PHYS159

Physics for Global Citizens

S2 Day 2015

Dept of Physics and Astronomy

Contents

General Information

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Credit points
3

Prerequisites

Corequisites

Co-badged status

Unit description
Do you want to understand current global issues: the energy crisis, the greenhouse effect and climate change, nuclear energy and nuclear weapons, for example? This unit makes the science underlying these important real-world issues accessible using demonstrations of physical principles in action, but without complex mathematical computation. A well-equipped laboratory provides students with an enjoyable introduction to basic scientific measurement and analysis.

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:

To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
To measure, analyse, interpret and present scientific information in the form of text, figures and graphs; to use a range of scientific measuring equipment in the laboratory.
To apply technical writing and speaking skills by writing commentaries on a scientific article of choice and by participating in in-class and online discussions; to analyse a range of readings and technical texts relevant to syllabus topics.
To demonstrate an awareness of the physics foundations of topical issues in today's society and to appreciate the relevance of this knowledge in ones role as an engaged local and global citizen. Examples are: nuclear energy and nuclear weapons, alternative energy sources and telecommunications.
To analyse and discuss everyday issues in terms of underlying physics concepts with the use of diagrams, graphs and simple calculations.

Assessment Tasks

Name	Weighting	Due
In Class Quizzes	15%	Weekly
Commentaries	20%	End of weeks 3, 6, 9 and 12
Laboratory	25%	Weeks 3, 4, 8, 9, 10 and 11
Final Examination	40%	University Examination Period

In Class Quizzes

Due: **Weekly**
Weighting: **15%**

In each week's tutorial there will be a short 5-minute quiz that is based on the content of the relevant book chapter. Each quiz will either consist of several multiple-chioce questions or one single question that needs to be answered in about 50-80 words of writing.

On successful completion you will be able to:

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To demonstrate an awareness of the physics foundations of topical issues in today's society and to appreciate the relevance of this knowledge in ones role as an engaged local and global citizen. Examples are: nuclear energy and nuclear weapons, alternative energy sources and telecommunications.
- To analyse and discuss everyday issues in terms of underlying physics concepts with the use of diagrams, graphs and simple calculations.

Commentaries

Due: **End of weeks 3, 6, 9 and 12**
Weighting: **20%**

Four short commentary-style summaries of scientific articles of choice relevant to the lecture material of the preceding three weeks. The article, of length greater than your commentary, should have appeared in a quality newspaper or in a journal such as Scientific American, New Scientist, etc. It could be a report of an invention or a scientific discovery, or perhaps a political or economic issue which has scientific themes. Further details will be provided in the lectures and on iLearn.

On successful completion you will be able to:

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To apply technical writing and speaking skills by writing commentaries on a scientific article of choice and by participating in in-class and online discussions; to analyse a range of readings and technical texts relevant to syllabus topics.
- To demonstrate an awareness of the physics foundations of topical issues in today's society and to appreciate the relevance of this knowledge in ones role as an engaged local and global citizen. Examples are: nuclear energy and nuclear weapons, alternative energy sources and telecommunications.

Laboratory

Due: **Weeks 3, 4, 8, 9, 10 and 11**
Weighting: **25%**

There will be six 2-hour laboratory sessions on the topic of sound. Students will work in pairs on a research-style investigation that will be planned and presented to the class. Finally, a written report will be prepared by each individual student. Further details will be provided on the first laboratory session in week 3.

Successful completion of the lab component is required for successful completion of this unit.

On successful completion you will be able to:

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To measure, analyse, interpret and present scientific information in the form of text, figures and graphs; to use a range of scientific measuring equipment in the laboratory.

Final Examination

Due: **University Examination Period**
Weighting: **40%**

Written 2-hour final exam (closed book).

