protons, 78 neutrons, and 54 electrons.

53 **a.** What is its atomic number?

131 **b.** What is the mass number of this atom?

Iodine, I **c.** What is the name of this element?

F, Cl, Br, At **d.** Identify two other elements that are in the same group as this element.

10. In a modern periodic table, every element is a member of both a horizontal row and a vertical column. Which one is the group, and which one is the period?

The group is the vertical column, and the period is the horizontal row.

11. Explain the distinction between atomic mass and atomic number of an element.

The atomic number is the number of protons in an atom. The atomic mass is a weighted average of the masses of the naturally occurring isotopes of that element.

12. In the periodic table, the atomic number of I is greater than that of Te, but its atomic mass is less. This phenomenon also occurs with other neighboring elements in the periodic table. Name two of these pairs of elements. Refer to the periodic table if necessary.

Co and Ni; Ar and K; Th and Pa; U and Np; Pu and Am; Sg and Bh. (The phenomenon occurs here because the mass of only the most stable isotope of each element is given.)

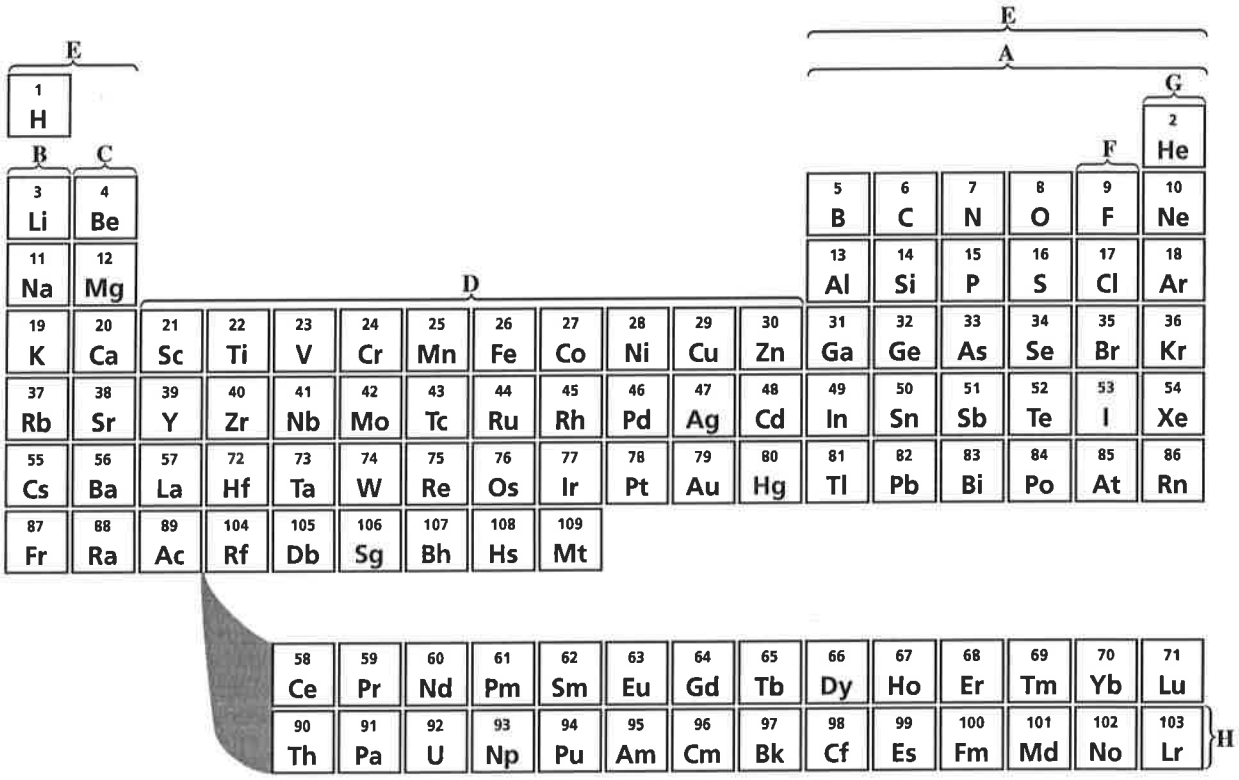
Name _____ Date _____ Class _____

CHAPTER 5 REVIEW

The Periodic Law

SECTION 2

SHORT ANSWER **Use this periodic table to answer the following questions in the space provided.**



