

# Moravian College Astronomy—Earth Science 130

## Spring Term 2010—Tuesdays/Thursdays 6:30-9:30 p.m.

(Syllabus subject to change)

**Instructor:** Gary A. Becker; **Phones:** Moravian Office-610-861-1476/W-484-765-5557/H-610-282-3583;  
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[garyabecker@gmail.com](mailto:garyabecker@gmail.com); **Web Page:** [www.astronomy.org](http://www.astronomy.org)

**Astronomy Tool Kit:** Always bring to class *Becker's Astronomy Survival Notebook* (BASN), *Universe: A Definitive Visual Guide* (UDVG), a calculator, a pen, several lead pencils, five different colored pencils (preferred-RYGBV), a good eraser, metric ruler, protractor, compass, a small flashlight and binoculars (if the night is clear).

| Date   | Cl | Topics   | Texts: BASN/UDVG  |
|--------|----|--|---|
| Jan-19 | 1  | <b>Getting Started:</b> Course Syllabus and class routine, use of BSAN, <a href="http://www.astronomy.org">www.astronomy.org</a> , What is Astronomy? Distill the word to its basic meaning. Test Your Visual Knowledge of Astronomy exercise.   | Get your astronomy tool kit together. Borrow a pair of binoculars if you do not already own one.            |
| Jan-21 | 2  | <b>Popular Misconceptions:</b> Session one vocabulary quiz, Harvard University's Misconceptions Exam., Astrology vs. Astronomy exercise; Earth, sun, moon relationships—seasons demonstrated (teacher/student), Seasons Lab, <b>Traditions of the Sun</b> assignment.  | <b>BASN:</b> Session 1 and 2<br><b>UDVG:</b> pp 6-7.  |
| Jan-26 | 3  | <b>Archaeoastronomy:</b> Save Your People, Win That Girl exercise, The Long Road to Chaco, Mysterious Pueblo Bonito exercise, <b>Light my Pole</b> under moonlight lab or assignment, depending upon evening weather conditions.   | <b>BASN:</b> Session 2 and 3<br><b>UDVG:</b> View from Earth, pp. 56-91.                                    |
| Jan-28 | 4  | <b>At ASD Planetarium:</b> Bus pickup 6:15 p.m. Collier Hall of Science. Introduction to the planetarium environment, seasons from home and different latitudes, lunar phases, NCP constellations.   | <b>BASN:</b> Session 2<br><b>UDVG:</b> Constellations, pp. 328-431 (N. Hem.), skim, enjoy.                  |
| Feb-2  | 5  | <b>Archaeoastronomy:</b> The Long Road to Chaco concluded, Stonehenge decoded.   | <b>BASN:</b> Session 3<br><b>UDVG:</b> Constellations, pp. 410-431 (N. Hem.)                                |
| Feb-4  | 6  | <b>At ASD Planetarium:</b> Bus pickup 6:15 p.m. Collier HS. Coordinate systems: Altitude and azimuth, latitude and longitude, equatorial coordinate system, precession, time, celestial navigation lab, constellations.  | <b>BASN:</b> Session 2 and 4<br><b>UDVG:</b> Constellations, pp. 432-449 (N. Hem.).                         |
| Feb-9  | 7  | <b>Lunar and Solar Eclipses:</b> Basic eclipse terminology, repetition of eclipses, the saros, chasing eclipses, equatorial coordinate system lab or assignment, pp 98-99.   | <b>BASN:</b> Session 6, get familiar with vocabulary.<br><b>UDVG:</b> Constellations, pp.450-467 (N. Hem.). |
| Feb-11 | 8  | <b>At ASD Planetarium:</b> Bus pickup 6:15 p.m. Collier HS. Demonstrations of parameters which influence eclipses, planetary motions, and configurations, constellations.  | <b>BASN:</b> Session 6<br><b>UDVG:</b> Constellations, pp. 468-485 (N. Hem.).                               |
| Feb-16 | 9  | <b>Telescopes:</b> Knowing your telescope, economizing the size of telescopes, telescopes at a glance. <b>Class starts 5:30 p.m. on rooftop observatory</b> to view Venus-Jupiter conjunction, moon. Check <a href="http://astronomy.org">astronomy.org</a> for go/no go by 3:30 p.m. Examine telescopes. Bring your binoculars. | <b>BASN:</b> Session 5<br><b>UDVG:</b> Exploring Space, pp. 80-111.   |

