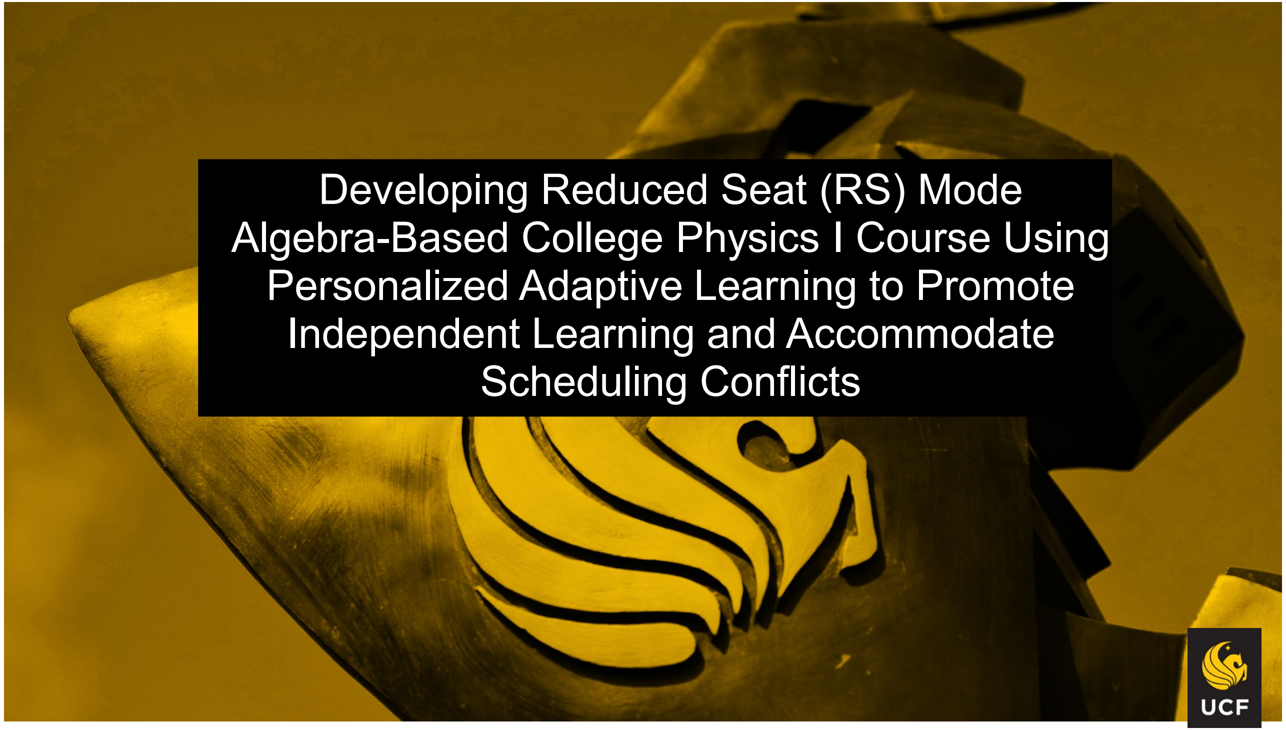

Developing Reduced Seat (RS) Mode Algebra-Based College Physics I Course Using Personalized Adaptive Learning to Promote Independent Learning and Accommodate Scheduling Conflicts

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Project Team Members

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Final Deliverable Goal

- Enhance learning to make students self-sufficient to learn the content.
- Reduce the dropout rate for students who withdraw due to time restrictions.
- Reduce DFW grades for students who are only able to attend classes on occasion.
- Increase the student enrollment rate in PHY 2053 course by providing an opportunity for students to attend classes with reduced seating time.
- Well-suited for students who are self-sufficient and independent learners.

