

Name and Surname:.....

Student number:.....

Group nr:.....

Physics 111

Problem set 1

11 February 2025

Time: 96 hours

Marks: 40

### Instructions:

- Please read the Course Reader to see the **Problem set and tutorial test cycle**.
- It is expected that you **start working early (about 30 to 45 minutes a day)** on the problem set on your own and in collaboration with your group during **self-study consultation periods**. Use the help available during self-study consultation period, i.e. your supportive group mates or tutors or lecturers in the self-study consultation periods.
- **You and your group must attend at least three of these self-study consultation periods in the ADM lab.**
- Please **put effort into mastering** questions/problems in the problem set.
- Please check how much the problem set and tutorial test contribute to your CAM (see Course Reader). **Failure to complete problem sets and tutorial tests will affect your CAM and make it more difficult to pass the course successfully.**

**Due date:** At the beginning of the tutorial period on Wednesday, 19 February 2025. **If you do not submit the completed problem set, you will not be granted access to the tutorial or permitted to write the tests.**

### Question 1 (10)

1.1 Read the statement below and answer the question that follow.

“The angle of incidence is equal to the angle of reflection, measured relative to the normal”.

Does this statement describe a scientific fact or law or theory? Explain your answer. (2)

1.2.1 State, with a reason, whether the following hypothesis is scientific or not: "Isaac Newton is the greatest physicist who ever lived." (2)

1.2.2 State, with a reason, whether the following hypothesis is scientific or not: "There is no oxygen on Mars." (2)

1.3 If an hypothesis is supported by an experiment, should it be accepted or rejected? Explain your answer. (2)

1.4.1 Write down the name of a physics law you know. (1)

1.4.2 Describe the relationship(s) indicated by the law you named in part 1.4.1. (1)

### Question 2 (10)

2. It is hypothesised that, in the absence of air resistance, all objects dropped from the same height will strike the ground at the same time. Based on this hypothesis, a PHY111 student predicts that all objects will fall with an acceleration of  $9.8 \text{ m/s}^2$ . To verify this prediction, he designs an experiment using a ticker timer. The ticker timer is used to measure the object's position and time. The results he obtained are shown on the ticker timer ribbon below. The ticker timer had a frequency of 2 Hz.



- 2.1 Use the position-time data displayed on the ticker tape to verify the prediction. *Hint: Use measurements to determine the acceleration.* (7)
- 2.2 If this experiment is repeated by many physics students around the world and the same result is obtained each time, should the hypothesis be accepted as a scientific fact, law, or theory? Explain your answer. (3)

**Question 3 (10)**

- 3.1.1 Is Einstein's theory of general relativity scientific knowledge? Explain your answer. (2)
- 3.1.2 How does scientific knowledge differ from religious knowledge? (2)
- 3.2 Explain what a scientific fact is and give an example of a scientific fact known to you *that has undergone change over time.* (2)
- 3.3.1 Is Bohr's explanation of the energy levels of the hydrogen atom a scientific model or a scientific theory? Explain your answer. (2)
- 3.3.2 In your opinion, is the theory of quantum mechanics reliable? Explain your answer. (2)

**Question 4 (10)**

Read the paragraph below on what technology is, along with its advantages and disadvantages, and answer the questions that follow:

Technology refers to the application of scientific knowledge for practical purposes, especially in industry. It involves the creation and use of tools, machines, techniques, and systems to solve problems and improve human life. Technology has significantly transformed various sectors, from communication and transportation to healthcare and education, making tasks more efficient and accessible. The advantages of technology include increased productivity, improved access to information, enhanced communication, and the ability to solve complex problems. However, technology also has disadvantages, such as contributing to environmental degradation, causing job displacement due to automation, and creating digital divides that leave certain populations without access to the latest advancements. Despite its challenges, technology continues to play a crucial role in shaping the modern world.

- 4.1 What is the primary purpose of technology as described in the paragraph? (2)
- 4.2 How can technology be used to improve access to healthcare, based on the paragraph? (2)
- 4.3 List two advantages and two disadvantages of technology mentioned in the text. (2)
- 4.4 In your own experience, can you think of an example where technology has increased productivity? Explain how. (2)
- 4.5 How might technology contribute to solving a complex problem in education? Provide an example based on the information in the paragraph. (2)