| <b>Date</b> | <b>CI</b> | <b>Topics</b>   | <b>Texts: BASN/UDVG</b>  |
|-------------|-----------|---|--|
| Feb-18      | 10        | <b>Dark Sky Observing at Jacob’s Farm, Ghost Mountain:</b> Bus pickup 5:50 p.m. Collier. Bring your binoculars. Arrive at farm during mid-twilight to view planets and the 20 percent lit moon. Tour of the constellations, view deep sky objects, number of stars visible. | <b>BASN:</b> Session 16<br><b>UDVG:</b> Constellations, pp. 328-431 (N. Hem.), skim, enjoy—repeated from Jan. 28 readings. |
| Feb-23      | 11        | <b>EXAM on lessons 1-10:</b> Student driven review for the first hour of class, observe the moon, 1.5 hour exam limit.  | Review necessary material in texts. Write out questions for discussion.  |
| Feb-25      | 12        | <b>Introduction to the Solar System:</b> Vocabulary list, graphical understanding of SS characteristics, Invasion of the Sarbra People, angular momentum, Kepler’s three laws (ellipses), sketch an orbit.  | <b>BASN:</b> Session 7, review insert section.<br><b>UDVG:</b> SS, pp. 114-119.  |
| Mar-2       | 13        | <b>Introduction to the Solar System:</b> Universal gravitation, magnetic fields, volatile versus refractory materials, stellar birth, a possible sequence of events for the origin of the solar system, calculating the mass of Jupiter.                                    | <b>BASN:</b> Session 7, review insert section.<br><b>UDVG:</b> SS, pp. 114-119.  |
| Mar-4       | 14        | <b>Comparative Planetology—The Earth:</b> Atmosphere and its circulation, interior structure and differentiation, plate tectonics, magnetic field, amount of volatiles contained in the Earth.  | <b>BASN:</b> Session 8, review insert section.<br><b>UDVG:</b> SS, pp. 138-147.  |
| Mar-16      | 15        | <b>Comparative Planetology—The Moon:</b> Survival on the Moon exercise, formation and evolution of the moon, lunar physical features, how the moon changes, when we went to the moon.   | <b>BASN:</b> Session 9, review insert section.<br><b>UDVG:</b> SS, pp. 148-159.  |
| Mar-18      | 16        | <b>Comparative Planetology:</b> Volcanism and cratering in the solar system, explore Venus via computer.  | <b>BASN/UDVG:</b> Cumulative review of appropriate readings.   |
| Mar-23      | 17        | <b>Mars:</b> Explore Mars with a computer, physical features via remote sensing of the planet’s surface, evidence for past and present water on Mars, Spirit, Opportunity, and Phoenix make their mark, Mercury, Venus if time permits.                                     | <b>BASN:</b> Session 10, review insert section.<br><b>UDVG:</b> SS, pp. 124-138, & <b>pp.160-175.</b>                      |
| Mar-25      | 18        | <b>Outer Solar System:</b> Jupiter will never be a star, internal structure, magnetic field, atmospheric circulation, ring systems focusing on Saturn, interesting moons of the outer planets, dwarf planets.   | <b>BASN:</b> Session 11, review insert section.<br><b>UDVG:</b> SS, pp. 176-203.   |
| Mar-30      | 19        | <b>Small Solar System Bodies:</b> Let’s build a comet, anatomy of a comet, morphology, naming comets, great comets, meteors, m. showers, meteorites, and asteroids.   | <b>BASN:</b> Session 12<br><b>UDVG:</b> SS, pp. 204-223.   |
| Apr-2       | 20        | <b>EXAM on lessons 12-19:</b> Student driven review for the first hour of class, observe Mars and Saturn if weather permits, 1.5 hour exam limit.   | Review necessary material in texts. Write out questions for discussion.  |
| Apr-6       | 21        | <b>Day Star Sun:</b> Observe the sun—Collier rooftop, think magnetic, “surface features,” sunspot cycle, internal structure, proton-proton reaction.  | <b>BASN:</b> Session 13<br><b>UDVG:</b> SS, pp. 120-123.   |
| Apr-8       | 22        | <b>Stars:</b> Basic characteristic of hydrogen burning stars, apparent and absolute magnitudes, parallax, distance modulus.   | <b>BASN:</b> Session 14<br><b>UDVG:</b> MW, pp. 230-245.   |

