PHYS310

Energy and Entropy

S2 Day 2016

Dept of Physics and Astronomy

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites
PHYS301

Corequisites

Co-badged status

Unit description
The physical world is governed by a myriad of laws, but two overriding thermodynamic principles guide and restrict this behaviour: the conservation of energy and the increase in entropy. This unit brings together the broad range of physical systems and theories studied by students throughout their degree, and explores how they are united and constrained by these two principles. Through rigorous analysis, research projects and group discussion we survey the impact of thermodynamic laws from the microscopic world to our own global energy challenges, while building core skills in communication.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Students will obtain an overview of the interrelationships between the major theories of physics.
Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
Students will gain experience in working in groups, in assigning and sharing responsibilities.
Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

General Assessment Information

This unit has a hurdle requirement, specifying a minimum standard that must be attained in an aspect of the unit. To pass this unit you must obtain a mark of at least:

- 50% in the unit overall

as well as

- 40% in the mid-term examination.

Note: To achieve 50% in the unit overall, any below 50% outcome in one or more components of the assessment must be compensated for by appropriately weighted above 50% performance in the other assessment tasks.

Assessment Tasks

Name	Weighting	Due
Assignments (3)	15%	See below for dates
Exercises	5%	Weekly
Exam	30%	1 October
Activity 1 presentation	5%	Week 9

Name	Weighting	Due
Activity 1 presentation	15%	Week 13
Activity 2 presentation	5%	Week 11
Activity 2 draft submission	5%	Week 12
Activity 2 final report	15%	Week 13
Active Participation	5%	Weeks 9, 11 & 13

Assignments (3)

Due: **See below for dates**
Weighting: **15%**

The first part of the unit will cover material in the general area of thermophysics, encompassing both thermodynamics and statistical mechanics.

As is the case with all areas of physics, working on a variety of mathematical and physical problems to address and deepen understanding of the subject material is integral to the learning process. To this end, students will be required to do three assignments in the first half of the session.

Assignment No. Available on iLearn on or before To be submitted for marking 1 5 August 19 August 2 19 August 2 September 3 2 September 16 September
On successful completion you will be able to:

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- Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing

Exercises

Due: **Weekly**
Weighting: **5%**

Weekly exercises consisting of short sharp questions involving the direct application in simple calculations, or clear restatement, of basic principles covered in lectures.

On successful completion you will be able to:

- Students will obtain an overview of the interrelationships between the major theories of physics.
- Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing

Exam

Due: **1 October**
Weighting: **30%**

A two hour written examination on the material covered in the first half of the unit will be given in week 8.

The final examination is a hurdle requirement. You must obtain a mark of at least 40% to pass the unit. If your mark in the final examination is between 30% and 39% inclusive then you will be a given a second and final chance to attain the required level of performance.

On successful completion you will be able to:

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- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing

Activity 1 presentation

Due: **Week 9**
Weighting: **5%**

During week 9 students will deliver **informal whiteboard presentations** of their Activity 1 topic. The presentation is to be done by pairs, with 10 minutes maximum time allocated to each student. It is possible, but not mandatory, for one member of the pair to present the background information then followed by the presentation of the current research by the other member.

On successful completion you will be able to:

- Students will obtain an overview of the interrelationships between the major theories of

physics.
- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.
- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Activity 1 presentation

Due: **Week 13**
Weighting: **15%**

During weeks 12 and 13 students will give individual short presentations of the Activity 1 articles (so each article will be presented by two students independently), **using any medium they wish**. The last part of the presentation should be aimed at either/or funding agency, private investors, industry making a case for funding/investment. The presentation schedule and the exact format will be determined at the beginning of the term in consultation with the students.

On successful completion you will be able to:

- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Activity 2 presentation

Due: **Week 11**
Weighting: **5%**

During week 11 the students are to give 5 minute presentations explaining the rationale for choosing a particular topic and its impact on the society.

On successful completion you will be able to:

- Students will obtain an overview of the interrelationships between the major theories of physics.
- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting

the modern world.

- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.
- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Activity 2 draft submission

Due: **Week 12**
Weighting: **5%**

The draft reports on Activity 2 are to be presented to Daniel Terno and discussed individually during week 12. The appointment is to be made during the unit hours. The grid will be announced during week 11 and will be filled on a "first come, first serve" basis.

On successful completion you will be able to:

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Activity 2 final report

Due: **Week 13**
Weighting: **15%**

The final report is to be submitted by Friday Nov 20, 17:00 AEST.

The report should be of sufficient length to convey the message, but no more than 10 A4 pages, including references and optional figures/diagrams, with the standard margins and the font size no smaller than 10-points.

On successful completion you will be able to:

- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Active Participation

Due: **Weeks 9, 11 & 13**
Weighting: **5%**

An additional 5 marks will be awarded for participation during the discussions following

presentations.

On successful completion you will be able to:

- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Delivery and Resources

Classes

All classes in the first half of the session will be lectures or tutorials presented as white-board/ black-board/computer-generated slides.

The second half of the unit will be project based along with student presentations.

Class times and locations

- Monday 1pm – 3pm W5C 302
- Thursday 12 pm – 2pm W5A 204

Required and Recommended Texts and/or Materials

Required Text

- Stephen J Blundell and Katherine M Blundell: Concepts in Thermal Physics 2nd edition.

Technology used and required

Unit web page

The web page for this unit can be found at http://ilearn.mq.edu.au

Please check this web page regularly for announcements and material available for downloading. Some learning resources for the unit will be provided in hardcopy rather on-line.

Teaching and Learning Strategy

The first half of this unit is taught through lectures and tutorials. We strongly encourage students to attend lectures because they provide a much more interactive and effective learning experience than studying a textbook. Questions during and outside lectures are strongly encouraged in this unit - please do not be afraid to ask, as it is likely that your classmates will also want to know the answer. You should aim to read the relevant sections of the textbook before and after lectures and discuss the content with classmates and lecturers.

You should aim to spend 3 hours per week working on the assignments. You may wish to discuss your assignment problems with other students and the lecturers, but you are required to hand in your own work (see the note on plagiarism below). Assignments are provided as one of the key learning activities for this unit, they are not there just for assessment. It is by applying knowledge learned from lectures and textbooks to solve problems that you are best able to test

and develop your skills and understanding of the material.

The second half of the unit will focus on project work that will involve presentations on progress and report writing.

Unit Schedule

Schedule of assessable tasks and related materials

Week No.	Task
1	Assignment 1 posted on iLearn
2	
3	Assignment 1 submitted Assignment 2 posted on iLearn
5	Assignment 1 returned Assignment 2 submitted Assignment 3 posted on iLearn
6	
7	Assignment 2 returned Assignment 3 submitted Danny Terno to introduce activities
Mid-session break	**19 Sept – 30 Sep**
8	Assignment 3 returned Examination
9	Informal whiteboard Activity 1 presentations
10	Supplementary classes on relevant topics if necessary.
11	Activity 2 informal presentations
12	Draft activity 2 report due
13	Activity 1 formal presentations Final activity 2 report due

Learning and Teaching Activities

Activity 1: understanding and presenting scientific results

During this activity students will choose a research article and an accompanying informal

(popular science) discussion of the research topic. A list of research articles together with their informal overviews will be given to the students not later than week 6. The students are expected to form pairs and select the article by the end of week 7. The articles are allocated on a "first come, first serve basis". If none of the articles seems suitable, an alternative [subject to approval] can be presented. In case of an odd number of students alternative arrangements will be found subject to the approval of the teaching staff. The students will then give presentations on the topic on two occasions, the first in Week 9 will be informal, the second in Week 13 will be at the level of a short seminar.

