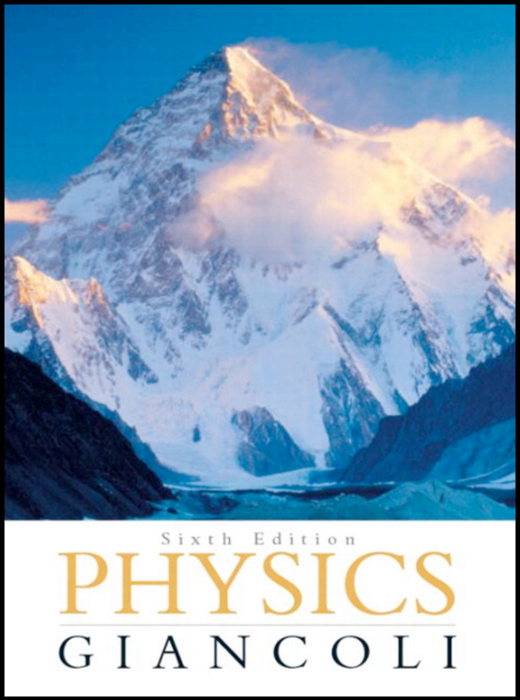

ConcepTest PowerPoints

Chapter 2

Physics: Principles with Applications, 6th edition

Giancoli

ConcepTest 2.1 Walking the Dog

You and your dog go for a walk to the park. On the way, your dog takes many side trips to chase squirrels or examine fire hydrants. When you arrive at the park, do you and your dog have the same displacement?

1) yes
2) no

ConcepTest 2.1 Walking the Dog

You and your dog go for a walk to the park. On the way, your dog takes many side trips to chase squirrels or examine fire hydrants. When you arrive at the park, do you and your dog have the same displacement?

1) yes
2) no

Yes, you have the same displacement. Since you and your dog had the same initial position and the same final position, then you have (by definition) the same displacement.

Follow-up: Have you and your dog traveled the same distance?

ConcepTest 2.2 Displacement

Does the displacement of an object depend on the specific location of the origin of the coordinate system?

1) yes
2) no
3) it depends on the coordinate system

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1) yes
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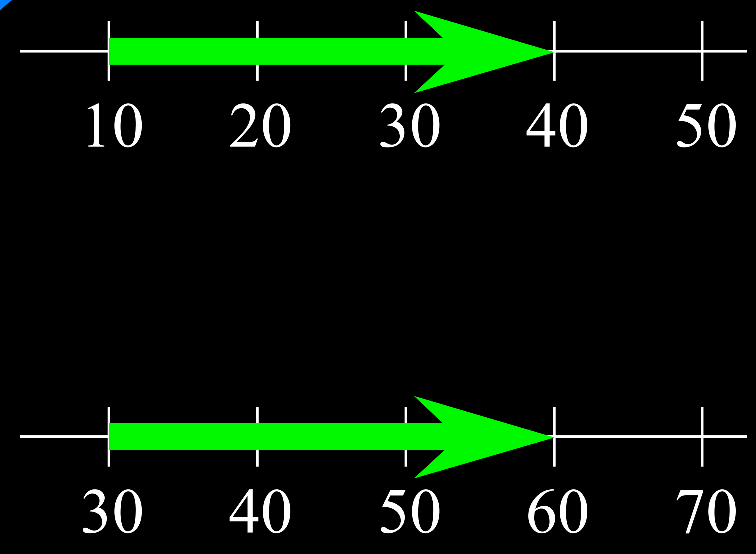
Since the displacement is the ***difference*** between two coordinates, the origin does not matter.



ConcepTest 2.3 Position and Speed

If the position of a car is zero, does its speed have to be zero?

1) yes
2) no
3) it depends on the position

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If the position of a car is zero, does its speed have to be zero?

1) yes
2) no
3) it depends on the position

No, the speed does not depend on position, it depends on the *change* of position. Since we know that the displacement does not depend on the origin of the coordinate system, an object can easily start at $x = -3$ and be moving by the time it gets to $x = 0$.

ConcepTest 2.4 Odometer

Does the odometer in a car measure distance or displacement?

1) distance
2) displacement
3) both

ConcepTest 2.4 Odometer

Does the odometer in a car measure distance or displacement?

1) distance
2) displacement
3) both

If you go on a long trip and then return home, your odometer does not measure zero, but it records the total miles that you traveled. That means the odometer records distance.

Follow-up: How would you measure displacement in your car?

ConcepTest 2.5 Speedometer

Does the speedometer in a car measure velocity or speed?

1) velocity
2) speed
3) both
4) neither

ConcepTest 2.5 Speedometer

Does the speedometer in a car measure velocity or speed?

1) velocity
2) speed
3) both
4) neither

The speedometer clearly measures speed, not velocity. Velocity is a vector (depends on direction), but the speedometer does not care what direction you are traveling. It only measures the magnitude of the velocity, which is the speed.

Follow-up: How would you measure velocity in your car?

ConcepTest 2.6a Cruising Along I

You drive for 30 minutes at 30 mi/hr and then for another 30 minutes at 50 mi/hr. What is your average speed for the whole trip?

1) more than 40 mi/hr
2) equal to 40 mi/hr
3) less than 40 mi/hr

ConcepTest 2.6a Cruising Along I

You drive for 30 minutes at 30 mi/hr and then for another 30 minutes at 50 mi/hr. What is your average speed for the whole trip?

1) more than 40 mi/hr
2) equal to 40 mi/hr
3) less than 40 mi/hr

It is 40 mi/hr in this case. Since the average speed is distance/time and you spend the same amount of time at each speed, then your average speed would indeed be 40 mi/hr.

ConcepTest 2.6b Cruising Along II

You drive 4 miles at 30 mi/hr and then another 4 miles at 50 mi/hr. What is your average speed for the whole 8-mile trip?

1) more than 40 mi/hr
2) equal to 40 mi/hr
3) less than 40 mi/hr

ConcepTest 2.6b Cruising Along II

You drive 4 miles at 30 mi/hr and then another 4 miles at 50 mi/hr. What is your average speed for the whole 8-mile trip?

1) more than 40 mi/hr
2) equal to 40 mi/hr
3) less than 40 mi/hr

It is not 40 mi/hr! Remember that the average speed is distance/time. Since it takes longer to cover 4 miles at the slower speed, you are actually moving at 30 mi/hr for a longer period of time! Therefore, your average speed is closer to 30 mi/hr than it is to 50 mi/hr.

Follow-up: How much further would you have to drive at 50 mi/hr in order to get back your average speed of 40 mi/hr?

ConcepTest 2.7 Velocity in One Dimension

If the average velocity is non-zero over some time interval, does this mean that the instantaneous velocity is never zero during the same interval?