Overview

- College Physics I – PHY 2053
- Student Learning Challenges
- Promoting Student Learning
- Planned Technology
  - Personalized Adaptive Learning (PAL) – Realizeit
  - Webcourses

College Physics 1
PHY 2053

- Algebra-based
- Mechanics and waves
- Lecture-mode format
- Maximum enrollment: 293

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Student Learning Challenge

Scheduling and Other Challenges:

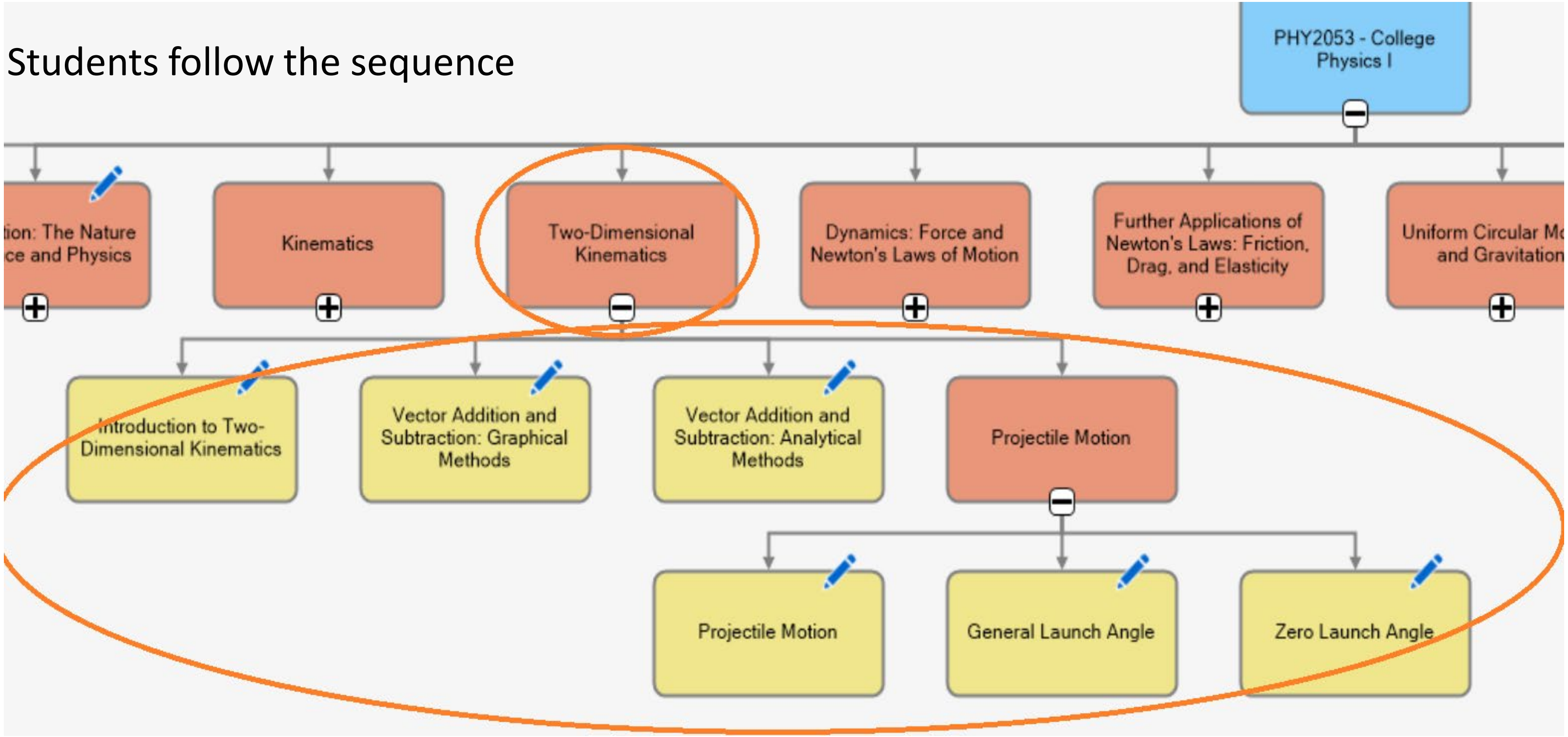
- Accommodating working students with scheduling conflicts.
- Accommodating dyslexic and auditory learners.
- Providing opportunities for independent learners.

Student Learning Challenge

Content Related Challenges:

- Understanding the simplicity of problem-solving.
- Relating physics concepts to problem-solving.
- Interpreting formulas in words.
- Confidently communicating physics concepts.

