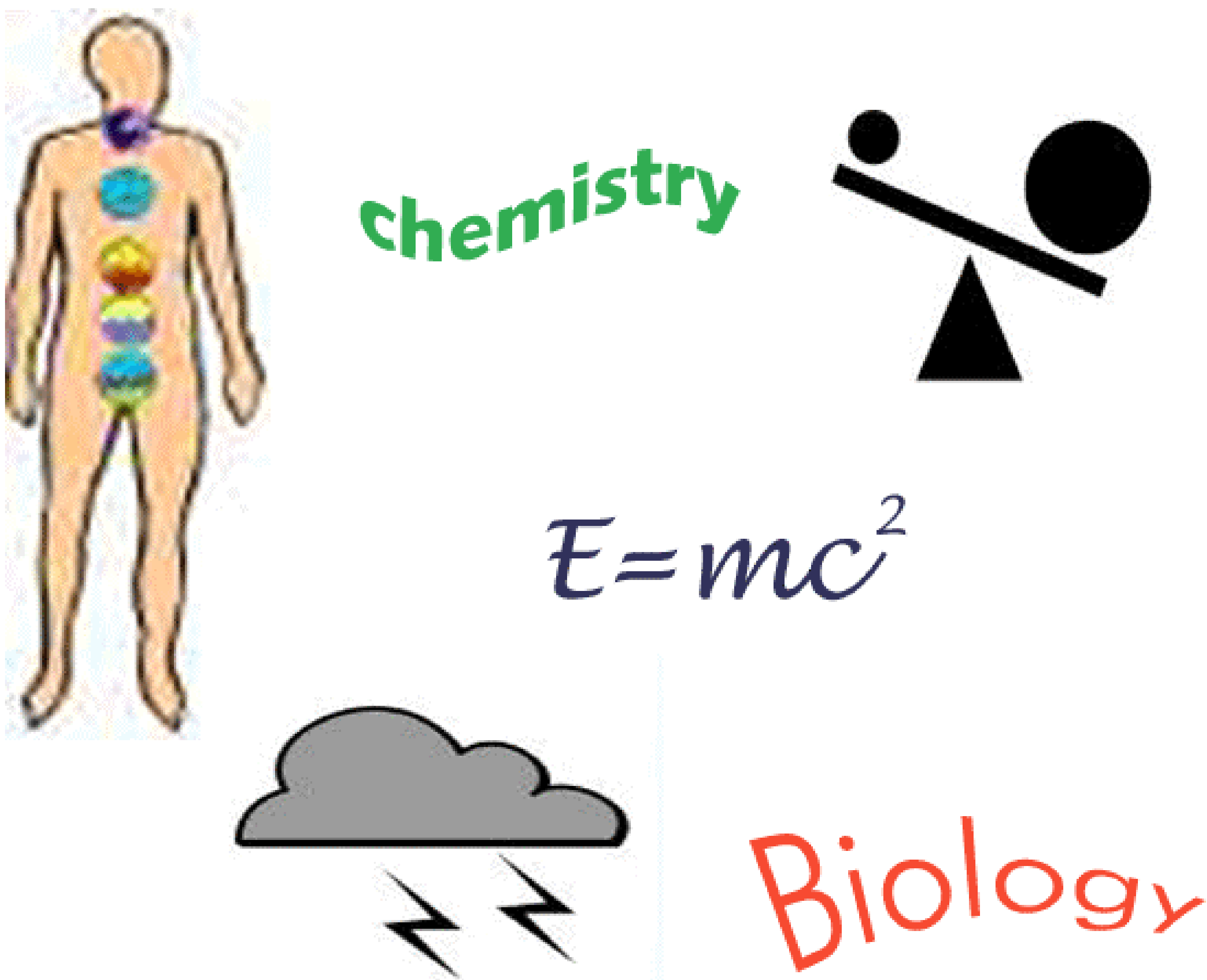
Teacher Workbooks

Science and Nature Series



Atomic Structure, Electron Configuration, Classifying Matter and Nuclear Chemistry, Vol. 1

Teachnology Publishing Company

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Classifying Matter and Nuclear Chemistry, Vol. 1

Teachnology Publishing Company
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Atomic Structure

An atom is composed of protons, neutrons, and electrons. The protons and neutrons are found in the nucleus of the atom. The electrons are found in the electron cloud, which is an area that surrounds the nucleus.

A standard periodic table of elements can provide you with a great deal of insight into the composition of an atom. The atomic number is equal to the number of protons. The mass number is equal to the number of protons and neutrons. In a neutral atom, the number of protons and electrons are equal. When an atom is in a charged state (ion), the charge indicates the imbalance between protons and electrons. Too many electrons produces a negative charge, too few electrons results in a positive charge.

Example:

O^{-2}	Explanation:
Mass Number= 16 Atomic Number = 8 8 protons, 8 neutrons (16-8), 10 electrons (8+2)	Protons = Atomic Number Neutrons = Mass Number – Atomic Number Electrons = Charge (+/-) Proton Number.