Activity 2: impact/application of energy and entropy concepts

For this activity, students will be required to choose any topic that is concerned with energy and entropy and its role in /impact on society, and prepare a written report. A broad list of topics will be announced by the end of week 2. This activity is individual. During week 11 the students are to give 5 minute presentations explaining the rationale for choosing a particular topic and its impact on society. Drafts on the final report are to be presented to Danny Terno and discussed individually during the week 12 and a final report is to be submitted by Friday Nov 11 17:00 AEST.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcome

- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing

Assessment tasks

- Assignments (3)
- Exercises
- Exam
- Activity 1 presentation
- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.

Assessment tasks

- Assignments (3)
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- Activity 1 presentation
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- Activity 2 draft submission
- Activity 2 final report
- Active Participation

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcomes

- Students will obtain an overview of the interrelationships between the major theories of physics.
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- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report
- Active Participation

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Students will obtain an overview of the interrelationships between the major theories of physics.
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- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.

Assessment tasks

- Assignments (3)
- Exercises
- Exam
- Activity 1 presentation
- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Students will obtain an overview of the interrelationships between the major theories of physics.
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- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report
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Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions

applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
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Assessment tasks

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- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.

Assessment tasks

- Assignments (3)
- Exercises
- Exam
- Activity 1 presentation

- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report
- Active Participation

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.
- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Assessment tasks

- Assignments (3)
- Exam
- Activity 1 presentation
- Activity 2 presentation

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.
- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Assessment tasks

- Assignments (3)
- Exam
- Activity 1 presentation
- Activity 2 presentation

Changes from Previous Offering

Daniel Terno will be taking the second half of the unit, replacing David Coutts.

Feedback

Student Liaison Committee

The Physics Department values quality teaching and engages in periodic student evaluations of its units, external reviews of its programs and course units, and seeks formal feedback from students via focus groups and the Student Liaison Committee. Please consider being a member of this committee, which meets once during the semester (lunch provided), with the purpose of improving teaching via student feedback. The class will be asked to nominate two students as representatives for the PHYS310 unit on the student liaison committee. This nomination process will be conducted during lectures and the lecturer will forward the names to the Head of Department. The SLC meetings are minuted and student representatives receive copies of the minutes from the two preceding SLC meetings prior to the meeting. An update on the responses that have been made by the department to the feedback obtained at the two preceding SLC meetings are reported by the Head of Department at the beginning of each SLC meeting. These responses are also minuted. The feedback is acted upon in a number of ways mostly initiated via Department of Physics and Astronomy meetings, where decisions on actions are taken.

For responses to the 2015 SLC meeting comments on PHYS310, see `Changes from previous offering'.

Standards Expectation

Grading

An aggregate standard number grade (SNG) corresponding to a pass (P) is required to pass this unit.

High Distinction (HD, 85-100%): provides consistent evidence of deep and critical understanding in relation to the learning outcomes. There is substantial originality and insight in identifying, generating and communicating competing arguments, perspectives or problem solving approaches; critical evaluation of problems, their solutions and their implications; creativity in application.

Distinction (D, 75-84%): provides evidence of integration and evaluation of critical ideas, principles and theories, distinctive insight and ability in applying relevant skills and concepts in relation to learning outcomes. There is demonstration of frequent originality in defining and analysing issues or problems and providing solutions; and the use of means of communication appropriate to the discipline and the audience.

Credit (Cr, 66-74%): provides evidence of learning that goes beyond replication of content knowledge or skills relevant to the learning outcomes. There is demonstration of substantial understanding of fundamental concepts in the field of study and the ability to apply these concepts in a variety of contexts; plus communication of ideas fluently and clearly in terms of the conventions of the discipline.

Pass (P, 50-65%): provides sufficient evidence of the achievement of learning outcomes. There is demonstration of understanding and application of fundamental concepts of the field of study; and communication of information and ideas adequately in terms of the conventions of the discipline. The learning attainment is considered satisfactory or adequate or competent or capable in relation to the specified outcomes.

Fail (F, 0-49%): does not provide evidence of attainment of all learning outcomes. There is missing or partial or superficial or faulty understanding and application of the fundamental concepts in the field of study; and incomplete, confusing or lacking communication of ideas in ways that give little attention to the conventions of the discipline.