

PHYSICAL SCIENCE 100

PHYSICAL SCIENCE FUNDAMENTALS

COURSE INFORMATION

Spring Semester 2002

For information about:	see page
• purposes of the course	1
• help resources	2
• study suggestions	3
• BYU standards	3
• credit and grades	4
• examinations	5
• testing center procedures	6
• Mini-Labs	6
• UW's and I's	7
• exemption examinations	8
• class and examination schedule	9
• faculty listing	9
• errata	10
• Mini-Lab worksheets	11

PURPOSES OF THE COURSE

1. To gain a conceptual understanding of most of the fundamental principles that govern the physical universe.
2. To understand how these few principles, and models that are consistent with them, explain much of what we observe directly in nature and some of what is observed when modern technology expands our view to include things that are very small and also things that are very large.
3. To understand how science works by assuming "self-evident truths," postulating or guessing what might be, experimenting and using the measured results to test for consistency between what is guessed and what is observed. To understand the hope of scientists that as errors are discovered and rejected, it is possible to come closer to the "truth."

We believe that a study of the universe, done in the proper spirit, can increase faith in the Savior who under the direction of our Eternal Father organized the earth and heavens in harmony with Divine Law as a part of the plan that would make it possible for us to gain immortality and eternal life.

HELP RESOURCES

If any student has a need for special testing arrangements, note taking, or other accommodations please feel free to discuss this with the instructor. Accommodation letters from the Services for Students with Disabilities (SSD) office will be required to authorize certain accommodations. The SSD office is located in 1520 WSC (378-2767, 378-8984 TTY).

Class sessions:

Class time will be used to clarify and illustrate ideas in the text through demonstrations and discussions. You should read the chapter to be covered before attending class. One of the primary purposes of class is to provide students with the opportunity to ask questions they may have concerning the material they have read in the text. Please come prepared with questions from the assigned chapter.

Text:

Physical Science Concepts, 2nd Edition, by Mason, Griffen, Merrill, and Thorne.

A study guide is provided at the end of each chapter of the text. It provides you with an outline of the fundamental principles, models, main questions, and terms that you will be expected to understand, answer, or use appropriately.

Focus Questions:

Focus Questions are included in the Study Guide sections of the text. All of the essay questions in your examinations will be based on these questions.

Web Page:

The course web page is: <http://ps100.byu.edu> . There is a link from this course page to professor's individual pages, practice problems, and online material.

Teaching Assistants:

Several teaching assistants (TAs) are available in a walk-in lab on a regular schedule to help with individual questions and problems. No appointments are necessary.

Location: N252 ESC

Phone Number: 378-3307

Hours: 10:00 am to 5:00 pm Monday

10:00 am to 6:00 pm Tuesday*-Thursday (*closed for devotionals Tues. 10:45-12:15)

10:00 am to 5:00 pm Friday,

The teaching assistants can help you best if you visit them regularly throughout the term. Help is not available while examinations are being read and no individual help will be available during the final exam period.

STUDY SUGGESTIONS

Successful students in this course study each chapter in the following way:

1. They read both the outline of the chapter in the Study Guide and the corresponding chapter material before it is discussed in class. They read the essay questions for the chapter very carefully before coming to class.
2. They listen carefully to the lecture demonstration discussions. They take very brief notes. They ask questions or record questions to ask later.
3. They study the chapter carefully before the next class. They write out answers to all of the Focus Questions in the Study Guide.
4. They go to the TAs in N252 ESC or come to their instructor to review their answers to the Focus Questions and to ask questions.
5. They review their graded exams with the TA's so they will not repeat mistakes on the final.

BYU STANDARDS

Honor Code:

We fully support the church program of which BYU is a part. It is our intention and commitment to support and uphold the honor system, the standards of dress and appearance, the highest level of personal integrity, and all other University traditions, rules and guidelines. If you observe any actions on our part which you think are inconsistent with this commitment, please let us know in a forthright but confidential way. We will treat you with the same courtesy.

Sexual Harassment:

Gender based discrimination and sexual harassment are against BYU policy and federal law. This extends not only to employees of the university but students as well. If you encounter unlawful sexual harassment or gender based discrimination, please talk to your professor, contact the Equal Employment Office (378-5895), or the Honor Code Office (378-2847).

CREDIT AND GRADES

General Education credit for the Physical Science (Arts and Science Core) requirement is given to students enrolled in Physical Science 100 who pass the course with a D- grade or better.

Grades are assigned based on the following work:

Exams 1-4	68 points/exam
Final Exam	184 points
Mini-Labs	8 points each (32 points)

We will compute your overall letter grade, using the grading scale below, in two ways:

1. Using only your score on the final exam.
2. Using your score on the **final exam** plus the four midterm exams and Mini-Labs.

Your grade will be the higher of the two. **Note:** The final exam is always included in your grade.