Complete the following chart.

Element or Ion	Atomic Number	Mass Number	# of Protons	# of Neutrons	# of Electrons
Li		7			
Ba^{+2}		137			
Al^{+3}		27			
F-		19			
Br		80			
Ru^{+3}		101			
Cr^{+2}		52			
S^{-2}		32			
Si		28			
C		12			
P^{-3}		31			

Name ______________________ Date _______________________

Atomic Structure Practice Sheet 1

1. How many protons and neutrons are present is an atom of calcium (Mass # = 40)?

Protons = ________

Neutrons = ________

2. How many protons and neutrons are present is an atom of krypton (Mass # = 84)?

Protons = ________

Neutrons = ________

3. How many protons and neutrons are present is an atom of tin (Mass # = 119)?

Protons = ________

Neutrons = ________

4. How many protons and neutrons are present is an atom of tungsten(Mass # = 184)?

Protons = ________

Neutrons = ________

5. How many protons and neutrons are present is an atom of titanium (Mass # = 48)?

Protons = ________

Neutrons = ________

6. What is the name, symbol, and charge of an ion that contains 12 protons and 10 electrons?

Name = ________________

Symbol = ________

Charge = ________

7. What is the name, symbol, and charge of an ion that contains 15 protons and 18 electrons?

Name = ________________

Symbol = ________

Charge = ________

8. What is the mass number, symbol, and charge of an ion that contains 35 protons, 45 neutrons and 36 electrons?

Mass Number = ________________

Symbol = ________

Charge = ________

9. What is the mass number, symbol, and charge of an atom that contains 19 protons, 20 neutrons and 19 electrons?

Mass Number = ________________

Symbol = ________

Charge = ________

10. What is the mass number, symbol, and charge of an ion that contains 87 protons, 136 neutrons and 86 electrons?

Mass Number = ________________

Symbol = ________

Charge = ________

Name ______________________ Date ______________________

Atomic Structure Practice Sheet 2

1. Write the complete chemical symbol for the ion with 37 protons and 36 electrons.

____

2. How many protons, neutrons, and electrons are present in the $^{93}Nb^{+3}$ ion?

Protons = _____

Neutrons = _____

Electrons = _____

3. How many protons, neutrons, and electrons are present in the $^{141}Ce^{+4}$ ion?

Protons = _____

Neutrons = _____

Electrons = _____

4. How many protons, neutrons, and electrons are present in the $^{128}Te^{-2}$ ion?

Protons = _____

Neutrons = _____

Electrons = _____

5. How many protons, neutrons, and electrons are present in the $^{73}Ge^{-4}$ ion?

Protons = _____

Neutrons = _____

Electrons = _____

6. Write the complete chemical symbol for the ion with 82 protons and 80 electrons.

____

7. What is the atomic mass of and element that has 37 protons, 43 neutrons, and 36 electrons?

____

8. Write the complete chemical symbol for the ion with 73 protons, 108 neutrons, and 68 electrons.

____

9. Write the complete chemical symbol for the ion with 75 protons, 111 neutrons, and 71 electrons.

____

10. Write the complete chemical symbol for the ion with 26 protons, 29 neutrons, and 24 electrons.

____

Name ________________________ Date _________________________

Atomic Structure Quiz

Version A

Element Name	Symbol	Atomic #	Mass #	# Protons	# Neutrons	# Electrons	Charge
Potassium					20	18	
	F		19				-1
				6	6	6	

Version B

Element Name	Symbol	Atomic #	Mass #	# Protons	# Neutrons	# Electrons	Charge
Barium					81	54	
	O		15				-2
				17	18	18	

Version C

Element Name	Symbol	Atomic #	Mass #	# Protons	# Neutrons	# Electrons	Charge
Sodium					12	11	
	Si		28				0
				13	14	13	

Name ______________________ Date _______________________

Electron Configuration

Electrons are found in the electron cloud that surrounds the nucleus of an atom. The electron cloud is separated into principal energy level (1,2,3,…), sublevels (s, p, d, f). In an electron configuration, the electrons of an atom are described by identifying the energy level of each electron and its sublevel.

The complete electron configuration of an atom is shown by writing symbols for all of the occupied sublevels in sequence, starting from the lowest energy level.

Example: Electron Configuration for Magnesium
Mg = $1s^2\ 2s^2\ 2p^6\ 3s^2$

Write the complete electron configuration for each of the following elements.

1. Lithium
2. Oxygen
3. Neon
4. Carbon
5. Chlorine
6. Calcium
7. Aluminum
8. Phosphorus
9. Sulfur
10. Hydrogen

Name ______________________ Date ______________________

Electron Configuration Practice Sheet 1

Identify the element that corresponds to each of the following electron configurations?

