LIFEPAC®

SCIENCE

TEACHER'S GUIDE

9th Grade

Alpha Omega
PUBLICATIONS

SCIENCE 900
Teacher's Guide

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Alpha Omega
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Teacher Notes

INSTRUCTIONS FOR SCIENCE

The LIFEPAC curriculum from grades two through twelve is structured so that the daily instructional material is written directly into the LIFEPACs. The student is encouraged to read and follow this instructional material in order to develop independent study habits. The teacher should introduce the LIFEPAC to the student, set a required completion schedule, complete teacher checks, be available for questions regarding both content and procedures, administer and grade tests, and develop additional learning activities as desired. Teachers working with several students may schedule their time so that students are assigned to a quiet work activity when it is necessary to spend instructional time with one particular student.

The Teacher Notes section of the Teacher's Guide lists the required or suggested materials for the LIFEPACs and provides additional learning activities for the students. The materials section refers only to LIFEPAC materials and does not include materials which may be needed for the additional activities. Additional learning activities provide a change from the daily school routine, encourage the student's interest in learning and may be used as a reward for good study habits.

If you have limited facilities and are not able to perform all the experiments contained in the LIFEPAC curriculum, the Science Project List may be a useful tool for you. This list prioritizes experiments into three categories: those essential to perform, those which should be performed as time and facilities permit, and those not essential for mastery of LIFEPACs. Of course, for complete understanding of concepts and student participation in the curriculum, all experiments should be performed whenever practical. Materials for the experiments are shown in Teacher Notes – Materials Needed.

A suggested support item for this course is the 9th Grade Science Experiments video, SD0901. The video includes presentations of many of the experiments in this course. Several of the experiments that require special equipment or materials are demonstrated on these videos. They can either be used for answering the questions of the lab report or as a demonstration of the procedure prior to performing the experiment. A notice is included with each experiment in the LIFEPAC where the video is available.

Science Projects List

Key

(1) = Those essential to perform for basic understanding of scientific principles.

(2) = Those which should be performed as time permits.

(3) = Those not essential for mastery of LIFEPACs.

S = Equipment needed for home school or Christian school lab.

E = Explanation or demonstration by instructor may replace student or class lab work.

H = Suitable for homework or for home school students. (No lab equipment needed.)

V = This experiment is available on the Science Experiments video.

Science 901

pp	8	(1)	H
	9	(2)	H
	12	(1)	S&V
	18	(1)	H or S&V

Science 902

pp	7	(1)	S&V
	12	(2)	S
	20	(1)	S&V
	24	(1)	S
	29	(1)	S
	35	(1)	H
	39	(2)	S&V
	41	(2)	H
	44	(1)	S&V

Science 903

pp	12	(1)	S&V
	38	(1)	S&V

Science 904

pp	15	field trip

Science 905-908

None

Science 909

pp	8	(1)	H
	12	(2)	H
	15	(2)	H
	17	(1)	H&V
	20	(1)	H
	31	(1)	S&V
	41	(3)	H

Science 910

none

Materials Needed for LIFEPAC

Required:
masking tape
two magnets marked with north and south poles
one small piece of wood about the size of the magnets
clay — two colors ($\frac{1}{2}$ cup each)

Suggested:
pencil, block, ice cube
a balloon
9th grade Science Experiments video

Additional Learning Activities

Section I Structure of Matter

1. Help the student to research the size of atoms and compute the relative size of hydrogen, oxygen, and sulfur atoms.
2. Discuss the three phases of matter. Have the students give examples for each phase. Write the examples on the board.
3. Have the students make flash cards containing the elements. Have them drill each other on the atomic number for each of the elements.
4. Make a chart showing the different phases of matter. Cut out pictures or draw pictures representing the different phases for your chart.

Section II Radioactivity

1. Demonstrate the use of a Geiger counter, if one is available.
2. Have the students plot intensity and distance on a graph similar to the one on Section III of LIFEPAC 901. Use the following numbers:

Intensity	Distance
6,572	1 cm
4,398	2 cm
3,221	4 cm
2,000	8 cm
1,582	16 cm
984	32 cm

3. Research the lives and discoveries of Marie and Pierre Curie. Have the students write a one-page report on their discoveries and read it to the class.