A	90% or above
A-	86-90%
B+	83-86%
B	79-83%
B-	75-79%
C+	70-75%
C	65-70%
C-	60-65%
D+	56-60%
D	53-56%
D-	50-53%
E	Below 50%

EXAMINATIONS

All exams are closed-book, closed-note tests. They will be taken in the Testing Center (Grant Building) on or before the dates listed below. They will be available three days before the deadlines given.

Exam	Format	Deadline
Exams 1-3	18 multiple choice questions 4 essay questions	Tues. May 14 Thurs. May 23 Thurs. June 6
Exam 4	34 multiple choice questions	Mon. June 17
Final Exam - <i>You must take the final exam</i>	60 multiple choice questions 8 essay questions	Thurs. June 20

Scoring Procedures

Multiple-choice questions are worth 2 points each. Your score on the *multiple-choice* section will reflect the number of correct responses. There is no penalty for incorrect choices.

Essay are worth 8 points each. All essay questions for the exams will be based on the Focus Questions given to you in the text. Answers must express the all the main ideas without serious error and demonstrate an acceptable writing skill level. If graders cannot discern what you are saying, due to either poor writing or grammar, your work will receive no credit. Partial credit will sometimes be given for answers which are incomplete or contain minor errors..

If questions are phrased in parts, answer them in parts. For example, an answer might look like this:

- a).....
- b).....
- c).....

Rules

1. All exams will be closed book and closed notes. You are not allowed aids of any kind, with the exception of a foreign language dictionary for those whose native language is not English. A Periodic Chart, a list of elements, and various tables and figures will be provided when necessary.
2. You will need a pencil and a picture I.D. (preferably your BYU activity card) to take the exams.
- 3. The exam questions are confidential and are not to be discussed with anyone, other than the class instructors or assistants, at any time.**

The scored answer booklets will be distributed in boxes just outside N252 ESC. They are usually available about one week after the exam deadline. *You may review a copy of the exam with a teaching assistant in N252 ESC before the next exam.* The deadlines for reviewing exams 1,2, and 3 are the same as the deadlines for taking exams 2,3, and 4 respectively. Final exams are not returned but may be reviewed in N252 ESC.

TESTING CENTER PROCEDURES

Hours

Day	Open	Last test distributed	Closed
Mon.	10:00	6:00	7:00
Tues	Noon	8:00	9:00
Wed.-Thurs.	10:00	8:00	9:00
Fri.	8:00	4:00	5:00
Sat.	8:00	1:00	2:00

General Information

The deadline to pick up a test Friday is 4:00 pm, you then have until 5:00 pm to finish the exam. This means that a student who gets to the Testing Center line at 4:01pm on the last day of test 2 will not be allowed to take the test. The Testing Center is generally crowded during afternoon hours on exam deadline dates. You will find morning hours less crowded.

MINI-LABS

A limited amount of credit is earned by completing 4 of the mini-labs found at the end of this packet.

Grading: Each mini-lab is worth 8 points. These assignments are 'all or nothing'. You will receive either 8 or 0 points. They will be graded in front of you by a Teaching Assistant in Room N252 ESC, and you will then be given the chance to correct your mistakes before turning it in. Should you choose to turn it in without reviewing your work with a TA, you run the risk of losing credit. All work must be neat and legible, or you will not receive credit.

Deadlines: You are required to select and complete at most one activity from each of the four quarters of the class. The assignments must be completed before the deadlines listed below:

Part	Deadline
1	Thurs. May 9
2	Tues. May 21
3	Fri. May 31
4	Wed. June 12

UW's and I's

A *UW* (Unofficial Withdrawal) is assigned to those who take no exams. **If any exam is taken**, the semester grade will be determined as described above, with zero scores for exams which are not taken or assignments which are not turned in. A *UW* affects your grade point average the same as an *E* does.

An *I* (Incomplete) is given by arrangement with your professor. An *I* is only given when extenuating circumstances (serious illness, death in the immediate family, etc.) occur **after** the twelfth week of a semester, or sixth week of a term. In case of such extenuating circumstances **prior** to this, you should apply directly to the Registration office, B-130 ASB, to officially withdraw from the class. An *I* is never given when you are failing or have failed the course.

If you think you qualify for an *I*, please contact your instructor. There is a \$10.00 fee for an *I*. An *I* is not counted as a failing grade in your grade point average until four months after you receive it. Thereafter, it becomes a failing grade in your grade point average until it is cleared.

EXEMPTION EXAMINATIONS

It is possible to satisfy the university physical science requirement by taking and passing an exemption exam. If you are not enrolled in PS100, the exam costs \$10 and you must take the test May 2-May 7. **If you are currently enrolled in the class you can obtain a test authorization form from your instructor and have the fee waived.** The exemption exam for this course is the equivalent of a final exam. It is comprehensive and will include 100 multiple-choice questions. Taking the Exemption Exam will not hurt your grade. If you do well on the Exemption Exam, you have several different options depending on your grade on the exam.