Electron Configuration	Element Name	Element Symbol
1. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$		
2. $1s^2\ 2s^1$		
3. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$		
4. $1s^2$		
5. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$		
6. $1s^2\ 2s^2\ 2p^5$		
7. $1s^2\ 2s^2$		
8. $1s^2\ 2s^2\ 2p^3$		
9. $1s^2\ 2s^2\ 2p^6$		
10. $1s^2\ 2s^2\ 2p^6\ 3s^2$		
11. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$		
12. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$		
13. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$		

Name ______________________ Date ______________________

Electron Orbital Diagrams

Electrons are distributed in the electron cloud into principal energy levels (1, 2, 3, 4, 5, …), sub levels (s, p, d, f), orbital (s has 1, p has 3, d has 5, and f has 7), and spin (2 electrons per orbital).

Example: Draw an orbital diagram for Mg

Step 1. Draw the electron configuration: $1s^2$ $2s^2$ $2p^6$ $3s^2$

Step 2. Draw orbital based on sublevels: ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓

Draw orbital diagrams for the following atoms:

1. F
2. K
3. B
4. S
5. Cl
6. Al
7. P
8. Ne

Name ______________________ Date ______________________

Electron Configuration Review Sheet

Directions: For each atom complete the information requested.

1. F (Mass # = 19) Number of protons = ________ Number of electrons = ________ Number of neutrons = ________ Electron Configuration: ______________________________ Orbital Diagram: ☐ ☐ ☐ ☐ ☐	2. Be (Mass # = 9) Number of protons = ________ Number of electrons = ________ Number of neutrons = ________ Electron Configuration: ______________________________ Orbital Diagram: ☐ ☐
3. N (Mass # = 14) Number of protons = ________ Number of electrons = ________ Number of neutrons = ________ Electron Configuration: ______________________________ Orbital Diagram: ☐ ☐ ☐ ☐ ☐	4. Mg (Mass # = 24) Number of protons = ________ Number of electrons = ________ Number of neutrons = ________ Electron Configuration: ______________________________ Orbital Diagram: ☐ ☐ ☐ ☐ ☐ ☐
5. Na (Mass # = 23) Number of protons = ________ Number of electrons = ________ Number of neutrons = ________ Electron Configuration: ______________________________ Orbital Diagram: ☐ ☐ ☐ ☐ ☐ ☐	6. O (Mass # = 16) Number of protons = ________ Number of electrons = ________ Number of neutrons = ________ Electron Configuration: ______________________________ Orbital Diagram: ☐ ☐ ☐ ☐ ☐

Name ______________________ Date _______________________

Valence Electrons

The electrons found in the outer most energy level of an atom are collectively referred to as **valence electrons.**

Example: Oxygen

Electron configuration = $1s^2$ **$2s^2$ $2p^4$**

Therefore, Oxygen has 6 valence electrons.

Determine the number of valence electrons in the following atoms:

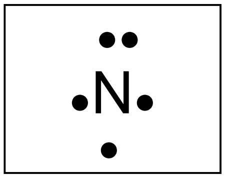
1. Phosphorus
2. Carbon
3. Neon
4. Silicon
5. Chlorine
6. Nitrogen
7. Helium
8. Potassium
9. Sulfur
10. Helium
11. Hydrogen
12. Boron
13. Lithium
14. Magnesium
15. Aluminum
16. Argon
17. Calcium
18. Beryllium

Name ________________________ Date _________________________

Lewis Dot Diagrams

Lewis Dot Diagrams are used to indicate the number of valence electrons for an atom.

Example: Nitrogen



Electron configuration = $1s^2$ $\boxed{2s^2\ \mathbf{2p^3}}$

Therefore, Nitrogen has 5 valence electrons.

Draw Lewis dot diagrams for the following atoms.

1. Oxygen	6. Potassium
2. Phosphorus	7. Beryllium
3. Helium	8. Hydrogen
4. Carbon	9. Aluminum
5. Magnesium	10. Boron

Name ______________________ Date _______________________

Electron Configuration Review

Directions For 1-7: Given the element Sulfur (Atomic Number 16, Mass Number 32), please provide all the following information for this element.

1. Number of Protons ________________________

2. Number of Neutrons ________________________

3. Number of Electrons ________________________

4. Write the electron configuration __________________________

5. Draw the orbital diagram:

6. Number of valence electrons ________

7. Draw the Lewis dot diagram:

S

Directions For 8-14: Given the element Magnesium (Atomic Number 12, Mass Number 24), please provide all the following information for this element.

8. Number of Protons ________________________

9. Number of Neutrons ________________________

10. Number of Electrons ________________________

11. Write the electron configuration __________________________

12. Draw the orbital diagram:

13. Number of valence electrons ________

14. Draw the Lewis dot diagram:

Mg

Name ________________________ Date _________________________

Electron Configuration Quiz: Form A

Directions: For identified element identify the ground state electron configuration, orbital diagram, Lewis dot diagram, and number of valence.

1. F- Fluorine

Ground State Electron Configuration: ____

Orbital Diagram:

Lewis Dot:

F

# of Valence Electrons: ______

Name ________________________ Date _________________________

Electron Configuration Quiz: Form B

Directions: For identified element identify the ground state electron configuration, orbital diagram, Lewis dot diagram, and number of valence.

