

Changes in *Physics by Inquiry* teaching at Ohio State University

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and
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The organization of Physics by Inquiry classes at Ohio State University has evolved over the years that Physics by Inquiry has been taught. We have lately introduced two major changes: the pretests, previously used for physics education research data collection has been turned into a learning tool, and a “question of the day” has been introduced. We discuss the ramifications of these changes using illustrations from Physics by Inquiry classes.

PHYSICS 106 (OSU Marion Campus, Winter, 2003)



Class time: 12:00 - 14:50 (noon - 2:50 PM), Wednesday and Friday

Instructors: Gordon Aubrecht, Room 211C, Morrill Hall, 740-389-6786, ext. 6250; home 740-369-0992, aubrecht.1@osu.edu, Office Hours: by appointment

Carol Bowman, Room 330, Morrill Hall, 389-6786, ext. 6319, bowman.79@osu.edu, Office Hours: by appointment
possible student assistant

Office hours: 11 to 12, Wednesday and Friday

Required Text: *Physics by Inquiry, Vol. I: Properties of Matter* (J. Wiley & Sons, New York, 1996; ISBN 0-471-14440-1)

Other required material: Lab notebook (unless you take notes in your book, which is the recommended way to keep your notes)

The course is graded on the basis of 700 points (no curve). To get an A or A⁻, get better than 90%, or 630 points. To get a B⁺, B, or B⁻, score above 80%, or 560 points. Most students (about 85% historically) in this class earn either an A or B. It is possible to fail, if no studying is done, no homework is done well, no pretests are reworked, and the exams are blown, although this is not easy!

This course is aimed at helping you create your own understanding of the material. Therefore, everyone needs to participate as much as possible in the experiments and exercises. The teacher is there to provide help and to ask difficult questions to try to make sure you have understood what you are doing. In most cases, questions to the teacher will be answered by other questions. **Memorization may have helped you up to this point, but memorization will not be helpful in this class! Pay attention to your experiences.**

The tests are all open book, open note (which is why your notes are best kept in the book).

Do not be tempted to buy a used book, as there is no guarantee that the student who used it before had any idea of what he or she was doing, and the notes written may actually harm your own understanding!

Grading:

• 20 laboratory sessions at 4 points each	80 points
• 18 questions of the day at 3 points each	54 points
• 10 homework assignments at 12 points (av.) each	121 points
• Pretest for each section (3 points each)	45 points
• Journal for each week (-5 points for each missing)	30 points
• 2 quizzes at 30 points each	60 points
• 2 midterms at 80 points each	160 points
• 1 final exam at 150 points	150 points
• TOTAL Possible	700 points
• Homework Bonus points (If all 10 are done on time)	15 points

Laboratory grades are earned by participating actively in the laboratory work for the full period at each class meeting. Students are expected to come in on time, leave on time and actively engage in doing experiments related to class material to earn 4 points for each period. (1 point will be deducted for any person leaving early).

The **Question of the Day** (QoD) is a short written question based on your previous class work. Each class session will begin when the QoD is handed out promptly at 12:00; it is collected about 10 minutes later. You are encouraged to discuss your answers with fellow group members; however, your answer should be written in your own words. Each QoD is worth 3 points. QoDs reward students who arrive on time; therefore, anyone arriving after the QoD is collected is not eligible to complete it. If a student arrives at 12:09, the student must still turn in the QoD by 12:10, or whenever the instructor asks for them.

The **homework** will be a group grade: one randomly picked group member will be graded for each homework problem. There will be two to four homework problems each week. If a student turns in every homework **on time**, the student will receive 15 bonus points. Homework will be assigned and collected on Wednesdays, unless announced otherwise. Homework is due at the beginning of class before the QoD to be on time (late homework is docked 5 points). No credit at all will be given for homework over a week past due. Solutions will be made available subsequently at [homework solutions](#).

Journal entries will be read but not graded on content (assuming that there are more than just a few words, not qualifying as an entry). Your original 30 points will be reduced by 5 points for each missing journal entry. Therefore, if more than 6 entries are missing, the total journal grade will be a negative number. On Wednesdays, the next journal entries will be assigned on the [journal](#) website and the email journal is also due in Gordon's email (unless announced otherwise). Please put your preferred email address at the top of **each** email journal entry, as you may send it from a machine that automatically puts another return address on the file. No handwritten or typed journals can be accepted.

Pretest questions are answered by each person both before beginning each textbook section and after completing each section. Before starting the section, students write their answers to the pretest questions on the left half of the pretest page. In this first attempt, students work individually (not as a group) and keep their original pretest. After completion of the section, students rework their pretest and write their answers on the right half of the page. When reworking, students may consult with other group members. Each correctly reworked pretest is worth 3 points. The actual total number of pretest points you will get depends on the number of sections your group completes. (The 45 points above is only an estimate assuming only 15 sections--Section 1 through Section 14--will have been done by your group.) You will generally do the reworking at home. It is expected that you will submit the reworked pretest within a week of finishing the section.