Grade	Options
60%-100%	<ol style="list-style-type: none">1. If you are enrolled in the class you can stay enrolled and do nothing. Your grade on the exemption exam will be posted as your grade on the class final, and hence, your grade in the class.2. If you are enrolled in the class, you can stay enrolled and take the final during the final exam period to try to improve on your score. Your grade in the class will be the higher of the two grades.3. If you are enrolled in the class, you can stay enrolled and take the class, completing all assignments and tests. Your grade in the class will be the higher of 3 grades: your grade on the exemption exam, your grade on the final, or your grade on all completed work including the final.4. If you are enrolled in the class you can drop the class and fill out a blue credit form at the Testing Center and pay the fee to have the appropriate letter grade posted on your transcript. You will receive a grade and GE credit without staying enrolled in the class and paying tuition for it. However, credit received in this manner does not count for the purposes of financial aid, or full time status.
75%-100%	<ol style="list-style-type: none">5. If you are enrolled in the class you can drop the class. You will have a waiver posted on your transcript without having the grade posted or receiving the credits. (The option of having the grade posted and getting credit is still opened to you. See 4. above.) YOU MUST DROP THE CLASS IF YOU DO NOT WANT THE GRADE POSTED.

The exact letter grade is determined by the scale given on page 4. Any score below 60% is not considered a passing grade on the exemption exam, and you must take the class to receive credit.

The exam is offered in the Testing Center from May 2-May 7.

Spring 2001 CLASS AND EXAMINATION SCHEDULE

May	1	W	Introduction and Prologue	Chapter 1
		W	Science and the Universe	Chapter 2
	3	F	Laws of Motion	Chapter 3
		F	Fundamental Interactions	Chapter 4
	6	M	Applications	Chapter 5
		M	Internal Forces	Chapter 6
	8	W	Conservation Laws	Chapter 7
		W	Motion Symmetry/Special Relativity	Chapter 8/9
deadline	9	<i>Thurs.</i>	<i>Mini-Lab 1 due</i>	
	10	F	Special Relativity	Chapter 9
	13	M	Questions and Answers on Chapters 1-9	
		M	Physical Properties of Matter	Chapter 10
deadline	14	Tues.	Exam 1 Deadline	
	15	W	Molecular Model	Chapter 11
		W	Increasing Disorder	Chapter 12
	17	F	Waves	Chapter 13
		F	Properties of Light	Chapter 14
	20	M	The Nuclear Atom	Chapter 15
		M	Duality of Matter	Chapter 16
deadline	21	<i>Tues</i>	<i>Mini-Lab 2 due</i>	
	22	W	Wave Model of the Atom	Chapter 17
		W	Questions and Answers on Chapters 10-17	
deadline	23	Thurs.	Exam 2 Deadline	
	24	F	Periodic Table	Chapter 18
		F	Molecules and Compounds	Chapter 19
	27	M	Holiday	
	29	W	Metals and Their Compounds	Chapter 20
		W	Compounds of Nonmetals	Chapter 21
deadline	31	<i>F</i>	<i>Mini-Lab 3 due</i>	
	31	F	Chemistry of Living Things	Chapter 22
		F	How Life Works	Chapter 23
June	3	M	Nuclear Structure	Chapter 24
		M	Nuclear Forces and Energy	Chapter 25
	5	W	Questions and Answers on Chapters 18-25	
		W	Cosmology	Chapter 26
deadline	6	Thurs.	Exam 3 Deadline	
	7	F	History of a Star	Chapter 27
		F	Planet Earth	Chapter 28
	10	M	Geologic Time	Chapter 29/33
		M	Earth's Interior	Chapter 30
deadline	12	<i>W</i>	<i>Mini-Lab 4 due</i>	
	12	W	Evidence of Plate Tectonics	Chapter 31
		W	Plate Tectonics	Chapter 32
	14	F	Earth's Changing Face	Chapter 34
		F	Questions and Answers on Chapters 26-34	
deadline	17	M	Exam 4 Deadline	
	17	M	Final Review	
deadline	20	Thurs.	Final Exam Deadline (The final is in the testing center.)	

FACULTY-Spring Semester 2001

Class	Faculty	Office	Phone	eMail
sec. 1 (11:00 MWF)	Mason	N249 ESC	2-7834	masong@byu.edu
sec. 2,3 (1:00 MWF)	Eastman	242 CB	2-2759	paul_eastman@byu.edu

ERRATA

The following errors were made in the first printing. Please make these corrections in your text.