1. Na- Sodium

Ground State Electron Configuration: ____

Orbital Diagram:

Lewis Dot:

Na

# of Valence Electrons: ______

Name ______________________ Date ______________________

Identifying Compounds, Elements, Mixtures through Common Names

Elements are substances that cannot be broken into simpler substances by chemical means. **Compounds** are composed of two or more elements that are chemically combined in definite proportions by mass. **Mixtures** are combinations of two or more substances that can be separated by physical means.

Directions: Place a check in the correct box to indicate the classification of each form of matter.

	Element	Compound	Mixture
Soil			
Water			
Sodium			
Ice			
Glucose			
Antimony			
Carbon Dioxide			
Air			
Oxygen			
Table Salt			
Salt and Pepper			
Krypton			
Cola			
Gallium			
Yttrium			
Oil and Water			
Zirconium			

Name ______________________ Date ______________________

Identifying Compounds, Elements, Mixtures through Chemical Symbols

Elements are substances that cannot be broken into simpler substances by chemical means. **Compounds** are composed of two or more elements that are chemically combined in definite proportions by mass. **Mixtures** are combinations of two or more substances that can be separated by physical means.

Directions: Place a check in the correct box to indicate the classification of each form of matter.

	Element	**Compound**	**Mixture**
Cu			
H_2O			
$C_6H_{12}O_6$			
$NH_3 + H_2O$			
B			
$CO + CO_2$			
Carbon Dioxide			
Air			
Oxygen			
Table Salt			
Salt and Pepper			

Name ________________________ Date _________________________

Nuclear Chemistry: Identifying Forms of Radiation

Nuclear reactions are quite different than chemical reactions in that they involve a change inside the nucleus rather than an exchange or sharing of electrons. An unstable nucleus decays into a products that are more stable. When an unstable nucleus decays, it releases radiation in the form of alpha particles, beta particles, and/or positrons.

Alpha Decay:	$^{239}_{94}Pu \longrightarrow ^{235}_{92}U + ^{4}_{2}He$
Beta Decay:	$^{60}_{27}Co \longrightarrow ^{60}_{28}Ni + ^{0}_{-1}\beta$
Positron Emission:	$^{37}_{20}Ca \longrightarrow ^{37}_{19}K + ^{0}_{+1}\beta$

Directions: Place a check to identify the form of radiation demonstrated by each reaction below.

	Alpha	Beta	Positron
1. $^{234}_{91}Pa \longrightarrow ^{234}_{92}U + ^{0}_{-1}\beta$			
2. $^{222}_{86}Rn \longrightarrow ^{218}_{84}Po + ^{4}_{2}He$			
3. $^{37}_{19}K \longrightarrow ^{37}_{18}Ar + ^{0}_{+1}\beta$			
4. $^{99}_{43}Tc \longrightarrow ^{99}_{44}Ru + ^{0}_{-1}\beta$			
5. $^{19}_{10}Ne \longrightarrow ^{19}_{9}F + ^{0}_{+1}\beta$			
6. $^{32}_{15}P \longrightarrow ^{32}_{16}S + ^{0}_{-1}\beta$			
7. $^{238}_{92}U \longrightarrow ^{234}_{90}Th + ^{4}_{2}He$			
8. $^{53}_{26}Fe \longrightarrow ^{53}_{25}Mn + ^{0}_{+1}\beta$			
9. $^{220}_{87}Fr \longrightarrow ^{216}_{85}At + ^{4}_{2}He$			

Name ______________________ Date ______________________

Nuclear Chemistry: Predicting Nuclear Decay Part 1

Directions: Predict the products of the following nuclear reactions.

1. $^{235}U \longrightarrow {}^{231}Th$ + ____________

2. $^{6}_{3}Li + {}^{1}_{0}n \longrightarrow {}^{4}_{2}He$ + ____________

3. $^{14}_{6}C \longrightarrow {}^{14}_{7}N$ + ____________

4. $^{226}Ra \longrightarrow {}^{222}Rn$ + ____________

5. $^{32}P + {}^{0}_{-1}e \longrightarrow$ ____________

6. $^{220}_{87}Fr + {}^{4}_{2}He \longrightarrow$ ____________

7. $^{198}Au \longrightarrow {}^{198}Hg$ + ____________

8. $^{14}_{7}N + {}^{4}_{2}He \longrightarrow {}^{1}_{1}H$ + ____________

Name ______________________ Date ______________________

Nuclear Chemistry: Predicting Nuclear Decay Part 2

Directions: Predict the reactants of the following nuclear reactions.