Personalized Adaptive Learning (PAL)- Realizeit



College Physics I Openstax Reading Content

Physical Quantities and Units

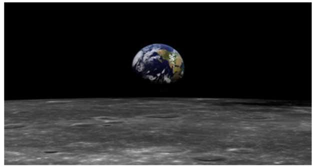


Figure 1. The distance from Earth to the Moon may seem immense, but it is just a tiny fraction of the distances from Earth to other celestial bodies. (credit: NASA)

The range of objects and phenomena studied in physics is immense. From the incredibly short lifetime of a nucleus to the age of the Earth, from the tiny sizes of sub-nuclear particles to the vast distance to the edges of the known universe, from the force exerted by a jumping flea to the force between Earth and the Sun, there are enough factors of 10 to challenge the imagination of even the most experienced scientist. Giving numerical values for physical quantities and equations for physical principles allows us to understand nature much more deeply than does qualitative description alone. To comprehend these vast ranges, we must also have accepted units in which to express them. And we shall find that (even in the potentially mundane discussion of meters, kilograms, and seconds) a profound simplicity of nature appears—all physical quantities can be expressed as combinations of only four fundamental physical quantities: length, mass, time, and electric current.

We define a physical quantity either by *specifying how it is measured* or by *stating how it is calculated* from other measurements. For example, we define distance and time by specifying methods for measuring them, whereas we define *average speed* by stating that it is calculated as distance traveled divided by time of travel.

Measurements of physical quantities are expressed in terms of units, which are standardized values. For example, the length of a race, which is a physical quantity, can be expressed in units of meters (for sprinters) or kilometers (for distance runners). Without standardized units, it would be extremely difficult for scientists to express and compare measured values in a meaningful way.

Next Exit

I wonder

Vector Addition: Head-to-Tail Method

The head-to-tail method is a graphical way to add vectors, described in Figure 3.11 below and in the steps following. The tail of the vector is the starting point of the vector, and the head (or tip) of a vector is the final, pointed end of the arrow.