Physical Science Concepts, 2nd Edition, *first printing*.

p.20 Error in figure 3.4. In most copies a corrected figure has been pasted over the original.

p. 177 $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ (Requires a factor of 2 in front of Mg.)

p. 226 ${}_{19}^{40}\text{K} + {}_{-1}^0\text{e} \rightarrow {}_{18}^{40}\text{Ar} + {}_0^0\text{neutrino}$ (The chemical symbol for argon is Ar not A.)

pp. 229-230 The half-life of carbon-14 is 5,730 years, not 5,370 years (5 occurrences).

Part 1, Option A

Name (print) _____

SS# _____

TA _____

Signature

Title: Weight and Contact Force

Objectives: To learn the difference between weight and contact force and to observe the relationship between net force and acceleration when a person is standing on a scale in an elevator.

Grading: This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

Instructions: Check out a scale from the TA lab (N252 ESC). (Sometimes scales are already in the elevator.) Take the scale to the passenger elevator in the ESC or SWKT and stand on it. Record the contact force observed, deduce the weight by reasoning, and describe what you know about the direction of the acceleration in the following situations. Do the entire activity when the elevator is either moving up **or** down. Do not try and mix data taken up and down in your analysis. hint: What does a scale measure, how much you weigh or how hard you push on it? (Text p. 21, 23,31,39)

1. When the elevator is at rest.

_____ contact force	_____ weight
_____ net force	_____ acceleration (direction only)

2. Just as the elevator begins to move.

_____ contact force	_____ weight
_____ net force	_____ acceleration (direction only)

3. As the elevator moves between floors.

_____ contact force	_____ weight
_____ net force	_____ acceleration (direction only)

4. As the elevator slows to a stop.

_____ contact force	_____ weight
_____ net force	_____ acceleration (direction only)

What is the difference between the weight and the contact force? Describe the two interactions responsible for these forces.

What relationship do you observe between the net force and the acceleration?

I personally participated in the activity and wrote the response in my own words:

Signature: _____

Part 1, Option B

Name (print) _____

SS# _____

TA _____

Signature

Title: Newton's Laws of Motion

Objective: To test the validity of Newton's second and third laws of motion when sitting on a rollerboard and interacting with other objects.

Grading: This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

Instructions: Obtain the following equipment or check it out from the TA lab (N252 ESC): Two rollerboards, a ten-foot length of rope, and a 2 liter bottle filled with rice, or some other object of equivalent mass. You will also need a companion (preferably someone whose weight is quite different than your own).

For each of the following experiments, report what you observe and how it is accounted for by Newton's laws of motion. Carefully note the evidence of forces and observed accelerations in the following situations.

When appropriate, contrast the strength of the various forces and explain the differences in acceleration of interacting objects. (Text p.23-24)

1. Pushing. Sit toe to toe on the rollerboards and push away from each other.
What happened?

Explain what happened in terms of Newton's laws.

2. Pulling. Sit on the rollerboards about ten feet apart holding the rope between you. Try to pull your companion toward you. Have your companion try to pull you toward her/him.
What happened?

Explain what happened in terms of Newton's laws.

3. Tossing the mass. Be careful. Try the experiment gently at first. Sit on the rollerboards, facing each other about three feet apart. Toss the mass to your companion. Have your companion toss the mass to you.
What happened?

Explain what happened in terms of Newton's laws.

I personally participated in the activity and wrote the response in my own words:

Signature: _____

Part 1, Option C

Name (print) _____

SS# _____

TA

Signature

Title: "Cartesian Retriever"

Objective: To alter the buoyant force on an object in such a way as to control its motion.

Grading: This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

Instructions: Go to the TA lab (N252 ESC) and locate a "Cartesian Retriever". Some describe it as a poor man's video game. This is an invitation to go and try the game for credit. By squeezing on the a bottle, you can move a hook up and down and, if you are good enough, catch an object on the bottom of the bottle. Actually, it can be pretty difficult, so it doesn't matter so much whether you are successful in mastering the game. The idea is to control the buoyant force on the retriever by changing its volume. When you do, you will observe that the retriever accelerates. By controlling the motion, try to pick up the object in the bottom of the container with the hook on the retriever.

Describe on this sheet how you change the **buoyant force** on the retriever and why that causes it to accelerate. Use Archimedes' principle and Newton's Laws in your description of this simple event. (Text p. 23, 49)

I personally participated in the activity and wrote the response in my own words:

Signature: _____

Part 2, Option A

Name (print) _____

SS# _____

TA _____
Signature

Title: Change of State

Objective: To allow you to demonstrate that you understand temperature and heat flow in terms of the molecular model and can correctly relate changes in temperature to changes in internal kinetic and internal potential energy.

Grading: This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

Instructions: When water boils, a funny thing happens. When you put water on the stove and turn the stove on, the temperature of the water begins to rise. When you reach the boiling point, the temperature stops rising, even though the water is boiling madly and the stove is still turned on. In case you don't believe it, this is a chance to find out. After all, if you really want to "know", you have to do the experiment.