1. ____________ $\longrightarrow$ $^{231}\mathrm{Th}$ + $^{4}_{2}\mathrm{He}$

2. ____________ $\longrightarrow$ $^{0}_{-1}\mathrm{e}$ + $^{131}_{54}\mathrm{Xe}$

3. ____________ + $^{4}_{2}\mathrm{He}$ $\longrightarrow$ $^{241}\mathrm{Pu}$ + $^{1}_{0}\mathrm{n}$

4. ____________ $\longrightarrow$ $^{0}_{-1}\mathrm{e}$ + $^{10}_{5}\mathrm{B}$

5. $^{7}\mathrm{Li}$ + ____________ $\longrightarrow$ $^{8}_{4}\mathrm{Be}$

6. $^{235}\mathrm{U}$ + ____________ $\longrightarrow$ $^{72}\mathrm{Zn}$ + $4\,^{1}_{0}\mathrm{n}$ + $^{160}_{62}\mathrm{Sm}$

7. ____________ $\longrightarrow$ $^{0}_{-1}\mathrm{e}$ + $^{3}\mathrm{He}$

8. ____________ $\longrightarrow$ $^{216}_{85}\mathrm{At}$ + $^{4}_{2}\mathrm{He}$

Name ______________________ Date ______________________

Nuclear Chemistry: Half-life

Radioactive substances decay at a constant rate. There are a number of unstable nuclei that decay in a given time. The time that it takes for half of the atoms in a given sample of an element to decay is termed the half-life.

To determine half-life:	To determine how much of an unstable remains after a given time:
Half-life = $\frac{\text{total time elapsed}}{\text{half-life}}$	Fraction remaining= $(1/2)^{\text{Half-life}}$

Data Table 1: Known Half-life of selected elements:

^{198}Au: 2.69 days	^{131}I: 8.07 days	^{42}K: 12.4 hours
^{32}P: 14.3 days	^{90}Sr: 28.1 years	^{53}Fe: 8.51 minutes

1. Predict the mass of a 75.00 g sample of ^{198}**Au** after 16.14 years.

2. How many days are required for ^{32}**P** to undergo 6 half-lives?

3. Predict the mass of a 125.00 g sample of ^{42}**K** after 62.0 years.

4. Of all of the elements listed above, which element decays the fastest? Predict the mass of a 107g sample of this element after 34.04 minutes.

5. If a 120 g sample of a radioactive element decays to 15 g in 40 minutes, what is the element's half-life?

Name ______________________ Date ______________________

Nuclear Chemistry Review Quiz: Form A

Directions (Questions 1 and 2): For questions 1 and 2 predict the missing reactant or product and identify the form of radiation demonstrated in each problem.

1. $^{198}\text{Au} \longrightarrow {}^{198}\text{Hg} + \_\_\_\_\_\_\_\_\_\_\_\_$

Form of radiation: ____________________

2. $^{238}\text{U} + \_\_\_\_\_\_\_\_\_\_\_\_ \longrightarrow {}^{241}\text{Pu} + {}^{1}_{0}\text{n}$

Form of radiation: ____________________

3. Predict the mass of a 135 gram sample ^{85}Kr after 32.28 years.

^{85}Kr **Half-life = 10.76 years**

Nuclear Chemistry Review Quiz: Form B

Directions (Questions 1 and 2): For questions 1 and 2 predict the missing reactant or product and identify the form of radiation demonstrated in each problem.

1. $^{14}_{6}\text{C} \longrightarrow {}^{14}_{7}\text{N} + \_\_\_\_\_\_\_\_\_\_\_\_$

Form of radiation: ____________________

2. $\_\_\_\_\_\_\_\_\_\_\_\_ \longrightarrow {}^{0}_{-1}\text{e} + {}^{3}\text{He}$

Form of radiation: ____________________

3. Predict the mass of a 155 gram sample ^{32}P after 28.6 days.

^{32}P **Half-life = 14.3 days**

Name ______________________ Date _______________________

Unit Test: Form A

Final Score: _____

Part A.

1. For an **atom** of the element **Argon** indicate the following information:

A. Chemical Symbol _________ B. Atomic Number _________

C. Mass Number 40 D. Number of protons _________

E. Number of neutrons _________ F. Number of electrons _________

2. For an **ion** of **Magnesium** (charge = +2) indicate the following information:

A. Chemical Symbol _________ B. Atomic Number _________

C. Mass Number 24 D. Number of protons _________

E. Number of neutrons _________ F. Number of electrons _________

3. For an **ion** of **Sulfur** (charge = -2) indicate the following information:

A. Chemical Symbol _________ B. Atomic Number _________

C. Mass Number 32 D. Number of protons _________

E. Number of neutrons _________ F. Number of electrons _________

4. Identify the element that corresponds to each of the following ground state electron configurations.

A. $1s^2\ 2s^2\ 2p^6\ 3s^1$ _________________

B. $1s^2\ 2s^2\ 2p^4$ _________________

C. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$ _________________

D. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$ _________________

Scoring Part A: ____ correct out of _______ Total Score: ______

Name ______________________ Date _______________________

Part B.

5. For an atom of each element below write the electron configuration, orbital diagram, total number of valence electrons, and Lewis dot structure.

A. Silicon

Electron configuration: ____

Orbital Diagram:

Total number of valence electrons: _____

Lewis dot structure:

Si

B. Oxygen

Electron configuration: ____

Orbital Diagram:

Total number of valence electrons: _____

Lewis dot structure:

O

Scoring Part B: ____ correct out of _______ Total Score: ______

Name ________________________ Date ________________________

Part C.