1. Identify the element and write the noble-gas notation for each of the following:

a. the Group 14 element in Period 4

Ge; [Ar]$3d^{10}4s^24p^2$

b. the only metal in Group 15

Bi; [Xe]$4f^{14}5d^{10}6s^26p^3$

c. the transition metal with the smallest atomic mass

Sc; [Ar]$3d^14s^2$

d. the alkaline-earth metal with the largest atomic number

Ra; [Rn]$7s^2$

Name _____ Date _____ Class _____

SECTION 2 continued

2. On the periodic table given, several areas are labeled with letters A–H.

p block — **a.** Which block does **A** represent, *s*, *p*, *d*, or *f*?

b. Identify the remaining labeled areas of the table, choosing from the following terms: *main-group elements, transition elements, lanthanides, actinides, alkali metals, alkaline-earth metals, halogens, noble gases.*

alkali metals — **B**

alkaline-earth metals — **C**

transition elements — **D**

main-group elements (also in B and C) — **E**

halogens — **F**

noble gases — **G**

actinides — **H**

3. Give the symbol, period, group, and block for the following:

a. sulfur

S, Period 3, Group 16, *p* block

b. nickel

Ni, Period 4, Group 10, *d* block

c. $[Kr]5s^1$

Rb, Period 5, Group 1, *s* block

d. $[Ar]3d^5 4s^1$

Cr, Period 4, Group 6, *d* block

4. There are 18 columns in the periodic table; each has a group number. Give the group numbers that make up each of the following blocks:

1–2 **a.** *s* block

13–18 **b.** *p* block

3–12 **c.** *d* block

Name _____ Date _____ Class _____

CHAPTER 5 REVIEW

The Periodic Law

SECTION 3

SHORT ANSWER **Answer the following questions in the space provided.**

1. __c__ When an electron is added to a neutral atom, energy is

(a) always absorbed.
(b) always released.
(c) either absorbed or released.
(d) neither absorbed nor released.

2. __d__ The energy required to remove an electron from a neutral atom is the atom's

(a) electron affinity.
(b) electron energy.
(c) electronegativity.
(d) neither absorbed nor released.

3. From left to right across a period on the periodic table,

__negative__ **a.** electron affinity values tend to become more (negative or positive).

__increase__ **b.** ionization energy values tend to (increase or decrease).

__smaller__ **c.** atomic radii tend to become (larger or smaller).

4. __At__ **a.** Name the halogen with the least-negative electron affinity.

__Li__ **b.** Name the alkali metal with the highest ionization energy.

__Ar__ **c.** Name the element in Period 3 with the smallest atomic radius.

__C__ **d.** Name the Group 14 element with the largest electronegativity.

5. Write the electron configuration of the following:

a. Na

$1s^2 2s^2 2p^6 3s^1$

b. Na^+

$1s^2 2s^2 2p^6$

c. O

$1s^2 2s^2 2p^4$

d. O^{2-}

$1s^2 2s^2 2p^6$

e. Co^{2+}

$1s^2 2s^2 2p^6 3s^2 3p^6 3d^7$

Name _____ Date _____ Class _____

SECTION 3 continued

6. a. Compare the radius of a positive ion to the radius of its neutral atom.

The radius of a positive ion is smaller than the radius of its corresponding neutral atom.

b. Compare the radius of a negative ion to the radius of its neutral atom.

The radius of a negative ion is larger than the radius of its corresponding neutral atom.

7. a. Give the approximate positions and blocks where metals and nonmetals are found in the periodic table.