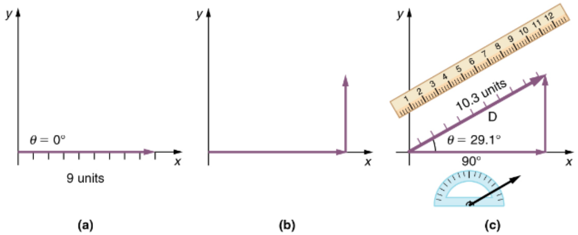


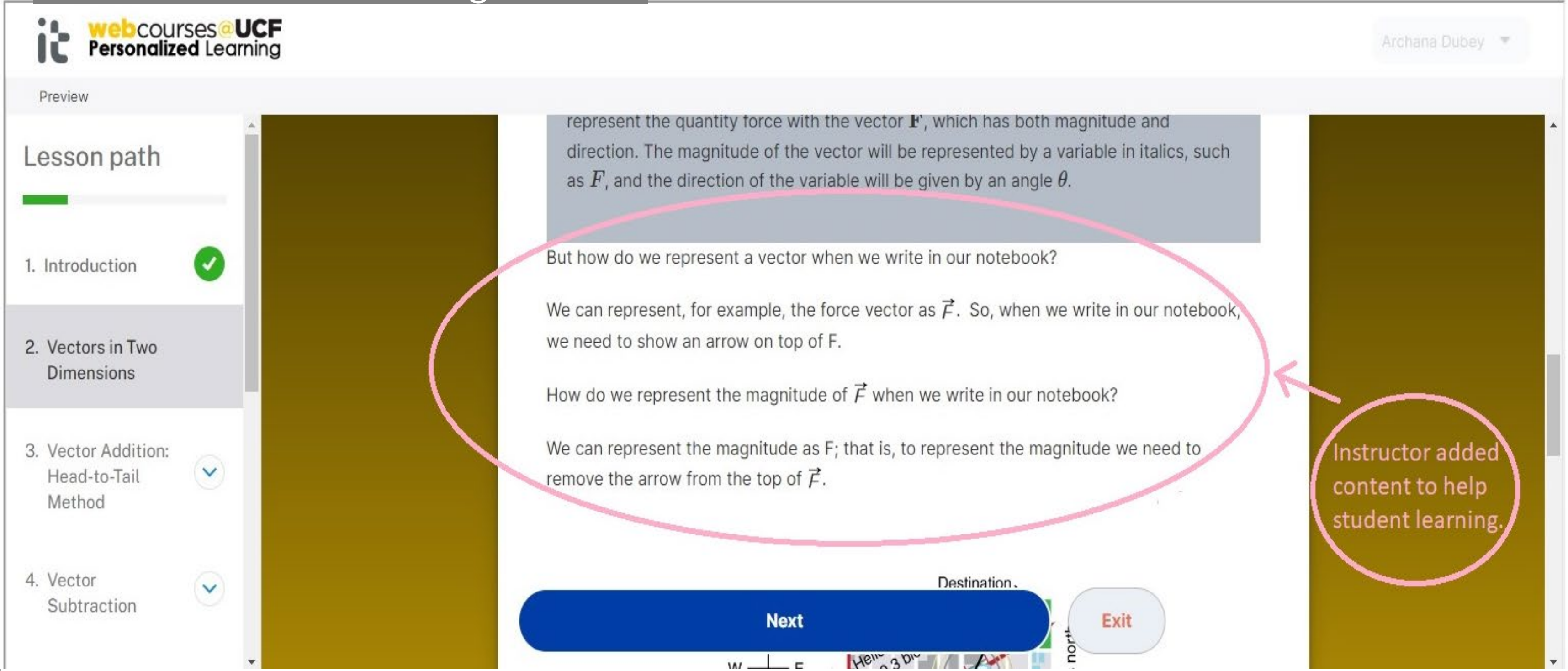
Figure 3.11 Head-to-Tail Method: The head-to-tail method of graphically adding vectors is illustrated for the two displacements of the person walking in a city considered in

Important Vocabulary Words

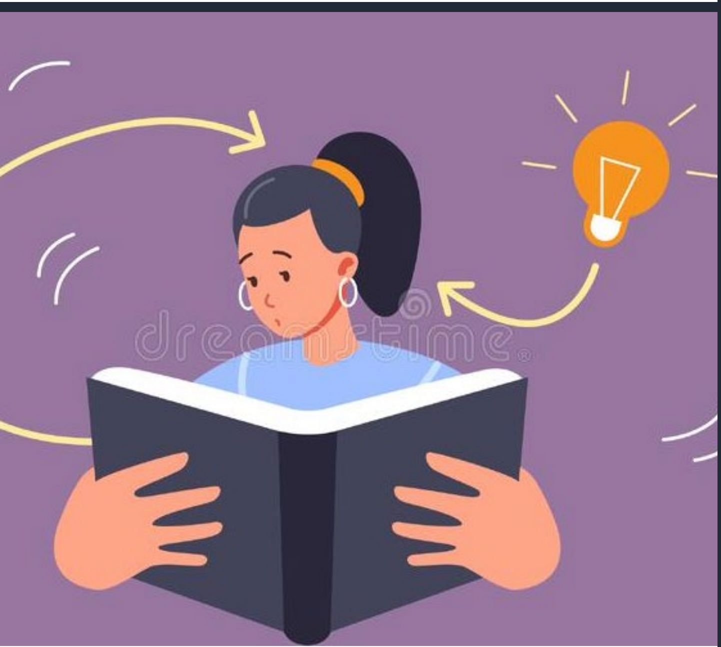
head-to-tail method ×

a method of adding vectors in which the tail of each vector is placed at the head of the previous vector

Instructor Added Reading Content



Promoting Student Learning



Interactive Example Problems:

- Improving problem-solving skills.
- Relating physics concepts to problem-solving.
- Interpreting formulas in words.

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webcourses@UCF Personalized Learning

Archana Dubey

Preview

Lesson path

1. Interactive example

Interactive Examples

Laura throws a tennis ball (mass = 0.0570 kg) vertically upward. The ball returns to the point of release after 4.40 s. What is the momentum of the ball when it returns to the point of release?

