

## PHYS 1830: Life in the Universe– Winter 2018

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**Office Hours:** Mondays & Wednesdays 1:00-2:00 pm (or by appointment)

**Class Hours:** 10:30-11:20 am MWF (3 Jan. - 6 Apr, 2018)

**Location (Lectures):** Armes 200

**Course Website:** <http://www2.physics.umanitoba.ca/u/odea/phys1830/>

Note: Any questions about the lectures and tests material should be directed to Prof. O’Dea. Please also check the course website or UMLearn for regular updates related to the course or for any announcements. During Winter 2018 the planetarium is closed for renovations and there will be no planetarium exercise.

### Synopsis:

The discovery of over 2000 exoplanets in other solar systems, microorganisms that live in extreme environments on earth (extremophiles), and subsurface oceans on Jovian moons such as Europa and Enceladus raise the possibility that life exists elsewhere than on Earth. This descriptive, general interest course explores the topic of Life in the Universe. The following topics are covered. (1) Some astronomy fundamentals (gravity, light). (2) The solar system (an introduction to the solar system, the formation of the solar system, the origin of life on Earth, extremophiles, the conditions needed for life, possible locations for life in the solar system). (3) Exoplanets (discovery methods, properties of detected Exoplanets, the Habitable Zone). (4) Star system formation (pre-stellar disks, planetary migration). (5) The Interstellar medium (nebulae, molecular clouds). (6) Our Milky Way galaxy as an environment for life and the Drake Equation. (7) The Search for Extra Terrestrial Intelligence (SETI). This course is qualitative with simple arithmetic and trigonometry used occasionally.

**See below for a list of the course topics.** *This is a 3.0 credit hour-course.*

Prerequisites: None.

### Textbooks and Resources:

Bennet, J. and Shostak, S. Life in the Universe (4th edition), Pearson (2016) (optional)

Chaisson, E. and McMillan, S. Astronomy Today (9<sup>th</sup> edition e-version, or hardcopy 8th edition), Pearson (2013) (optional)

The lecture notes will be posted to UMLearn after the lectures.

**iClicker:** All students will require an iClicker, a classroom response system keypad available at the bookstore for purchase (some of you may already have it as it’s also required for other courses at the University). The iClickers will be used regularly in class for the following reasons: 1) as a learning tool (particularly for practicing test questions) and to engage the students, 2) for monitoring students progress or areas of difficulty, 3) to assess the students understanding of concepts covered in class or to be discussed during the upcoming lecture, and 4) to aid the instructor in taking attendance.

*Bring your iClicker to class every class. 5% will be assigned to the iClickers sessions.*

### Grading Scheme

The final grade consists of the following components:

- 40% - two term tests: 20% for test1, 20% for test2
- 45% - final examination

- 10% - iClicker quizzes
- 5% iClicker participation in class

### Test Information

The term tests and the final exam will emphasize the material presented in the lectures. All tests are closed textbooks. The iClicker questions done in class could serve as practice test questions. The two term tests will take place in class and during the lecture time (so no conflicts with any other courses should occur).

### Term tests

There will be **two** multiple-choice tests given during the term, tentatively scheduled for **Fri. Feb 2** and **Fri. Mar. 9** (during the class hour). The exact dates will be announced in class and posted on the course website and/or UMLearn. Do not make any travel plans around those dates as there are no make-ups!

Also, remember to bring a pencil to the test!

**Duration:** 50 minutes each

**Location:** in the classroom

**Value:** Both tests are worth 40% total (20% on the first test and 20% on the second test).

**There will be no deferred term test under any circumstance.** Only in the case that a written note provides a valid reason (such as illness, funeral) for missing a test, then a mark for the missed test will be assessed from the final exam. However, any test missed without a valid official written note will receive a mark of zero.

### Final Examination

**Duration:** 3 hours.

**Value:** Test is worth 45%. Deferred exams are arranged by the student with their faculty, **not** with the instructor of the course, and will be subject to the University guidelines.

**For both the tests and the final exam, no programmable calculators or textbooks are allowed.** Also cell phones and any other electronic device are explicitly listed as unauthorized materials, and must not be present during tests or examinations.