A maximum of one-half of the assigned credit can be given when a missing homework is made up, if there is a valid excuse. **There can be no make-up for exams and quizzes.** If a quiz or an exam is missed for a valid reason, then the grade for that exam will be created from the average percent achieved on the other quizzes and tests multiplied by the points appropriate for the missed exam. For example, if the second midterm is missed and the average on all other tests is 80%, 0.8 will be multiplied by 80, the midterm maximum score, to create a midterm grade of 64 for the missed midterm, which is then counted as your second midterm grade.

All **exams and quizzes** are open notes and open book; the emphasis is on *reasoning and explaining from experience* for answers. Quizzes and exams are graded individually. Solutions to homework, quizzes, and midterms are posted subsequently on [homework solutions](#).

Tentative schedule (times approximate):

Week 1

- Jan. 8, 10: Section 1 (pages 3-5), Mass [1.5 hours]
Section 2 (pages 6-14), Balancing [3.5 hours]
Section 3 (pages 15-19), Measurement of mass [1 hour]

Week 2

- Jan. 15: Section 3 (pages 15-19), Measurement of mass [1.5 hours]
Section 4 (pages 20-26), Uncertainty [1.5 hours]
- Jan. 17, Section 5 (pages 27-33), Operational definitions [2 hours]; First Quiz on Jan. 17 through Sec. 4

Week 3

- Jan. 22: finish Sec. 5 [1 hour]; Section 6 (pages 34-37), Volume [2 hours]
- Jan. 24: Section 6 (pages 34-37), Volume [2 hours]; Do Expt. 7.1 as a class [1 hour]

Week 4

- Jan. 29: Section 7 (page 38-41), Changes in mass & volume [3 hours]
Section 8 (pages 42-43), Distinguishing mass from volume [done ahead by students as part of homework, checkpointed in class]
- Jan. 31: Section 9 (pages 44-50), Proportional reasoning [Ex. 9.3 and 9.4 done ahead by students as part of homework, checkpointed in class] [1 hour];
First MIDTERM on Jan. 31 through Sec. 8

Week 5

- Feb. 5: finish Sec. 9 [1.5 hours]; Handout, 9.4 A, B, and C, Whole and package reasoning [1.5 hours]
- Feb. 7: Section 10 (pages 51-54), Density [3 hours]

Week 6

- Feb. 12: Section 11 (pages 55-57), Measurement of densities [3 hours]
- Feb. 14: Section 12 (pages 58-65), Sinking and floating [2 hours]; Second Quiz on Feb. 14 through Section 11

Week 7

- Feb. 19: Section 12 (pages 58-65), Sinking and floating [3 hours]
- Feb. 21: Section 12 (pages 58-65), Sinking and floating [1 hour]
Section 12A (handout, pretest), Sinking and floating of inhomogeneous objects [2 hours]

Week 8

- Feb. 26: Section 13 (pages 66-75), Graphing mass and volume [3 hours]
- Feb. 28: Section 14 (pages 76-81), Interpreting algebraic expressions [1 hour]; Second MIDTERM on Feb. 28 through Sec. 13

Week 9

- Mar. 5: Section 14 (pages 76-81), Interpreting algebraic expressions [1.5 hours];
Section 15 (pages 82-89), Interpreting the equal sign [1.5 hours]
- Mar. 7: Section 16 (pages 90-91), Reasoning by analogy [done as part of homework, checkpointed in class]
Section 17 (pages 92-93), Dissolving in water [1.5 hours]
Section 18 (pages 94-97), Concentration of solutions [18.1-18.4 will be done as part of homework, checkpointed in class] [1.5 hours]

Week 10

- Mar. 12: Section 18 (pages 94-97), Concentration of solutions [1.5 hours]
Section 19 (pages 98-99), Changes in concentration [1.5 hours]
- Mar. 14: Section 20 (pages 100-102), Measurements of concentration [done as part of homework, checkpointed in class]
Section 22 (pages 108-111), Analogies [3 hours]

Note: If you finish a section ahead of schedule, proceed on to the next pretest and section.

Additional note: The end of a section is always a check point.

FINAL EXAM: Thursday, 20 March 2003, 12:00 - 13:50 (noon-1:50 PM).

Review for final, Wednesday, 19 March 2003 from 13:00 to 14:30 (1:00 to 2:30 PM), or some other time by later mutual arrangement.