Is this a Free-Fall problem?

- Yes
- No

I don't know

One attempt

Submit answer

Exit

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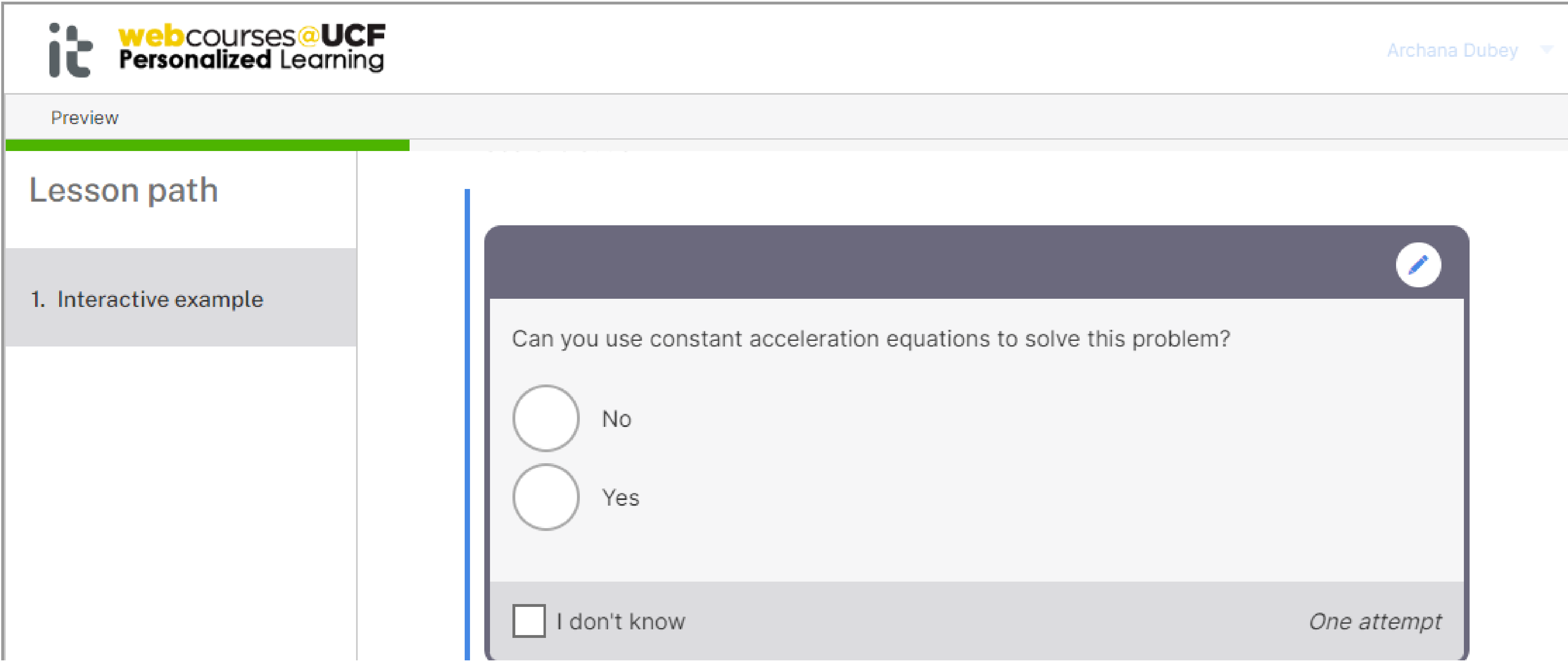
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Archana Dubey
Preview
Lesson path
1. Interactive example
Can you use constant acceleration equations to solve this problem?
No
Yes
I don't know
One attempt

Is this a 1D or 2D motion problem?

- 2D
- 1D

- [ ] I don't kno

Which of the following equations are constant acceleration equations in the y-direction? (select all the correct equations)

- [ ] $v_y^2 = v_{0y}^2 + 2a_x(y_0 - y)$
- [ ] $y - y_0 = v_{0y}t + a_yt^2$
- [ ] $y - y_0 = v_{0y}t +$
- [ ] $v_y = v_{0y} + a_y$
- [ ] $y - y_0 = v_{0y}t +$
- [ ] $v_y = v_{0y} + a_yt$
- [ ] $v_y^2 = v_{0y}^2 + a_y(y$

Submit answer

Exit

What is the acceleration?

a_y = ______ $\frac{m}{s^2}$

- [ ] I don't know

One attempt

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Read the question once again and determine what information is given in the problem.

