LIFEPAC®

SCIENCE

TEACHER'S GUIDE

12th Grade

Alpha Omega
PUBLICATIONS

SCIENCE 1200

Teacher's Guide

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Alpha Omega PUBLICATIONS

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INSTRUCTIONS FOR SCIENCE

The LIFEPAC curriculum from grades 2 through 12 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.

Videos of many of the labs may be available from online sources. These are useful as a demonstration of the lab procedure and for suggestions on alternate materials and equipment that can be used.

NOTE: Data tables and formulas can be found throughout the curriculum. They should be available to the students (where appropriate) any time they are answering problems in section exercises, self tests, or LIFEPAC tests.

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 homeschool or Christian school lab.

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

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

Science 1201

pp	7	(1)	S
	15	(1)	S
	22	(1)	S
	36	(1)	S
	42	(1)	S
	44	(1)	S

Science 1202

pp	9	(1)	S
	29	(1)	S
	38	(1)	S
	40	(1)	S
	47	(2)	H

Science 1203

pp	18	(1)	S
	23	(1)	H
	33	(2)	S

Science 1204

pp	6	(1)	S or H
	8	(1)	S or H
	10	(1)	S
	11	(2)	S
	17	(1)	S
	18	(1)	S or H
	19	(1)	S
	21	(1)	S or H
	23	(1)	S
	24	(1)	S or H
	26	(1)	S or H
	27	(1)	S
	36	(1)	S
	37	(1)	S
	38	(1)	S

Science 1205

pp	8	(1)	S or H
	10	(1)	S or H
	11	(1)	S or H
	13	(1)	S
	16	(1)	S or H
	18	(1)	S
	24	(1)	S or H
	28	(1)	S
	31	(1)	S or H
	38	(1)	S or H
	41	(1)	S or H

Science 1206

pp	10	(1)	S or H

Science 1207

none

Science 1208

pp	8	(2)	S or H
	17	(1)	S or H

Science 1209

none

Science 1210

none

SCIENCE 1201

Unit 1: Kinematics

TEACHER NOTES

MATERIALS NEEDED FOR LIFEPAC	
Required	**Suggested**
• Section 1: screw, paper straw, 2 microscope slides, needle, ruler, razor blade, wood block, tongue depressor, clothespin, paper • Section 2: 100-cc graduated cylinder, 50-cc graduated cylinder, large tray, 2 eyedroppers, talcum powder, oleic acid, alcohol, meter stick • Section 3: C-clamp, spark timer, timer tape, ruler • Section 4: spark timer, timer tape, ruler, C-clamp • Section 5: 15 to 30 thermometers, 3 acetate sheets, roll of adding machine tape, meter stick	(none)

Additional Activities

The following activities may be reproduced as student worksheets.

» SECTION 1: UNITS, SCALARS, AND VECTORS

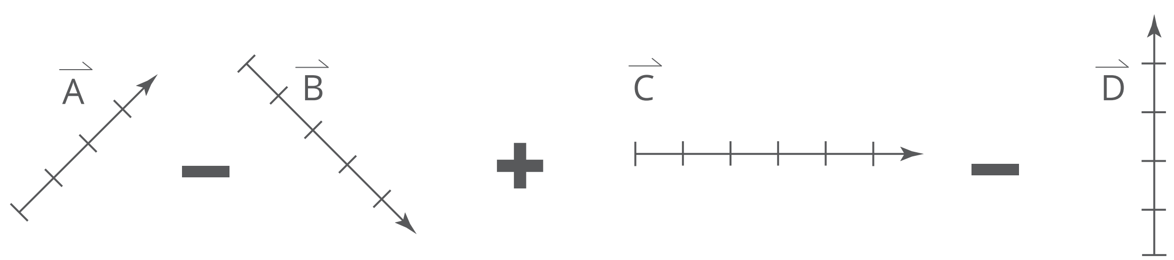
1. Calculate $1.8 \cdot 10^{4}$ times $4 \cdot 10^{-6}$ divided by $3 \cdot 10^{2}$.

2. Calculate $7 \cdot 10^{-2}$ times $4 \cdot 10^{-3}$ divided by $5 \cdot 10^{-7}$.

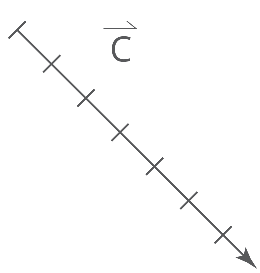
3. Express $5 \cdot 10^{5}$ m in km.

