

PHY131H1F Summer Introduction to Physics I Class 1



ME →


- Welcome - please make yourself comfortable!
- I am **Jason Harlow**. It's nice to meet you.
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 - Office: MP129-A
 - Email: jharlow@physics.utoronto.ca
- Please make sure you fill out the Student Survey (1/2 page) – place on the front table before you leave tonight.




Please download and read the **Course Syllabus!**
It is available on portal.utoronto.ca
You will be tested on it next class!

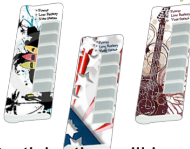
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Help us out by printing only when necessary, double-siding, and reusing paper.

More information at uoft.me/greencourses






Skin Your iClicker Today




- Beginning next class, Class Participation will be measured using “i>clickers” – you can buy one at the bookstore for \$42 new, or \$32 used.
- You will use your **clicker** every Tuesday and Thursday class. Don't forget it!
- If you are not actually in class, please do **NOT** ask a friend to use your clicker for you!!
☹️ That's against the rules! ONO!



What is Physics?

- Randall Knight, the author of the course textbook, opens the book with the following quote:
Said Alice to the Cheshire cat,
“Cheshire-Puss, would you tell me, please, which way I ought to go from here?”
“That depends a good deal on where you want to go,” said the Cat.
“I don’t much care where—” said Alice.
“Then it doesn’t matter which way you go,” said the Cat.
- Lewis Carroll, *Alice in Wonderland*
- The point is, physicists try to understand nature by observing nature and looking for patterns and principles which explain things.


Physics at U of T




Physics UNIVERSITY OF TORONTO

<http://www.physics.utoronto.ca/>

Physics at UofT Students Research Our People



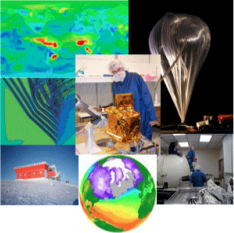
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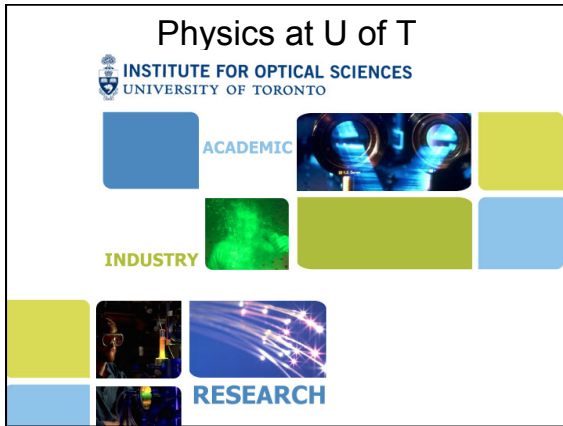


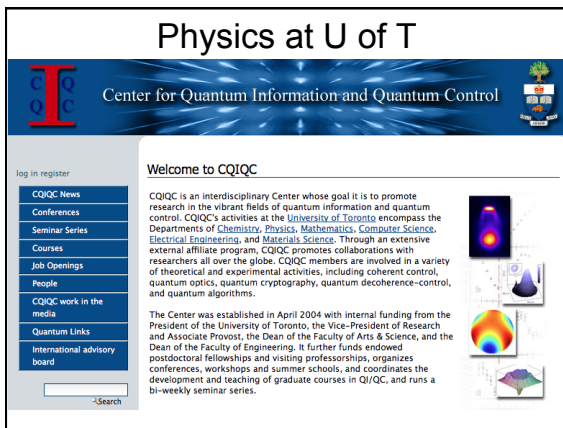
Atmospheric Physics

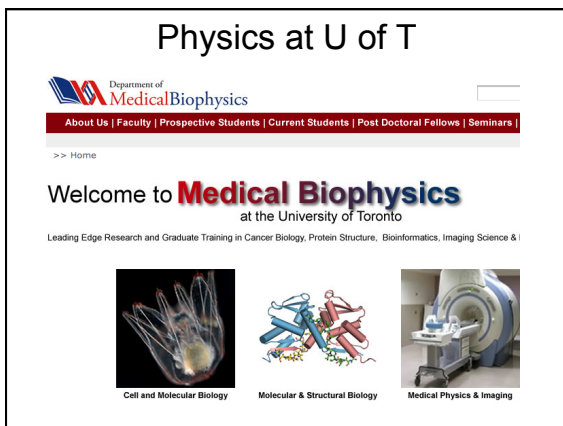
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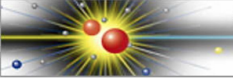

