6. Indicate if the item presented is an element, compound, or mixture.

A. Water ______________________

B. Air ______________________

C. Gold ______________________

D. Soil ______________________

E. Neon ______________________

7. Predict the reactants or products of each of the following nuclear reactions.

A. $^{27}_{13}\text{Li} + ^{4}_{2}\text{He} \longrightarrow ^{1}_{0}\text{n} +$ ______________

B. ______________ $\longrightarrow ^{0}_{-1}\text{e} + ^{42}_{20}\text{K}$

C. $^{234}\text{Th} \longrightarrow ^{234}\text{Pa} +$ ______________

D. ______________ $\longrightarrow ^{0}_{+1}\text{e} + ^{20}_{9}\text{Ne}$

E. $^{9}_{4}\text{Be} +$ ______________ $\longrightarrow ^{12}_{6}\text{C} + ^{1}_{0}\text{n}$

Scoring Part C: ____ correct out of _______ Total Score: ______

Name ______________________ Date _______________________

Part D.

8. Half-life

A. ^{3}**H** has a half-life of 12.26 years. A sample was allowed to decay for 49.04 years. What fraction of the original sample will remain?

B. A 75 gram sample of a radioisotope decayed to 9.375 grams in 66 years. What is the half-life?

C. A radioisotope has a half-life of 30 days. 1 gram remains after 90 days. What was the initial mass of the radioisotope?

Scoring Part D: ____ correct out of _______ Total Score: ______

Name ______________________ Date ______________________

Unit Test: Form B

Final Score: _____

Part A.

1. For an **atom** of the element **Calcium** indicate the following information:

A. Chemical Symbol _________ B. Atomic Number _________

C. Mass Number 40 D. Number of protons _________

E. Number of neutrons _________ F. Number of electrons _________

2. For an **ion** of **Sodium** (charge = +1) indicate the following information:

A. Chemical Symbol _________ B. Atomic Number _________

C. Mass Number 23 D. Number of protons _________

E. Number of neutrons _________ F. Number of electrons _________

3. For an **ion** of **Fluorine** (charge = -1) indicate the following information:

A. Chemical Symbol _________ B. Atomic Number _________

C. Mass Number 19 D. Number of protons _________

E. Number of neutrons _________ F. Number of electrons _________

4. Identify the element that corresponds to each of the following electron configurations.

A. $1s^2\ 2s^2\ 2p^6$ _________________

B. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$ _________________

C. $1s^2\ 2s^1$ _________________

D. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$ _________________

Name ______________________ Date _______________________

Part B.

Scoring Part A: ____ correct out of _______ Total Score: ______

diagram, total number of valence electrons, and Lewis dot structure.

A. Phosphorus

Electron configuration: ____

Orbital Diagram:

Total number of valence electrons: _____

Lewis dot structure:

P

B. Magnesium

Electron configuration: ____

Orbital Diagram:

Total number of valence electrons: _____

Lewis dot structure:

Mg

Scoring Part B: ____ correct out of _______ Total Score: ______

Name ________________________ Date _________________________

Part C.

6. Indicate if the item presented is an element, compound, or mixture.

A. Tungsten ______________________

B. Table Salt ______________________

C. Soil ______________________

D. Phosphorus ______________________

E. Oil and Water ______________________

7. Predict the reactants or products of each of the following nuclear reactions.

A. $^{220}Fr \longrightarrow {}^{216}At$ + ______________

B. ______________ $\longrightarrow {}^{0}_{-1}e + {}^{99}_{44}Ru$

C. $^{222}Rn \longrightarrow {}^{218}Po$ + ______________

D. ______________ $\longrightarrow {}^{0}_{+1}e + {}^{37}_{19}K$

E. $^{27}_{13}Li + {}^{4}_{2}He \longrightarrow {}^{1}_{0}n$ + ______________

Scoring Part C: ____ correct out of _______ Total Score: ______

Name ______________________ Date _______________________

Part D.

8. Half-life

A. ^{53}**Fe** has a half-life of 8.51 minutes. A sample was allowed to decay for 42.55 minutes. What fraction of the original sample will remain?

B. A 120 gram sample of a radioisotope decayed to 7.5 grams in 60 years. What is the half-life?

C. A radioisotope has a half-life of 13 days. 3 grams remain after 52 days. What was the initial mass of the radioisotope?

Scoring Part D: ____ correct out of _______ Total Score: ______

Name ______________________ Date ______________________

Answers

Page 1.

Element or Ion	Atomic Number	Mass Number	# of Protons	# of Neutrons	# of Electrons
Li	3	7	3	4	3
Ba^{+2}	56	137	56	81	54
Al^{+3}	13	27	13	14	10
F-	9	19	9	10	10
Br	35	80	35	45	35
Ru^{+3}	44	101	44	57	41
Cr^{+2}	24	52	24	28	22
S^{-2}	16	32	16	16	18
Si	14	28	14	14	14
C	6	12	6	6	6
P^{-3}	15	31	15	16	18

Page 2.