4. Express $3.2 \cdot 10^{2}$ m in cm.

5. Add these vectors.



6. Find the vertical and horizontal components of C.



» SECTION 2: MEASUREMENT OF LENGTH

1. If you travel 3 blocks north and 4 blocks east, calculate the distance traveled and the displacement.

2. An object 4 cm wide, 5 cm long, and 2 cm high has a mass of 8 g.

a) Find the area of the base.
b) Find the volume.
c) Calculate the density.

» SECTION 3: RATE OF LENGTH CHANGE

1. City B is 80 miles north of City A but travel by road is 100 miles. It takes 2 hours to travel by car from B to A.

a) Calculate the speed.
b) Calculate the velocity.

» SECTION 4: RATE OF VELOCITY

1. Calculate the acceleration of an object traveling at 30 $\frac{\text{ft}}{\text{sec}}$ in a radius of 9 ft.

2. A car traveling at 60 $\frac{\text{m}}{\text{sec}}$ NE changes to 70 $\frac{\text{m}}{\text{sec}}$ NE in 5 seconds.
Calculate the acceleration.

3. An object falls from rest under the influence of gravity for 4 seconds.
Calculate the distance it falls in meters and feet.

Additional Activities, Answer Key

Section 1: Units, Scalars, and Vectors

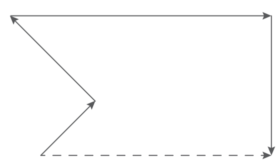
1. $\dfrac{(1.8 \cdot 10^4)(4 \cdot 10^{-6})}{3 \cdot 10^2} = \dfrac{(1.8)(4)}{3} \cdot 10^{4-6-2}$
$= 2.4 \cdot 10^{-4}$

2. $\dfrac{(7 \cdot 10^{-2})(4 \cdot 10^{-3})}{5 \cdot 10^{-7}} = \dfrac{(7)(4)}{5} \cdot 10^{-2-3-(-7)}$
$= \dfrac{28}{5} \cdot 10^2 = 5.6 \cdot 10^2$

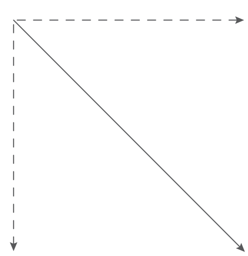
3. $5 \cdot 10^5$ m $= 5 \cdot 10^2 \cdot 10^3$ m $= 5 \cdot 10^2$ km
$= 500$ km

4. $3.2 \cdot 10^2$ m $= 3.2 \cdot 10^2 \cdot (10^{+2} \cdot 10^{-2})$ m
$= 3.2 \cdot 10^2 \cdot 10^2$ cm
$= 3.2 \cdot 10^4$ cm

5.

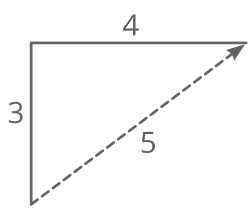


6.



Section 2: Measurement of Length

1.



distance is 3 + 4 blocks = 7 blocks
displacement is $\sqrt{3^2 + 4^2} = 5$

2. a. $A = l \cdot w$ 4 cm • 5 cm = 20 cm^2
b. $V = l \cdot w \cdot h$ 4 cm • 5 cm • 2 cm = 40 cm^3
c. Density $= \dfrac{\text{Mass}}{\text{Volume}} = \dfrac{8 \text{ g}}{40 \text{ cm}^3} = \dfrac{5 \text{ g}}{\text{cc}}$

Section 3: Rate of Length Change

1. a. $S = \dfrac{\Delta d}{\Delta t} = \dfrac{100 \text{ mi}}{2 \text{ hr}} = 50$ mph
b. $v = \dfrac{\Delta d}{\Delta t} = \dfrac{80 \text{ mi north}}{2 \text{ hr}} = 40$ mph, north

Section 4: Rate of Velocity

1. $a = \dfrac{v^2}{R} = \dfrac{(30 \frac{\text{ft}}{\text{sec}})(30 \frac{\text{ft}}{\text{sec}})}{9 \text{ ft}} = \dfrac{900 \frac{\text{ft}^2}{\text{sec}^2}}{9 \text{ ft}}$
$= 100 \dfrac{\text{ft}}{\text{sec}^2}$, direction is always toward the center

2. $a = \dfrac{\Delta v}{\Delta t} = \dfrac{70 \frac{\text{m}}{\text{sec}} - 60 \frac{\text{m}}{\text{sec}}, \text{NE}}{5 \text{ sec}}$
$= \dfrac{10 \frac{\text{m}}{\text{sec}}}{5 \text{ sec}}$, NE $= 2 \dfrac{\text{m}}{\text{sec}^2}$, NE

3. $d = \dfrac{1}{2}gt^2 = \dfrac{1}{2}(32 \dfrac{\text{ft}}{\text{sec}^2})(4 \text{ sec})^2$
$= 16 \cdot 16 \dfrac{\text{ft}}{\text{sec}^2}$
$= 256 \dfrac{\text{ft}}{\text{sec}^2}$

