

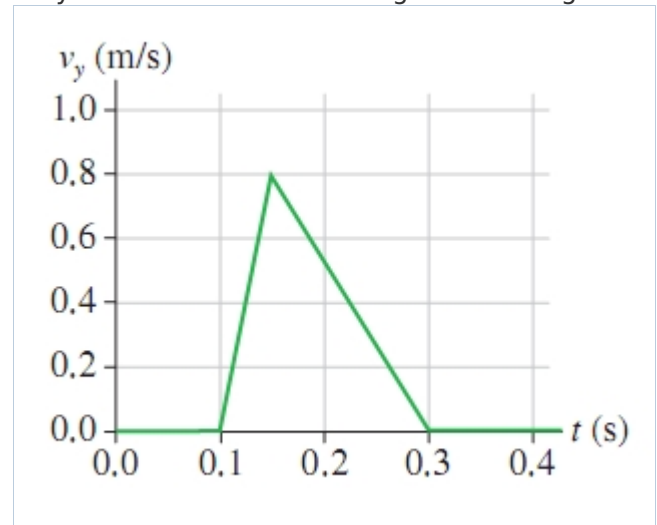
## HW #1: Introduction to kinematics

Due: 11:59pm on Wednesday, September 4, 2024

You will receive no credit for items you complete after the assignment is due. [Grading Policy](#)

### Problem 2.8 - Enhanced - with Hints and Feedback

The following figure is a somewhat idealized graph of the velocity of blood in the ascending aorta during one beat of the heart.



#### Part A

Approximately how far, in cm, does the blood move during one beat?

**Express your answer in centimeters.**

You did not open hints for this part.

ANSWER:

$l =$   cm

### Problem 2.14

A jet plane is cruising at 310 m/s when suddenly the pilot turns the engines up to full throttle. After traveling 4.1 km, the jet is moving with a speed of 400 m/s.

#### Part A

What is the jet's acceleration, assuming it to be a constant acceleration?

**Express your answer with the appropriate units.**

ANSWER:

$a =$

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## Problem 2.17

A speed skater moving to the left across frictionless ice at  $8.8 \text{ m/s}$  hits a  $4.9\text{-m}$ -wide patch of rough ice. She slows steadily, then continues on at  $5.5 \text{ m/s}$ .

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### Part A

What is the magnitude of her acceleration on the rough ice?

**Express your answer with the appropriate units.**

ANSWER:

$a =$

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## Problem 2.23

As a science project, you drop a watermelon off the top of the Empire State Building,  $320 \text{ m}$  above the sidewalk. It so happens that Superman flies by at the instant you release the watermelon. Superman is headed straight down with a speed of  $33.0 \text{ m/s}$ .

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### Part A

How fast is the watermelon going when it passes Superman?

**Express your answer with the appropriate units.**

ANSWER:

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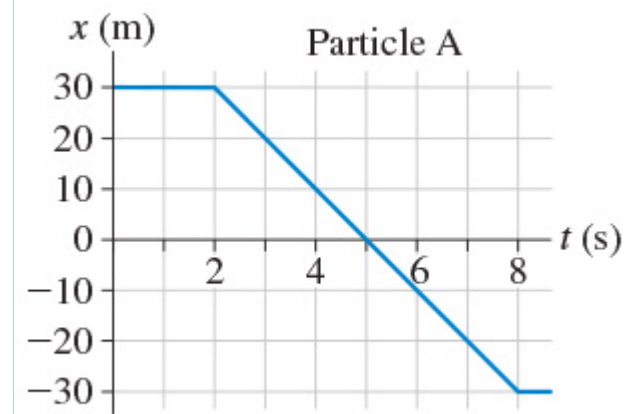
## Problem 2.37 - Enhanced - with Hints and Feedback

Three particles move along the  $x$ -axis, each starting at  $t_0 = 0 \text{ s}$ . The graph for A is a position-versus-time graph; the graph for B is a velocity-versus-time graph; the graph for C is an acceleration-versus-time graph.

### Part A

Find the velocity of the particle A at  $t = 7.5$  s.

**Express your answer with the appropriate units.**



You did not open hints for this part.

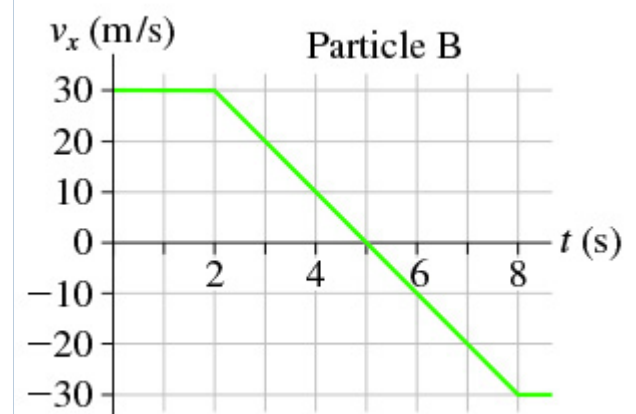
ANSWER:

$v_A =$

### Part B

Find the velocity of the particle B at  $t = 7.5$  s.