Senior final: Wednesday, 12 March 2003, immediately after class. It will probably be comprehensive at least through Section 14 material, and probably through Section 16. The grade given will assume the group member attends class on 14 March; if this is not the case, a grade alteration will be made.

We may skip some parts of various sections to reach our goals. Also, some homework assignments will include preparation for checkpoints out of class.

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[latest revision, 14 December 2002]

PHYSICS 107 (OSU Marion Delaware Campus, Winter, 2003)



Class time: 17:00 - 19:50 (5:00 to 7:50 PM), Monday and Wednesday, Delaware Campus OSUM (near Orange Road)

Instructors: Gordon Aubrecht, Room 211C Morrill Hall, 740-389-6786, ext. 6250; home 740-369-0992

Carol Bowman, Room 330 Morrill Hall, 740-389-6786, ext. 6319

Brian Gillis, Student Assistant

We will try to be there early on Wednesdays for office hours.

Required Text: *Physics by Inquiry, Vol. II: Electric Circuits* (J. Wiley & Sons, New York, 1996; ISBN 0-471-14441-X)

Other required material: Lab notebook (unless you take notes in your book, **which is the recommended way to keep your notes**)

The course is graded on the basis of 700 points (no curve). To get an A or A⁻, get better than 90%, or 630 points. To get a B⁻, B, or B⁺, score above 80%, or 560 points. Most students (well over 60% historically) in this class earn either an A or B. About one-third get other grades. It is possible to fail, if no studying is done, no homework is done well, no pretests are reworked, and the exams are blown, although this is not easy!

This course is aimed at helping you create your own understanding of the material. Therefore, everyone needs to participate as much as possible in the experiments and exercises. The teacher is there to provide help and to ask difficult questions to try to make sure you have understood what you are doing. In most cases, questions to the teacher will be answered by other questions. Memorization may have helped you up to this point, but *memorization will not be helpful* in this class! Pay attention to your experiences.

The tests are all open book, open note (which is why your notes are best kept in the book).

Do not be tempted to buy a used book, as there is no guarantee that the student who used it before had any idea of what he or she was doing, and the notes written may actually *harm* your own understanding!

Grading:

• 19 laboratory sessions at 4 points each	76 points
• 17 questions of the day at 3 points each	51 points
• 10 homework assignments at 14 points (av.) each	137 points
• Pretest for each section (3 points each)	36 points
• Journal for each week (-5 points for each missing)	30 points
• 2 quizzes at 30 points each	60 points
• 2 midterms at 80 points each	160 points
• 1 final exam at 150 points	150 points
• TOTAL Possible	700 points
• Homework Bonus points (If all 10 are done on time)	15 points

Laboratory grades are earned by participating actively in the laboratory work for the full period at each class meeting. Students are expected to come in on time, leave on time and actively engage in doing experiments related to class material to earn 4 points for each period. (1 point will be deducted for any person leaving early).

The **Question of the Day** (QoD) is a short written question based on your previous class work. Each class session will begin when the QoD is handed out promptly at 5:00; it is collected about 10 minutes later. You are encouraged to discuss your answers with fellow group members; however, your answer should be written in your own words. Each QoD is worth 3 points. QoDs reward students who arrive on time; therefore, anyone arriving after the QoD is collected is not eligible to complete it. If a student arrives at 5:09, the student must still turn in the QoD by 5:10, or whenever the instructor asks for them.

The **homework** will be a group grade: one randomly picked group member will be graded for each homework problem. There will be two to four homework problems each week. If a student turns in every homework **on time**, the student will receive 15 bonus points. Homework will be assigned and collected on Wednesdays, unless announced otherwise. Homework is due at the beginning of class before the QoD to be on time (late homework is penalized 5 points). No credit at all will be given for homework over a week past due. Solutions will be made available subsequently at [homework solutions](#).

Journal entries will be read but not graded on content (assuming that there are more than just a few words, not qualifying as an entry). Your original 30 points will be reduced by 5 points for each missing journal entry. Therefore, if more than 6 entries are missing, the total journal grade will be a negative number. On Wednesdays, the next journal entries will be posted on this website and the email journal for the week is due in Gordon's email (unless announced otherwise). Please put your preferred email address at the top of **each** email journal entry, as you may send it from a machine that automatically puts another return address on the file or you may be sending it from someone else's machine. No handwritten or typed journals can be accepted.

Pretest questions are answered by each person both before beginning each textbook section and after completing each section. Before starting the section, students write their answers to the pretest questions on the left half of the pretest page. In this first attempt, students work individually (not as a group) and keep

their original pretest. After completion of the section, students rework their pretest and write their answers on the right half of the page. When reworking, students may consult with other group members. Each correctly reworked pretest is worth 3 points. The actual total number of pretest points you will get depends on the number of sections your group completes. (The 36 points above is only an estimate assuming only 15 sections--Section 1 through Section 12--will have been done by your group.) You will generally do the reworking at home. It is expected that you will submit the reworked pretest within a week of finishing the section.