1) yes
2) no
3) it depends

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If the average velocity is non-zero over some time interval, does this mean that the instantaneous velocity is never zero during the same interval?

1) yes
2) no
3) it depends

No!!! For example, your average velocity for a trip home might be 60 mph, but if you stopped for lunch on the way home, there was an interval when your instantaneous velocity was zero, in fact!

ConcepTest 2.8a Acceleration I

If the velocity of a car is non-zero ($v \neq 0$), can the acceleration of the car be zero?

1) yes
2) no
3) depends on the velocity

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If the velocity of a car is non-zero ($v \neq 0$), can the acceleration of the car be zero?

1) yes
2) no
3) depends on the velocity

Sure it can! An object moving with ***constant*** **velocity** has a non-zero velocity, but it has **zero acceleration** since the velocity is not changing.

ConcepTest 2.8b Acceleration II

When throwing a ball straight up, which of the following is true about its velocity *v* and its acceleration *a* at the highest point in its path?

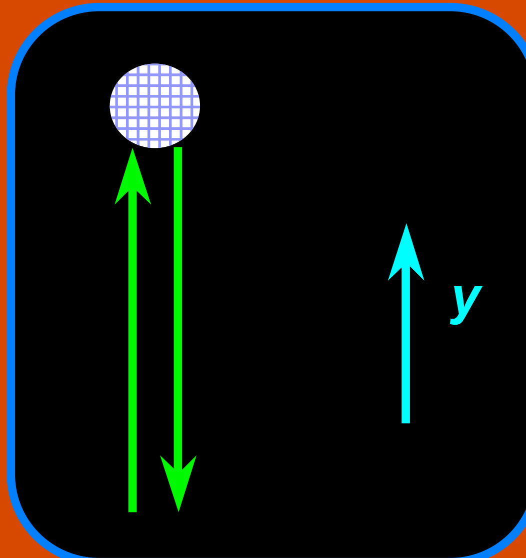
1) both $v = 0$ and $a = 0$
2) $v \neq 0$, but $a = 0$
3) $v = 0$, but $a \neq 0$
4) both $v \neq 0$ and $a \neq 0$
5) not really sure

ConcepTest 2.8b Acceleration II

When throwing a ball straight up, which of the following is true about its velocity *v* and its acceleration *a* at the highest point in its path?

1) both $v = 0$ and $a = 0$
2) $v \neq 0$, but $a = 0$
3) $v = 0$, but $a \neq 0$
4) both $v \neq 0$ and $a \neq 0$
5) not really sure

At the top, clearly $v = 0$ because the ball has momentarily stopped. But the velocity of the ball is changing, so its acceleration is definitely not zero! Otherwise it would remain at rest!!



Follow-up: …and the value of *a* is…?

ConcepTest 2.9a   Free Fall I

You throw a ball straight up into the air. After it leaves your hand, at what point in its flight does it have the **maximum** value of acceleration?

1) its acceleration is constant everywhere
2) at the top of its trajectory
3) halfway to the top of its trajectory
4) just after it leaves your hand
5) just before it returns to your hand on the way down

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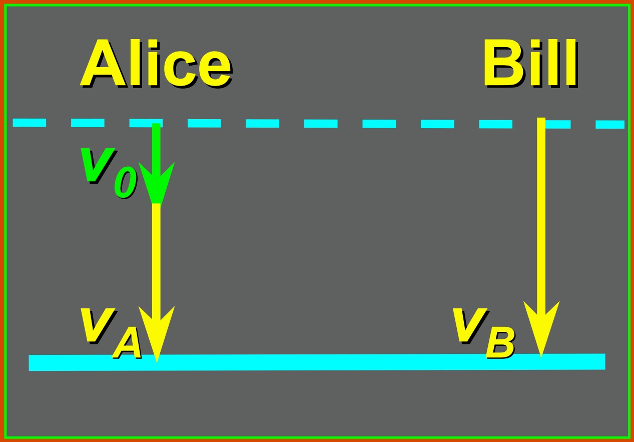
3) halfway to the top of its trajectory
4) just after it leaves your hand
5) just before it returns to your hand on the way down

The ball is in free fall once it is released. Therefore, it is entirely under the influence of gravity, and the only acceleration it experiences is *g*, which is constant at all points.

ConcepTest 2.9b Free Fall II

Alice and Bill are at the top of a building. Alice **throws** her ball downward. Bill simply **drops** his ball. Which ball has the greater acceleration just after release?

1) Alice's ball
2) it depends on how hard the ball was thrown
3) neither -- they both have the same acceleration
4) Bill's ball



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1) Alice's ball
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3) neither -- they both have the same acceleration
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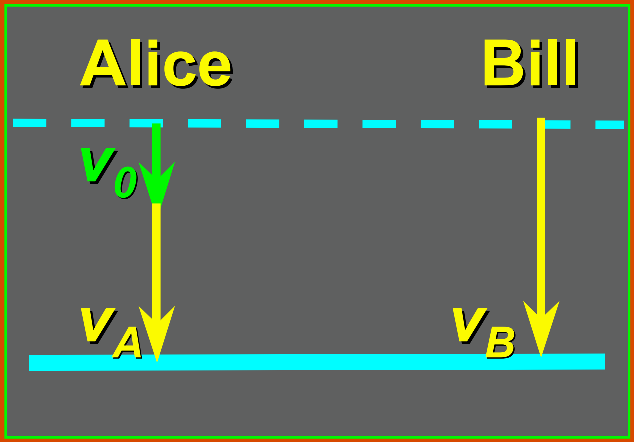
Both balls are in free fall once they are released, therefore they both feel the acceleration due to gravity (*g*). This acceleration is independent of the initial velocity of the ball.



Follow-up: Which one has the greater velocity when they hit the ground?

ConcepTest 2.10a Up in the Air I

You throw a ball upward with an initial speed of 10 m/s. Assuming that there is no air resistance, what is its speed when it returns to you?

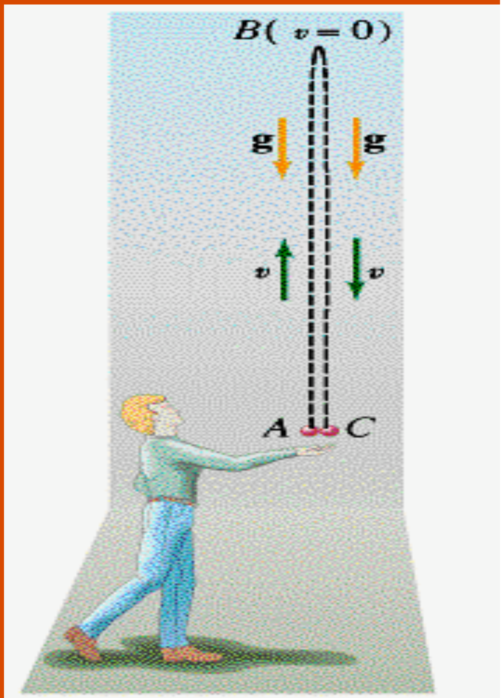
1) more than 10 m/s
2) 10 m/s
3) less than 10 m/s
4) zero
5) need more information

ConcepTest 2.10a Up in the Air I

You throw a ball upward with an initial speed of 10 m/s. Assuming that there is no air resistance, what is its speed when it returns to you?