Physics at U of T



University of Toronto
Particle Physics

 Overview	 Seminars	 Students
 ATLAS	 CDF	 T2K
 ZEUS	 Theory	 Other Activities


Physics at U of T

IsoTrace Laboratory


The Canadian Centre for Accelerator Mass Spectrometry

The IsoTrace (ISOTop and Rare Atom Counting Equipment) Laboratory is a multi-disciplinary centre, established at the University of Toronto, for research in the ultra-high sensitivity analysis of materials using Accelerator Mass Spectrometry (AMS), and for the development of new apparatus and procedures for use in this field.


As a national facility, IsoTrace makes the results of this research and development available as analytical services to a wide range of academic, government, industrial and commercial researchers, in fields such as archaeology, biology, chemistry, earth and environmental science, materials analysis, medicine and physics.



Physics at U of T



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About Learning Physics

- In PHY131, the test and exam will involve understanding concepts and solving problems. There will be math.
- Each concept builds on previous ones. This will continue into the second half of the full course: PHY132
- Assimilating any concept takes time.
- Keep up with your studies. Come to every class.
- The “last minute cram” before a test or exam is not likely to help you.

What can you expect of me?

- To try to teach well and explain physics clearly, at an appropriate level.
- To treat you with courtesy, respect and kindness.
- To be fair.
- To be in my office at scheduled office hours.
- To answer emails within 48 hours.
- To begin class at 6:10 and end class at or slightly before 8:00pm.

What do I expect of you?

- To read the assigned readings **before** coming to class.
- To be seated and ready for class at 6:10.
- To use the clickers honestly.
- To not make lots of noise during class or do stuff which distracts your neighbours.
- To be patient with me when I make mistakes, and also to point out any mistakes I don't notice right away.

Practicals

- Note that Practical sessions begin on Thursday in MP125.
- You will be assigned to sit with 3 other people from this course, and the 4 of you will form a team for the next five practical sessions.
- You will be working on practical activities together and sharing a mark on the notebooks.
- Teams are scrambled half-way through the course.
- The Practical Coordinator is Brian Wilson

Today.. Motion!

Chapter 1: Sections 1.1 to 1.3

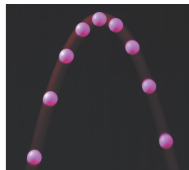




Translational Motion



Circular Motion



Projectile Motion



Rotational Motion

Making a Motion Diagram

An easy way to study motion is to make a movie of a moving object. A movie camera takes photographs at a fixed rate, typically 30 photographs every second. Each separate photo is called a frame, and the frames are all lined up one after the other in a filmstrip, as shown. The car is in a somewhat different position in each frame.

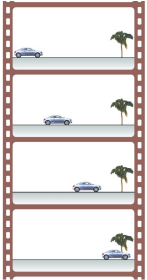


FIGURE 1.2 Four frames from the movie of a car.

Making a Motion Diagram

Suppose we cut the individual frames of the filmstrip apart, stack them on top of each other, and project the entire stack at once onto a screen for viewing. The result is shown. This composite photo, showing an object's position at several equally spaced instants of time, is called a motion diagram.

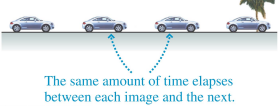


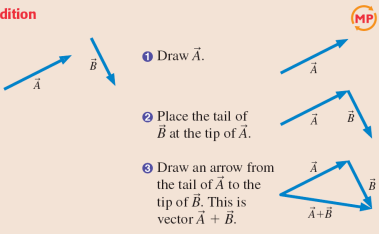
FIGURE 1.3 A motion diagram of the car shows all the frames simultaneously.

The same amount of time elapses between each image and the next.

Tactics: Vector Addition

TACTICS BOX 1.1 Vector addition

To add \vec{B} to \vec{A} :



- 1 Draw \vec{A} .
- 2 Place the tail of \vec{B} at the tip of \vec{A} .
- 3 Draw an arrow from the tail of \vec{A} to the tip of \vec{B} . This is vector $\vec{A} + \vec{B}$.