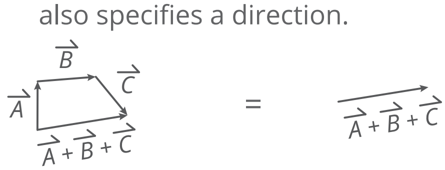
$d = \dfrac{1}{2}\text{g}t^2 = \dfrac{1}{2}(9.8 \dfrac{\text{m}}{\text{sec}^2})(4 \text{ sec})^2$
$= (4.9)(16) \dfrac{\text{m}}{\text{sec}^2}$
$= 78.4 \dfrac{\text{m}}{\text{sec}^2}$

ANSWER KEY

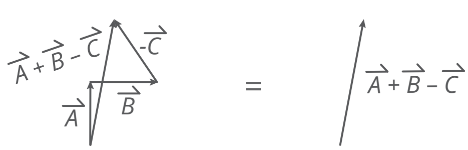
SECTION 1

1.1 time
1.2 length
1.3 mass or inertia
1.4 kinematics
1.5 varies, depending on grade of paper used. Approximately 400 g.
1.6 varies, depending on grade of paper used. Approximately 4 g.
1.7 varies, depending on size of paper used. Approximately 600 g.
1.8 varies, depending on size of paper used. Approximately 0.007 g.
1.9 varies, depending on the sensitivity of the balance.
1.10 varies, depending on the size of paper used. Approximately 0.007 g or less.
1.11 Unless the hair is dyed, black hair strands are more massive.
1.12 4×10^{-6}
1.13 4.8×10^{-3}
1.14 3×10^{4}
1.15 4.560 km
1.16 7.3×10^{-3} g
1.17 50 μs
1.18 a. c
b. 6.2 m north is not a scalar since it not only designates a magnitude (6.2 m) but also specifies a direction.

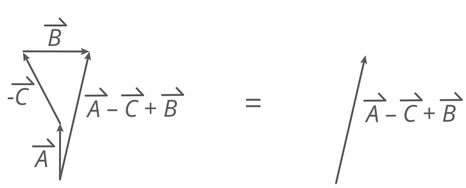
1.19



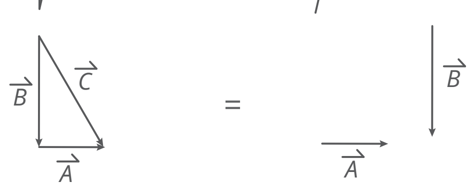
1.20



1.21

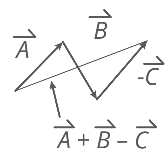


1.22

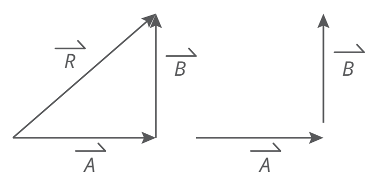


SELF TEST 1

1.01 e
1.02 c
1.03 h
1.04 i
1.05 f
1.06 k
1.07 j
1.08 b
1.09 g
1.010 a
1.011



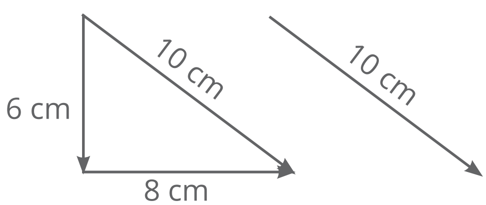
1.012



1.013 $(4.2)(4.0) \times 10^{5-9}$
16.8×10^{-4}
1.68×10^{-3}
1.014 $\frac{6.0}{3.0} \times 10^{-6-3}$
2.0×10^{-9}
1.015 30 km
1.016 2000 mg (or 2×10^{3} mg)
1.017 200,000 cm (or 2×10^{5} cm)
1.018 1 ms
1.019 6 km
1.020 .035 mg (or 3.5×10^{-2} mg)