- Time taken by the ball to go from the maximum height to the point of release.
- Time taken by the ball to reach the maximum height.
- Velocity of the ball when it returns to the point of release.
- Time taken by the ball to return to the point of releas
- Acceleration of the ball when it returns to the point o
- Velocity of the ball when it is at the maximum height

Read the question once again and determine what you are looking for?

- Time taken by the ball to reach the maximum height.
- Acceleration of the ball when it returns to the point of release.
- Time taken by the ball to go from the maximum height to the point of release.
- Momentum of the ball when it is at the maximum height of its trajectory.
- Time taken by the ball to return to the point of release.
- Momentum of the ball when it returns to the point of release.

Submit answer **Exit**

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Enter the constant acceleration equation you would use to find the answer.

× ÷ π $\frac{a}{b}$ a^b a_b ()

?

Symbols αβγ Func

I don't know

Submit a

What is the velocity of the ball at the maximum height?

$\frac{m}{s}$

I don't know *One attempt*

Submit answer

Exit

UCF

Determine the velocity of the ball when it returns to the point of release.

______ $\frac{m}{s}$

☐ I don't know

2 attempts

Determine the momentum of the ball when it returns to the point of release.

______ $kg \cdot \frac{m}{s}$

☐ I don't know

2 attempts

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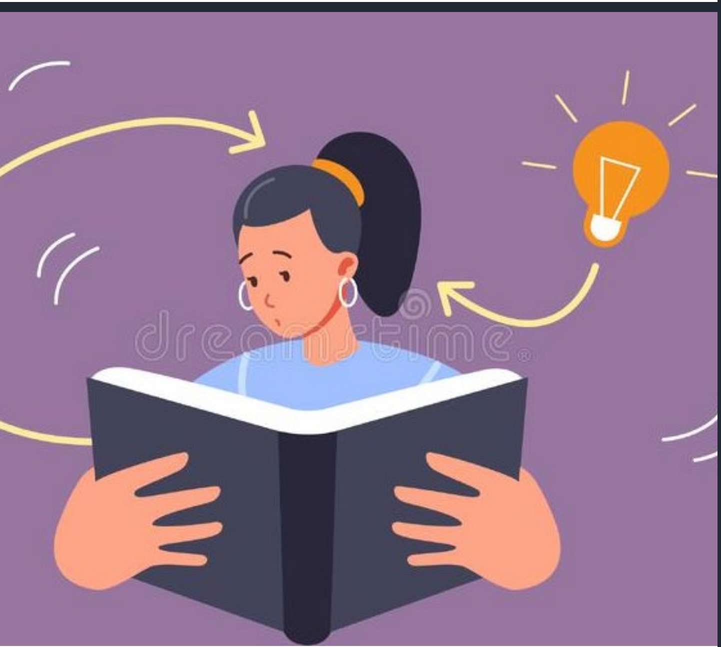
Promoting Student Learning



Dividing Problems in Assessments:

- Multi-step problems: problems divided into several parts, such as (a), (b), etc.…
- Relating physics concepts to problem-solving.

A toy rocket is launched straight upward from the ground level. Starting from rest it accelerates upward at 9.50 m/s^2 for 6.25 s. After 6.25 s, the engine shuts down.

(a) Determine the velocity of the rocket when the engin shuts down.

(b) Determine the maximum height achieved by the rocket.

(c) Suppose that the mass of the rocket is 0.230 kg, determine gravitational potential energy of the rocket-earth system when the rocket is at it

(a) ______ $\frac{m}{s}$

(b) ______ m

(c) ______ J

Submit answer

Instructor designed question bank

A toy rocket is launched straight upward from the ground level. Starting from rest it accelerates upward at 6.00 m/s^2 for 10.0 s. After 10.0 s, the engine shuts down.