Metals are on the left side of the periodic table, mostly in the *s*, *d*, and *f* blocks. Nonmetals are on the right side of the periodic table, all in the *p* block (except for hydrogen).

b. Of metals and nonmetals, which tend to form positive ions? Which tend to form negative ions?

Metals tend to form positive ions; nonmetals tend to form negative ions.

8. **Table 3** on page 155 of the text lists successive ionization energies for several elements.

$3s^2$ **a.** Identify the electron that is removed in the first ionization energy of Mg.

$3s^1$ **b.** Identify the electron that is removed in the second ionization energy of Mg.

$2p^6$ **c.** Identify the electron that is removed in the third ionization energy of Mg.

d. Explain why the second ionization energy is higher than the first, the third is higher than the second, and so on.

As electrons are removed in successive ionizations, fewer electrons remain within the atom to shield the attractive force of the nucleus. Each electron removed from an ion experiences a stronger effective nuclear pull than the electron removed before it.

9. Explain the role of valence electrons in the formation of chemical compounds.

Valence electrons are the electrons most subject to the influence of nearby atoms or ions. They are the electrons available to be lost, gained, or shared in the formation of chemical compounds.

Name _____ Date _____ Class _____

CHAPTER 5 REVIEW

The Periodic Law

MIXED REVIEW

SHORT ANSWER **Answer the following questions in the space provided.**

1. Consider the neutral atom with 53 protons and 74 neutrons to answer the following questions.

53 **a.** What is its atomic number?

127 **b.** What is its mass number?

atomic number **c.** Is the element's position in a modern periodic table determined by its atomic number or by its atomic mass?

2. Consider an element whose outermost electron configuration is $3d^{10}4s^24p^x$.

Period 4 **a.** To which period does the element belong?

5 **b.** If it is a halogen, what is the value of x?

True **c.** The group number will equal $(10 + 2 + x)$. True or False?

3. *p* **a.** In which block are metalloids found, *s*, *p*, *d*, or *f*?

d **b.** In which block are the hardest, densest metals found, *s*, *p*, or *d*?

4. fluorine, F **a.** Name the most chemically active halogen.

$1s^22s^22p^5$ **b.** Write its electron configuration.

$1s^22s^22p^6$ for 1− ion **c.** Write the configuration of the most stable ion this element makes.

5. Refer only to the periodic table at the top of the review of Section 2 to answer the following questions on periodic trends.

In **a.** Which has the larger radius, Al or In?

Ca **b.** Which has the larger radius, Se or Ca?

Ca **c.** Which has a larger radius, Ca or Ca^{2+}?

nonmetals **d.** Which class has greater ionization energies, metals or nonmetals?

Cl **e.** Which has the greater ionization energy, As or Cl?

negative ion **f.** An element with a large negative electron affinity is most likely to form a (positive ion, negative ion, or neutral atom)?

Name _____ Date _____ Class _____

MIXED REVIEW continued

small — **g.** In general, which has a stronger electron attraction, a large atom or a small atom?

O — **h.** Which has greater electronegativity, O or Se?

O — **i.** In the covalent bond between Se and O, to which atom is the electron pair more closely drawn?

6 — **j.** How many valence electrons are there in a neutral atom of Se?

6. Ca^+ and Zn^{2+} — Identify all of the following ions that do not have noble-gas stability.
K^+ S^{2-} Ca^+ I^- Al^{3+} Zn^{2+}

7. Use only the periodic table in the review of Section 2 to give the noble-gas notation of the following:

$[Ar]3d^{10}4s^24p^5$ — **a.** Br

$[Ar]3d^{10}4s^24p^6$ — **b.** Br^-

$[Kr]4d^{10}5s^25p^1$ — **c.** the element in Group 13, Period 5

$[Xe]4f^15d^16s^2$ — **d.** the lanthanide with the smallest atomic number

8. Use electron configuration and position in the periodic table to describe the chemical properties of calcium and oxygen.