A thermometer, hot plate, beaker and water will be available to do the experiment in the TA lab. If you wish to do the activity at home, try the experiment with a candy thermometer. If you don't have one, borrow one from a friend. When prepared with the right equipment and a note pad, turn on the stove and record the temperature every 30 seconds or so until after you reach the boiling point. Make two or three measurements after the water is boiling. Now explain in your own words what you observed, and why it happened. (Make sure that the thermometer's bulb is not touching the side of the container, and that the lower portion of the thermometer stem is completely covered by water at all times during the experiment.) (Text p. 101)

I personally participated in the activity and wrote the response in my own words:

Signature: _____

Part 2, Option B

Name (print) _____

SS# _____

TA _____
Signature

Title: Light Spectra

Objective: To allow you to observe discrete and continuous spectra in order to better understand how different atoms emit different colors of light.

Grading: This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

Instructions: On the East wall of the hallway leading from the foyer of the Eyring Science Center to the TA lab (N252 ESC), you will find a "spectrum maker". The display contains a normal light bulb and several special gas tube lamps. There is a diffraction grating in front of the lamps that separates the light into a spectrum.

1. Turn on the incandescent (normal) light bulb. It takes a few seconds to warm up before it comes on. What type of spectrum is produced?

2. Turn on the gas tube lamps. Look through the diffraction grating there to be sure you have seen that different kinds of atoms produce different discrete spectra. Do you think you could get good enough to distinguish the kind of light source by just looking at its spectrum? Briefly describe (or sketch) two different spectra.

3. Explain how atoms give rise to discrete spectra. (Text p. 138-139)

I personally participated in the activity and wrote the response in my own words:

Signature: _____

Part 2, Option C

Name (print) _____

SS# _____

TA _____
Signature

Title: Rainbows and waves

Objective: To observe waves and to understand a rainbow.

Grading: This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

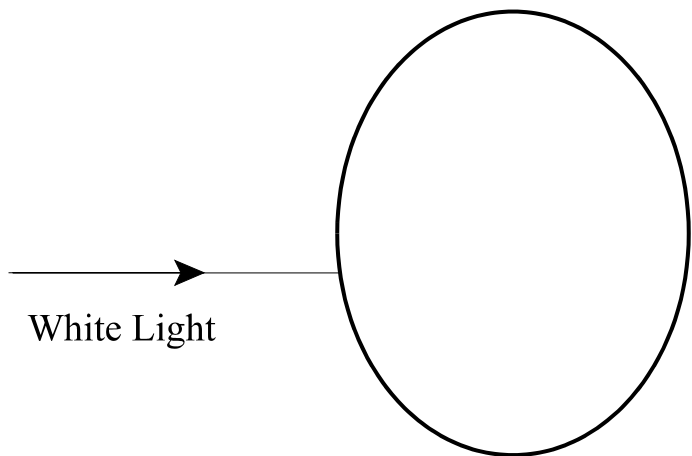
Instructions: Maybe you don't want to know how a rainbow works. Maybe it is like knowing how da Vinci created Mona Lisa's smile. Nevertheless, here is a chance to understand a rainbow.

In the hallway leading from the foyer of the Eyring Science Center to the TA lab (N252 ESC), you will find a "rainbow maker." Go play with the rainbow maker, read the posted material and then explain how rainbows are formed. (p. Text 118-120)

1. Explain how rainbows are formed. Sketch the path of a light ray through the 'raindrop' below and show how **reflection** and **refraction** of waves play a role in forming a rainbow.

I personally participated in the activity and wrote the response in my own words:

Signature: _____



Part 3, Option A

Name (print) _____

SS# _____

TA _____
Signature

Title: Orbitals

Objective: To experiment with observable standing waves and then apply the idea to orbitals in the wave model of the atom.

Grading: This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

Instructions: Near the ceiling of the foyer of the Eyring Science Center is a device called the BYU Wave-a-tron. Upstairs on the balcony in the center (due east of the Wave-a-tron), you will find a cabinet with the computer that controls the Wave-a-tron. Using the console, the Wave-a-tron can be set into many kinds of wave motion. They are fascinating to watch.

Go play with the Wave-a-tron. Push the buttons on the console and see what you get. Can you get traveling waves?

Can you get standing waves? (p. 155)

Describe what is happening when you produce a standing wave pattern. Why does the wave appear to stand still if it is caused by waves traveling in opposite directions?

Describe what an orbital is. (p.143) How is a standing wave of probability produced and what does it represent?

I personally participated in the activity and wrote the response in my own words:

Signature: _____

Part 3, Option B

Name (print) _____

SS# _____

TA _____
Signature

Title: Geology Mineral Exhibit

Objectives: To look at metals and salts and to review how some of their properties are determined by the bonds that hold them together.