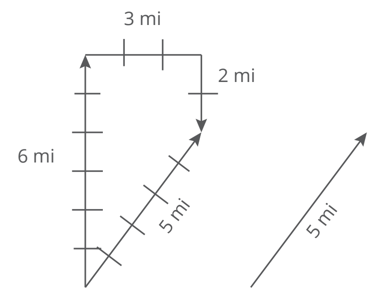
SECTION 2

2.1 Yes, then draws together.
2.2 5%
2.3 10% of 5%, or 0.5%
2.4 $\frac{1}{50}$ cm^3 = .02 cm^3
2.5 5% of .02 cm^3 = (.005)(.02) = 1×10^{-4} cm^3
2.6 varies: approximately 15 cm
2.7 varies: approximately 900 cm^2
2.8 varies from 8×10^{-8} cm to 7×10^{-7} cm
2.9 varies: approximately 1×10^{-21} cm^3
2.10 varies: approximately $\frac{1 \times 10^{-4}}{1 \times 10^{-21}}$
which equals 1×10^{17} molecules
2.11 varies: approximately (0.89 g/cm^3) (1×10^{-21} cm^3) which equals 0.89×10^{-21} or 8.9×10^{-22} g
2.12 298 cm, assuming that on the 99th try he reaches the top but can not pull himself over before sliding 1 cm down. On the 100th try he simply goes 1 cm to get to the top of the wall. (99 tries × 3 cm) + 1 cm = 298 cm
2.13 100 cm (or 1 m) up
2.14 298 cm + 100 cm = 398 cm
2.15 0 cm
2.16



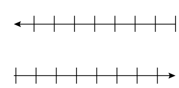
SELF TEST 2

2.01 h
2.02 g
2.03 b
2.04 d
2.05 e
2.06 j
2.07 i
2.08 c
2.09 k
2.010 a
2.011 2000 mm
2.012 0.035 km
2.013 11 miles
2.014



2.015 $D = m/v$ {Dimensions}
$v = m/D$ {g cm^3/g}
7.5 g
$v = \frac{7.5 \text{ g}}{2.5 \text{ g/cm}^3}$
$v = 3.0$ cm^3

2.016



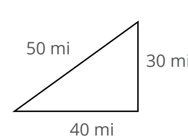
0 units

2.017 v = area × height
v = (3.6 cm^2)(2.0 cm)
v = 7.2 cm^3

2.018 $(3.2 \times 10^{-4})(4.02)$
$(3.2)(4.02) \times 10^{-4}$
12.86×10^{-4} (round off permitted)
1.29×10^{-3}

2.019 $\frac{3 \times 10^2}{5 \times 10^{-4}} = \frac{3}{5} \times 10^{2(-4)}$
$= .6 \times 10^6 = 6 \times 10^5$

2.020 70 miles



This is a 3-4-5 triangle.

SECTION 3

3.1 Teacher check

3.2 300 cm

3.3 600 s

3.4 .5 cm/s

$$s = \frac{\Delta v}{\Delta t}$$

$$= \frac{300\text{ cm}}{600\text{ s}} = .5\text{ cm/s}$$

3.5 70 km

3.6 1 hr

3.7 $$s\text{ avg} = \frac{\text{total distance}}{\text{total time}}$$

$$= \frac{70\text{ km}}{1\text{ hr}} = 70\text{ km/hr}$$

3.8 $$s\text{ avg} = \frac{\text{total distance}}{\text{total time}}$$

$$= \frac{70\text{ km}}{1\text{ hr}} = 70\text{ km/hr}$$

3.9 5 5
6 6
9 9
7 7
3 3

3.10 No, they vary; as hand moved forward dots were farther apart.

3.11 No, because the hand swung back and forth.

3.12 varies, would be larger speed values.

3.13 Because the dots are farther apart indicating high speeds.

3.14 varies, would be smaller speed values.

3.15 Because hand moving back indicates less distance covered forward.

3.16 varies

3.17 Yes, it could be larger than some and smaller than others.

3.18 Teacher check

3.19
$$\begin{array}{r} 300\text{ up} \\ \underline{+\ 100\text{ down}} \\ 400\text{ cm (rounded)} \end{array}$$

3.20 $$s\text{ avg} = \frac{\text{total distance}}{\text{total time}}$$

$$= \frac{400\text{ cm}}{600\text{ s}}$$

$$= \frac{2}{3}\text{ cm/s}$$

3.21 $$v = \frac{\Delta d}{\Delta t} = \frac{100\text{ cm}\uparrow}{600\text{ s}}$$