Tactics: Vector Subtraction

TACTICS
BOX 1.2 **Vector subtraction**

To subtract \vec{B} from \vec{A} :

- 1 Draw \vec{A} .
- 2 Place the tail of $-\vec{B}$ at the tip of \vec{A} .
- 3 Draw an arrow from the tail of \vec{A} to the tip of $-\vec{B}$. This is vector $\vec{A} - \vec{B}$.

Motion Diagrams with Velocity Vectors

FIGURE 1.13 Motion diagram of the tortoise racing the hare.

These are average velocity vectors.

The length of each arrow represents the average speed. The hare moves faster than the tortoise.

The Particle Model

- If we restrict our attention to objects undergoing translational motion, we can consider the object as if it were just a single point, without size or shape.
- We can also treat the object as if all of its mass were concentrated into this single point.
- An object that can be represented as a mass at a single point in space is called a particle.
- A particle has no size, no shape, and no distinction between top and bottom or between front and back.

Linear Acceleration

Because velocity is a vector, it can change in two possible ways.

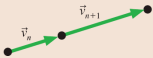
1. The magnitude can change, indicating a change in speed, or
2. The direction can change, indicating that the object has changed direction.

We will concentrate for now on the first case, a change in speed.

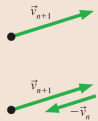
Tactics: Finding the acceleration vector

TACTICS BOX 1.3 Finding the acceleration vector (MP)

To find the acceleration as the velocity changes from \vec{v}_n to \vec{v}_{n+1} :

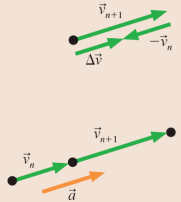


- 1 Draw the velocity vector \vec{v}_{n+1} .
- 2 Draw $-\vec{v}_n$ at the tip of \vec{v}_{n+1} .



Tactics: Finding the acceleration vector

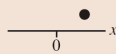
- 3 Draw $\Delta\vec{v} = \vec{v}_{n+1} - \vec{v}_n = \vec{v}_{n+1} + (-\vec{v}_n)$
This is the direction of \vec{a} .
- 4 Return to the original motion diagram. Draw a vector at the middle point in the direction of $\Delta\vec{v}$; label it \vec{a} . This is the average acceleration at the midpoint between \vec{v}_n and \vec{v}_{n+1} .

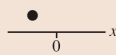


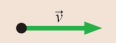
Tactics: Finding the acceleration vector

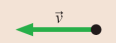
- The sign of position (x or y) tells us *where* an object is.
- The sign of velocity (v_x or v_y) tells us *which direction* the object is moving.
- The sign of acceleration (a_x or a_y) tells us which way the acceleration vector points, *not* whether the object is speeding up or slowing down.

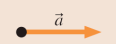
Tactics: Finding the acceleration vector

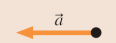

 $x > 0$ Position to right of origin.


 $x < 0$ Position to left of origin.



 $v_x > 0$ Direction of motion is to the right.



 $v_x < 0$ Direction of motion is to the left.



 $a_x > 0$ Acceleration vector points to the right.



 $a_x < 0$ Acceleration vector points to the left.


Tactics: Finding the acceleration vector


 $y > 0$ Position above origin.


 $y < 0$ Position below origin.


 $v_y > 0$ Direction of motion is up.


 $v_y < 0$ Direction of motion is down.


 $a_y > 0$ Acceleration vector points up.



 $a_y < 0$ Acceleration vector points down.

FIGURE 1.25 Determining significant figures.

Leading zeros locate the decimal point. They are not significant.

$$0.00620 = 6.20 \times 10^{-3}$$

A trailing zero is reliably known. It is significant.

The number of significant figures is the number of digits when written in scientific notation.

- The number of significant figures \neq the number of decimal places.
- Changing units shifts the decimal point but does not change the number of significant figures.

Before Class 2 on Thursday

- Read the Course Syllabus, Chapter 1 and 2 of Knight, and the the Error Analysis Mini-Documnet (10 page PDF) available on course web-site.
- Establish your MasteringPhysics account
- Register your clicker with your 9-digit Student Number at www.iclicker.com & bring your clicker to the next class!!
- Establish your MasteringPhysics account – complete the Introduction to MasteringPhysics assignment for practice.
- Something to think about: If your friend says, “My height is 150 cm,” is there an implicit error in that number?