Grading: This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

Instructions: BYU is home to some beautiful mineral exhibits. Some are displayed in display cases in the main hallway between the south stairways on the 2nd floor (between rooms C285 and C295).

1. Find the large pieces of native copper. Describe them. Do you think they would flatten out if you pounded on them with a hammer, or would they shatter? **Use your understanding of a metallic bond to explain your answer.** (Text p. 183-184)

2. Now find the beautiful crystals of fluorite (CaF_2). Describe them. Are they transparent? **Why?** Would they flatten out or shatter if you pounded on them with a hammer? **Use your understanding of ionic bonds to explain your answers.** (Text p. 186-187)

3. Take a minute and look at the other beautiful specimens. Which did you find most interesting?

I personally participated in the activity and wrote the response in my own words:

Signature: _____

Part 3, Option C

Name (print) _____

SS# _____

TA _____

Signature _____

Title: Orbitals

Instructions: Go to the TA lab (N252 ESC) and check out a 25-foot long piece of rubber tubing. For this one you will need another person to hold one end of the tube while you make waves. **Do this activity outside the building.** Professors and other students do not appreciate being hit with the tubing.

(A) Pull the end of the tubing to one side and wiggle it back and forth. Do you produce a longitudinal wave or a shear wave by doing this? BE CAREFUL! Don't let go when the tubing is stretched. You can hurt someone.

(B) Send a wave down the tubing again and then additional waves just as the previous waves reflects from the other end. What kind of interference can you create? (Text p. 120)

(C) See if you can create "standing waves" (Text p. 155) in the tubing by swinging it from side to side in rhythm. It takes a little practice. How many nodes can you get to stand at one time (the record is 7)?

(D) The speed of a wave on the tubing increases as you increase the tension in the tubing. Now, stretch the tube. If you wiggle the stretched tube at about the same frequency, does it get longer or shorter? Does increasing the tension tend to increase or decrease the number of nodes for about the same frequency? Use the following relationship to explain your answer:

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

(E) Describe what an orbital is. How is a standing wave of probability produced and what does it represent? (Text p. 143)

I personally participated in the activity and wrote the response in my own words:

Signature: _____

Part 4, Option A

Name (print) _____

SS# _____

TA _____

Signature

Title: Earth Science Museum

Objective

To examine and think about dinosaurs and other fossils. Specifically, to imagine the conditions that produced the fossils.

Grading

This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

Location

BYU Earth Science Museum at 1683 North, Canyon Road in Provo, directly west of the Cougar Stadium. (801)378-3680.

North American Museum of Ancient Life at Thanksgiving Point 2095 Thanksgiving way off of I15 in Lehi.. 766-5000 (There is a charge, and many exhibits are not opened yet.)

Note: Before going to the Museum, please check to see when they are open.

Instructions

Go to either the BYU Earth Science Museum or the Museum of Ancient Life.

List 5 different dinosaurs, the approximate time they lived, and the corresponding geologic era.

Name:	Absolute Date (in Years)	Relative Date (Era not Period)

Estimate how tall the tallest of the animals would have stood? _____

A floor on a building occupies ten feet. How many stories tall would the animal have been? _____

Describe one thing in the Museum that you found to be most interesting to you.

I personally went to the museum this semester or term and wrote the response in my own words:

Signature: _____

BYU Earth Science Museum

Step Back in Time and Discover a Real Jurassic Park

Explore a world filled with creatures of fantastic size. Imagine Jurassic predators tall enough to peer over a two-story building. Picture Jurassic plant-eating giants one-third of a football field long able to look into a fifth-story window. Envision strange, unfamiliar trees stretching toward the sky and subtropical plants competing for the remaining sunlight.

Step into the BYU Earth Science Museum and Discover.....

Dinosaurs, ice-age mammals and ancient forms of sea life.

Museum exhibits include. . .

- Expansive 20x11 foot mural depicting Ultrasaurus and Supersaurus as they may have appeared during the Jurassic period.
- 9-foot shoulder blade of Ultrasaurus.
- 150 million year old Jurassic dinosaur egg with X-ray revealing an embryo; discovered by BYU fossil preparator, Dee Hall. The egg is the most complete and only the second found from the Jurassic period.
- Preparation lab window showing museum personnel preparing fossils in the lab.
- two fully mounted skeletons of Camptosaurus and Allosaurus.
- A touch table featuring real fossils.
- Displays of Tyrannosaurus Rex, Triceratops & Deinonychus (a monstrous 50-foot crocodile).

Tours

The Earth Science Museum offers guided and self-guided tours. Call the Museum at (801)378-3680 for more information.

Prehistory Week

Each May, the Earth Science Museum sponsors Utah Prehistory Week activities and lectures. Call 378-3680 for more information.

Gift Shop

Fossil Casts, Rocks, Gems, T-shirts, posters, postcards, books, dinosaur “doodads” and other items are available at the museum gift shop.