$$= \frac{1}{6}\text{ cm/s}\uparrow$$

$$= \frac{1}{6}\text{ cm/s up}$$

3.22 $$\vec{v} = \frac{\Delta d}{\Delta t}\text{ but }\Delta d = 0\text{ cm}$$

$$\vec{v} = \frac{0\text{ cm}}{600\text{ s}} = 0\text{ cm/s}$$

3.23 $$s = \frac{\Delta d}{\Delta t}$$

$$= \frac{40\text{ mi}}{1\text{ hr}}$$

$$= 40\text{ mph}$$

3.24 $$\vec{v} = \frac{\Delta d}{\Delta t}$$

$$= \frac{40\text{ mi, north}}{1\text{ hr}}$$

$$= 40\text{ mph, north}$$

3.25 $$s\text{ avg} = \frac{\text{total distance}}{\text{total time}}$$

$$= \frac{200\text{ miles}}{5.5\text{ hr}}$$

$$= 36.4$$

3.26 $$\vec{v}\text{ avg} = \frac{\Delta d}{\Delta t}$$

$$= \frac{0}{\Delta t} \longleftarrow \text{ round trip}$$

$$\vec{v}\text{ avg} = 0$$

3.27 $$s = \frac{\Delta d}{\Delta t} = \frac{400\text{ miles}}{8\text{ hr}}$$

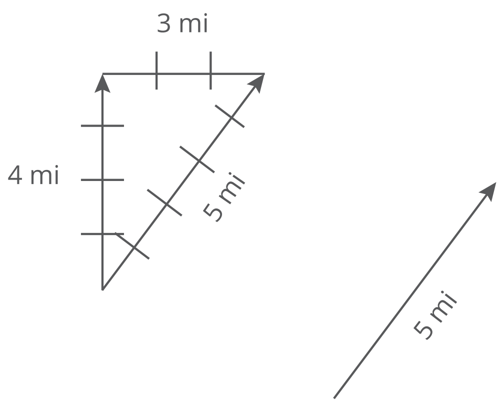
$$s = 50\text{ mph}$$

3.28 $$\vec{v} = \frac{\Delta d}{\Delta t} = \frac{320\text{ miles}}{8\text{ hr}}\text{, north}$$

$$\vec{v} = 40\text{ mph, north}$$

SELF TEST 3

3.01 e
3.02 l
3.03 f
3.04 n
3.05 g
3.06 k
3.07 m
3.08 o
3.09 j
3.010 c
3.011 5 miles



3.012 $\vec{v} = \dfrac{\Delta \vec{d}}{\Delta t}$

$= \dfrac{5 \text{ miles} \nearrow}{\frac{1}{4} \text{ hr}}$

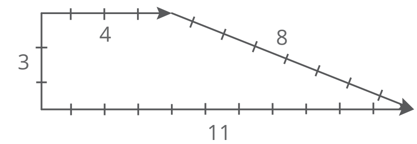
20 mph ↗

3.013 $\dfrac{8.1 \times 10^{-3}}{3 \times 10^{2}}$

$\dfrac{8.1}{3} \times 10^{-3-2}$

2.7×10^{-5}

3.014 11 units



3.015 $D = \dfrac{m}{v} = \dfrac{45 \text{ g}}{\frac{1}{4}(60 \text{ cm}^3)}$

$= \dfrac{45 \text{ g}}{15 \text{ cm}^3}$

$= 3 \dfrac{\text{g}}{\text{cm}^3}$

3.016

20 mph for ½ hr	=	10 miles
40 mph for 1 hr	=	40 miles
30 mph for ½ hr	=	15 miles
50 mph for 2 hrs	=	100 miles
		165 miles

3.017 $s \text{ avg} = \dfrac{\text{total distance}}{\text{total time}}$

$= \dfrac{(10 + 40 + 15 + 100) \text{ miles}}{(\frac{1}{2} + 1 + \frac{1}{2} + 2) \text{ hr}}$

$= \dfrac{165 \text{ miles}}{4 \text{ hr}} = 41\frac{1}{4} \text{ mph}$

3.018 Since a marble will roll down a pan and up the other side just as high (if there is no friction); then if you extend the bottom of the pan so that it extends infinitely out, the marble will keep on rolling.

3.019 To express very large numbers or very small numbers without having to use lots of zeros.

3.020 A pilot of an airplane needs to know which way the wind is blowing or he'll get blown off course.

SECTION 4

4.1 $a = \dfrac{\Delta v}{\Delta t}$

$= \dfrac{60 \text{ ft/s} - 45 \text{ ft/s}}{5\text{s}}$ east

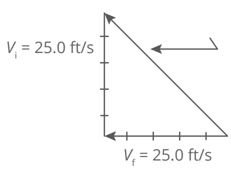
$= \dfrac{15 \text{ ft/s}}{5\text{s}} = \dfrac{3 \text{ ft/s}^2\text{, east}}{}$

4.2 $\vec{a} = \dfrac{\Delta \vec{v}}{\Delta t} = \dfrac{30 \text{ mph} - 60 \text{ mph}}{12 \text{ min}}$

$= \dfrac{30 \text{ mph} - 60 \text{ mph, south}}{1/5 \text{ hr}}$

$= \dfrac{-30 \text{ mph, south}}{1/5 \text{ hr}} = -150 \text{ mi/hr}^2$, south

4.3



$v_f - v_i = \Delta\vec{v} = 35.4$ ft/s

$\vec{a} = \dfrac{\Delta \vec{v}}{\Delta t} = \dfrac{35.4 \text{ ft/s}}{0.100 \text{ s}}$ $\quad \vec{a} = 354.\ \text{ft/s}^2$ ↖