Calcium is a Group 2 alkaline-earth metal with $[Ar]4s^2$ configuration. It forms a stable 2+ ion, has relatively low ionization energy, and forms salt-like ionic compounds. Oxygen, with $[He]2s^22p^4$ configuration, is a typical Group 16 nonmetal, making a stable 2− ion; it has high electronegativity and ionization energy and quite negative electron affinity.

9. Copper's electron configuration might be predicted to be $3d^94s^2$. But in fact, its configuration is $3d^{10}4s^1$. The two elements below copper in Group 11 behave similarly. (Confirm this in the periodic table in **Figure 6** on pages 140–141 of the text.)

$3d^{10}4s^1$ — **a.** Which configuration for copper is apparently more stable?

Yes — **b.** Is the *d* sublevel completed in the atoms of these three elements?

True — **c.** Every element in Period 4 has four levels of electrons established. True or False?

Name _____ Date _____ Class _____

CHAPTER 21 REVIEW

Nuclear Chemistry

SECTION 1

SHORT ANSWER **Answer the following questions in the space provided.**

1. b Based on the information about the three elementary particles on page 683 of the text, which has the greatest mass?

(a) the proton
(b) the neutron
(c) the electron
(d) They all have the same mass.

2. a The force that keeps nucleons together is

(a) a strong nuclear force.
(b) a weak nuclear force.
(c) an electromagnetic force.
(d) a gravitational force.

3. d The stability of a nucleus is most affected by the

(a) number of neutrons.
(b) number of protons.
(c) number of electrons.
(d) ratio of neutrons to protons.

4. b If an atom should form from its constituent particles,

(a) matter is lost and energy is taken in.
(b) matter is lost and energy is released.
(c) matter is gained and energy is taken in.
(d) matter is gained and energy is released.

5. b For atoms of a given mass number, those with greater mass defects, have

(a) smaller binding energies per nucleon.
(b) greater binding energies per nucleon.
(c) the same binding energies per nucleon as those with smaller mass defects.
(d) variable binding energies per nucleon.

6. Based on **Figure 1** on page 684 of the text, which isotope of He, helium-3 or helium-4,

helium-3 **a.** has the smaller binding energy per nucleon?

helium-4 **b.** is more stable to nuclear changes?

7. The number of neutrons in an atom of magnesium-25 is 13.

8. Nuclides of the same element have the same atomic number.

Name _____ Date _____ Class _____

SECTION 1 continued

9. Atom X has 50 nucleons and a binding energy of 4.2×10^{-11} J. Atom Z has 80 nucleons and a binding energy of 8.4×10^{-11} J.

True **a.** The mass defect of Z is twice that of X. True or False?

atom Z **b.** Which atom has the greater binding energy per nucleon?

atom Z **c.** Which atom is likely to be more stable to nuclear transmutations?

10. Identify the missing term in each of the following nuclear equations. Write the element's symbol, its atomic number, and its mass number.

$^{14}_{7}N$ **a.** $^{14}_{6}C \rightarrow {}^{0}_{-1}e +$ ____

$^{60}_{28}Ni$ **b.** $^{63}_{29}Cu + {}^{1}_{1}H \rightarrow$ ____ $+ {}^{4}_{2}He$

11. Write the equation that shows the equivalency of mass and energy.

$E = mc^2$

12. Consider the two nuclides $^{56}_{26}Fe$ and $^{14}_{6}C$.

a. Determine the number of protons in each nucleus.

Iron-56 has 26 protons; carbon-14 has 6 protons.

b. Determine the number of neutrons in each nucleus.

Iron-56 has 30 neutrons; carbon-14 has 8 neutrons.

c. Determine whether the $^{56}_{26}Fe$ nuclide is likely to be stable or unstable, based on its position in the band of stability shown in **Figure 2** on page 685 of the text.

Iron-56 is likely to be stable.