**Express your answer with the appropriate units.**



You did not open hints for this part.

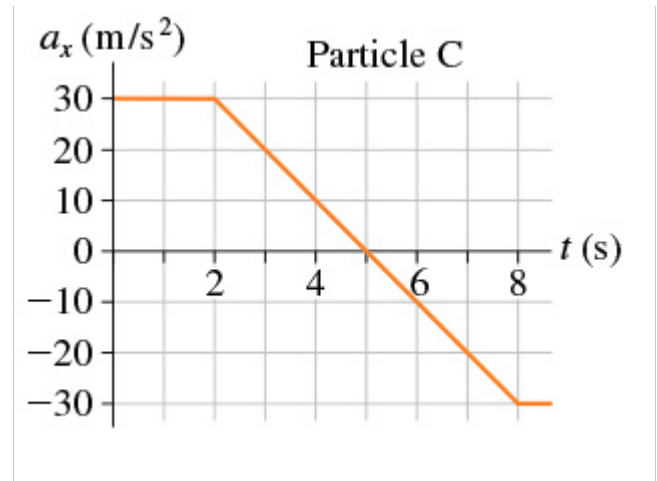
ANSWER:

$v_B =$

### Part C

Find the velocity of the particle C at  $t = 7.5$  s. Particle starts with  $v_{0x} = 10$  m/s at  $t_0 = 0$  s.

Express your answer with the appropriate units.



You did not open hints for this part.

ANSWER:

$v_C =$

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## Problem 2.48

The takeoff speed for an Airbus A320 jetliner is  $80 \text{ m/s}$ . Velocity data measured during takeoff are as shown.

$t \text{ (s)}$	$v_x \text{ (m/s)}$
0	0
10	23
20	46
30	69

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### Part A

Is the jetliner's acceleration constant during takeoff?

ANSWER:

- ☐ yes
- ☐ no

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### Part B

At what time do the wheels leave the ground?

Express your answer with the appropriate units.

ANSWER:

$t =$

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### Part C

What is the takeoff distance of the jetliner?

**Express your answer with the appropriate units.**

ANSWER:

$s_f =$

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**Part D** Complete previous part(s)

Instructors: [View all hidden parts](#)

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## Problem 2.52

A cheetah spots a Thomson's gazelle, its preferred prey, and leaps into action, quickly accelerating to its top speed of  $30 \text{ m/s}$ , the highest of any land animal. However, a cheetah can maintain this extreme speed for only  $15 \text{ s}$  before having to let up. The cheetah is  $230 \text{ m}$  from the gazelle as it reaches top speed, and the gazelle sees the cheetah at just this instant. With negligible reaction time, the gazelle heads directly away from the cheetah, accelerating at  $4.6 \text{ m/s}^2$  for  $5.0 \text{ s}$ , then running at constant speed.

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### Part A

Does the gazelle escape?

ANSWER:

- ☐ Yes, the gazelle will run more than the cheetah could run at all during the gazelle's acceleration.
- ☐ No, the cheetah will approach the gazelle during its acceleration.
- ☐ Yes, but in order to escape gazelle needs to maintain the constant speed for a while.
- ☐ No, the cheetah will approach the gazelle during its run at a constant speed.

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**Part B** Complete previous part(s)

Instructors: [View all hidden parts](#)

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## Problem 2.56

A 200 kg weather rocket is loaded with 100 kg of fuel and fired straight up. It accelerates upward at  $30 \text{ m/s}^2$  for 32 s, then runs out of fuel. Ignore any air resistance effects.

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### Part A

What is the rocket's maximum altitude?

**Express your answer with the appropriate units.**

ANSWER:

$h =$

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### Part B

How long is the rocket in the air before hitting the ground?

**Express your answer with the appropriate units.**

ANSWER:

$t =$

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## Problem 2.57

A lead ball is dropped into a lake from a diving board 5.00 m above the water. After entering the water, it sinks to the bottom with a constant velocity equal to the velocity with which it hit the water. The ball reaches the bottom 4.50 s after it is released.

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### Part A

How deep is the lake?

**Express your answer with the appropriate units.**

ANSWER:

### Score Summary:

Your score on this assignment is 0.0%.

You received 0 out of a possible total of 9 points.