$= 354.\ \text{ft/s}^2$

4.4 $\vec{a} = \dfrac{v^2/R}{} = \dfrac{(20 \text{ ft/s})^2}{25 \text{ ft}} = \dfrac{400 \text{ ft}^2/\text{s}^2}{25 \text{ ft}}$

4.5 Teacher check

4.6 Teacher check

4.7 Teacher check

4.8 $d = d_0 + v_0t + ½\ at^2$

$d = 0 + 0 + ½(-980 \text{ cm/s}^2)(10\text{s})^2$

$d = -49{,}000$ cm or -490 m

" - " indicates down

4.9 $v^2 = v_0^{\ 2} + 2a(d - d_0)$, at the top

$0 = (28 \text{ m/s})^2 + 2(-9.8 \text{ m/s}^2)d$

$\dfrac{-400 \text{ m}^2/\text{s}^2}{-19.6 \text{ m/s}^2} = d$

$\dfrac{-400 \text{ m}^2/\text{s}^2}{-19.6 \text{ m/s}^2} = +20.4 \text{ m} = d$

$d = 20.4$ m

4.10 $d = d_0 + ½(v_0 + v)t$

$d = ½(20 \text{ m/s})t$

$\dfrac{20.4 \text{ m}}{10 \text{ m/s}} = t$

$t = 2.04$ s

4.11 Teacher check

4.12 Teacher check

4.13 varies, should be approximately 980 cm/s²

4.14 The student should compare his long answer to 980 cm/s². (His answer will probably be lower because of friction of the tape with the timer.)

SELF TEST 4

4.01 j

4.02 a

4.03 d

4.04 b

4.05 f

4.06 o

4.07 n

4.08 k

4.09 i

4.010 g

4.011 $d = ½\ gt^2$

$= ½(-32 \text{ ft/s}^2)(5\text{s})^2$

$= -(½)(32)(25)$ ft

$d = -400$ ft, down

4.012 $v^2 = v_0^{\ 2} + 2ad = 0$

$(20 \text{ m/s})^2 = 0 + 2(a)(50\text{m})$

$\dfrac{400 \text{ m}^2\text{s}^2}{100 \text{ m}} = a$

$\vec{a} = 4 \text{ m/s}^2$

4.013 $\vec{v} = \dfrac{\Delta \vec{d}}{\Delta t} = \dfrac{400 \text{ miles}}{10 \text{ hr}}$, east

$= 40$ mph, east

4.014 $d = ½at^2$ $\qquad d_0 = 0;\ v_0 = 0$

$441 \text{ m} = ½(5)(9.8 \text{ m/s}^2)t^2$

$\dfrac{441 \text{ m}}{24.5 \text{ m/s}^2} = t^2$

(remember to take the square root)

$\sqrt{18\text{s}^2} = t$

$4.24\text{s} = t$

4.015 $a = v^2/R$

$= \dfrac{(10 \text{ mph})^2}{.2 \text{ mi}}$

$= \dfrac{100 \text{ mi}^2/\text{hr}^2}{.2 \text{ mi}} = 500 \text{ mi/hr}^2$

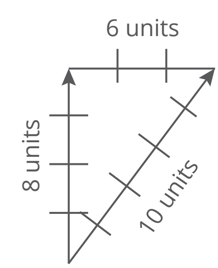
$a = 500 \text{ mi/hr}^2$

4.016 $\dfrac{2 \times 10^{-3}}{2.5 \times 10^4} = \dfrac{2}{2.5} \times 10^{-3-(4)}$

$= 0.8 \times 10^{-7}$

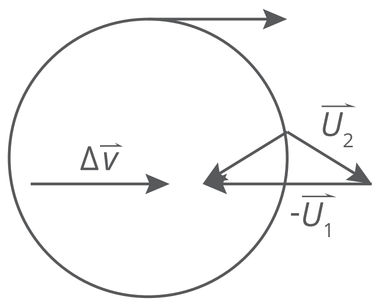
$= 8 \times 10^{-8}$

4.017 10 units NE.



4.018 $\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$

it points to the center at all times



4.019 Because the force of gravity causes a body to speed up while falling at 9.8 m/s^2 or 32 ft/s^2

4.020 a. an object speeding up in a straight line
b. an object slowing down in a straight line
c. an object at the same speed going in an arc of a circle

4.021 $\vec{v} = \frac{\Delta\vec{d}}{\Delta t}$

$\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$

SECTION 5

5.1 Isotherms cannot cross because to cross would indicate two different temperature readings for the same point.

5.2 Example:
Heat (or cold air) from the vents and heat (or cold) from outside windows and doors.
It depends on the season of the year.