A maximum of one-half of the assigned credit can be given when a missing homework, a missing journal, or a missing pretest is made up, if there is a valid excuse. **There can be no make-up for exams and quizzes.** If a quiz or an exam is missed for a valid reason, then the grade for that exam will be created from the average percent achieved on the other quizzes and tests multiplied by the points. For example, if the second midterm is missed and the average on all other tests is 80%, 0.8 will be multiplied by 80, the midterm maximum score, to create a midterm grade of 64 for the missed midterm.

All exams and quizzes are open notes and open book; the emphasis is on *reasoning and explaining from experience* for answers. Quizzes and exams are graded individually. Solutions are posted subsequently on [homework solutions](#).

Tentative schedule:

Week 1: Jan 6, 8: Section 1 (page 383--); start Section 2 (page 390--)

Week 2: Jan. 13, 15: Section 3 (page 397--); Gordon in Texas Jan. 13, First Quiz on Jan. 15 (end of class, 60 min)

Week 3: Jan. 20, Martin Luther King holiday; 22: start Section 4 (page 406--)

Week 4: Jan. 27, 29: start Section 5 (page 418--); First MIDTERM on Jan. 29 (end of class, about 100 min)

Week 5: Feb. 3, 5: finish Section 5 (page 418--); start Section 6 (page 426--)

Week 6: Feb. 10, 12: start Section 7 (page 430--); start Section 8 (page 445--); Second Quiz on Feb. 12 (end of class, 60 min)

Week 7: Feb. 17, 179: finish Section 8 (page 445--)

Week 8: Feb. 24, 26: Section 9 through 9.6 (page 455--462); Second MIDTERM on Feb. 24 (end of class, about 100 min)

Week 9: Mar. 3, 5: Section 10 (page 462--);

Week 10: Mar. 10, 12: Section 11 (page 478--); Section 12 (page 485--)

Note: If you finish a section ahead of schedule, proceed on to the next pretest and section.

Additional note: The end of a section is always a check point.

FINAL EXAM: MONDAY, 17 March 2003, 17:00 - 19:00 (5:00 PM--7:00 PM)

A review session will be organized prior to the final earlier Monday.

Senior final is to be taken immediately after class Wednesday, 12 March 2003. It will probably be comprehensive at least through Section 11 material, and probably through Section 12.

We may skip some parts of various sections to reach our goals. Also, some homework assignments will include preparation for checkpoints out of class.

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Pretests

As may be seen from the syllabi, the course is taught with students in groups (of 3 or 4). They gain almost half their fixed number of points by attending, doing homework, and doing journals and the pretests. The remaining points, ~53%, come from the exams.

Pretests have been used for a long time as an introduction to the section. Students did them, but never returned to reconsider their answers. Faculty sometimes examined the pretests to see the sorts of changes in student thinking that occurred. Two years ago, a suggestion by one of the OSU faculty members teaching Physics by Inquiry led to our revamping the pretests and making them into a greater part of the student learning experience.

The following are a few examples of reworked pretests (see handout).

PHYSICS 108 (Marion Campus, Autumn 2002)



Class time: 9:00 - 11:50, Wednesday and Friday, Room 385, Morrill Hall

Instructors: Gordon Aubrecht: Room 211C Morrill Hall, 389-6786, ext. 6250, aubrecht.1@osu.edu, Office Hours: 12:00-13:00, Wednesday and Friday, Rooms 211C/385 Morrill Hall

Mary Wildermuth: (614) 267-9762, wildermuth.1@osu.edu, Office Hours: 8:30-9:00, Wednesday and Friday, Room 385

Carol Bowman, Room 330 Morrill Hall, 389-6786, ext. 6319, bowman.79@osu.edu, Office Hours: by appointment

Required Texts: *Physics by Inquiry, Vol. I* (J. Wiley & Sons, New York, 1995; ISBN 0-471-14440-1)

Physics by Inquiry, Vol. II (J. Wiley & Sons, New York, 1995; ISBN 0-471-14441-X)

Other required material: Lab notebook (unless you take notes in your book, **which is the recommended way to keep your notes**)

The course is graded on the basis of 700 points (no curve). To get an A or A⁻, get better than 90%, or 630 points. To get a B⁻, B, or B⁺, score above 80%, or 560 points. Most students in this class earn either an A or B. It is possible to fail, if no studying is done, no homework is done well, and the exams are blown, although this is not easy!