1) more than 10 m/s
2) 10 m/s
3) less than 10 m/s
4) zero
5) need more information

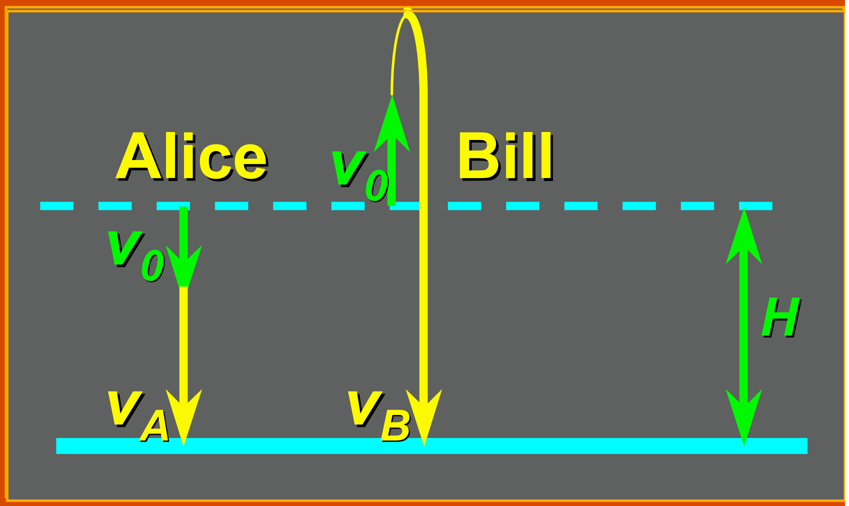
The ball is slowing down on the way up due to gravity. Eventually it stops. Then it accelerates downward due to gravity (again). Since *a* = *g* on the way up and on the way down, the ball reaches the same speed when it gets back to you as it had when it left.



ConcepTest 2.10b Up in the Air II

Alice and Bill are at the top of a cliff of height H. Both throw a ball with initial speed v_0, Alice straight down and Bill straight up. The speeds of the balls when they hit the ground are v_A and v_B. If there is no air resistance, which is true?

1) $v_A < v_B$
2) $v_A = v_B$
3) $v_A > v_B$
4) impossible to tell

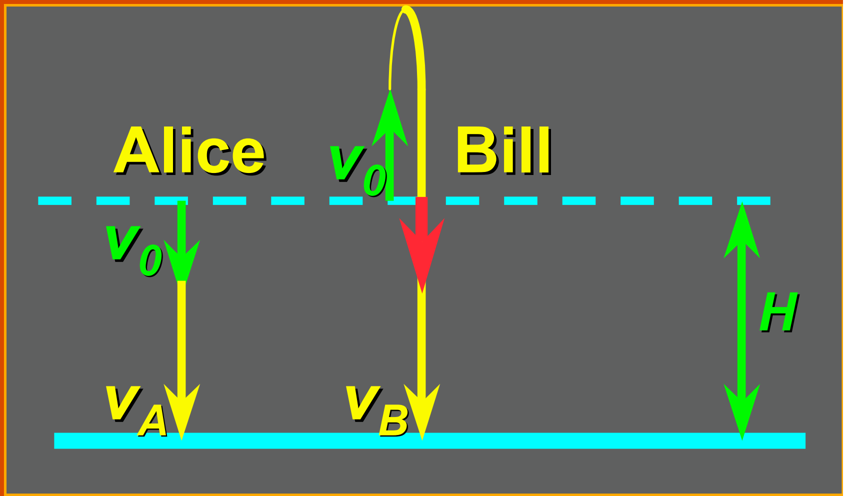


ConcepTest 2.10b Up in the Air II

Alice and Bill are at the top of a cliff of height *H*. Both throw a ball with initial speed v_0, Alice straight **down** and Bill straight **up**. The speeds of the balls when they hit the ground are v_A and v_B. If there is no air resistance, which is true?

1) $v_A < v_B$
2) $v_A = v_B$
3) $v_A > v_B$
4) impossible to tell

Bill's ball goes up and comes back down to Bill's level. At that point, **it is moving downward with v_0, the same as Alice's ball**. Thus, it will hit the ground with the same speed as Alice's ball.



Follow-up: What happens if there is air resistance?

ConcepTest 2.11 Two Balls in the Air

A ball is thrown straight upward with some initial speed. When it reaches the top of its flight (at a height *h*), a second ball is thrown straight upward with the same initial speed. Where will the balls cross paths?

1) at height h
2) above height h/2
3) at height h/2
4) below height h/2 but above 0
5) at height 0

ConcepTest 2.11 Two Balls in the Air

A ball is thrown straight upward with some initial speed. When it reaches the top of its flight (at a height *h*), a second ball is thrown straight upward with the same initial speed. Where will the balls cross paths?

1) at height h
2) above height h/2
3) at height h/2
4) below height h/2 but above 0
5) at height 0

The first ball starts at the top with no initial speed. The second ball starts at the bottom with a large initial speed. Since the balls travel the same time until they meet, the second ball will cover more distance in that time, which will carry it over the halfway point before the first ball can reach it.

Follow-up: How could you calculate where they meet?

ConcepTest 2.12a Throwing Rocks I

You drop a rock off a bridge. When the rock has fallen 4 m, you drop a second rock. As the two rocks continue to fall, what happens to their separation?

1) the separation increases as they fall
2) the separation stays constant at 4 m
3) the separation decreases as they fall
4) it is impossible to answer without more information

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1) the separation increases as they fall
2) the separation stays constant at 4 m
3) the separation decreases as they fall
4) it is impossible to answer without more information

At any given time, the first rock always has a greater velocity than the second rock, therefore it will always be increasing its lead as it falls. Thus, the separation will increase.

ConcepTest 2.12b Throwing Rocks II

You drop a rock off a bridge. When the rock has fallen 4 m, you drop a second rock. As the two rocks continue to fall, what happens to their velocities?

1) both increase at the same rate

2) the velocity of the first rock increases faster than the velocity of the second

3) the velocity of the second rock increases faster than the velocity of the first

4) both velocities stay constant

ConcepTest 2.12b Throwing Rocks II

You drop a rock off a bridge. When the rock has fallen 4 m, you drop a second rock. As the two rocks continue to fall, what happens to their velocities?