On successful completion you will be able to:

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To apply technical writing and speaking skills by writing commentaries on a scientific article of choice and by participating in in-class and online discussions; to analyse a range of readings and technical texts relevant to syllabus topics.
- To demonstrate an awareness of the physics foundations of topical issues in today's society and to appreciate the relevance of this knowledge in ones role as an engaged local and global citizen. Examples are: nuclear energy and nuclear weapons, alternative energy sources and telecommunications.
- To analyse and discuss everyday issues in terms of underlying physics concepts with the use of diagrams, graphs and simple calculations.

Delivery and Resources

Lectures:

Each week there will be two 1-hour long lectures on the subject outlined in the unit schedule. Lectures will be recorded on Echo 360 but lecture attendance is highly recommended.

Lecture 1: Thursday 10-11 am, E8A 341

Lecture 2: Friday 1-2 pm, W5C 320

Tutorials:

Each week there will be a 1-hour long tutorial. During the tutorial, one or more topics with

relevance to the unit content will be discussed and debated. Specific topics for each week will be posted on iLearn in advance. It is expected that students come prepared to the tutorials so that they can make informed contributions to the discussions.

Tutorial: Thursday 11am-12 pm, E3B 118

Laboratories:

Time: Monday 9-11 am OR Friday 11-1 pm

Location: E7B 114 Physics Lab

Laboratories will commence in the third week of semester and students will work in pairs.

Lab Session 1 (week 3): What is Sound?

Students will interact with demonstrations pertaining to Sound, with an emphasis on understanding how sounds can be generated.

Lab Session 2 (week 4): Measuring Sound.

Students will interact with demonstrations pertaining to Sound, with an emphasis on describing and measuring sound.

Lab Session 3 (week 8): Classroom investigation about the speed of Sound.

Students will conduct a guided experiment to experimentally determine the speed of Sound.

Lab Sessions 4-6 (weeks 9-11): An authentic, open-ended investigation

Students will conduct an open-ended inquiry on a topic of their choosing that relates to sound. They will conduct research about the topic, carry out experimentation at home and/or in lab (weeks 9 and 10). They will give a presentation about their inquiry to the class in week 11.

Laboratory work will be assessed in three parts:

Part 1: Designing an Investigation. One 2-page investigation plan must be submitted by each pair. (25% of the total lab mark, due on the Monday in Week 9).

Part 2: Presentation. Each pair will present the results of their investigation to the class. (25% of the total lab mark, during Lab session 6, week 11).

Part 3: Written report. Each student must submit an individual report. (50% of the total lab mark, due end of week 12).

Further details will be provided on the first laboratory session in week 3.

Required and Recommended Texts and/or Materials:

Required Text: Physics and Technology for Future Presidents: An Introduction to the Essential Physics Every World Leader Needs to Know, Richard Muller, Princeton Press, 2010

The PHYS159 Laboratory Manual notes will be handed out at the laboratory sessions.

Other Introductory Physics textbooks, such as those by Hewett or Giancoli are also useful to read.

Teaching and Learning Strategy

This unit content is taught through lectures (including echo recordings), critical discussions (during tutorials, online and during lectures) and laboratory experiments. We strongly encourage students to attend lectures because they provide a much more interactive and effective learning experience than listening to a recording or studying a text book. 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 read the relevant chapters of the textbook before the lectures and discuss the content with classmates and lecturers.

This unit includes a compulsory laboratory component. The activities in the laboratory sessions comprise an in-depth exploration of Sound through hands-on experimentation and investigation. The laboratory sessions should be an engaging, and enjoyable experience in which students learn by discovery and practice skills of observing, questioning, measurement, presenting and analysing data, and carrying out an investigation.

You should aim to spend 9 hours per week on activities associated with this unit. Commentaries and discussions are key learning activities for this unit; they are not there just for assessment. It is by applying knowledge learned from lectures and textbooks to discuss questions and review information that you are best able to test and develop your skills and understanding of the material.