### Grading Scale

A+	90%
A	80%
B+	75%
B	70%
C+	65%
C	60%
D	50%
F	Below 50%

### Some important dates (Winter 2018):

<http://umanitoba.ca/student/records/deadlines/>

Jan. 3: 1<sup>st</sup> day for PHYS1830.

Jan. 9: Last date for Winter Term Fee Payment without financial penalty

Feb. 20-23: Mid-term break. No classes.

Mar. 16: Last day for Voluntary Withdrawal (VW) from Winter courses.

Apr. 6: Last day of classes.

Apr. 9-23: Final examination period.

Students must remain available until all examination obligations have been fulfilled. *Final exam date for phys1830 is to be scheduled by the University at a later time (to be announced as soon as it's known).*

**Course Topics:**

I Astronomy Fundamentals

1. Astronomical distances, parallax
2. Kepler's Laws, Newton, tidal forces
3. EM Spectrum, Blackbody radiation, Kelvin temperature scale, Wien's Law, colors of stars, photon energy
4. Spectral Lines. the spectrograph, the hydrogen atom, molecular lines, the 21 cm line, Doppler effect, analysis of spectral lines,
5. Telescopes. mirrors, resolution, detectors, atmospheric seeing.

II The Solar System

1. Basic Properties of the Solar System
2. Terrestrial and Jovian Planets
3. Formation of the Solar System

III Life on Earth

1. The Timeline for Life on Earth
2. Geological Processes: Volcanism, Plate Tectonics
3. The Greenhouse Effect
4. Organic Molecules
5. The Biology of Life
6. The Origin and Evolution of Life
7. Extremophiles
8. The Requirements for Life

IV Searching for Life in the Solar System

1. Mars
2. Moons of the Jovian Planets

V. Exoplanets

1. Discovery methods
2. Properties of Exoplanets
3. The Habitable Zone

VI Star and Planet Formation

1. The Interstellar Medium
2. Star formation
3. Protoplanetary disks
4. Planetary Migration

VII The Milky Way Galaxy

1. Components of the Galaxy
2. Formation of the Milky Way
3. Star Formation and Evolution in the Galaxy

VIII Life in the Galaxy

1. The Drake Equation
2. Search for Intelligent Life
3. Interstellar Travel and The Fermi Paradox

### **Academic Policies**

The Faculty of Science asks us to inform you that academic dishonesty has serious consequences.

The Faculty of Science and The University of Manitoba regard acts of academic dishonesty in quizzes, tests, examinations, laboratory reports or assignments as serious offences and may assess a variety of penalties depending on the nature of the offence.

Acts of academic dishonesty include, but are not limited to bringing unauthorized materials into a test or exam, copying from another individual, using answers provided by tutors, plagiarism, and examination personation.

Penalties that may apply, as provided for under the University of Manitoba's Student Discipline ByLaw, range from a grade of zero for the assignment or examination, failure in the course, to expulsion from the University. The Student Discipline ByLaw may be accessed at:

[http://umanitoba.ca/admin/governance/governing\\_documents/students/student\\_discipline.html](http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html)

The Students' Discipline Document is available from the Faculty of Science:  
<http://umanitoba.ca/faculties/science/resources/ScienceDisciplineProcedures-June2013.pdf>

All Faculty members (and their teaching assistants) have been instructed to be vigilant and report all incidents of academic dishonesty to the Head of the Department.

Some other links:

The Faculty of Science Template Statement on Academic Dishonesty:

[http://umanitoba.ca/faculties/science/resources/Science\\_StatementOnAcademicDishonesty2013.pdf](http://umanitoba.ca/faculties/science/resources/Science_StatementOnAcademicDishonesty2013.pdf)

How to avoid cheating and plagiarism -- take the Academic Honesty Quiz:

[http://umanitoba.ca/student/resource/student\\_advocacy/academic\\_honesty\\_quiz.html](http://umanitoba.ca/student/resource/student_advocacy/academic_honesty_quiz.html)

Last but not least: **Want to do more physics or astronomy?** Check this out (or talk to me!)

<http://umanitoba.ca/faculties/science/departments/physics/index.html>