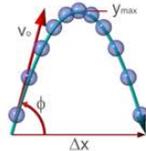PHY131H1S - Class 7

Today:

- Review for tomorrow's test
- 6:00 – 7:30pm in Exam Centre, 255 McCaul St.
- On Chapters 1-3, Error Analysis Mini-Document, and Sections 4.1 through 4.4.
- Bring a calculator and one 8.5x11' aid sheet which you prepare, double-sided

- You drop a glass barometer from the top of McLennan Physical Labs. A short time later, before the barometer hits the ground, you drop a bottle of scotch. As they fall, the distance between the barometer and bottle

A. decreases

B. increases

C. stays the same.

Niels Bohr

Projectile Motion

Projectile motion is made up of two independent motions: uniform motion at constant velocity in the horizontal direction and free-fall motion in the vertical direction. The kinematic equations that describe these two motions are

$$x_f = x_i + v_{ix}\,\Delta t \qquad\qquad y_f = y_i + v_{iy}\,\Delta t - \tfrac{1}{2}g(\Delta t)^2$$

$$v_{fx} = v_{ix} = \text{constant} \qquad v_{fy} = v_{iy} - g\,\Delta t$$

Recall from last time: Projectile Motion / Freefall Question

"A monkey hanging from the branch of a tree is spotted by a hunter. The monkey sees that the barrel of the gun is pointed directly at him. At the exact instant the gun is fired, the monkey lets go of the branch. Will the bullet hit the monkey?

- Had the monkey stayed on the tree, the ball would have curved under its target as gravity causes it to fall a distance $\frac{1}{2}gt^2$ below the straight line.
- But $\frac{1}{2}gt^2$ is also the distance the monkey falls while the ball is in flight.
- So *yes*, the ball hits the monkey!
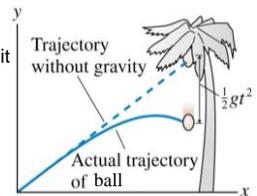
Problem Solving

MODEL Make simplifying assumptions.

VISUALIZE Use:

- **Pictorial representation**
- **Graphical representation**

SOLVE Use a **mathematical representation** to find numerical answers.

ASSESS Does the answer have the proper units? Does it make sense?

Position locates an object with respect to a chosen coordinate system. Change in position is called displacement.

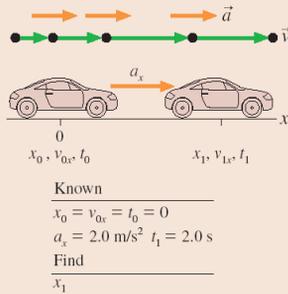Velocity is the rate of change of the position vector $\vec{r}$.

Acceleration is the rate of change of the velocity vector $\vec{v}$.

An object has an acceleration if it

- Changes speed and/or
- Changes direction.

Pictorial Representation

❶ Draw a motion diagram.

❷ Establish coordinates.

❸ Sketch the situation.

❹ Define symbols.

❺ List knowns.

❻ Identify desired unknown.

Known
$x_0 = v_{0x} = t_0 = 0$
$a_x = 2.0 \text{ m/s}^2$ $t_1 = 2.0 \text{ s}$
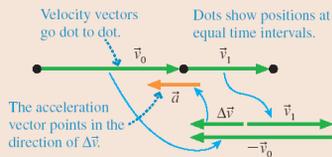
Find
x_1

For **motion along a line:**

- Speeding up: $\vec{v}$ and $\vec{a}$ point in the same direction, v_x and a_x have the same sign.

- Slowing down: $\vec{v}$ and $\vec{a}$ point in opposite directions, v_x and a_x have opposite signs.

- Constant speed: $\vec{a} = \vec{0}$, $a_x = 0$.

Acceleration a_x is positive if $\vec{a}$ points right, negative if $\vec{a}$ points left. The sign of a_x does *not* imply speeding up or slowing down.

Motion Diagrams

- Help visualize motion.

- Provide a tool for finding acceleration vectors.

Velocity vectors go dot to dot.

Dots show positions at equal time intervals.

$\vec{v}_0$ $\vec{v}_1$

The acceleration vector points in the direction of $\Delta \vec{v}$.

$\vec{a}$ $\Delta \vec{v}$ $\vec{v}_1$ $-\vec{v}_0$

▶ These are the average velocity and the average acceleration vectors.

A particle moves from position 1 to position 2 during the interval Δt. Which vector shows the particle's average velocity?

A   B
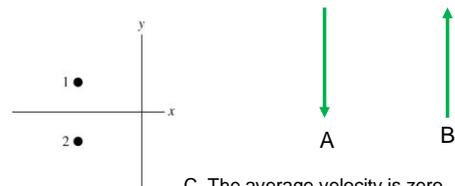
C. The average velocity is zero
D. None of the above
E. It is impossible to determine without more information about the motion

A particle moves from position 1 to position 2 during the interval Δt. Which vector shows the particle's average acceleration?