Unit Schedule

Week	Subject	Content	Textbook Chapter	Lecturer
1	Energy and power	Forms of energy, energy content of materials, explosions, fuel cells, measuring energy, power, cost of energy	1	Alex Fuerbach
2	Atoms and heat	Atomic theory of matter, heat and noise, temperature, Kelvin scale, thermal expansion, ideal gases, absolute zero, heat engines, entropy	2	Alex Fuerbach
3	Waves and Sound	Types of waves, describing sound, how sound travels, sound in the atmosphere and oceans, sound phenomena, music	7	Helen Pask
4	Light	Light propagation, Light interaction with matter, Light in life and nature, lasers and other light sources, optical communication, light in health and the developing world	8	Helen Pask
5	Gravity, force and space	Gravity, forces, satellites, air resistance and fuel efficiency, black holes, momentum, rockets, hot air balloons, storms	3	Judith Dawes
6	Nuclei and radioactivity	Radioactivity, radiation exposure, linear hypothesis, Chernobyl disaster, Xrays, fission, fusion	4	Judith Dawes

7	Chain reactions, nuclear reactors, atomic bombs	Chain reactions and exponential growth, cancer growth, population, nuclear weapons, nuclear reactors, nuclear fusion	5	Judith Dawes
8	Electricity and Magnetism	Electrons, electric current, fuses, superconductors, voltage, electric power, magnets, electric and magnetic fields, electric motors and generators, earth magnetic field, transformers, AC and DC electricity, magnetic levitation	6	Judith Dawes
9	Invisible light	IR, sensing, UV, sunburn, electromagnetic radiation, radio, microwaves, Xrays, gamma rays, medical imaging	9	Alex Fuerbach
10	Climate change	Global warming, history of climate, carbon dioxide, greenhouse effect, weather, fossil fuels, alternative energy sources	10	Alex Fuerbach
11	Quantum Physics	Electrons are waves and particles, lasers, photoelectric effect, transistors, superconductors, quantum physics	11	Alex Fuerbach
12	The Universe	Big Bang Theory, history of the universe, future of the universe, galaxies, black holes	13	Alex Fuerbach
13	Revision		1-11	Judith Dawes, Helen Pask and Alex Fuerbach

Learning and Teaching Activities

Lectures

The topics outlined in the unit schedule will be presented using demonstrations and videos where possible to illustrate relevant physical phenomena. Opportunities to ask questions are provided throughout the lectures.

Tutorials

Students are encouraged to form an opinion about various topics of global interest and to defend their position in discussions. Relevant discussion topics will be provided throughout the semester.

Practicals

The activities in the laboratory modules comprise an in-depth exploration of Sound through hands-on experimentation and investigation. The laboratory sessions should be an engaging, and enjoyable experience in which students learn by discovery and practice skills of observing, questioning, measurement, presenting and analysing data, and carrying out an investigation.

Commentaries

Students are encouraged to read widely on the topics covered in this unit. They then write commentaries on scientific or technical articles of their choice to explain and summarise the main concepts.

Textbook readings

The Textbook for the unit is "Physics and Technology for Future Presidents" by Richard Muller. Students need to own this book and extensive readings from the book are required.

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

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

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

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.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://informatics.mq.edu.au/help/.

When using the University's IT, you must adhere to the Acceptable Use 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 outcomes

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To measure, analyse, interpret and present scientific information in the form of text, figures and graphs; to use a range of scientific measuring equipment in the laboratory.
- To demonstrate an awareness of the physics foundations of topical issues in today's society and to appreciate the relevance of this knowledge in ones role as an engaged local and global citizen. Examples are: nuclear energy and nuclear weapons, alternative energy sources and telecommunications.
- To analyse and discuss everyday issues in terms of underlying physics concepts with the use of diagrams, graphs and simple calculations.

Assessment tasks

- In Class Quizzes
- Commentaries
- Laboratory
- Final Examination

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

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To apply technical writing and speaking skills by writing commentaries on a scientific article of choice and by participating in in-class and online discussions; to analyse a range of readings and technical texts relevant to syllabus topics.
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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

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.