| Date   | Cl | Topics   | Texts: BASN/UDVG  |
|--------|----|--|---|
| Apr-13 | 23 | <b>Stars:</b> The nature of light, temperature, black body curves, colors of stars, Bohr atom, Kirchhoff's laws, fluorescence spectral lab.  | <b>BASN:</b> Session 14<br><b>UDVG:</b> MW, 246-261.                    |
| Apr-15 | 24 | <b>Stars:</b> Spectroscopy quiz, absorption spectrum lab, construction of an H-R diagram lab.  | <b>BASN:</b> Session 14<br><b>UDVG:</b> Cumulative review of readings.  |
| Apr-20 | 25 | <b>Stellar Evolution and the H-R Diagram:</b> What does an H-R diagram tell us, luminosity classifications, using the H-R diagram as a tool for understanding the distance, stellar birth, life, intrinsic and eclipsing variable stars. | <b>BASN:</b> Session 14<br><b>UDVG:</b> MW, pp. 270-289.                |
| Apr-22 | 26 | <b>Stellar Evolution:</b> Stellar old age, supernovae and the death of stars, white dwarfs, neutron stars, black holes.  | <b>BASN:</b> Session 14<br><b>UDVG:</b> MW, pp. 262-269.                |
| Apr-27 | 27 | <b>The Universe and its Fate:</b> Big Bang not really a bang, cosmic microwave background, dark matter, dark energy, open or closed universe?  | <b>BASN:</b> Session 15<br><b>UDVG:</b> MW, pp. 292-325.                |
| Apr-29 | 28 | <b>Don't get your hopes up:</b> TBA. Student driven review for final exam which will focus specifically on lessons 21-28.  | Review necessary material in texts. Write out questions for discussion. |
| May-4  |    | <b>EXAM on lessons 21-28:</b> Same weight as other exams.  | <b>Happy Summer!</b>  |

**Goals of the Course:** Read “ASD Student Foreword,” Astronomy Course Objectives, and *Astronomy Survival Notebook*, pp. i-iii in *Becker's Astronomy Survival Notebook..* These will also be discussed during the first class meeting.

**Course Objectives from the Previous Instructor, Dr. Joseph Gerencher...** Students will understand the basic elements of time, date, seasons, positional coordinates, and observed celestial motions, the appropriate methods by which celestial objects and systems are observed, studied, presented, and analyzed, the use of the telescope [and binoculars] for making astronomical observations, a reasonable sense of scale concerning sizes, distances, brightness, masses, speeds, forces, and processes application of appropriate fundamental scientific principles to study celestial objects and systems, and the interaction and evolution of celestial objects and systems through time. Kindly consider these also.

**Required Texts:** *Becker's Astronomy Survival Notebook* (copy supplied by instructor free of charge), *Universe: The Definitive Visual Guide*, General Editor, Martin Rees (Moravian College Bookstore).

**Attendance Policy:** **Students will sign in when they arrive to class.** Students are expected to be in class on time (6:30 p.m.), in a state of preparedness, and attend all classes. Pupils who miss a class will be expected to provide legitimate, written proof about why they were absent to avoid penalty. A penalty structure for missed classes without proof of absence will be as follows:

|                              |     |           |           |           |            |            |            |         |             |                   |
|------------------------------|-----|-----------|-----------|-----------|------------|------------|------------|---------|-------------|-------------------|
| Classes Missed:              | 0   | 1         | 2         | 3         | 4          | 5          | 6          | EVENT   | 7           | <b>BLACK HOLE</b> |
| Penalty Deduct:              | +10 | -1 +      | -2 +      | -4 +      | -8 +       | -16 +      | -32 +      | HORIZON | -64         | <b>OF DEATH</b>   |
| <b>Total Penalty Applied</b> |     | <b>-1</b> | <b>-3</b> | <b>-7</b> | <b>-15</b> | <b>-31</b> | <b>-63</b> |         | <b>-127</b> |                   |

**Academic Honesty Policy:** As per the Moravian College Catalog 2008-2010, p. 47... Put in very Basic English: You cheat, you get caught, and you will fail.