A   B
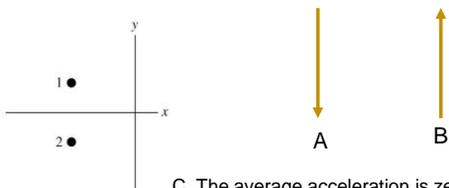
C. The average acceleration is zero.
D. None of the above
E. It is impossible to determine without more information about the motion

Midterm Test 1

- Tuesday, October 2, from 6:00pm to 7:30pm. Tomorrow!
- The test will actually begin at 6:10pm and last for 80 minutes; please arrive 10 minutes early if you can, so you can get settled
- This test will count for 15% of your mark in the course
- **There will be no make-up** for this test. Students who miss a test for legitimate and documented reasons will have the weight of the test transferred to the other test which will then count for 30% of their course mark
- The test will be held in the Exam Centre, 255 McCaul St.
- You must go to the correct room, based on your Practical Group
- Your practical group is the one that shows under the "*My PRA groups*" link on the Portal

"Which room am I in on Tuesday at 6:00pm?"

Group	Room
M2A	EX 320
M2B	EX 100
M3A	EX 320
M3B	EX 100

Group	Room
T1A	EX 200
T1B	EX 310
T2A	EX 100
T2B	EX 200
T3A	EX 310
T3B	EX 200

Group	Room
W2A	EX 300
W2B	EX 100
W3A	EX 300
W3B	EX 200
W4A	EX 310

Group	Room
R1A	EX 200
R2A	EX 200
R2B	EX 200
R3A	EX 300
R3B	EX 200

Group	Room
F1A	EX 100
F1B	EX 100
F2A	EX 320
F3A	EX 100
F3B	EX 100

Midterm Test 1

- The test will have:
  - **8** multiple-choice questions
  - two multi-part long-answer problems counting for a total of **16** marks, which will be graded in detail; part marks may be awarded, but **only if you show your work**.
- Please bring:
  - ❑ **Your student card.**
  - ❑ A calculator without any communication capability.
  - ❑ A **soft-lead** 2B or 2HB pencil with an eraser.
  - ❑ A single, original, handwritten 8 1/2 × 11 inch sheet of paper on which you may have written anything you wish, on both sides.

Midterm Test 1 – what to expect

- Chapter 1: ie Motion Diagrams, Unit Conversions, position, velocity, acceleration
- Error Analysis: ie standard deviation, propagation of errors, reading error, error in the mean
- Chapter 2: ie Constant Velocity motion, Constant Acceleration motion, Freefall, Motion on an inclined plane
- Chapter 3: ie Scalars and Vectors, coordinate systems and components, vector addition / subtraction
- Sections 4.1 – 4.4, ie Kinematics in 2D, Projectile Motion, Relative Motion
- The math includes algebra and trigonometry similar to the level on the MasteringPhysics and end-of-chapter problems
- You will **not** have to do derivatives or integrals on the test

Midterm Test 1 - hints

- **Don't be late.** If you're very early, just wait outside the room.
- Spend the first 2 or 3 minutes skimming over the entire test from front to back before you begin. Look for the easy problems that you have confidence to solve first.
- Before you answer anything, read the question *very carefully*. The **most common mistake** is misreading the question!
- Manage your time; if you own a watch, bring it. 10 problems over 80 minutes means an average of 8 minutes per problem.
- You CANNOT HAVE YOUR PHONE with you at a test or exam at U of T – you must store it in your bag at the edge of the room, at least 3 m away from you

Midterm Test 1 – *more hints!*

- Some of the multiple choice are conceptual and can be answered in less than 2 minutes.. Maybe do these ones first?
- If you start a longer problem but can't finish it within about 10 minutes, leave it, make a mark on the edge of the paper beside it, and come back to it after you have solved all the easier problems.
- When you are in a hurry and your hand is not steady, you can make little mistakes; if there is time, do the calculation twice and obtain agreement.
- Bring a snack or drink.
- Don't leave a test early! You might spend the first half getting 95% of the marks you're going to get, and the second half getting the other 5%, but it's still worth it.

Little survey (optional):
How are you feeling about the test tomorrow?

A. I feel confident about the test tomorrow; I believe I will get an A
B. I'm not too sure what to expect, but I'm hopeful I'll do well
C. I have no particularly positive or negative feelings about the test tomorrow..
D. I'm not too sure what to expect, but I'm worried it will be awful
E. I am very worried about the test tomorrow; I'm afraid I'm going to fail!

Significant figures are reliably known digits. The number of significant figures for:

- **Multiplication, division, powers** is set by the value with the fewest significant figures.
- **Addition, subtraction** is set by the value with the smallest number of decimal places.

The appropriate number of significant figures in a calculation is determined by the data provided.

Problem 55 from Chapter 4 on Relative Motion

"While driving north at 25 m/s during a rainstorm you notice that the rain makes an angle of 38° with the vertical. While driving back home moments later at the same speed but in the opposite direction, you see that the rain is falling straight down. From these observations, determine the speed and angle of the raindrops relative to the ground."

A 50 g ball rolls off a table and lands 2 m from the base of the table.
A 100 g ball rolls off the same table with the same speed. It lands at a distance

A. less than 2 m from the base.

B. 2 m from the base.

C. greater than 2 m from the base.

Before Class 8 on Wednesday

- Test is tomorrow! 255 McCaul St, 6:00pm.
- On Chs. 1-3, Error Analysis, and Sections 4.1 through 4.4.
- Bring a calculator and one 8.5x11' aid sheet which you prepare, double-sided
- By Wednesday, please finish reading Chapter 4
- Something to think about: You are driving North Highway 427, on the smoothly curving part that will join to the Westbound 401. Your speedometer is constant at 115 km/hr. Your steering wheel is not rotating, but it is turned to the left to follow the curve of the highway. Are you accelerating? If so, in what direction?