1) both increase at the same rate

2) the velocity of the first rock increases faster than the velocity of the second

3) the velocity of the second rock increases faster than the velocity of the first

4) both velocities stay constant

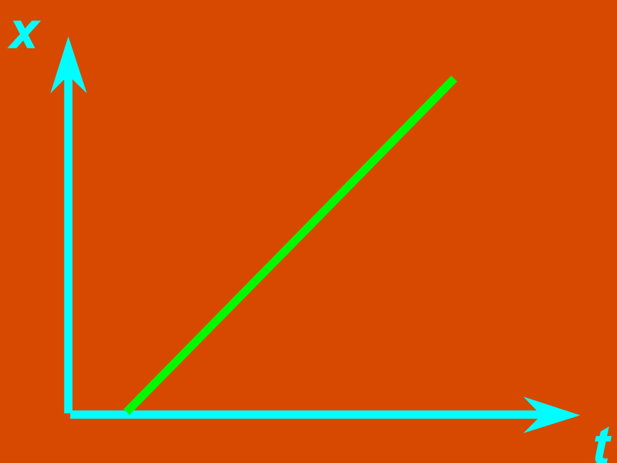
Both rocks are in free fall, thus under the influence of gravity only. That means they both experience the constant acceleration of gravity. Since acceleration is defined as the change of velocity, both of their velocities increase at the same rate.

Follow-up: What happens when air resistance is present?

ConcepTest 2.13a Graphing Velocity I

The graph of position versus time for a car is given below. What can you say about the velocity of the car over time?

1) it speeds up all the time
2) it slows down all the time
3) it moves at constant velocity
4) sometimes it speeds up and sometimes it slows down
5) not really sure



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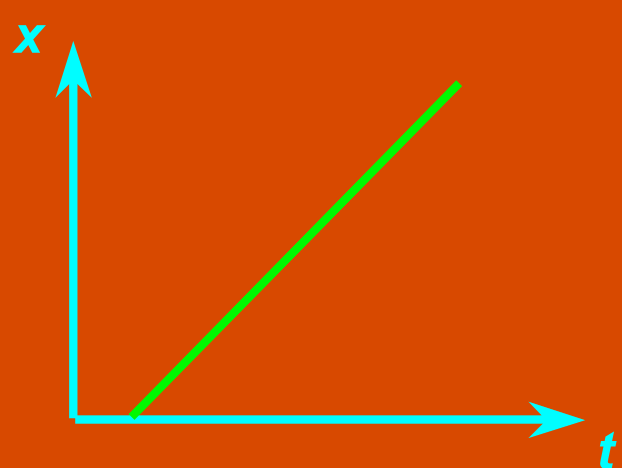

The car moves at a constant velocity because the x vs. t plot shows a straight line. The slope of a straight line is constant. Remember that the slope of x versus t is the velocity!

ConcepTest 2.13b Graphing Velocity II

The graph of position vs. time for a car is given below. What can you say about the velocity of the car over time?

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3) it moves at constant velocity
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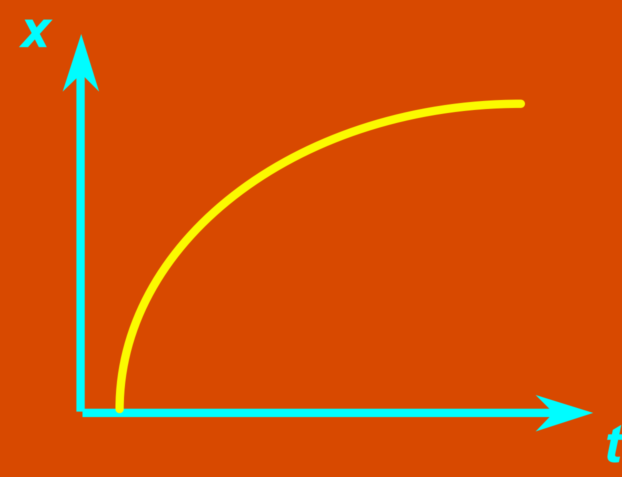

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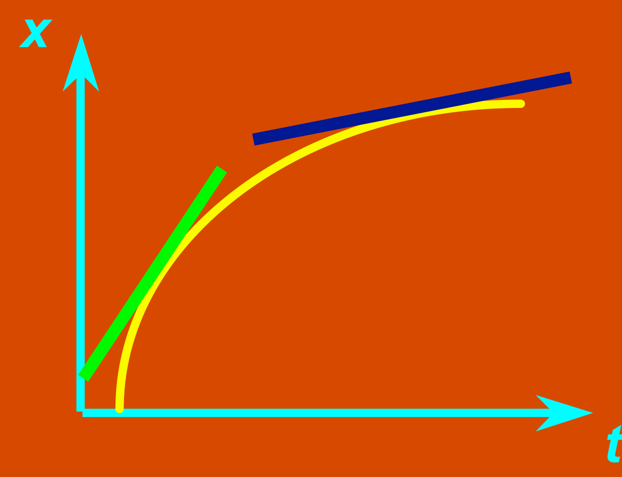
The graph of position vs. time for a car is given below. What can you say about the velocity of the car over time?

1) it speeds up all the time
2) it slows down all the time
3) it moves at constant velocity
4) sometimes it speeds up and sometimes it slows down
5) not really sure

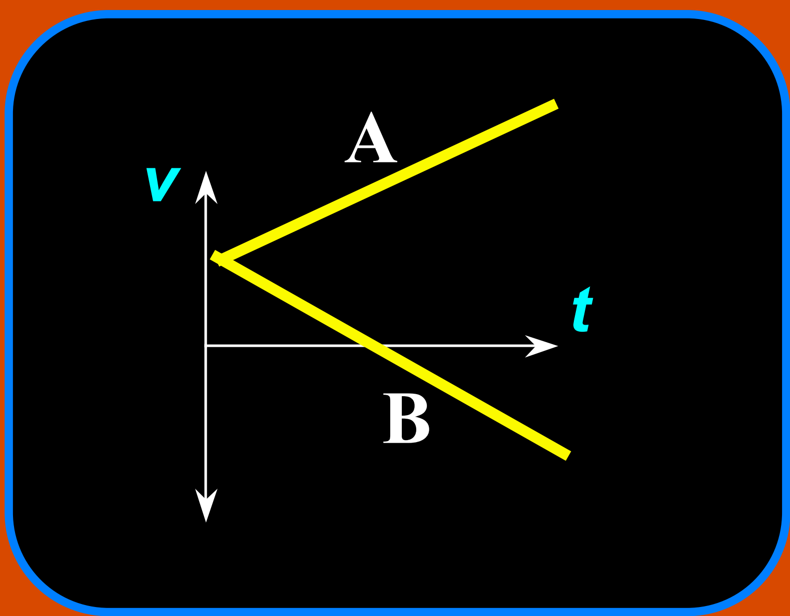
The car slows down all the time because the slope of the *x* vs. *t* graph is diminishing as time goes on. Remember that the slope of *x* vs. *t* is the velocity! At large *t*, the value of the position *x* does not change, indicating that the car must be at rest.