Section III Atomic Nuclei

1. Explain the following formula:
   number of neutrons = atomic mass - atomic number.
   Work several problems on the board.
2. Have the students make a bulletin board that lists the seven particles and one ray that make up a complex nucleus.
3. Have the students draw and label a diagram of an atom.
4. Research Carl Anderson's life and discoveries and have the students give an oral report to the class.

Section IV Nuclear Energy

1. Discuss fission and fusion. Write these words on the blackboard and ask the students to describe and compare the two.
2. Research the life and discoveries of Enrico Fermi. Have the students write a one-page paper on the importance of Fermi's discoveries to nuclear science.
3. Make a chart showing the advantages and disadvantages of nuclear power.

Section V Nuclear Applications and Environmental Hazards

1. Visit a nuclear generating plant with a friend.
2. Have the students write down several ways in which atomic energy can be used for good purposes, as well as how atomic power can be used for destructive purposes. Discuss your lists with the class. Do they agree with you? Ask your students to add to both lists.

Alternate Tests

Reproducible Tests
for use with the Science 900
Teacher's Guide

Name _____

Answer *true* or *false* (each answer, 1 point).

1. _____ A solid has definite shape, size, and mass.
2. _____ Neutrons are found in the atomic nucleus.
3. _____ Electrons and positrons are the same.
4. _____ Isotopes all have the same atomic mass.
5. _____ Gamma rays are not affected by a magnet.
6. _____ Neutrinos have been examined by scientists under microscopes.
7. _____ Enrico Fermi received a Nobel Prize for identifying new elements and discovering nuclear reactions.
8. _____ Cadmium is used to make control rods in fission reactors.
9. _____ Fission involves producing heavier elements and energy.
10. _____ Fossil fuels are plentiful today, and nuclear generating plants are not needed.

Match these items (each answer, 2 points).

11. _____ neutral particle
12. _____ uranium
13. _____ negative particle
14. _____ CO_2
15. _____ bent toward South Pole

a. electron
b. proton
c. neutron
d. element
e. compound
f. alpha particle

Write the letter for the correct answer on each line (each answer, 2 points).

16. The least dense form of matter is _____ .
    a. gas b. liquid c. solid
17. Radium was discovered by _____ .
    a. Fermi b. Becquerel c. Madame Curie
18. The intensity of a radioactive sample is measured by _____ .
    a. a cloud chamber b. a Geiger counter c. an x-ray
19. $^{226}_{88}$Ra has _____ neutrons.
    a. 314 b. 138 c. 88
20. An atom of the element nitrogen, whose atomic number is 7, contains _____ electrons.
    a. 7 b. 14 c. 5

21. In a nuclear reactor the fuel contains a fissionable material which _____ .
    a. provides unstable nuclei
    b. cools the heat
    c. moderates
22. Energy use per capita in the United States is increasing _____ .
    a. slower than the population
    b. the same as population growth
    c. more rapidly than population growth
23. The symbol for sodium is _____ .
    a. S b. So c. Na
24. The smallest of the three major particles of the atom is the _____ .
    a. electron b. neutron c. proton
25. The strongest in penetration of the three types of particles is _____ .
    a. alpha b. beta c. gamma

Complete these statements (each answer, 3 points).

26. The element fermium was named after _____ .
27. Marie Curie named _____ for the country of her birth.
28. The amount of material which, when brought together, would react spontaneously, is called _____ .
29. A spontaneous reaction that continues to feed itself and keep going is a _____ .
30. The unit of measurement of radiation biological material absorbs is the _____ .
31. Radioactive wastes are stored in abandoned _____ mines.
32. The nucleus of the atom is made up of the a. _____ , and b. _____ , and the c. _____ orbits around the nucleus.
33. Stars are examples of a. _____ reactors; a nuclear reaction producing lighter elements and energy is b. _____.
34. A particle like an electron with a positive charge is a _____ .
35. Members of each element that have differing atomic masses are _____.
36. The scientist who determined that uranium gives off rays was _____ .
37. Three phases of matter are a. _____ , b._____ , and c. _____ .