PROBLEM **Write the answer on the line to the left. Show all your work in the space provided.**

13. 0.172 46 amu Neon-20 is a stable isotope of neon. Its actual mass has been found to be 19.992 44 amu. Determine the mass defect in this nuclide.

Name _____ Date _____ Class _____

CHAPTER 21 REVIEW

Nuclear Chemistry

SECTION 2

SHORT ANSWER **Answer the following questions in the space provided.**

1. __a__ The nuclear equation $^{210}_{84}Po \rightarrow {}^{206}_{82}Pb + {}^{4}_{2}He$ is an example of an equation that represents
(a) alpha emission.
(b) beta emission.
(c) positron emission.
(d) electron capture.

2. __d__ When ${}^{a}_{b}Z$ undergoes electron capture to form a new element X, which of the following best represents the product formed?
(a) ${}^{a-1}_{b}X$
(b) ${}^{a+1}_{b}X$
(c) ${}^{a}_{b+1}X$
(d) ${}^{a}_{b-1}X$

3. __a__ Which of the following best represents the fraction of a radioactive sample that remains after four half-lives have occurred?
(a) $\left(\frac{1}{2}\right)^4$
(b) $\left(\frac{1}{2}\right) \times 4$
(c) $\left(\frac{1}{4}\right)$
(d) $\left(\frac{1}{4}\right)^2 \times 4$

4. Match the nuclear symbol on the right to the name of the corresponding particle on the left.

__c__ beta particle — **(a)** ${}^{1}_{1}p$
__a__ proton — **(b)** ${}^{4}_{2}He$
__d__ positron — **(c)** ${}^{0}_{-1}\beta$
__b__ alpha particle — **(d)** ${}^{0}_{+1}\beta$

5. Label each of the following statements as True or False. Consider the U-238 decay series on page 692 of the text. For the series of decays from U-234 to Po-218, each nuclide

False **a.** shares the same atomic number
True **b.** differs in mass number from others by multiples of 4
True **c.** has a unique atomic number
False **d.** differs in atomic number from others by multiples of 4

Name _____ Date _____ Class _____

SECTION 2 continued

6. $^{235}_{92}U$ Identify the missing term in the following nuclear equation. Write the element's symbol, its atomic number, and its mass number.

$$\_?\_ \rightarrow {}^{231}_{90}Th + {}^{4}_{2}He$$

7. Lead-210 undergoes beta emission. Write the nuclear equation showing this transmutation.

$^{210}_{82}Pb \rightarrow {}^{0}_{-1}\beta + {}^{210}_{83}Bi$

8. Einsteinium is a transuranium element. Einsteinium-247 can be prepared by bombarding uranium-238 with nitrogen-14 nuclei, releasing several neutrons, as shown by the following equation:

$$^{238}_{92}U + {}^{14}_{7}N \rightarrow {}^{247}_{99}Es + x\,{}^{1}_{0}n$$

What must be the value of x in the above equation? Explain your reasoning.

The value of x is 5. The total mass of the reactants is 252 amu, therefore the total mass of the products must be 252. Then 252 − 247 leaves 5 amu for neutrons at 1 amu each.

PROBLEMS **Write the answer on the line to the left. Show all your work in the space provided.**

9. 42.9 days Phosphorus-32 has a half-life of 14.3 days. How many days will it take for a sample of phosphorus-32 to decay to one-eighth its original amount?

10. 5.0 mg Iodine-131 has a half-life of 8.0 days. How many grams of an original 160 mg sample will remain after 40 days?

11. 0.24 mg Carbon-14 has a half-life of 5715 years. It is used to determine the age of ancient objects. If a sample today contains 0.060 mg of carbon-14, how much carbon-14 must have been present in the sample 11 430 years ago?