This course is aimed at helping you create your own understanding of the material. Therefore, everyone needs to participate as much as possible in the experiments and exercises. The teacher is there to provide help and to ask difficult questions to try to make sure you have understood what you are doing. In most cases, questions to the teacher will be answered by other questions. **Memorization may have helped you up to this point, but memorization will not be helpful in this class! Pay attention to your experiences.**

The tests are all open book, open note (which is why your notes are best kept in the book).

Do not be tempted to buy a used book, as there is no guarantee that the student who used it before had any idea of what he or she was doing, and the notes written may actually harm your own understanding!

Grading:

• 21 laboratory sessions at 4 points each	84 points
• 20 questions of the day at 3 points each	60 points
• 10 homework assignments at 13 points (av.) each	126 points
• Pretest for each section (3 points each)	30 points
• Journal for each week (-5 points for each missing)	30 points
• 2 quizzes at 30 points each	60 points
• 2 midterms at 80 points each	160 points
• 1 final exam at 150 points	150 points
• TOTAL Possible	700 points
• Homework Bonus points (If all 10 are done on time)	15 points

Laboratory grades are earned by participating actively in the laboratory work for the full period at each class meeting. Students are expected to come in on time, leave on time and actively engage in doing experiments related to class material to earn 4 points for each period. (1 point will be deducted for any person leaving early).

The **Question of the Day** (QoD) is a short written question based on your previous class work. Each class session will begin when the QoD is handed out promptly at 9:00; it is collected about 10 minutes later. You are encouraged to discuss your answers with fellow group members; however, your answer should be written in your own words. Each QoD is worth 3 points. QoDs reward students who arrive on time; therefore, anyone arriving after the QoD is collected is not eligible to complete it. If a student arrives at 9:09, the student must still turn in the QoD by 9:10, or whenever the instructor asks for them.

The **homework** will be a group grade: one randomly picked group member will be graded for each homework problem. There will be two to four homework problems each week. If a student turns in every homework **on time**, the student will receive 15 bonus points. Homework will be assigned and collected on Wednesdays, unless announced otherwise. Homework is due at the beginning of class before the QoD to be on time (late homework is docked 5 points). No credit at all will be given for homework over a week past due. Solutions will be made available subsequently at [homework solutions](#).

Journal entries will be read but not graded on content (assuming that there are more than just a few words, not qualifying as an entry). Your original 30 points will be reduced by 5 points for each missing journal entry. Therefore, if more than 6 entries are missing, the total journal grade will be a negative number. On Wednesdays, journal entries will be assigned on the [journal](#) website and the email journal is also due in Gordon's email prior to class Wednesdays (unless announced otherwise). Please put your preferred email address at the top of **each** email journal entry, as you may send it from a machine that automatically puts another return address on the file. No handwritten or typed journals can be accepted.

Pretest questions are answered by each person both before beginning each textbook section and after completing each section. Before starting the section, students write their answers to the pretest questions on the left half of the pretest page. In this first attempt, students work individually (not as a group) and keep their original pretest. After completion of the section, students rework their pretest and write their answers on the right half of the page. When reworking, students may consult with other group members. Each correctly reworked pretest is worth 3 points. The actual total number of pretest points depends on the number of sections your group completes. (The 30 points above is only an estimate assuming only 10 sections will have been done by your group.) Depending on how you are keeping to the schedule, you may have to do the reworking at home.

A maximum of one-half of the assigned credit can be given when a missing homework is made up, if there is a valid excuse. **There can be no make-up for exams and quizzes.** If a quiz or an exam is missed for a valid reason, then the grade for that exam will be created from the average percent achieved on the other quizzes and tests multiplied by the points appropriate for the missed exam. For example, if the second midterm is missed and the average on all other tests is 80%, 0.8 will be multiplied by 80, the midterm maximum score, to create a midterm grade of 64 for the missed midterm, which is then counted as your second midterm grade.

All **exams and quizzes** are open notes and open book; the emphasis is on *reasoning and explaining from experience* for answers. Quizzes and exams are graded individually. Solutions to homework, quizzes, and midterms are posted subsequently on [homework solutions](#).

Tentative schedule (times approximate):

LO-I means Light & Color from Vol. 1; LO-II means Light & Optics from Vol. 2; Ast means Astronomy from Vol. 1. Note: If you finish a section ahead of schedule, proceed on to the next pretest and section. We list the expected approximate times for you to complete the sections shown.