73/91

Date _____
Score _____

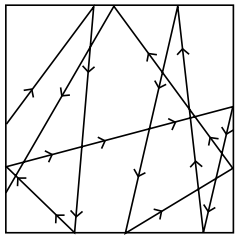
Answer Keys

SECTION ONE

1.1 Example:

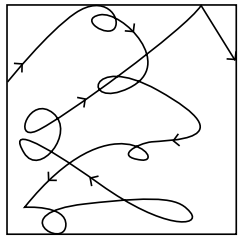
It has shape, size and mass. It does not move around. It stays where you put it.

1.2 a.



b. Moved in straight lines; had little freedom to move, turn, or change direction; motion very restricted.

1.3 a.



b. Can now move from place to place and turn (rotate) as I move; have more freedom, also move faster than as a solid.

1.4 Liquids must be restrained to remain in one spot. Liquids flow easily. Liquids take on the shape of the container. Liquids are soft. Liquids have mass. Liquids have a flat-topped surface.

1.5 The molecules press against the sides, hitting the sides and pushing them back. The more gas, the more push.

1.6 The balloon flies around because the gas escapes, lowering the pressure on the outlet side which forces the balloon forward.

1.7 Gases occupy the entire container and must be totally covered or they will escape. The distance between particles is great because even when packed into a balloon they can't be seen. The density is very low. There is mass (because gas is matter) but the amount and volume is less than that of solids or liquids.

1.8 I have freedom of movement in all directions without restrictions. I collide infrequently with other particles. My speed is greatly increased.

1.9 parent check

1.10 repel

1.11 a. repel
b. repel
c. repel
d. repel
e. attract
f. attract

1.12 nothing

1.13 nothing

1.14 no

1.15 a. repel
b. repel
c. attract
d. neither
e. no
f. Because the n behaves like the wood and is not affected by the charged particles.

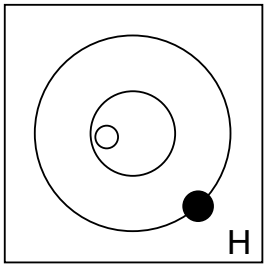
1.16 a. 1
b. 6
c. 7
d. 8
e. 12
f. 13
g. 16
h. 20
i. 26
j. 53

1.17 H = 1
C = 6
N = 7
O = 8
Mg = 12
Al = 13
S = 16
Ca = 20
Fe = 26
I = 53

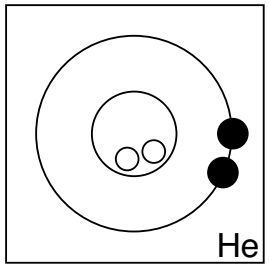
1.18 H = 1
C = 6
N = 7
O = 8
Mg = 12
Al = 13
S = 16
Ca = 20
Fe = 26
I = 53

1.19 Note: Placement of electrons on a particular ring may be done in any location on that ring or shell.

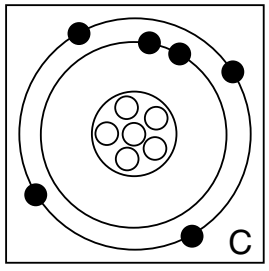
a.



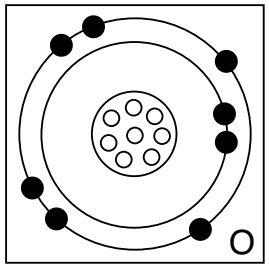
b.



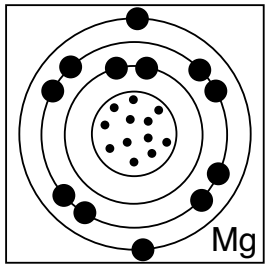
c.



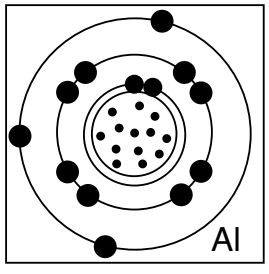
d.

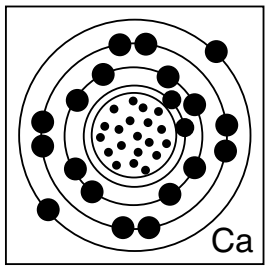


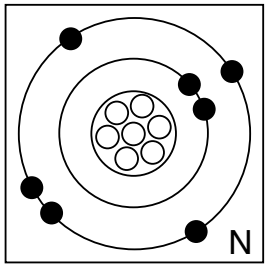
e.



f.



g. 

h. 