Name _____ Date _____ Class _____

CHAPTER 21 REVIEW

Nuclear Chemistry

SECTION 3

SHORT ANSWER **Answer the following questions in the space provided.**

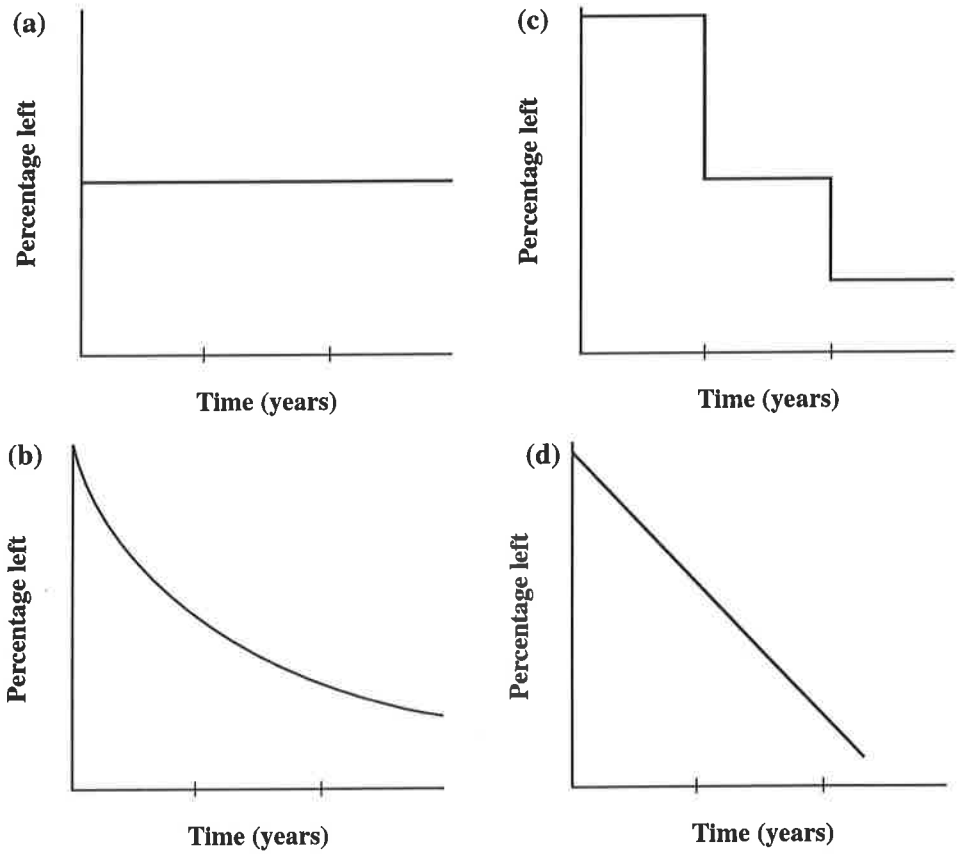
1. d The radioisotope cobalt-60 is used for all of the following applications *except*

(a) killing food-spoiling bacteria.
(b) preserving food.
(c) treating heart disease.
(d) treating certain kinds of cancers.

2. c All of the following contribute to background radiation exposure *except*

(a) radon in homes and buildings.
(b) cosmic rays passing through the atmosphere.
(c) consumption of irradiated foods.
(d) minerals in Earth's crust.

3. b Which one of the graphs shown below best illustrates the decay of a sample of carbon-14? Assume each division on the time axis represents 5715 years.



Name _____ Date _____ Class _____

SECTION 3 continued

4. Match the item on the left with its description on the right.

c	Geiger-Müller counter	(a) device that uses film to measure the approximate radiation exposure of people working with radiation
b	scintillation counter	(b) instrument that converts scintillating light to an electric signal for detecting radiation
a	film badge	(c) meter that detects radiation by counting electric pulses carried by gas ionized by radiation
d	radioactive tracers	(d) radioactive atoms that are incorporated into substances so that movement of the substances can be followed by detectors

5. Which type of radiation is easiest to shield? Why?

Alpha radiation penetrates the least and is most easily absorbed.