**Determination of Grades:** Refer to *Becker's Astronomy Survival Notebook*, pp. i-ii. Note that the attendance policy will not include an attendance grade as stated in BASN p. ii. Students will receive a bonus of 10 points if they are present for all classes. Moravian's +/- policy with regards to grading will also be adhered to as noted below:

A =>93%,            A- =>89.5%<93%,  
B+ <89.5%=>87%,    B <87% =>83%,    B- =>79.5%<83%,  
C+ <79.5%=>77%,    C <77% =>73%,    C- =>69.5%<73%,  
D+ <69.5%=>67%,    D <67% =>63%,    D- =>59.5%<63%,  
F <59.5%

Students' grades will be available for inspection during class, but grades will not be posted.

**Participation:** If you have a question and do not ask it, you do yourself and me a disservice. Your chances of learning specific concepts are diminished, and I get a false sense of accomplishment, neither of which is good. Your participation is genuinely encouraged and it will be rewarded in your grade. It becomes boring if information is flowing from only one direction. STUDENTS HAVE A RESPONSIBILITY TO KEEP CLASSES INTERESTING AND TO HELP ME ACHIEVE AT MY GREATEST POTENTIAL.

**Learning Disabilities:** Any student who wishes to disclose a disability and request accommodations under the Americans with Disabilities Act (ADA) for this course first MUST meet with either Mrs. Laurie Roth in the Office of Learning Services (for leaning disabilities and/or ADD/ADHD) or Dr. Ronald Kline in the Counseling Center (for all other disabilities).

**Cell Phones:** Turn your cell phones off when in class unless you are using a cell phone and a peripheral device to take and transmit notes during class. If there is an emergency, kindly inform me about this situation and communicate outside of the classroom. During breaks, cell phones may be used. Consider the educational process to be similar to live theater. The actors and audience need to concentrate in order to understand the storyline.

**Food:** Class time is not mealtime. Keep snacking to a minimum. The preferred drink of choice is water, but I will be a little more lenient here. If you make a mess, you'll be responsible for cleaning it up!

**Observation Sessions:** From time to time class observations will be made from the Collier Rooftop Observatory. Conditions can be windy and cold. On clear nights students should bring to class extra protection for the head and hands in addition to normal winter clothing worn during the cold season.

AND THE REST WE'LL MAKE UP AS WE GO ALONG... (If necessary)

\*\*\* BECKER'S \*\*\*

# ASTRONOMY SURVIVAL NOTEBOOK

## ASD STUDENT FOREWORD

**ASTRONOMY**, as the author teaches it, is a science elective designed for students who have always wanted to know more about the macrocosm that surrounds them. The major areas of focus include a thorough understanding of the solar system and stellar evolution. Additional topics include misconceptions, archaeoastronomy, eclipses, navigation, time, instrumentation, observational techniques, relativity, string theory, and constellation identification. Current events in the field of astronomy, student preferences, and teacher preferences often dictate the order of topics that are presented during the semester. After nearly than four decades of astronomy instruction, I have yet to be convinced of a prescribed methodology for maximizing teaching efficiency. Generally, college textbook writers arrange their order of development outward, starting with Earth-centered topics. I believe that an instructor can fundamentally start anywhere within the discipline and teach a good course.

A basic reason why pupils choose to elect this course over other subjects is because of their access to the Allentown School District Planetarium located at Dieruff High School. Students living in an urban environment want to know more about the universe that surrounds them. Becoming even a little familiar with the nighttime sky makes learning astronomy more enjoyable because the attained knowledge becomes more personal. A student can look up into the sky and see what she or he has learned.