1.20 two thousand

1.21 Either order: (for a and b)

a. protons

b. neutrons

c. electrons

1.22 electrons

1.23 a. proton

b. electron

c. neutron

1.24 1

2

5

29

13

47

14

17

82

SECTION TWO

2.1 Either order:

a. photographic plates

b. the magnet

2.2 Any order:

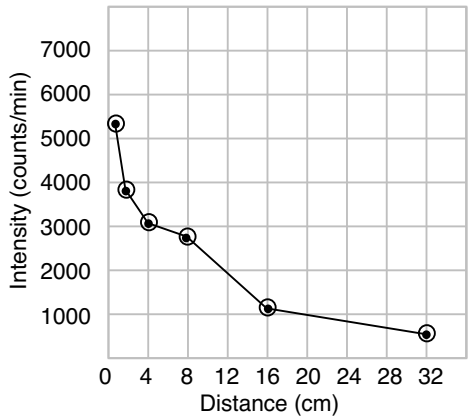
a. Beta particles are bent sharply toward the North Pole.

b. Alpha particles are slightly bent to the South Pole.

c. Gamma rays are not affected.

2.3 Example:

Becquerel wrapped some uranium ore in papers and set it in a drawer. Unknowingly, he had set it on an undeveloped photographic plate. He discovered later that in the places where he had laid the ore, the plate developed as if it had been exposed to light.

2.4 

2.5 The intensity decreases because the further you get from the source, the chance of being hit decreases.

2.6 The Wilson cloud chamber detects the presence of radioactive materials as well as speed and mass. The Geiger counter measures the quantity (intensity) of radiation striking a certain area of space.

SECTION THREE

3.1
a. 1
b. 6
c. 7
d. 8
e. Na
f. Al
g. Ni
h. Fe

3.2
a. oxygen
b. atomic mass
c. number of protons (atomic number)

3.3
a. $^{1}_{1}H$
b. $^{12}_{6}C$
c. $^{35}_{17}Cl$
d. $^{2}_{1}H$
e. $^{13}_{6}C$
f. $^{37}_{17}Cl$

3.4
a. 2
b. 8
c. 7
d. 10
e. 12
f. 146
g. 138
h. 124
i. 0
j. 5

3.5
a. β
b. α
c. ϒ
d. near speed of light, very fast (301,320 km.sec. 186,000 mps)
e. very fast (21,00 km/sec. or 13,010 mps)
f. at speed of light
g. stopped by 1 mm of skin
h. stopped by a few layers of skin
i. strong - can pass through body

3.6 Any order:
a. electrons
b. neutrinos
c. mesons
d. protons
e. neutrons
f. positrons
g. alpha particles

3.7 gamma ray

3.8
a. 75
b. 77
c. 78
d. 80

3.9 One model has the glue of the nucleus, the buffer between the protons, being the neutrons and other particles of the nucleus. Gamma rays result when proton or neutron drops to a lower level in the nucleus.

3.10 When the protons and neutrons increase and the n:p ratio is greater than 1.5, the nucleus is not balanced and flies apart.

SECTION FOUR

4.1 1938 for identifying new elements and discovering nuclear reactions.

4.2 Sample outline:

I. The Setting
  A. Time reference
    1. 8:30 A.M.
    2. Wednesday
  B. Place
    1. Squash court
    2. Stagg Field Stadium

II. The Experiment Part 1
  A. Rods withdrawn
    1. Counters click faster
    2. Pen moves up
    3. Levels off
  B. Zip withdrawn
    1. Counters click faster
    2. Pen moves up
    3. Levels off
  C. Lunch break

III. The Experiment Part 2
  A. Zip withdrawn
    1. Counters click faster
    2. Pen moves up
    3. Levels off
  B. Zip withdrawn
    1. Levels off
    2. Self-sustaining

IV. Results
  A. Nuclear reaction
    1. Sustained
    2. Stopped
  B. Code given
    1. Mission performed
    2. Mission successful

4.3 The breaking of heavy, complex nuclei into smaller masses (atoms or particles).

4.4 ${}^{1}_{0}\text{n}$, ${}^{90}_{38}\text{Sr}$

4.5 A chain reaction is a nuclear reaction in which one of the products of nuclear decay initiates the decay of another atom. This can be controlled or stopped by inserting a substance that will absorb or buffer the decay products from the unstable nuclei.