1. Protons = 20, Neutrons = 20
2. Protons = 36, Neutrons = 48
3. Protons = 50, Neutrons = 69
4. Protons = 74, Neutrons = 110
5. Protons = 22, Neutrons = 26
6. Name = Magnesium, Symbol = Mg or Mg^{+2}, Charge = +2
7. Name = Phosphorus, Symbol = P or P^{-3}, Charge = -3
8. Mass Number = 80, Symbol = Br or Br^{-1}, Charge = -1
9. Mass Number = 39, Symbol = K or K^{0}, Charge = 0
10. Mass Number = 223, Symbol = Fr or Fr^{+1}, Charge = +1

Page 3.

1. ${}_{37}Rb^{+1}$
2. Protons = 41, Neutrons = 52, Electrons = 38
3. Protons = 58, Neutrons = 83, Electrons = 54
4. Protons = 52, Neutrons = 76, Electrons = 50
5. Protons = 32, Neutrons = 41, Electrons = 36
6. ${}_{82}Pb^{+2}$
7. ${}^{80}_{37}Rb^{+1}$
8. ${}^{181}_{73}Ta^{+5}$
9. ${}^{186}_{75}Re^{+4}$
10. ${}^{55}_{26}Fe^{+2}$

Name ______________________ Date ______________________

Page 4.

Version A

Element Name	Symbol	Atomic #	Mass #	# Protons	# Neutrons	# Electrons	Charge
Potassium	K	19	39	19	20	18	+1
Fluorine	F	9	19	9	10	10	-1
Carbon	C	6	12	6	6	6	0

Version B

Element Name	Symbol	Atomic #	Mass #	# Protons	# Neutrons	# Electrons	Charge
Barium	Ba	56	137	56	81	54	+2
Oxygen	O	8	15	8	7	10	-2
Chlorine	Cl	17	35	17	18	18	-1

Version C

Element Name	Symbol	Atomic #	Mass #	# Protons	# Neutrons	# Electrons	Charge
Sodium	Na	11	23	11	12	11	0
Silicon	Si	14	28	14	14	14	0
Aluminum	Al	13	27	13	14	13	0

Page 5.

1. $1s^2\ 2s^1$
2. $1s^2\ 2s^2\ 2p^4$
3. $1s^2\ 2s^2\ 2p^6$
4. $1s^2\ 2s^2\ 2p^2$
5. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
6. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$
7. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$
8. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$
9. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$
10. $1s^1$

Name ________________________ Date _________________________

Page 6.

1. Phosphorus, P
2. Lithium, Li
3. Argon, Ar
4. Helium, He
5. Potassium, K
6. Fluorine, F
7. Beryllium, Be
8. Nitrogen, N
9. Neon, Ne
10. Magnesium, Mg
11. Calcium, Ca
12. Aluminum, Al
13. Sulfur, S

Page 7.

1. $1s^2\ 2s^2\ 2p^5$

↑↓ ↑↓ ↑↓ ↑↓ ↑_

2. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$

↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑_

3. $1s^2\ 2s^2\ 2p^1$

↑↓ ↑↓ ↑_ __ __

4. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑_ ↑_

5. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑_

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

↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑_ __ __

7. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑_ ↑_ ↑_

8. $1s^2\ 2s^2\ 2p^6$

↑↓ ↑↓ ↑↓ ↑↓ ↑↓

Name ______________________ Date ______________________

Page 8.

1. P = 9, E = 9, N = 10, Elec. Config.= $1s^2\ 2s^2\ 2p^5$

Orbital Diagram: ↑↓ ↑↓ ↑↓ ↑↓ ↑_

2. P = 4, E = 4, N = 9, Elec. Config.= $1s^2\ 2s^2$

Orbital Diagram: ↑↓ ↑↓

3. P = 7, E = 7, N = 7, Elec. Config.= $1s^2\ 2s^2\ 2p^3$

Orbital Diagram: ↑↓ ↑↓ ↑_ ↑_ ↑_

4. P = 12, E = 12, N = 12, Elec. Config.= $1s^2\ 2s^2\ 2p^6\ 3s^2$

Orbital Diagram: ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓

5. P = 11, E = 11, N = 12, Elec. Config.= $1s^2\ 2s^2\ 2p^6\ 3s^1$

Orbital Diagram: ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑_

6. P = 8, E = 8, N = 8, Elec. Config.= $1s^2\ 2s^2\ 2p^4$

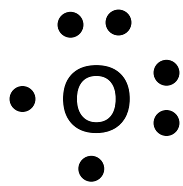
Orbital Diagram: ↑↓ ↑↓ ↑↓ ↑_ ↑_

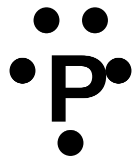
Page 9.