ConcepTest 2.14a *v* versus *t* graphs I

Consider the line labeled A in the *v* versus *t* plot. How does the speed change with time for line A?

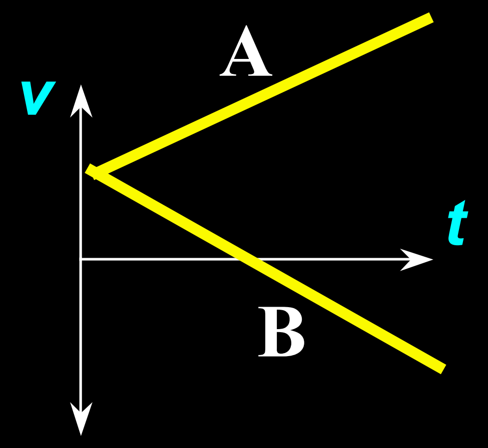
1) decreases
2) increases
3) stays constant
4) increases, then decreases
5) decreases, then increases



ConcepTest 2.14a — *v* versus *t* graphs I

Consider the line labeled A in the *v* versus *t* plot. How does the speed change with time for line A?

1) decreases
2) increases
3) stays constant
4) increases, then decreases
5) decreases, then increases

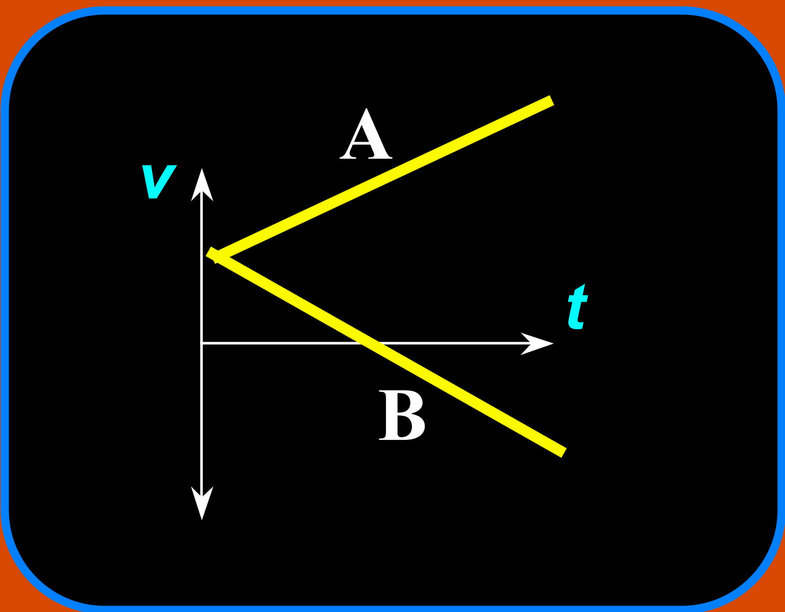


In case A, the initial velocity is positive and the magnitude of the velocity continues to increase with time.

ConcepTest 2.14b *v* versus *t* graphs II

Consider the line labeled B in the *v* versus *t* plot. How does the speed change with time for line B?

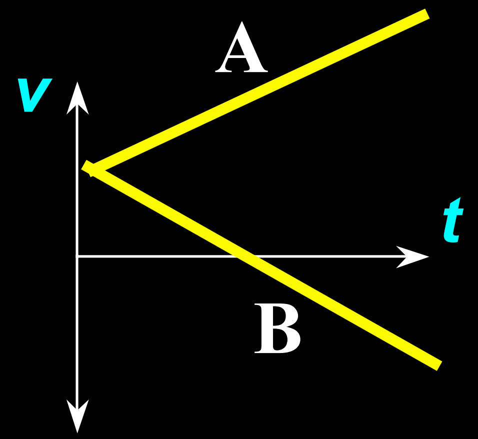
1) decreases
2) increases
3) stays constant
4) increases, then decreases
5) decreases, then increases



ConcepTest 2.14b v versus t graphs II

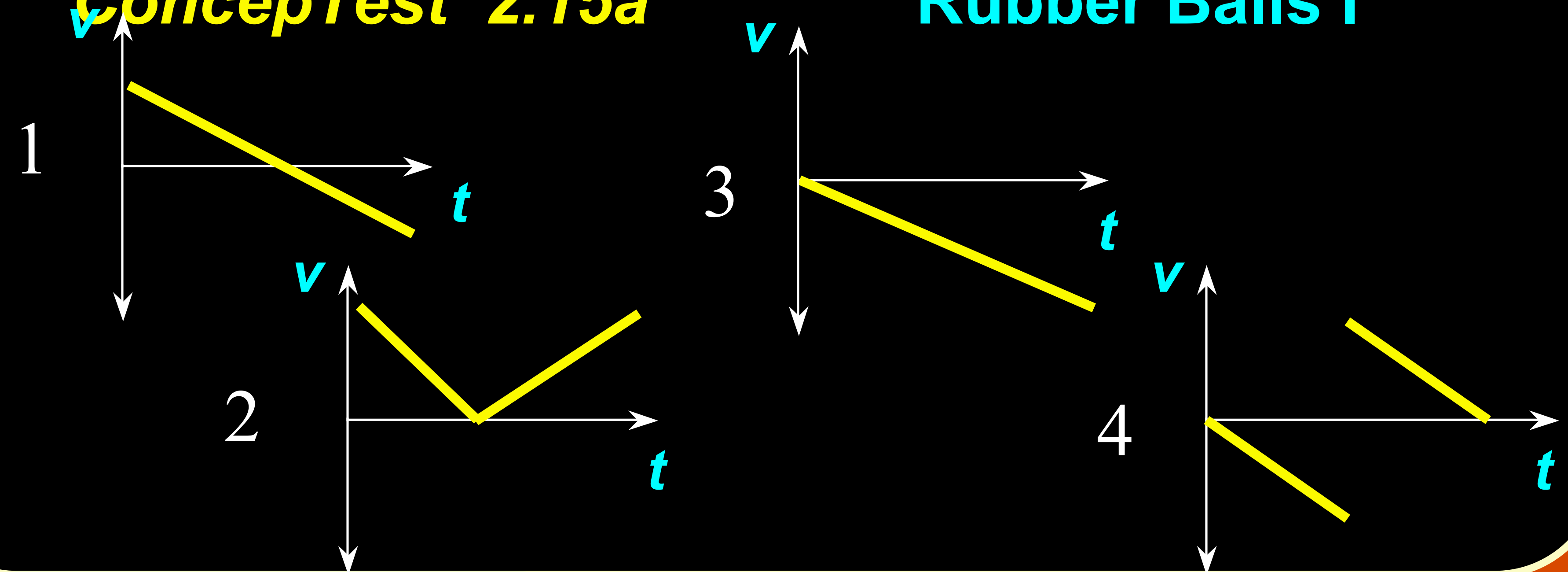
Consider the line labeled B in the *v* versus *t* plot. How does the speed change with time for line B?