Week 1

- Sept. 25: LO-I 1.1 to 1.6 (2.5 hours) [p. 225-229], How we see objects
- Sept. 27: Ast 1.1 to 1.4 (1.5 hours) [p. 325-327], Introduction to sunplots, set up sunboards and make observations
LO-I 2.1 to 2.3 (1.5 hours) [p. 230-232], Introduction to similar triangles

Week 2

- Oct. 2: Ast: 1.5 to 1.9 (3 hours) [p. 328-332], Length and time of shortest shadow (we provide plots for 1.7), prelude to similar triangles, bisecting angles
- Oct. 4: LO-I 2.8 to 2.9 (2 hours) [p. 232-238], Similar triangles

Week 3

- Oct. 9: LO-I 2.8 to 2.9 (2 hours) [p. 237-238], Similar triangles, images formed by varied holes
Ast 2.1 to 2.2 (1 hour) [p. 333-334], Fists method
- Oct. 11: Ast: 2.3 to 2.8 (2 hours) [p. 335-338]; First Quiz
Start moon data collection

Week 4

- Oct. 16: LO-I 3.1 to 3.5 (3 hours) [p. 239-243], Pinhole camera
Continue moon data collection
- Oct. 18: LO-I 4.1 to 4.5 (3 hours) [p. 244-246], Shadows (Gordon will be in class only part of the class time)

Week 5

- Oct. 23: Ast 3.1 to 3.5 (3 hours) [p. 339-342], Size and shape of Earth
- Oct. 25: Ast 4.1 to 4.5 (1.5 hours) [p. 343-345], Motion of the sun (we provide some sunplots); FIRST MIDTERM (Gordon will be in class only part of the class time)

Week 6

- Oct. 30: Ast 4.6 to 4.8 (1 hour) [p. 346-348], Motion of Earth relative to sun;
Handout, Seasons, (1 hour)
Ast 5.1 to 5.2 (1 hour) [p. 358], Moon phases--use standard data and our data
- Nov. 1: Ast 5.3 to 5.9 (3 hours) [p. 352-357], Moon phases(Gordon will be in class only part of the class time)

Week 7

- Nov. 6: Ast 5.10 to 5.11 (1 hour) [p. 358], Moon modeling
LO-II 1.1 to 1.5 (2 hours) [p. 539-544], Reflection in a mirror
- Nov. 8 LO-II 1.6 to 1.8 (2 hours) [p. 544-545], Reflection; Second Quiz

Week 8

- Nov. 13: LO-II 2.1 to 2.5 (3 hours) [p. 546-549], Image in a plane mirror
- Nov. 15: finish LO-II 2.6 to 2.12 (2 hours) [p. 551-554], Image in a plane mirror

Week 9

- Nov. 19: Evening lunar eclipse
- Nov. 20: LO-II 3.1 to 3.6 (3 hours) [p. 555-560], Multiple images
- Nov. 22: LO-II 3.6 to 3.9 (1.5 hour) [p. 560-561], Multiple images; SECOND MIDTERM

Week 10

- Nov. 27: finish LO-II 3.6 to 3.9 if not done; Parts of Section 4, Refraction, may be done as a class, time permitting
- Nov. 29: Thanksgiving holiday (Columbus Day celebrated)

Week 11

- Dec. 4: Ast 8.1 to 8.2 (1.5 hours) [p. 371]; Ast 6.1 to 6.3 (1.5 hours) [p. 359-363]
- Dec. 6: Ast 6.4 to 6.7 (3 hours) [p. 363-366]

Note: If you finish a section ahead of schedule, proceed on to the next pretest and section.

Additional note: The end of a section is always a check point.

FINAL EXAM: WEDNESDAY, 10 December 2002, 8:00 - 9:48

Senior final to be arranged. Seniors are urged to meet with Gordon early in the quarter to make sure the special senior final is scheduled correctly. It will most likely be on 4 December immediately after class.

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A few mentions of the **pretest**:

Q.: “What do you find helpful?”

(before change)

#1 Probably the only thing that I don't yet see the significance of, is the pretest.

(after change)

#1 Journals are helpful because we get feedback. It gives good one on one attention to problems. I haven't really had any experience with the exams yet, but the first quiz went rather well for me grade wise. I was a little paranoid, but it paid off. All in all the pretests probably help the most. Because I can compare what I already knew with the concepts that I have learned. So it is a definite way to see what I understand, and what I don't. I have something right in front of me to track the concepts. Right now we have only had one quiz, and I feel it came at the right time. The concepts we had been dealing with were fresh in our heads, and we hadn't yet gotten into anything new. The pretests help a lot, but it still is hard sometimes to keep track of when to get a new one, and when to rework the old one.

#2 The pretests are fine though I find them to be somewhat of a hassle. I have found myself doing the pretest which I don't mind but then I put it aside and seem to forget about it as there's so many other things going on in the class. I guess I would like it better if maybe we did the pretest and either got points for just doing it you know like maybe 1 or 2 points and you just

visually checking it to see that we've done it. I guess to me the post test is the exercises that we work through in the book and also the checkpoints it just feels like too much to also have to go back and redo the pretests.