- To measure, analyse, interpret and present scientific information in the form of text, figures and graphs; to use a range of scientific measuring equipment in the laboratory.
- To apply technical writing and speaking skills by writing commentaries on a scientific article of choice and by participating in in-class and online discussions; to analyse a range of readings and technical texts relevant to syllabus topics.
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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

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To measure, analyse, interpret and present scientific information in the form of text, figures and graphs; to use a range of scientific measuring equipment in the laboratory.
- To apply technical writing and speaking skills by writing commentaries on a scientific article of choice and by participating in in-class and online discussions; to analyse a range of readings and technical texts relevant to syllabus topics.
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local and global citizen. Examples are: nuclear energy and nuclear weapons, alternative energy sources and telecommunications.
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Assessment tasks

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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

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To measure, analyse, interpret and present scientific information in the form of text, figures and graphs; to use a range of scientific measuring equipment in the laboratory.
- To apply technical writing and speaking skills by writing commentaries on a scientific article of choice and by participating in in-class and online discussions; to analyse a range of readings and technical texts relevant to syllabus topics.
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- To analyse and discuss everyday issues in terms of underlying physics concepts with the use of diagrams, graphs and simple calculations.

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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

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To measure, analyse, interpret and present scientific information in the form of text, figures and graphs; to use a range of scientific measuring equipment in the laboratory.

Assessment tasks

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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

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To apply technical writing and speaking skills by writing commentaries on a scientific article of choice and by participating in in-class and online discussions; to analyse a range of readings and technical texts relevant to syllabus topics.
- To demonstrate an awareness of the physics foundations of topical issues in today's society and to appreciate the relevance of this knowledge in ones role as an engaged local and global citizen. Examples are: nuclear energy and nuclear weapons, alternative

energy sources and telecommunications.
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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

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To apply technical writing and speaking skills by writing commentaries on a scientific article of choice and by participating in in-class and online discussions; to analyse a range of readings and technical texts relevant to syllabus topics.
- To demonstrate an awareness of the physics foundations of topical issues in today’s society and to appreciate the relevance of this knowledge in ones role as an engaged local and global citizen. Examples are: nuclear energy and nuclear weapons, alternative energy sources and telecommunications.
- To analyse and discuss everyday issues in terms of underlying physics concepts with the use of diagrams, graphs and simple calculations.

Assessment tasks

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- Commentaries
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- Final Examination

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

- To explain key physics concepts such as energy, and to apply physics to everyday life and to global issues.
- To demonstrate an awareness of the physics foundations of topical issues in today's society and to appreciate the relevance of this knowledge in ones role as an engaged local and global citizen. Examples are: nuclear energy and nuclear weapons, alternative energy sources and telecommunications.
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Changes from Previous Offering

The number of lectures per week has been reduced from three to two and the tutorial is now held each week (instead of fortnightly). There are no written assignments required this year but the number of commentaries has been increased from three to four. Weekly quizzes have been introduced this year to encourage students to do the required pre-readings.

In order to better prepare the students for the laboratory sessions, the order the unit content will be delivered has been changed this year. Waves and Sound will already be introduced in Week 3, in time for the first laboratory session.

General reminders

Student Liaison Committee

The Department of Physics and Astronomy values quality teaching and engages in periodic student evaluations of its units, external reviews of its programs and course units, and seeks feedback from students via focus groups, and the Student Liaison Committee(SLC). Please consider being a member of the SLC, which meets once during the semester with the purpose of improving teaching via student feedback. Meetings are open and friendly, and invite honest

feedback. Student representatives receive a list of outcomes from the preceding meeting. At the beginning of each meeting, an update on the responss to feedback is provided by the Head of Department. Feedback is acted upon in a variety of ways, mostly initiated via department meetings where decisions on changes are taken.

Standards Expectations

Grades

The broad standards as defined by the academic senate can be found at

http://www.mq.edu.au/policy/docs/grading/policy.html