1. 5
2. 4
3. 8
4. 4
5. 7
6. 5
7. 2
8. 1
9. 6
10. 2
11. 1
12. 3
13. 1
14. 2
15. 3
16. 8
17. 2
18. 2

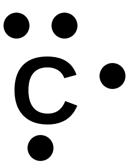
Name ______________________ Date ______________________

Page 11.

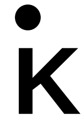
1. 

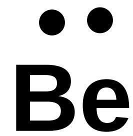
2. 

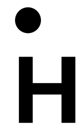
3. 

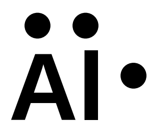
4. 

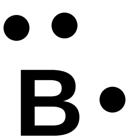
5. 

6. 

7. 

8. 

9. 

10. 

Page 12.

1. 16
2. 16
3. 16
4. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$
5. ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑_ ↑_
6. 6
7.
```
 ..
. S :
 .
```

8. 12
9. 12
10. 12
11. $1s^2\ 2s^2\ 2p^6\ 3s^2$
5. ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑_
6. 2
7.
```
 ..
Mg
```

Name ________________________ Date ________________________

Page 13.

Form A

1. $1s^2 2s^2 2p^5$
2. ↑↓ ↑↓ ↑↓ ↑↓ ↑
3.

..
. F :
..

4. 7

Form B

1. $1s^2 2s^2 2p^6 3s^1$
2. ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑
3.

.
Na

4. 1

Page 13.

	Element	Compound	Mixture
Soil			X
Water		X	
Sodium	X		
Ice		X	
Glucose		X	
Antimony	X		
Carbon Dioxide		X	
Air			X
Oxygen	X		
Table Salt		X	
Salt and Pepper			X
Krypton	X		
Cola			X
Gallium	X		
Yttrium	X		
Oil and Water			X
Zirconium	X		

Page 14.

	Element	Compound	Mixture
Cu	X		
H_2O		X	
$C_6H_{12}O_6$		X	
$NH_3 + H_2O$			X
B	X		
$CO + CO_2$			X
Carbon Dioxide		X	
Air			X
Oxygen	X		
Table Salt		X	
Salt and Pepper			X

Name ________________________ Date _________________________

Page 15.

1. Beta
2. Alpha
3. Positron
4. Beta
5. Positron
6. Beta
7. Alpha
8. Positron
9. Alpha

Page 16.

1. $^{4}_{2}He$
2. $^{3}_{1}H$
3. $^{0}_{-1}e$
4. $^{4}_{2}He$
5. $^{32}_{14}Si$
6. $^{224}_{89}Ac$
7. $^{0}_{-1}e$
8. $^{17}_{8}O$

Page 17.

1. $^{235}_{92}U$
2. $^{131}_{53}I$
3. $^{238}_{92}U$
4. $^{10}_{4}Be$
5. $^{1}_{1}H$
6. $2\ ^{1}_{0}n$
7. $^{3}_{1}H$
8. $^{220}_{87}Fr$

Name ______________________ Date ______________________

Page 18.

1. 4.689 g
2. 85.8 days ; Proper sig. Figs. = 90 days
3. 3.91 g
4. 6.688 g
5. 13.3 minutes

Page 19.

Form A

1. ${}^{0}_{-1}e$; Beta
2. ${}^{4}_{2}He$; Alpha
3. 16.88 g

Form B

1. ${}^{0}_{-1}e$; Beta
2. ${}^{3}_{1}H$; Beta
3. 38.75 g

Page 20.

1. A = Ar B = 18 D = 18 E = 22 F = 18
2. A = Mg B = 12 D = 12 E = 12 F = 10
3. A = S B = 16 D = 16 E = 16 F = 18
4. A. Na
   B. O
   C. K
   D. P

Name ______________________ Date ______________________

Page 21.

5.

A. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$

↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑_ ↑_ __

4

..
Si .
.

B. $1s^2\ 2s^2\ 2p^4$

↑↓ ↑↓ ↑↓ ↑_ ↑_

6

..
. O :
.

Page 22.

6. A. Compound B. Mixture C. Element D. Mixture E. Element

7. A. $^{30}_{15}P$ B. $^{42}_{19}K$ C. $^{0}_{-1}e$ D. $^{20}_{10}Ne$ E. $^{4}_{2}He$

Page 23.

8. A. 1/16 B. 22 years C. 8 g

Page 24.

1. A = Ca B = 20 D = 20 E = 20 F = 20
2. A = Na B = 11 D = 11 E = 12 F = 10
3. A = F B = 9 D = 9 E = 10 F = 10
4. A. Ne
   B. Si
   C. Li
   D. K

Name ________________________ Date ________________________

Page 25.

5.

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

↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑_ ↑_ ↑_

5

..
. P.
.

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

↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓

2

..
Mg

Page 26.

6. A. Element B. Compound C. Mixture D. Element E. Mixture

7. A. $^{4}_{2}He$ B. $^{99}_{43}Tc$ C. $^{4}_{2}He$ D. $^{37}_{20}Ca$ E. $^{30}_{15}P$

Page 27.

8. A. 1/32 B. 15 years C. 48 g