6. One technique for dating ancient rocks involves uranium-235, which has a half-life of 710 million years. Rocks originally rich in uranium-235 will contain small amounts of its decay series, including the nonradioactive lead-206. Explain the relationship between a sample's relative age and the ratio of lead-206 to uranium-235 in the sample.

The greater the ratio of lead-206 to uranium-235 in the sample, the older the rock sample is.

PROBLEMS **Write the answer on the line to the left. Show all your work in the space provided.**

7. **6.2 mg** The technetium-99 isotope, described in **Figure 13** on page 697 of the text, has a half-life of 6.0 h. If a 100. mg sample of technetium-99 were injected into a patient, how many milligrams would still be present after 24 h?

8. **3.5 units** A Geiger-Müller counter, used to detect radioactivity, registers 14 units when exposed to a radioactive isotope. What would the counter read, in units, if that same isotope is detected 60 days later? The half-life of the isotope is 30 days.

Name _____ Date _____ Class _____

CHAPTER 21 REVIEW

Nuclear Chemistry

SECTION 4

SHORT ANSWER **Answer the following questions in the space provided.**

1. Match each of the following statements with the process(es) to which they apply, using one of the choices below:

(1) fission only
(2) fusion only
(3) both fission and fusion
(4) neither fission nor fusion

__1__ **a.** A very large nucleus splits into smaller pieces.

__3__ **b.** The total mass before a reaction is greater than the mass after a reaction.

__1__ **c.** The rate of a reaction can be safely controlled for energy generation in suitable vessels.

__2__ **d.** Two small nuclei form a single larger one.

__3__ **e.** Less-stable nuclei are converted to more-stable nuclei.

2. Match the reaction type on the right to the statement(s) that applies to it on the left.

__a, c__ It requires very high temperatures. **(a)** uncontrolled fusion

__d__ It is used in nuclear reactors to make electricity. **(b)** uncontrolled fission

__a__ It occurs in the sun and other stars. **(c)** controlled fusion

__b__ It is used in atomic bombs. **(d)** controlled fission

3. Match the component of a nuclear power plant on the right to its use on the left.

__c__ limits the number of free neutrons **(a)** moderator

__a__ is used to slow down neutrons **(b)** fuel rod

__f__ drives an electric generator **(c)** control rod

__b__ provides neutrons by its fission **(d)** shielding

__e__ removes heat from the system safely **(e)** coolant

__d__ prevents escape of radiation **(f)** turbine

4. __b__ A chain reaction is any reaction in which

(a) excess reactant is present.
(b) the material that starts the reaction is also a product.
(c) the rate is slow.
(d) many steps are involved.

Name _____ Date _____ Class _____

SECTION 4 continued

5. As a star ages, does the ratio of He atoms to H atoms in its composition become larger, smaller, or remain constant? Explain your answer.

The ratio of He atoms to H atoms in a star's composition becomes larger. As a star ages, H atoms fuse into He atoms. A new star is almost 100% H, but the older the star becomes, the more of its H is converted into He.

6. The products of nuclear fission are variable; many possible nuclides can be created. In the feature "An Unexpected Finding," on page 702 of the text, it was noted that Meitner showed radioactive barium to be one product of fission. Following is an incomplete possible nuclear equation for the production of barium-141:

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{141}_{56}Ba + \underline{\ ?\ } + 4\,{}^{1}_{0}n + \text{energy}$$

$^{91}_{36}Kr$ **a.** Determine the missing fission product formed. Write the element's symbol, its atomic number, and its mass number.

Yes **b.** Is it likely that this isotope in part **a** is unstable? (Refer to **Figure 2** on page 685 of the text.)

7. Small nuclides can undergo fusion.

$^{10}_{4}Be$ **a.** Complete the following nuclear equation by identifying the missing term. Write the element's symbol, its atomic number, and its mass number.

$$^{3}_{1}H + {}^{7}_{3}Li \rightarrow \underline{\ ?\ } + \text{energy}$$

b. When measured exactly, the total mass of the reactants does not add up to that of the products in the reaction represented in part **a**. Why is there a difference between the mass of the products and the mass of the reactants? Which has the greater mass, the reactants or the products?