5.3 Varies depending on the time of the year and what type of heating/cooling system you have.

5.4 Yes. No, thermometers are an appropriate test object for temperature fields but different test objects are needed for measuring different fields.

5.5 The temperature field is a region of space which at every point a thermometer (testing object) will have a specific reading.

5.6 You would need to use a pressure gauge and get a particular reading at every point in a given region.

5.7

--	110.0
0.4	0.4
0.7	1.0
1.0	1.0
1.5	0.5
5.2	11.2
9.5	9.5
19.2	3.7
30.1	3.5
39.5	0.2

5.8 No, it shows average distance away.

5.9 A large sheet of paper twice as long and just as wide with the sun at the center and planets around and a huge field to lay the sheet of paper out.

5.10 Either use 1 meter = 1.5×10^8/km for all scales or 1/millimeter = 6400/km for all scale measurements.

5.11 110 mm or 11.0 cm or 0.110 m

5.12 No, they go at different speeds. Mercury orbits the fastest and Pluto the slowest. They are also in different planes.

5.13 No, they orbit at various angles to the sun with Pluto tilting the most away from the flat plane.

5.14 Where the sun is with respect to the galaxy, the satellites of the planets (moons), comets and so forth. Neither have we described how moons and planets affect each other.

5.15 No, they are mental constructs which may take on physical dimensions.

5.16 The model of an atom tries to convey the region where the particle might be located, its interaction with other parts, its occupation of space or volume, its electrical charge and nuclear forces along with electrical forces and also its chemical activity.

SELF TEST 5

5.01 b
5.02 j
5.03 a
5.04 e
5.05 d
5.06 g
5.07 k
5.08 i
5.09 c
5.010 h

5.011 $\vec{a} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}\text{ final} - \vec{v}\text{ initial}}{\Delta t}$

$= \frac{10\text{ m/s} - 20\text{ m/s}}{5\text{ s}}$

$= \frac{-10\text{ m/s}}{5\text{ s}}$

$= -2\text{ m/s}^2$, a negative acceleration

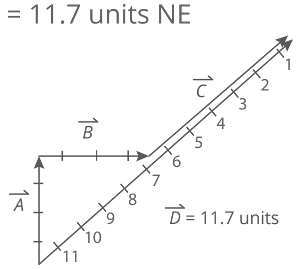
5.012

35 mph × 1 hr	= 35 miles;	1 hr
40 mph × ½ hr	= 20 miles;	½ hr
50 mph × 2 hr	= 100 miles;	2 hr
	155 miles	3½ hr

speed $= \frac{\Delta d}{\Delta t} = \frac{155\text{ miles}}{3.5\text{ hr}}$

speed = 44.3 mph

5.013 $\vec{D}$ = 11.7 units NE



5.014 1
5.015 3.2×10^5 cm
5.016 Mass and time; they do not depend on direction
5.017 An object at rest stays at rest or an object in motion stays in motion unless there are unbalanced external forces acting on it.
5.018 Because at every point in a region of space there is a value for temperature as recorded on a thermometer.
5.019 A resultant occurs by combining (add or subtract) two or more vectors and a component occurs when you take one vector and split it into its horizontal and vertical vectors.
5.020 Example:
Molecules like tiny BBs moving rapidly around and colliding with each other.

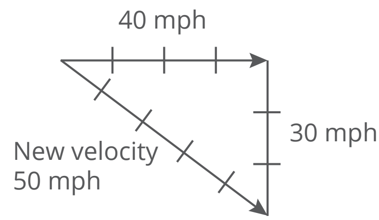
LIFEPAC TEST

1. b
2. d
3. f
4. e
5. c
6. a
7. a. 3×10^8 m/s
   b. 3×10^5 km/s
   c. 3.2×10^7 s
   d. Ly = distance = speed × time
      $= (3 \times 10^8 \text{ m/s})(3.2 \times 10^7 \text{ s})$
      $= 9.6 \times 10^{15}$ m
   e. $(9.6 \times 10^{15}) \times 10^2 \text{ cm} = 9.6 \times 10^{17}$ cm
8. $\vec{v} = \dfrac{\Delta\vec{d}}{\Delta t} = \dfrac{80 \text{ miles}}{2 \text{ hrs}}$, east

   v = 40 mph, east (a vector)
9. $D = \dfrac{\text{Mass}}{\text{Volume}} = 40 \text{ g/cm}^3 = \dfrac{40 \text{ g}}{1 \text{ cm}^3}$

   $D \text{ new} = \dfrac{40 \text{ g}}{1/3 \text{ cm}^3} = 40 \times 3 \text{ g/cm}^3$

   $D = 120 \text{ g/cm}^3$
10. Can't calculate displacement because no directions are given.