Hours

Monday through Friday: 9am-5pm
Saturday: 12 to 4pm

Location

The Earth Science Museum is at 1683 North, Canyon Road in Provo, directly west of the Cougar Stadium. (801)378-3680.

Tours

The Earth Science Museum offers guided and self-guided tours. Call the Museum at (801)378-3680 for more information.

Prehistory Week

Each May, the Earth Science Museum sponsors Utah Prehistory Week activities and lectures. Call 378-3680 for more information.

Gift Shop

Fossil Casts, Rocks, Gems, T-shirts, posters, postcards, books, dinosaur “doodads” and other items are available at the museum gift shop.

Hours

Monday through Friday: 9am-5pm
Saturday: 12 to 4pm

Location

The Earth Science Museum is at 1683 North, Canyon Road in Provo, directly west of the Cougar Stadium. (801)378-3680.

Part 4, Option B

Name (print) _____

SS# _____

TA _____

Signature

Title: Speed of a Dinosaur.

Objective: To observe a "trackway" of a dinosaur and to reason from the fossil evidence and the assertions of a scientist how fast the dinosaur that left these tracks could run. The trackway can be found on the wall in the north-south hallway near C295 ESC.

Grading: This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

Instructions: Estimate the length of the dinosaur's stride in centimeters (a stride = two steps) and the length of the dinosaur's foot. You will use the information to calculate how fast the dinosaur was moving. It might be helpful to use a reference distance, such as an 8 1/2" x 11" (~20cm x ~30 cm) piece of paper to get a more accurate estimate.

Length of dinosaur stride in centimeters= _____

Length of the dinosaur's foot= _____

Research shows that the length of this dinosaur's foot is approximately 1/4 the length of its leg. Calculate the length of the dinosaur's leg.

Length of the dinosaur's leg= _____

In the April 1991 edition of Scientific American there is an article that shows how to estimate how fast a dinosaur moved. The author, R. MacNeil Alexander, does this by analysis of the relationship of stride length, length of leg, and observed speed in modern animals. According to Alexander's research, the length of a walking stride is 1-2 times the length of a leg. The length of a running stride is 3-5 times the length of a leg.

Was this dinosaur walking or running? _____

Calculate the speed of this dinosaur using one of Alexander's equations below. Show all work.

If walking: $(\text{speed})^2 = 1000\text{cm/s}^2 \times (\text{length of leg in centimeters})$ If running: $(\text{speed})^2 = 4000\text{cm/s}^2 \times (\text{length of leg in centimeters})$ *note: 1000cm/s² is the gravitational acceleration in units cm/s²*

In these units, the speed will emerge in centimeters per second.

Speed in centimeters per second= _____

(A fast human walk is 220 centimeters per second and the best sprinters run at about 1100 centimeters per second.)

I personally participated in the activity, did my own calculations, and wrote the response in my own words:

Signature: _____

Part 4, Option C

Name (print) _____

SS# _____

TA _____
Signature

Title: Rock Canyon Geology

Objective: To identify and describe several geologic structures observed in the mouth of Rock Canyon.

Grading: This assignment will receive either 0 or 8 points. It will be graded in front of you by a TA, and you will then have the opportunity to correct your mistakes.