4.6 Critical mass is the amount of mass of a substance that if brought together in one pile will self destruct by a spontaneous chain reaction.

4.7 teacher check

4.8 a. Fuel rods provide the unstable nuclei.

b. Moderator slows the neutrons so they are correct energy for fission.

c. Control rods control the number of neutrons available to collide and fission the U-235.

d. Coolant is a liquid that absorbs the heat of a fission and heats the water for the steam turbine.

e. Shielding is concrete or lead that shields the environment from radiation.

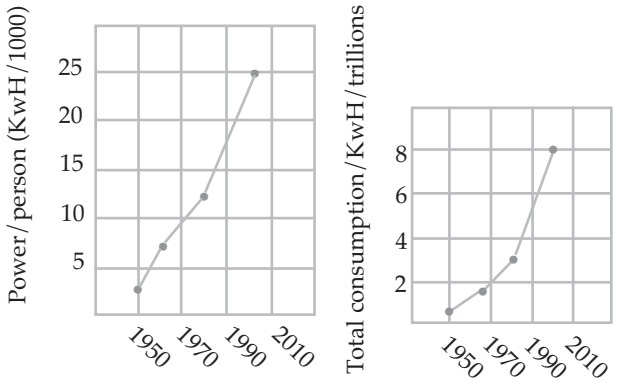
4.9 teacher check

4.10 Fusion is the combining of light nuclei to form heavier atoms and release energy. Fission is a process of decay (tearing down) while fusion is a process of building. Much energy is produced by both reactions.

4.11 Our knowledge of the destructive power of nuclear energy makes it easier to comprehend the judgement of God upon the earth. We have concrete examples of the type of burning that can destroy trees, grass and mountains as referenced by the passage in Revelation.

SECTION FIVE

5.1



5.2 Both curves indicate an increase in the rate of consumption and the rate continues to be greater than linear.

5.3 Either order:

a. increasing population

b. increasing use of electricity

5.4 quadrupled

5.5 Either order:

a. use up oxygen

b. add heat and chemicals

5.6 a. waste (heat)

b. low levels of radioactivity

5.7 teacher check

Examples:

a. How did you feel?

b. Were you afraid?

c. Did the treatments make you sick?

d. What did the doctors do?

e. How does this affect your relationship to God?

f. What does the treatment do to cancer?

g. How frequently are you treated?

h. What is your diet?

5.8 teacher check

5.9 Either order:

a. curie

b. roentgen

5.10 Materials are concentrated and made into solids, then placed in mines. Mines are safe because they're geologically stable, not connected to water sources, and water safe (water can't get in).

5.11 The effect heated water has on the original source when it is returned.

5.12 Either order:

a. irrigation of crops, keep oceans from freezing, and

b. prolongs shipping seasons, promotes growth in the oceans

5.13 teacher check

Test Keys

1. false
2. true
3. false
4. false
5. true
6. true
7. false
8. true
9. true
10. true

11. c
12. d
13. f
14. a
15. b
16. a
17. b
18. c
19. c
20. a
21. a
22. c
23. a
24. b
25. c

26. a. energy or speed, distance, direction
    b. intensity
27. fermium
28. a. underground tanks
    b. salt mines
29. Any order:
    a. mesons
    b. positrons
    c. neutrinos
30. Marie and Pierre Curie
31. Any two; any order:
    a. irrigation of crops, prolonged shipping season,
    b. increased growth in ocean
32. a. protons
    b. neutrons
    c. electrons
33. Any order:
    a. curie
    b. roentgen
34. critical mass
35. radiation biological material absorbs
36. inserting a substance that will absorb or buffer the decay products of unstable nuclei
37. electron

1. true
2. true
3. false
4. false
5. true
6. false
7. true
8. true
9. false
10. false
11. c
12. d
13. a
14. e
15. f
16. a
17. b
18. b
19. b
20. a
21. a
22. c
23. c
24. a
25. c
26. Enrico Fermi
27. polonium
28. critical mass
29. chain reaction
30. roentgen
31. salt
32. Any order (a. and b.):
    a. proton
    b. neutron
    c. electron
33. a. fusion
    b. fission
34. positron
35. isotopes
36. Becquerel
37. Any order:
    a. solid
    b. liquid
    c. gas

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