1) decreases
2) increases
3) stays constant
4) increases, then decreases
5) decreases, then increases



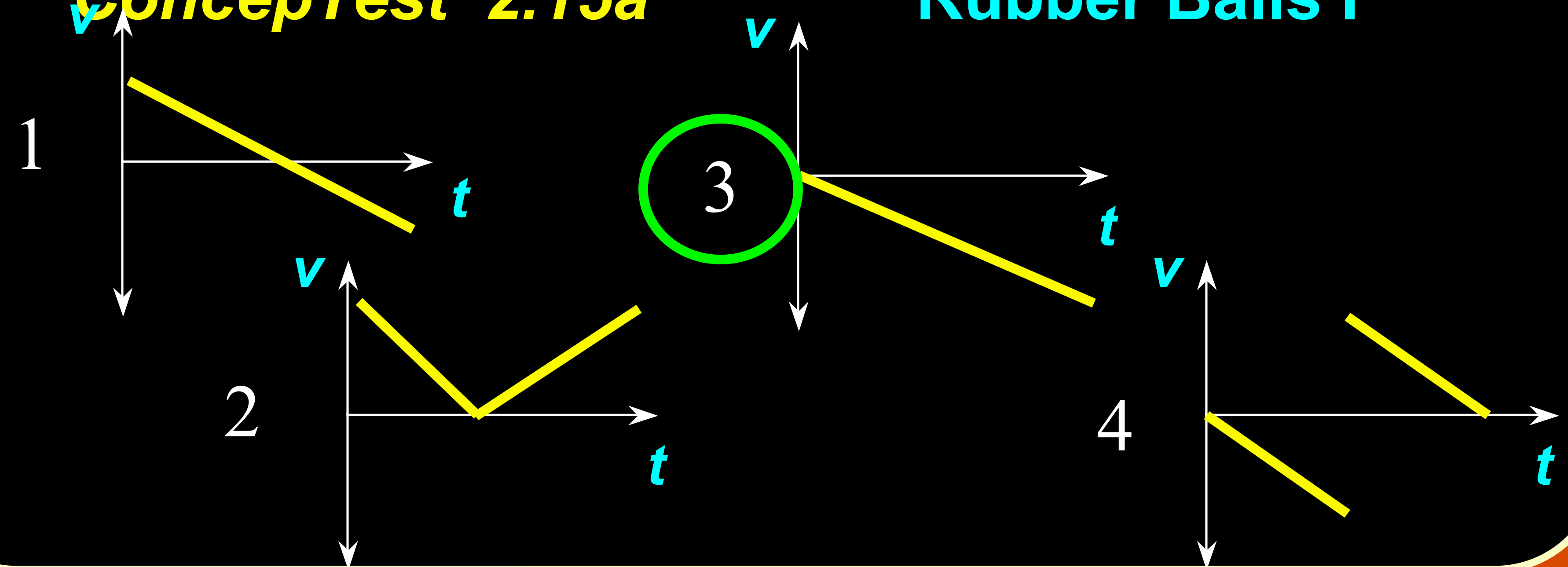
In case B, the initial velocity is positive but the magnitude of the velocity decreases toward zero. After this, the magnitude increases again, but becomes negative, indicating that the object has changed direction.

ConcepTest 2.15a Rubber Balls I



You drop a rubber ball. Right after it leaves your hand and before it hits the floor, which of the above plots represents the *v* vs. *t* graph for this motion? (Assume your y-axis is pointing up.)

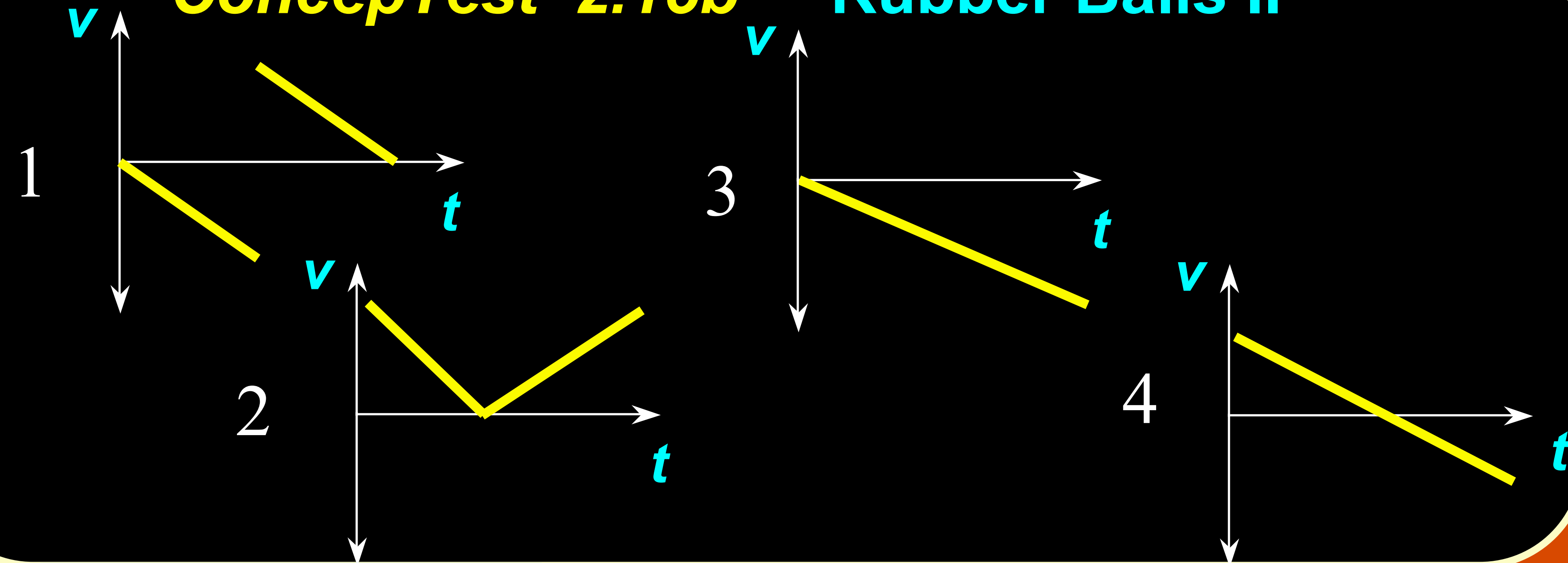
ConcepTest 2.15a Rubber Balls I



You drop a rubber ball. Right after it leaves your hand and before it hits the floor, which of the above plots represents the *v* vs. *t* graph for this motion? (Assume your y-axis is pointing up.)