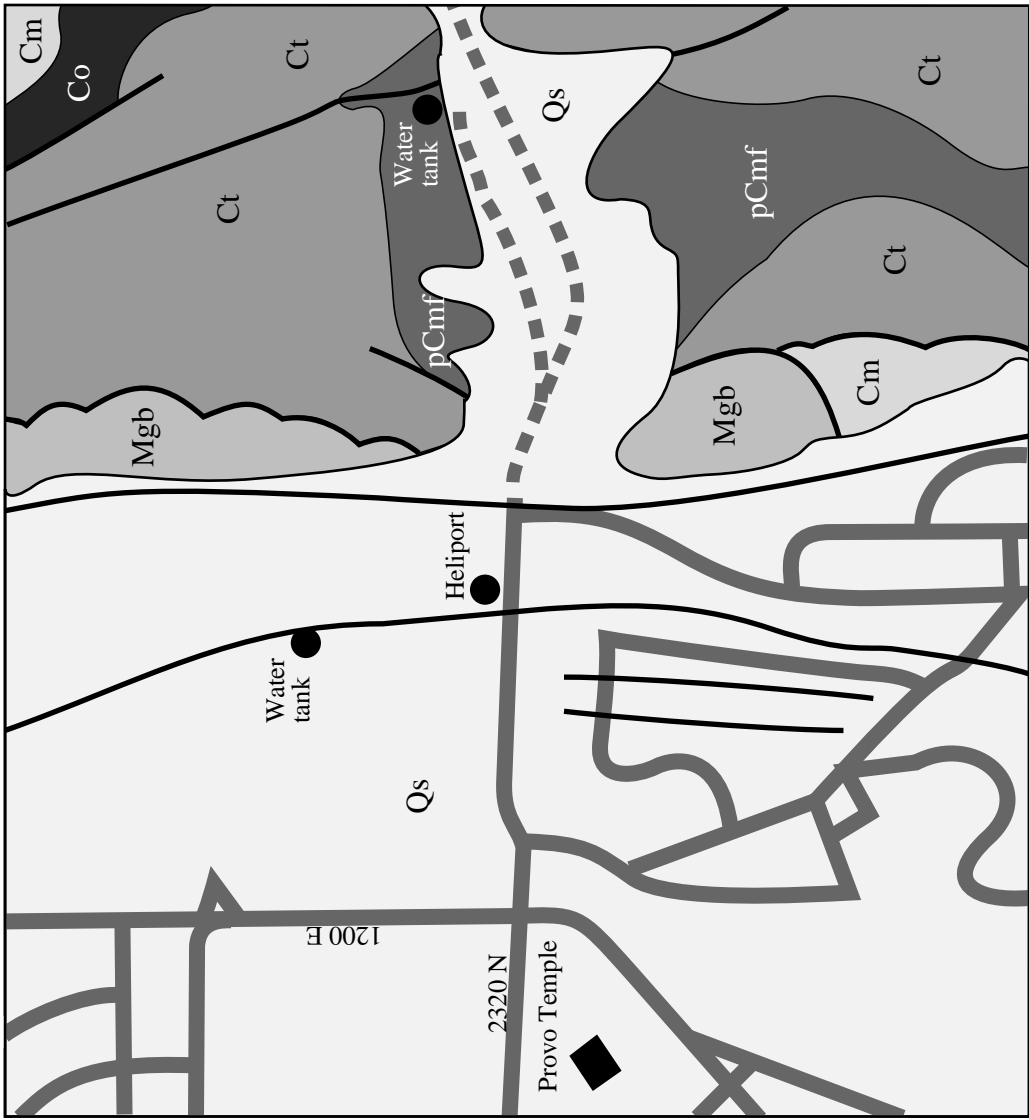
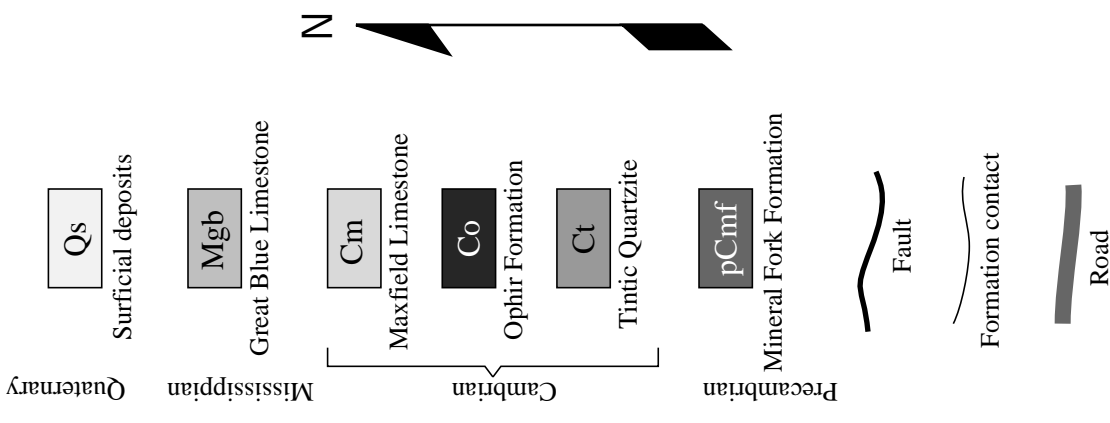
Instructions: Seeing geologic structures first-hand is far better than merely reading about them. So grab a friend and go to Rock Canyon (to look at geology)!

Attached to this sheet is a simplified geologic map of the areas just east of the Provo Temple around Rock Canyon.

Go to the site near the upper water tank at the end of the dashed route shown on the map. Look at the rock surrounding and to the north of the water tank. It is designated pCmf on the map. Geologists tell us that this rock is a Precambrian tillite. That means it was made when glacier action pulverized the rock under the glacier and piled it up. Now look at the red-brown rocks on top of the tillite (Ct on the map). Geologists explain that these rocks were formed from sand piled up on a beach. Also look up at the Great Blue Limestone (Mgb). These rocks make up many of the high cliffs that you see. The material making up these rocks was deposited at the bottom of a shallow sea. Observe the huge boulders that have fallen from these cliffs and are visible to the south. Can you see any folds in the rocks? Is there evidence for significant change in the local conditions over time? Write your answers on this sheet.

I personally participated in the activity and wrote the response in my own words:

Signature: _____



Rock Canyon Area
Simplified Geologic Map