THE UNIVERSITY OF SYDNEY

School of Physics

PHYS 1002 Physics 1 (Fundamentals) – Semester 1, 2017

Module 1 – The Language of Physics

This module is one of 3 comprising PHYS 1002 Physics 1 (Fundamentals). This document describes details of this module and should be read in conjunction with the more general unit of study outline for PHYS 1002 Physics 1 (Fundamentals).

GENERAL GOALS OF THIS MODULE

This module aims to develop an appreciation of how models based on the conceptual structure of physics can be used to describe the world. In particular you will examine and learn to explain why a ship stays afloat and how a satellite can remain in orbit using the specific language of physics. You will develop an understanding of the role of mathematics and representations in modelling the two case studies, and practise some basic skills in this area. You will need to adopt effective learning strategies and use the textbook to describe the two case studies and to solve relevant problems. This will serve as a good basis for understanding the mechanics and waves modules in the rest of this unit.

MODULE DEFINITION – LANGUAGE OF PHYSICS

This first module in the Fundamentals strand is designed as an introduction to the language, methods and problems dealt with in physics. It is therefore not as "traditional" a Physics course as you will encounter in later modules in Physics. The module begins with an overview of what physics is about, and the kind of thinking that will be useful to you in studying physics. These general points are then illustrated using two case studies, the first on flotation and the second on satellites. You will use your textbook as a resource in this module, but we will not work as closely from the textbook as you will do in later modules.

The specific objectives detailed below define what concepts and applications you should learn and understand. Understanding a term or concept means that you should be able to

- explain its meaning in words and give examples,
- interpret it correctly when you read or hear it,
- use it correctly in your own writing,
- apply it correctly to examples and problems.

Understanding will be tested in the exam by asking you to write descriptive answers to qualitative questions and by evaluating your explanations of physical principles. Memorisation of formulas and algebraic manipulation without understanding the physics is not the point and will not be explicitly rewarded.

ASSUMED KNOWLEDGE

The Fundamentals strand assumes no background in physics. We will however assume levels of literacy, numeracy and general knowledge at HSC standards.

MODULE CONTENT

Listed below are the chapters of Knight, Jones & Field most likely to be relevant to the case studies covered in this module. None of these chapters will be covered in its entirety. The two case studies are

1. Why does a concrete boat stay afloat? Sections from Chapters 5 and 13.
2. What keeps a satellite up? Sections from Chapters 1, 2, 3 and 6.

HINTS FOR STUDY

It is strongly recommended that you understand the worked examples from your lectures, and from the text. You must also understand the tutorial problems and demonstrations.

A list of formulas is provided in the exam. Last year's list is in your *Laboratory Manual*, and is available on eLearning It is desirable to become familiar with this list, since any differences in the list for this year will be slight. The laboratory, tutorial and lecture materials are coupled so use them together.

PROBLEM SOLVING

Discussion questions, exercises and problems selected from the textbook are recommended to you as additional practice in applying principles and knowledge developed in lectures.

A reading schedule as well as questions, exercises and problems have been selected and are listed below. These are not the focus of the module and some of these problems may be better done once you have achieved competency with problem solving, i.e by the end of the semester. The lecturers will point out the specific questions to be done as the module progresses.

DETAILED MODULE CONTENT (references are to the text, Knight, Jones & Field)

Please note the lecturers will guide you through this reading and problem-solving list.
Some of these problems will be discussed in lectures

By the end of Week 1 attempt the following.

Read section 1.4 on Measurement. The aim is to **begin to** understand techniques, conventions and tools used in physics. You will become increasingly familiar with these ideas as the unit of study progresses.

Understand Example 1.3 and Tactics Boxes 1.1, 1.2, 1.3

Do the following Multiple Choice Questions from Chapter 1: 25, 26, 27, 28

Do the following recommended Problems from Chapter 1: 14, 18, 19, 20, 56

By the end of Week 2 attempt the following.

Read section 13.1, 13.2, 13.3, 13.4.

Read Section 5.3 on Mass and Weight. Note that you will revisit this section in the next module. For this module you need to understand the difference between mass and weight, start using the term "force" and learn the concept of "balancing forces".

Understand all the Examples and Tactics Boxes in sections 13.1, 13.2, 13.3, 13.4

Do the following Conceptual Questions from Chapter 13: 2, 5, 6, 13, 15, 16, 21, 23

Do the following Multiple Choice Questions from Chapter 13: 33, 36,

Do the following recommended Problems from Chapter 13: 8, 13, 16, 21, 23, 25, 26, 28,

The first two experiments in your lab program, Pressure and Buoyancy-Icebergs and Titanic also cover these concepts. Read the Introductions and revise the Preparatory Work. Also read other discussion sections, i.e Activity 3 on Weight in Buoyancy-Icebergs and Titanic.

By the end of Week 3 attempt the following.

Read sections 1.1, 1.2, 1.3, 1.5 from Chapter 1 and sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7 from Chapter 2.

Understand Examples 1.8, 2.2, 2.5, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.15 and all Conceptual Examples.

Note that non SI units are not examinable

Learn to use the relevant Tactics Boxes from Chapters 1 and 2.

Do the following Conceptual Questions from Chapter 1: 2, 3, 19

Do the following recommended Problems from Chapter 1: 9, 10, 29, 43, 55, 57

Do the following Conceptual Questions from Chapter 2; 9, 10

Do the following Multiple Choice Questions from Chapter 2: 21, 26

Do the following recommended Problems from Chapter 2: 26, 27, 69

Do the following recommended Problems from Chapter 5: 16,17

The third experiment in your lab program, Motion - Train Journeys also covers these concepts. Read the Introduction and revise the Preparatory Work.

By the end of Week 4 attempt the following.

Read sections 3.1, 3.2, 3.3, 3.6, 3.7 from Chapter 3 and section 6.5 (omit equations and orbital period) from Chapter 6.

Understand Examples 3.1, 3.2, 3.3, 3.4, 3.5, 3.11, 3.12.

Learn to use the Tactics Boxes from relevant sections in Chapter 3.

Do the following Conceptual Questions from Chapter 3: 1, 5, 7, 13

Do the following Multiple Choice Questions from Chapter 3: 21, 22, 23, 24, 25, 26

Do the following recommended Problems from Chapter 3: 26, 27, 28, 32, 33, 52, 69, 72

The fourth experiment in your lab program, Projectiles. Read the Introduction and revise the Preparatory Work.

SPECIFIC OBJECTIVES

After studying this module you will be able to:

- Explain the process of modeling
- Use specific terms with precise physics meaning
- Understand the way physics is used to describe the world around us
- Understand the role of mathematics and representation in physics
- Understand measurements of physical quantities
- Use measurements of physical quantities
- Describe motion using displacement, velocity, acceleration and free fall acceleration
- Differentiate between average and instantaneous measurements
- Manipulate vectors describing physical situations
- Explain motion in one and two dimensions and do associated calculations
- Use the concepts of mass, weight and gravity
- Begin to use the concept of forces
- Use the concept of static equilibrium
- Use the concepts of density, buoyancy and pressure
- Explain phenomena associated with fluids at rest and flotation
- Explain variations in pressure with depth
- Use Archimedes' principle
- Explain the motion of satellites
- Explain mass and weight in the context of orbiting objects

