
LECTURE NOTES

PHYS1112: General Physics

HONG, Lanxuan

October 2, 2024

Self-study module:
Analysis of motion of projectile
Uncertainty and significant figures
sliding slope model(friction)

Contents

1	MECHANICS	4
1.1	Units, Physical Quantities, and Vectors	4
1.2	Frame of Reference & Relative Velocity	4
1.3	Newton's Law	5

1 MECHANICS

1.1 Units, Physical Quantities, and Vectors

As an experimental science, physics deals with measured quantities. We use numbers for the measurements and when doing so, we compare the observed quantities with some gauge.¹

SI system of units are commonly used in physics. Basic units includes kilogram², meter³ and second⁴.

Vector calculation is very important in physics. The note skip this part and please refer to MATH 1014 lecture note.

1.2 Frame of Reference & Relative Velocity

Consider the case that an observer making a measurement from his view. This form the frame of reference. Based on whether they follow the Newton's motion law(second law), the frame of reference have 2 types: the inertial frame of reference and the non-inertial frame of reference. **The Inertial frame of reference** is the frame of reference in which the Newton's motion law works. By contrary, the Newton's motion law does not work in a non-inertial frame of reference. Here is an example of observing the same object from different aspect which form different frame of reference

Example 1.1. Observing objects and frame of reference

1. A passer-by observing a passenger sitting in a moving train.^a
2. Another passenger on the train observing this passenger sitting in the train.

^aEarth is not an inertial frame of reference. However, in most of discussion, we can say that the surface of Earth is approximately an inertial reference frame.

Any reference frame, which moves with constant velocity with respect to an inertial frame is also an inertial frame.⁵ In other word, we can consider this frame as a frame without acceleration.

As for the **non-inertial frame of reference**, when observing from inertial frame of reference, it has certain acceleration. As a result, one may feel like being acted on by a force in a non-inertial frame of reference.⁶ One important usage of fictitious forces is using rotation to provide a sense of gravity in the space.

Example 1.2. Analysis of the motion of the projectile

¹pre-defined measures

²It is defined by comparing to the mass of a fixed "etalon" object

³Lights travels exactly 299,792,485 meters in 1 second. This shows that meter is measured after precise measurement of second.

⁴Scientists use the microwave radiation with a 9,192,631,770 cycles per second of cesium-133 atom to measure the second

⁵Do vector calculation and notice that the additional vector is constant

⁶More information about non-inertial frame of reference. [*Fictitious Forces Here*](#)

1.3 Newton's Law

Principle 1.1. Newton's Law of Motion

- Newton's First Law: A body acted on by no net force moves with constant velocity.^a
- Newton's Second Law: If a net external force acts on a body, the body accelerates according to the following relation:

$$\vec{F} = m \sum \vec{a}$$

- Newton's Third Law: Body A exerts a force on body B^b, then the Body B exerts a force on body A.^c

^aconstant speed and straight line

^bwhich is called "Action"

^cwhich is called "Reaction"

In real life experience, it is hard to find an object with no force acting on. So Newton's first law also apply to bodies in equilibrium.⁷ It is important to note that Newton's First and Second Law can be used only in inertial frame of reference, while Newton's Third Law can be used in both frame of reference.

⁷sum of external forces is 0