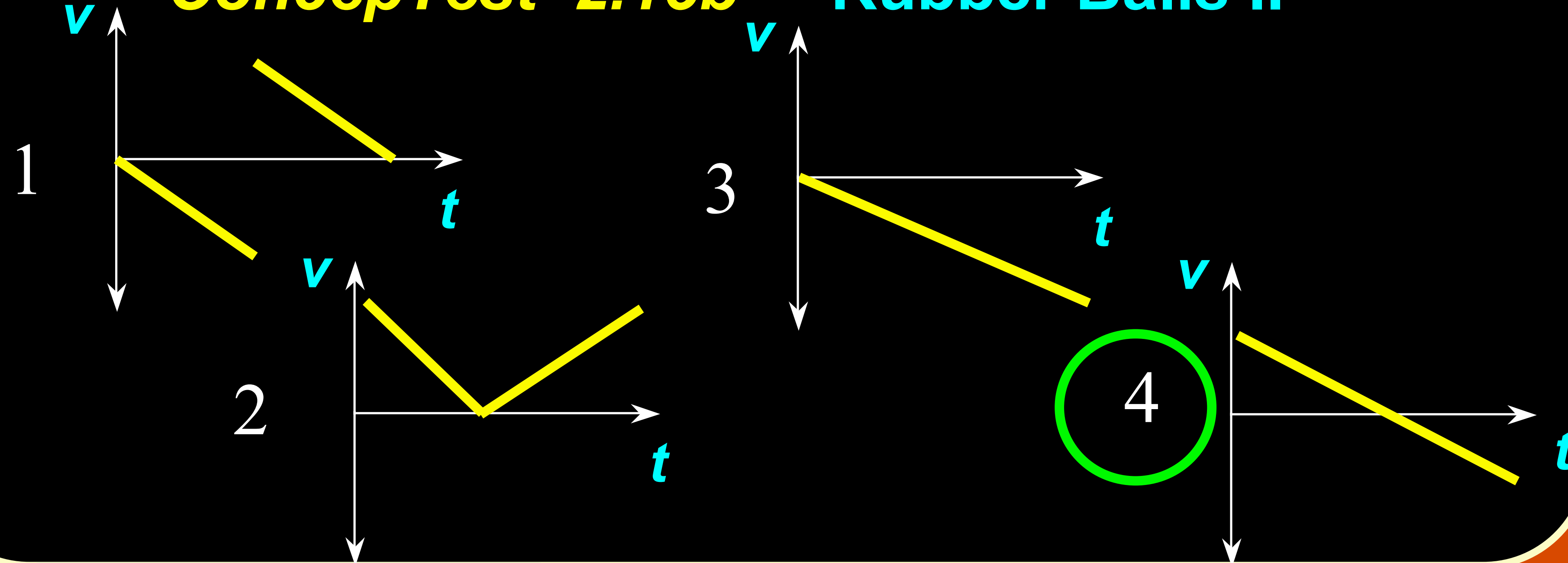
The ball is dropped from rest, so its **initial velocity is zero**. Since the y-axis is pointing upwards and the ball is falling downwards, its **velocity is negative** and becomes **more and more negative** as it accelerates downward.

ConcepTest 2.15b Rubber Balls II



You toss a ball straight up in the air and catch it again. Right after it leaves your hand and before you catch it, which of the above plots represents the *v* vs. *t* graph for this motion? (Assume your y-axis is pointing up.)

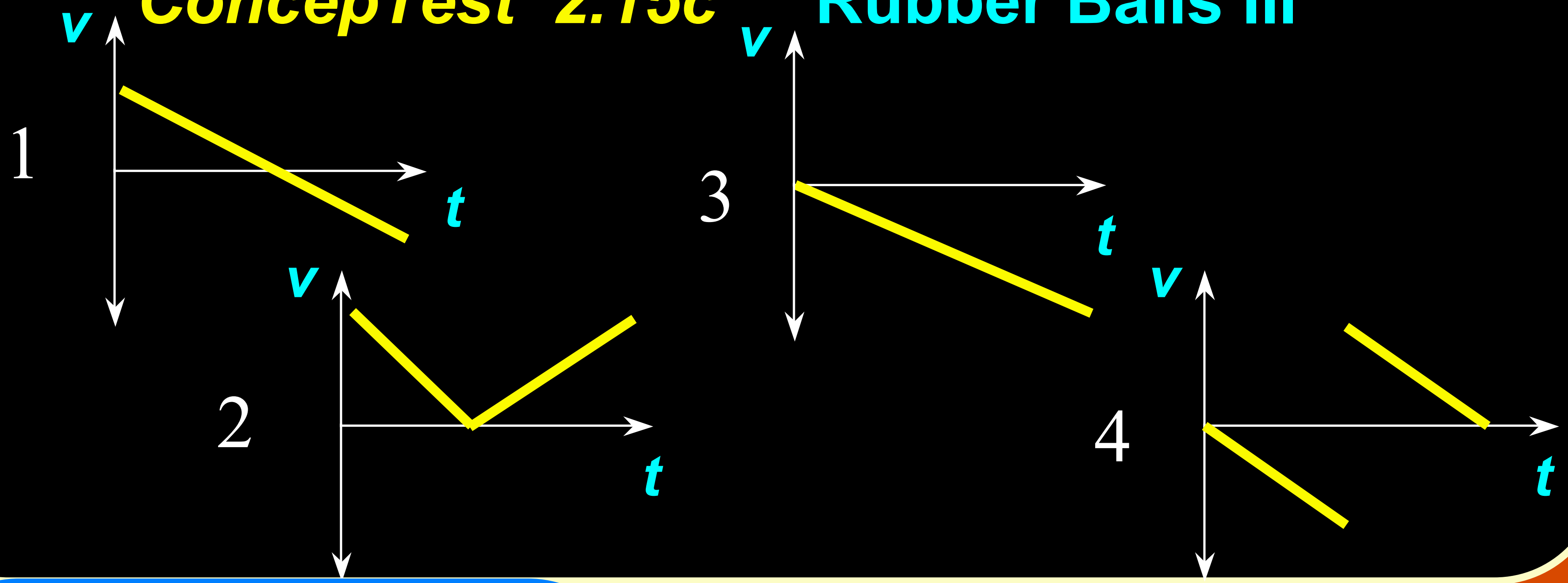
ConcepTest 2.15b Rubber Balls II



You toss a ball straight up in the air and catch it again. Right after it leaves your hand and before you catch it, which of the above plots represents the *v* vs. *t* graph for this motion? (Assume your y-axis is pointing up.)