During the reaction, some of the mass is converted into energy. The mass of the reactants is greater than the mass of the products.

8. What are some current concerns regarding development of nuclear power plants?

Current concerns include environmental requirements, safety of the operation, plant construction costs, and storage of spent fuel.

Name _____ Date _____ Class _____

CHAPTER 21 REVIEW

Nuclear Chemistry

MIXED REVIEW

SHORT ANSWER **Answer the following questions in the space provided.**

1. The ancient alchemists dreamed of being able to turn lead into gold. By using lead-206 as the target atom of a powerful accelerator, modern chemists can attain that dream in principle. Write the nuclear equation for a one-step process that will convert $^{206}_{82}Pb$ into a nuclide of gold-79. You may use alpha particles, beta particles, positrons, or protons.

$^{206}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{4}_{2}He + {}^{202}_{79}Au$

2. A typical fission reaction releases 2×10^{10} kJ/mol of uranium-235, while a typical fusion reaction produces 6×10^{8} kJ/mol of hydrogen-1. Which process produces more energy from 235 g of starting material? Explain your answer.

Fusion produces more energy per gram of starting material. For uranium-235, 235 g = 1.0 mol, and this releases 2×10^{10} J of energy in a fission reaction. For hydrogen-1, 235 g = 235 mol, and this releases 235(6×10^{8} J) or 1.4×10^{11} J of energy in a fusion reaction. This is seven times more energy than from fission of uranium-235.

3. Write the nuclear equations for the following reactions:

a. Carbon-12 combines with hydrogen-1 to form nitrogen-13.

$^{12}_{6}C + {}^{1}_{1}H \rightarrow {}^{13}_{7}N$

b. Curium-246 combines with carbon-12 to form nobelium-254 and four neutrons.

$^{246}_{96}Cm + {}^{12}_{6}C \rightarrow {}^{254}_{102}No + 4{}^{1}_{0}n$

c. Hydrogen-2 combines with hydrogen-3 to form helium-4 and a neutron.

$^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n$

4. Write the complete nuclear equations for the following reactions:

a. $^{91}_{42}Mo$ undergoes positron emission.

$^{91}_{42}Mo \rightarrow {}^{91}_{41}Nb + {}^{0}_{+1}\beta$

b. $^{6}_{2}He$ undergoes beta decay.

$^{6}_{2}He \rightarrow {}^{6}_{3}Li + {}^{0}_{-1}\beta$

c. $^{194}_{84}Po$ undergoes alpha decay.

$^{194}_{84}Po \rightarrow {}^{190}_{82}Pb + {}^{4}_{2}He$

Name _____ Date _____ Class _____

MIXED REVIEW continued

d. $^{129}_{55}Cs$ undergoes electron capture.

$^{129}_{55}Cs + {}^{0}_{-1}e \rightarrow {}^{129}_{54}Xe$

PROBLEMS Write the answer on the line to the left. Show all your work in the space provided.

5. 2.2×10^{-12} J It was shown in **Section 1** of the text that a mass defect of 0.030 377 amu corresponds to a binding energy of 4.54×10^{-12} J. What binding energy would a mass defect of 0.015 amu yield?

6. 24 days Iodine-131 has a half-life of 8.0 days; it is used in medical treatments for thyroid conditions. Determine how many days must elapse for a 0.80 mg sample of iodine-131 in the thyroid to decay to 0.10 mg.

7. Following is an incomplete nuclear fission equation:

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{90}_{38}Sr + {}^{141}_{54}Xe + x\,{}^{1}_{0}n + \text{energy}$$

5 **a.** Determine the value of x in the above equation.

1/8 **b.** The strontium-90 produced in the above reaction has a half-life of 28 years. What fraction of strontium-90 still remains in the environment 84 years after it was produced in the reactor?