    Distance = 7 miles
    2 + 3 + 2 = 7 miles
    distance = 7 miles
11. 

12. $v^2 \text{ final} = v^2 \text{ initial} + 2a(d \text{ final} - d \text{ initial})$

    $0^2 = (30 \text{ m/s})^2 + 2a(350 \text{ m} - 200 \text{ m})$

    $\dfrac{-900 \text{ m}^2/\text{s}^2}{2(150 \text{ m})} = \dfrac{-900}{300} \text{ m/sec}^2 = -3 \text{ m/s}^2 = a$

    or

    $v = v_0 + at$

    $0 = 30 \text{ m/s} + a(10\text{s})$

    $\dfrac{-30 \text{ m/s}}{10\text{s}} = a = -3 \text{ m/s}^2$
13. Using a barometer, measure the pressure at various altitudes and draw a relationship between altitude and pressure (a sharp student will note that this will differ over the equator as compared to the polar regions.)
14. Concentric circles simplify the picture for the young child but it is not completely accurate in describing the solar system it is merely an approximation or a simplification.

ALTERNATE LIFEPAC TEST

1. a
2. e
3. b
4. f
5. d
6. g
7. $s = 50$ mph
8. $a = \frac{5\text{ m}}{\text{sec}^2}$
9.
a. .2 cm × .2 cm × .2 cm
b. $V = 8 \times 10^{-3}$ cm^3 or .008 cm^3
c. 8×10^{-3} cm^3
d. $\frac{\text{volume (substance)}}{\text{volume (molecule)}} = \text{number of molecules}$
e. 5×10^{17} molecules

10. $D = \frac{3\text{g}}{\text{cm}^3}$
11. $D = 0$
12. $10 \frac{\text{m}}{\text{sec}}$
13. You can describe a temperature field by using a thermometer for readings. You would have to take readings for several years at different seasons to get an average pattern for each season of the year and this pattern would only be an average result.
14. The advantage is that it is simple and round and the child can understand. A disadvantage is that it does not show mountains, clouds, seasons, oceans, and so is limiting understanding.

SCIENCE 1201

ALTERNATE LIFEPAC TEST

54

67

NAME ____________________

DATE ____________________

SCORE ____________________

Match these items (each answer, 2 points).

1. ________ The fundamental unit on this list that is synonymous with mass.

2. ________ As a car slows down it undergoes ______ .

3. ________ The term that describes 400 miles by road between two cities.

4. ________ Traveling in one direction (north), the car's rate of distance changes as the time fluctuates. The average calculated is ______ .

5. ________ Distance is what kind of quantity?

6. ________ A plane travels 300 mph east; what term best describes this derived quantity?

a. inertia
b. distance
c. displacement
d. scalar
e. acceleration
f. average velocity
g. velocity

Complete these calculations (each answer, 5 points).

7. A car travels from City A eastward to City B. It takes 8 hours, and the road is 400 miles long, although it is only 320 miles between cities in a straight line. What is the average speed of the car?

8. A car traveling at 40 $\frac{\text{m}}{\text{sec}}$ speeds up to 60 $\frac{\text{m}}{\text{sec}}$ in 4 sec. What is the car's acceleration?

9. A certain molecule has the volume of $16 \cdot 10^{-21}$ cm^3. If you have a known volume, you can divide the known volume by the volume of a molecule to calculate the number of molecules in that known volume. You are given a 2 mm × 2 mm × 2 mm cubic volume of the substance.

a. What are the dimensions of the volume in centimeters?

b. What is the volume of the substance ($V = lwh$) in cm^3?

c. What is the volume of the substance in cm^3 using scientific notation?

d. What is the number of molecules in this volume?
Express the answer in scientific notation.

10. If the mass of a substance occupying a 3 cm × 3 cm × 3 cm cubic volume ($V = lwh$) is 81 g, what is its density?

11. Ike travels 2 miles east, 4 miles north, 2 miles west, and finally 4 miles south. What is his total displacement?

12. A model plane heads north at 8 $\frac{\text{m}}{\text{sec}}$ in a wind east at 6 $\frac{\text{m}}{\text{sec}}$. It is blown off course. What is its velocity along its new course? (*Hint*: use vectors.)

Answer these questions (each answer, 5 points).

13. Near the surface of the earth, the temperature decreases at high altitudes. Also, temperatures differ over land or water surfaces and change from night to day. Explain how you can describe the earth's atmosphere in terms of a temperature field. What are the difficulties involved?

14. What are the advantages and disadvantages of using a globe in describing the earth to an elementary school child?

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