(a) Determine the velocity of the rocket when the engine shuts down.

(b) Determine the velocity of the rocket at 15.9 s.

(c) Suppose that the mass of the rocket is 0.290 kg, determine the kinetic energy of the rocket at 15.9 s.

(a) ______ $\frac{m}{s}$

(b) ______ $\frac{m}{s}$

(c) ______ J

Submit answer Exit

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Promoting Student Learning

- Students must review the topics covered in previous chapters as they move forward to the next chapters.
- Several topics revisited in later chapters to learn and relate to new topics.

Personalized Adaptive Learning (PAL) - Realizeit

A ball (0.410 kg) is kicked at an angle of 58.0° above the horizontal axis (above the +x-axis). The initial speed of the ball is 24.6 m/s. Ignoring air resistance, determine the momentum of the ball just before it hits the ground.

[ ] $kg \cdot \frac{m}{s}$

[ ] I don't know

Amy wants to drive on a roadbed that is banked at 32°. Determine the magnitude of momentum of the car (1700 kg) to remain on the track if the radius of curvature of the roadbed is 255 m?

[ ] $kg \cdot \frac{m}{s}$

[ ] I don't know

One attempt

Instructor designed question bank

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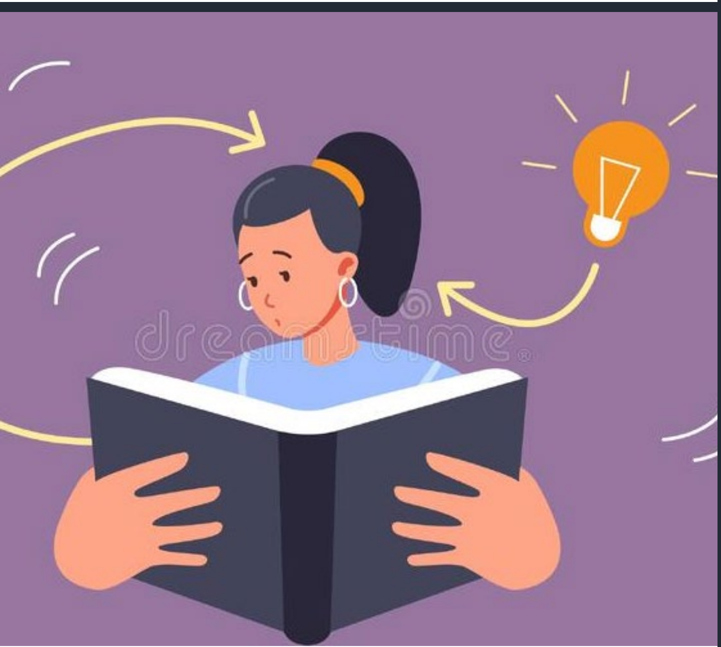
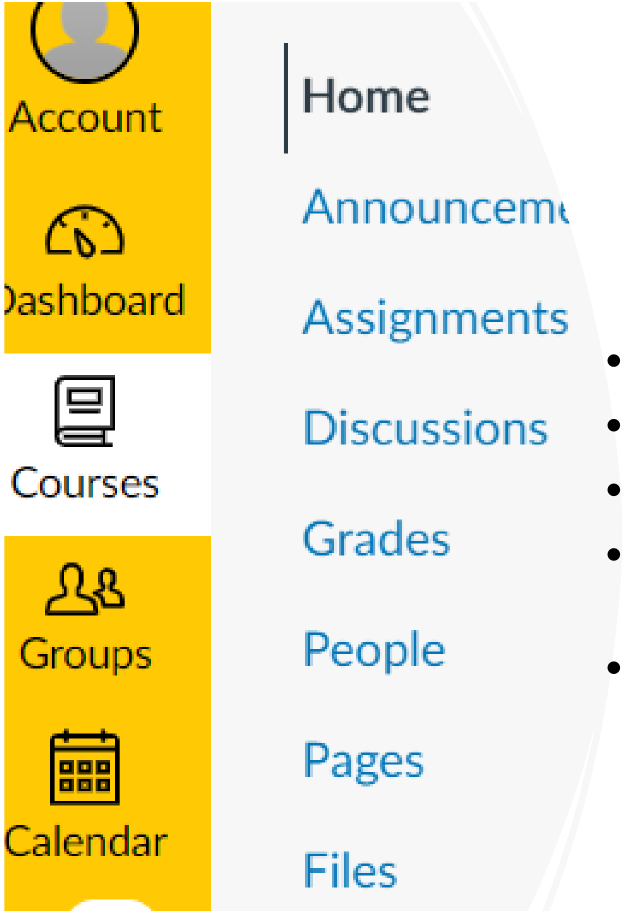
Promoting Student Learning