The astronomy course that you will be taking is primarily designed for nonscience majors at the college level or highly motivated, science-interested upperclassmen on the high school level. Although this astronomy course is mainly descriptive in nature, I have found that individuals with poor mathematical skills almost always experience some difficulty in conceptualizing some of the material associated with this subject. This does not mean that a final grade of an “A” or a “B” is unobtainable, but it does mean that the student will probably have to work harder to achieve this goal.

The Internet is an excellent tool for gaining valuable and particularly timely information about astronomy, but there is a catch. Much of the on-line material is incorrect or poorly written. To help with this dilemma, I have constructed a home page to be used along with this text. It can be accessed at [www.astronomy.org](http://www.astronomy.org). The links associated with *Astronomy*, *StarWatch*, *Programming*, *Photography*, and *Resources* should prove particularly useful. I also recommend the online astronomy articles found in *Wikipedia*. An older, but outdated edition of this notebook is online. Click on the appropriate link when [www.astronomy.org](http://www.astronomy.org) loads.

Thank you!

Gary A. Becker  
January 14, 2010

\*\*\* BECKER'S \*\*\*

## ASTRONOMY SURVIVAL NOTEBOOK

**DESCRIPTION OF CURRICULUM:** ASTRONOMY is a course designed for individuals who have always wanted to explore the universe around them. Topics of discussion may include archaeoastronomy (astronomy of the ancients), instrumentation, eclipses of the sun and moon, the evolution and current status of the solar system, and the life and death of stars. Students will also gain familiarity with the night sky through planetarium demonstrations and projects.

### **COURSE OBJECTIVES:**

1. To provide students with an accurate up-to-date informational portrait of the science of astronomy.
2. To show the validity of the process of science in problem solving situations.
3. To demonstrate the interdisciplinary nature of astronomy as it relates to other branches of science, mathematics, and the humanities.
4. To provide students with the opportunity to become familiar with the many facets of the night sky through planetarium demonstrations.
5. To provide the type of classroom experience in which a nonscience oriented individual feels that he or she has the opportunity to succeed.

**GRADING PROCEDURE:** Students' quarter grades will be determined by the number of points accumulated, divided by the total number of points possible. A participation grade will then be added to this numerical percentage to produce the final grade. Quarter grades will be accrued from the following criteria:

1. **Examinations:** There will be several examinations including a final. A sky identification test may be given in at the end of the semester in the planetarium. The tests will be objective in nature and compiled from classroom discussions. Exams are difficult and infrequent. Consequently, each exam carries a much greater weight in determining your final grade. Grades in an exam will always be scaled.
2. **Quizzes:** Numerous announced and unannounced quizzes will be administered during the semester. Each quiz will be approximately 10 minutes in duration and usually consist of questions that will be answered in written form. Questions may include material that students must acquire from the Internet. The home page of the ASD Planetarium is located at [www.astronomy.org](http://www.astronomy.org). Grades will not be scaled.
3. **Laboratory Exercises:** From time to time laboratory exercises will be assigned to students. Accuracy and clarity, as well as neatness, will be used as criteria for grading purposes. When graphs are submitted for examination, the following weights will be assigned: accuracy (3/5th of grade), labeling (1/5th of grade), and neatness (1/5th of grade).