#3 Using pretests at the start of a section help me to get thinking on what is coming up. When I go back to do the posttest, I see what I had learned during that section. Especially I learn how to explain my reasonings better.

“Do you think you,ve learned new ways of learning that will be of use in other contexts? Please explain how, or why not.”

I love the “raising curiosity” before beginning to solve a problem. When we are given a pretest to see what we know, when I don't know, I want to learn even more.

(indicative of student opinion both before & after)

Question of the Day

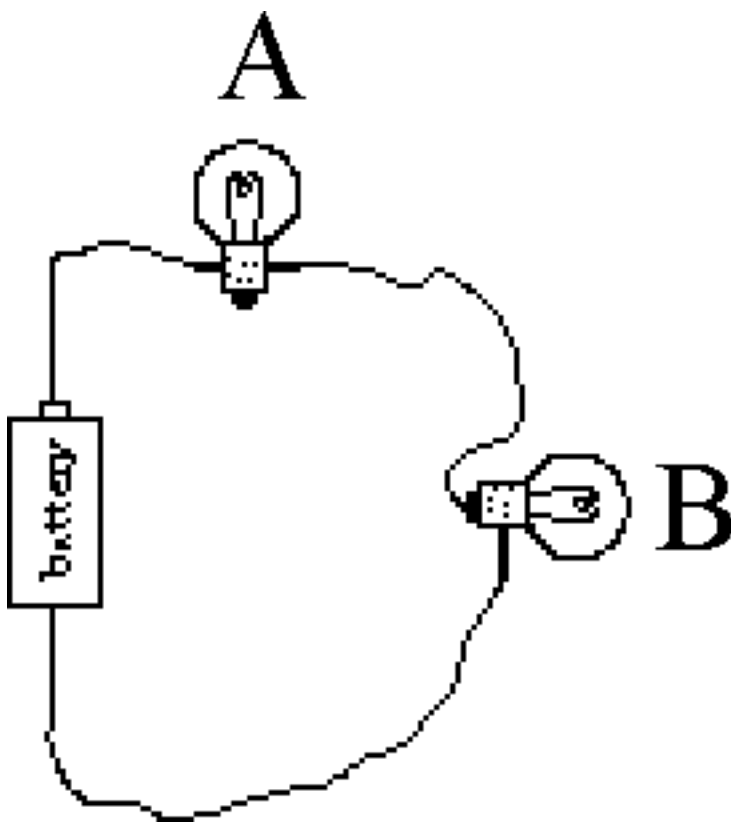
The other major change we made was to reduce the number of points for attendance and giving some of these for the “question of the day.” (Dave Andereck’s idea—why didn’t I think of it myself?) The idea was to help students come to class on time by having the first ten minutes be spent answering a question. Also, it reduced arguments with students about whether they should lose points for being late (if the question had been collected already, the student obviously couldn’t get credit).

Typical questions:

You open up your refrigerator door and see a) the refrigerator’s light bulb and b) a can of soda. Explain how your eye is able to see the light bulb and the can. Draw a diagram and explain your reasoning.

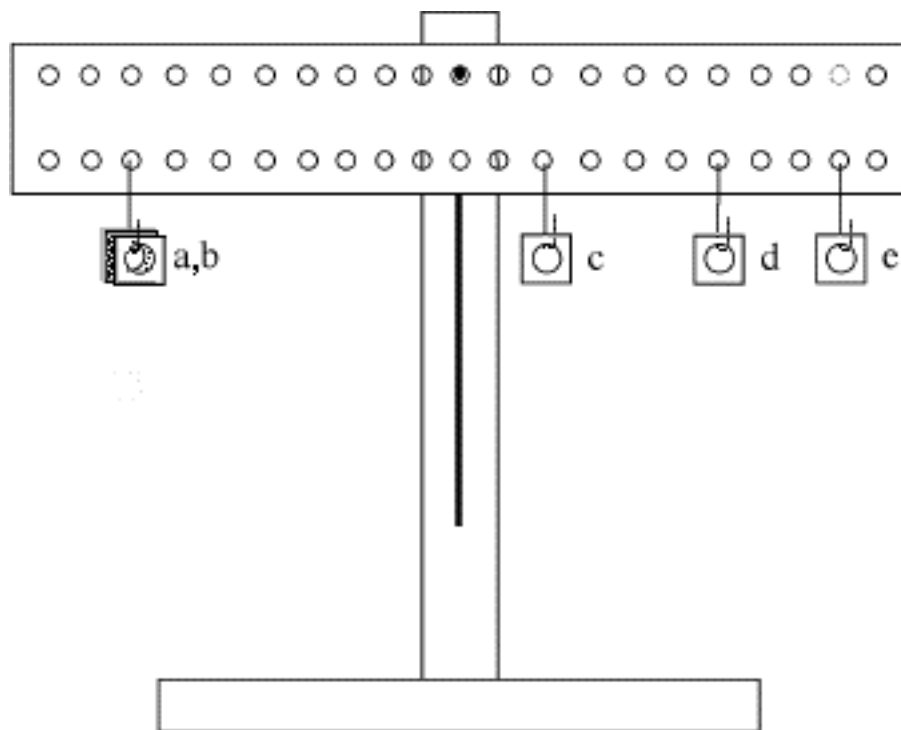
questions

What does the circuit diagram for the following circuit look like? Explain your reasoning. Use the conventions on page 387 for drawing the circuit elements.