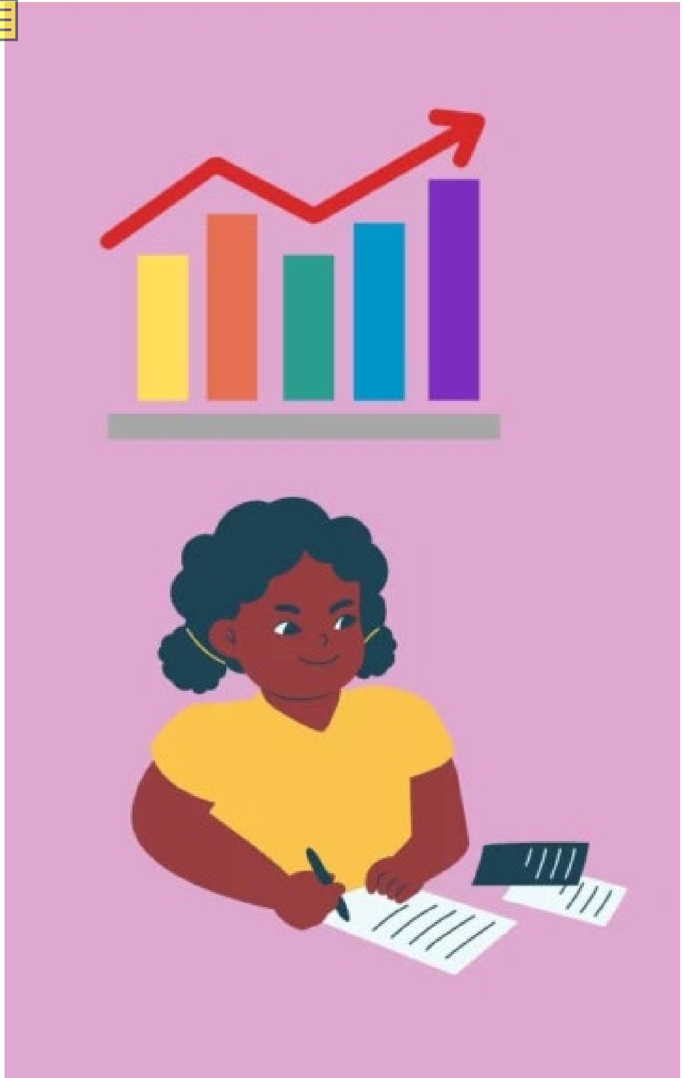


- Physics Demonstration Videos
- Chapter Objectives and Summary – AI Avatars



Webcourses:
RS Mode – PHY 2053

- First implementation – Fall 2024.
- Maximum enrollment – 293 students.
- Lecture recordings on Panopto, notes, quizzes.
- Robust question bank – proctored exams at the Evaluation and Proficiency Center (EPC).
- EPC exams – flexible time window…
  - Midterm exams: 3-4 days, 9:00 AM -9:00 PM
  - Final exam: entire finals week, 9:00 AM -9:00 PM



Project Impact

- High enrollment = high impact!
- Flexibility for students working full/part time for pay.
- Robust PAL and AI implementation for content creation…
    - Enhanced learning
    - Reduced DFW
    - Reduced dropout rate
- RS mode section – overall increase in enrollment.
- Promote learning for auditory learners.
- Promote self-sufficient and independent learners.
- Make students self-sufficient to learn the content.

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Evaluation Plans

- Student Feedback on PAL
- Student Feedback on RS Mode Instruction
- Student Performance on Proctored Assessments

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