4. **Work that is late:** Generally work that is submitted late will receive a lower grade than work submitted on time. This could be as much as 50%. After one week, it's a zero.
5. **Absenteeism:** Students are responsible for making up all missed work. Failure to complete assignments within a reasonable time will result in a grade of zero.
6. **Participation:** Meaningful participation will be acknowledged through additional credit that could significantly alter a student's grade. A student's grade, however, will never be lowered if he or she chooses not to participate in class.
7. **Attendance Grade:** 10% of final grade. Bring notebooks and IDs to class everyday.
8. **Free Points:** Students can accumulate free points from the daily question and other exercises. These points are added to the numerator of the final grade fraction.
9. **Notebook Information:**
  - a. Each student is required to keep a notebook containing all information that is given in class and any materials otherwise assigned. Your *Astronomy Survival Notebook* can serve this purpose.
  - b. Your notebook should be brought to class daily. It is your text for the course. You will never be allowed to go to your locker for your notebook or to get an assignment.
  - c. You may keep your notebook in class, but your instructor will not be responsible if it is lost or stolen. Make sure your notebook is identified with your name, address, and homeroom number.
  - d. Your notebook must be:
    - 1) Complete: It should include class lecture notes and blackboard illustrations, handout sheets, work sheets, etc.
    - 2) Organized: Keep information of one topic separate from other topics and in order.
    - 3) Neat: Information must be neat and legible and preferably written in pencil.
    - 4) Up-to-date: Your notebook may be checked at any time.
  - e. The replacement value of a lost notebook is \$15.00.
10. **Extra Credit** will be allowed only if a student's grade is a "C" or better. Permission from your instructor is required. Some suggestions follow:
  - a. Term paper (See grading the mini-term paper check list)
  - b. An art project. Creative art projects should be sophisticated enough that upon looking at them the instructor will have no doubt in determining that they are the labor of high school students. Juvenile projects will merit only low grades.
  - c. An oral presentation (15 minutes minimum)
  - d. Construction of an astronomical device or model
  - e. A systematic series of observations of the sky
  - f. An original astronomical computer program
  - g. An original short story with an astronomical theme
  - h. Your own suggestions as long as they relate to astronomy
11. **Quarter Grades:** Scaled examination scores, quizzes, class participation, daily prepared attendance, free points, notebooks, and laboratory exercises will determine quarter grades. Participation could add as many as five points to a final grade.

### **About Your Instructor:**

Name: Gary A. Becker

Office phone: 484-765-5557... I respond more rapidly by phone.

E-mail: ASD Pupils: [garyabecker@gmail.com](mailto:garyabecker@gmail.com) Moravian students: [garyabecker@moravian.edu](mailto:garyabecker@moravian.edu)

Home Page: [www.astronomy.org](http://www.astronomy.org)

Education: William Allen High School (1968), BS, Kutztown University (1972)  
MA, West Chester University (1984)

Hobbies: Astronomy, photography, writing, traveling (hiking), computers

Memberships: American Astronomical Society, International Planetarium Society, Lehigh  
Valley Amateur Astronomical Society, Inc.

**Personal Philosophy of Education:** The educational process should be enjoyable. Ideally, pupils should want to attend classes because of their own innate curiosities. Teachers should try to create a classroom in which the student feels emotionally at ease, while at the same time, he or she is being academically challenged.

**Student Responsibilities:** Students should make an honest attempt to grasp the daily lessons and homework assignments. In class he or she should play an aggressive roll in trying to gain familiarity with the subject material. Most importantly, a student should be honest with himself, his peers, and his teachers. In other words, no B.S., please!

Your *Astronomy Survival Notebook* and (ID ASD Pupils) should be brought to school each day. **No food or sugared liquids, PLEASE!**

### **FORMULA FOR SUCCESS:**

1. **Complete the exercises in your *Astronomy Survival Notebook*.** Skim through the chapters before they are discussed in class, so you will know what your teacher considers important.
2. **Use your text, libraries, the Internet, and astronomy instructor as resource avenues.** Your astronomy instructor is ready and willing to assist you in any reasonable manner to help your progress in this course. He enjoys his subject and wants you to succeed.
3. **Possess some mathematical skills** (at least Algebra I).
4. **Study** for exams over a period of several days.
5. **Participate** in classroom activities, take notes, and ask questions, when in doubt.
6. **Complete assignments on time** and laboratory exercises in a neat and orderly fashion.
7. **Attend class** regularly. You miss school; you miss out!
8. **Practice The Golden Rule: *Do unto others as you would have others do unto you.*** Treat your instructor with respect, and he will have no trouble returning that same respect to you.
9. **The ASD *Official Code of Conduct* applies to all students, but especially to those who feel that cooperation, responsibility, respect, and tolerance ARE NOT important to the educational process. EDUCATION IS NOT A DEMOCRACY! Be the best that you can be, and you'll make me the best that I can be. We'll have a great experience while learning astronomy together.**

**NEED HELP?** Please feel free to stay after class if you need extra help. If you are ill for several days, it would be to your advantage to contact Gary A. Becker to see what you have missed. I can be reached at 484-765-5557, e-mail: [garyabecker@gmail.com](mailto:garyabecker@gmail.com).