questions

Consider the usual balance apparatus with the usual square nuts hanging from it as shown below. Will the apparatus balance when set up this way? Explain. (Notice that the nuts are already labeled, and two nuts [a and b] are on the left.) If the scales do not balance, which side will be lower, right or left? Explain briefly.



questions

A mask with a circular hole is placed between a small lighted bulb and a screen. How would each of the following changes affect the size of the bright region on the screen? For each case, draw a sketch and explain your reasoning.

- a) The screen is moved closer to the mask (without moving the bulb or mask).
- b) The mask is moved closer to the screen (without moving the screen or bulb).
- c) The bulb is moved farther from the mask and screen (without moving the mask or screen).

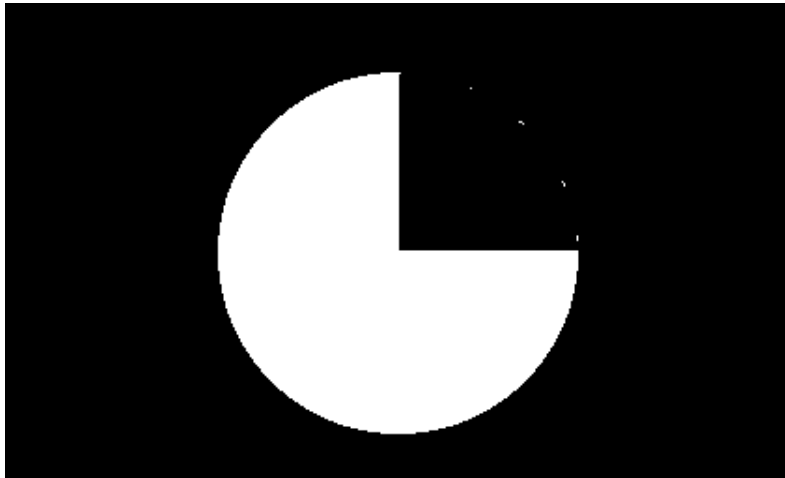
Draw a circuit diagram with two bulbs in series connected to a battery. Draw a second circuit diagram with two bulbs in parallel connected to a battery. Compare the brightness of all four bulbs and explain your reasoning.

questions

Hallie wants to get a good measurement of the volume of one of our plastic 1 cm^3 cubes in a graduated cylinder. She reasons that if she adds the blocks one at a time into the 250 mL graduated cylinder, and keeps track of the volume of each cube that way that she would have the smallest uncertainty in the volume. Assess Hallie's method. Is it the best? If so, why? If not, how would you change her method to get the smallest uncertainty in the volume of a plastic cube using the 250 mL graduated cylinder and 100 plastic cubes (and what it would be)?

questions

Consider a mask with a hole that looks like the opening below. Explain what the bright area on the screen would look like if a long filament bulb is held (a) horizontal and (b) vertical at some distance from the mask.



Samples of answered questions of the day are here.

(see handout)

a simple circuit

balance

Overall student evaluation

“How would you define inquiry-based instruction?”

I feel inquiry based instruction is very open. We learn everything by doing it ourselves, and if there is something we have a question on, it is usually figured out by thinking up an experiment to try it out. There are no study and answer kind of sheets, or tell all formulas.

“What is your general opinion of the course?”

#1 This course is definitely a good one for people first getting into physical sciences. Or thinking about teaching them. With all the room we are given to learn, get ahead, try and succeed or try and fail, it is a great class to see if you like what you are getting yourself into. The way it is set up gives us a ton of room to fail by getting off course, but we've been taught that even though we may not be learning what is in the book, we are still learning, and that's not failing at all. So the class also gives us all the room we want to succeed.

“What is your general opinion of the course?”

#2 This class has greatly changed my ways of looking at the world. First, I have realized that in the world people have varying levels of knowledge and common sense. I have learned that there are some with a vast knowledge of many subjects and I have learned that in life one will encounter and need to work with those who have very little common sense or a lack of knowledge in certain subjects. Often, this lack of knowledge and common sense is quite amazing! Second, I have learned that when faced with a challenge, you make the best of it and see what you can learn in the end.