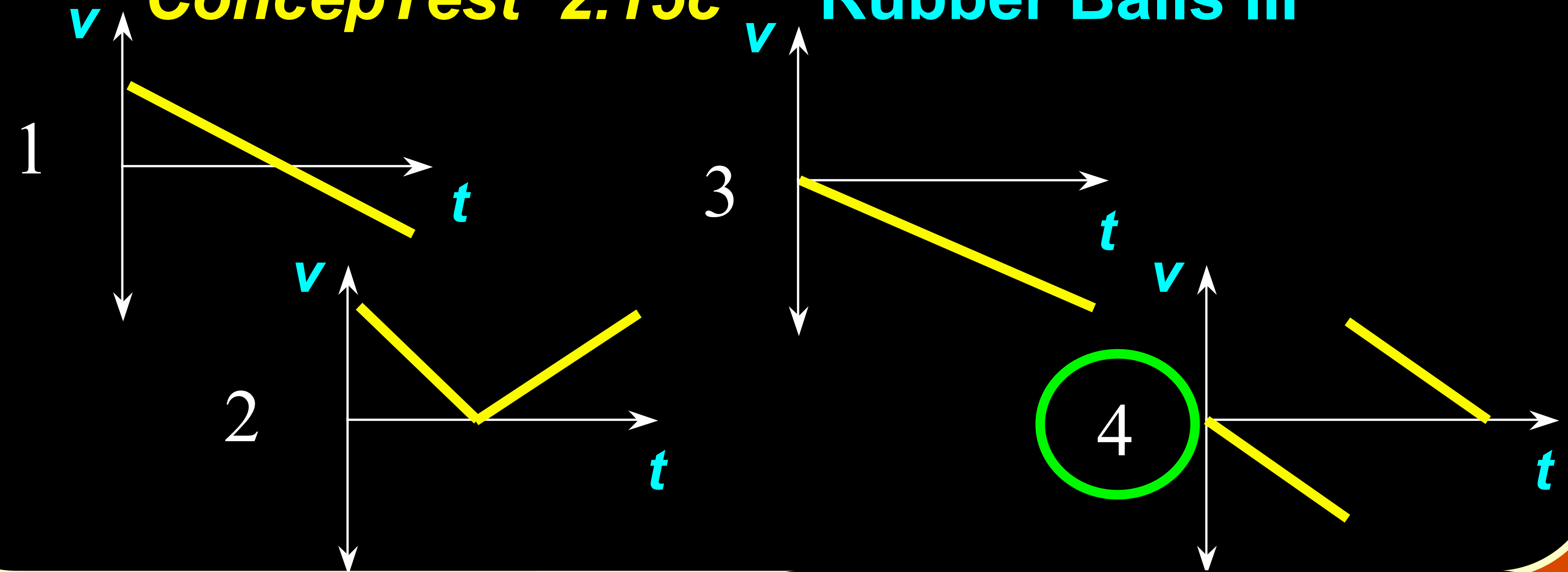
The ball has an **initial velocity that is positive** but diminishing as it slows. It stops at the top ($v = 0$), and then its **velocity becomes negative** and becomes **more and more negative** as it accelerates downward.

ConcepTest 2.15c Rubber Balls III



You drop a very bouncy rubber ball. It falls, and then it hits the floor and bounces right back up to you. Which of the following represents the *v* vs. *t* graph for this motion?

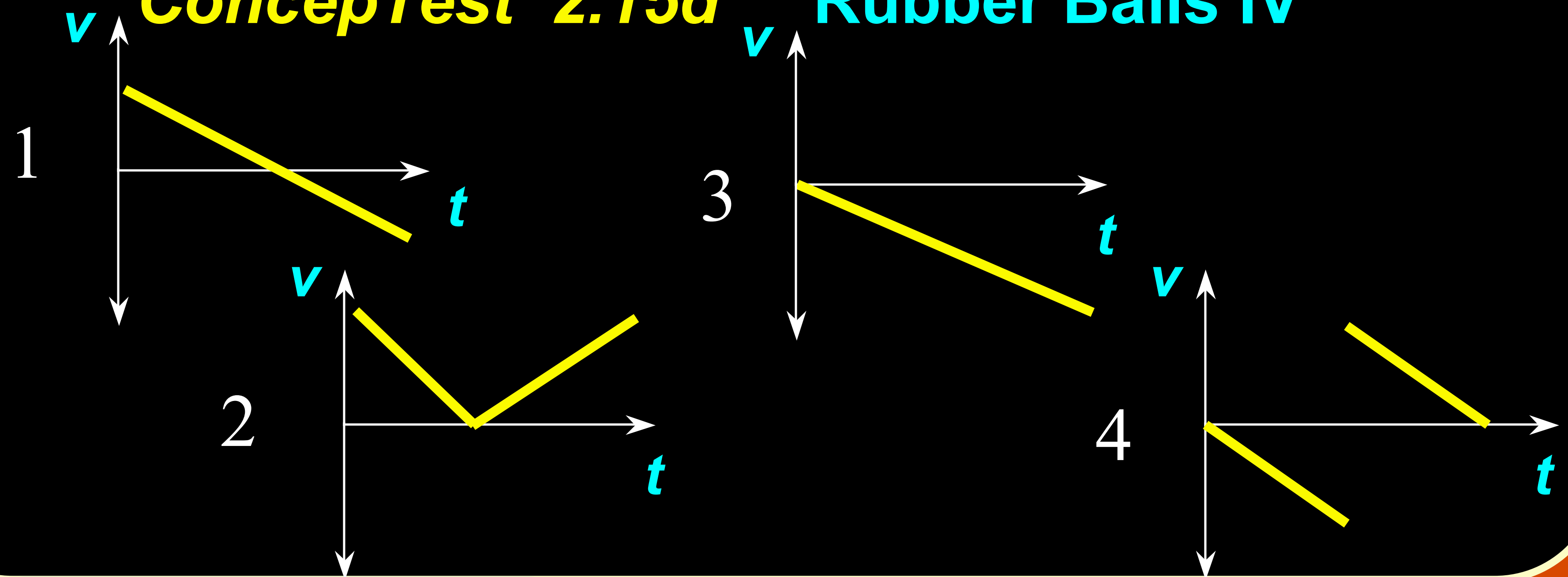
ConcepTest 2.15c Rubber Balls III



You drop a very bouncy rubber ball. It falls, and then it hits the floor and bounces right back up to you. Which of the following represents the *v* vs. *t* graph for this motion?

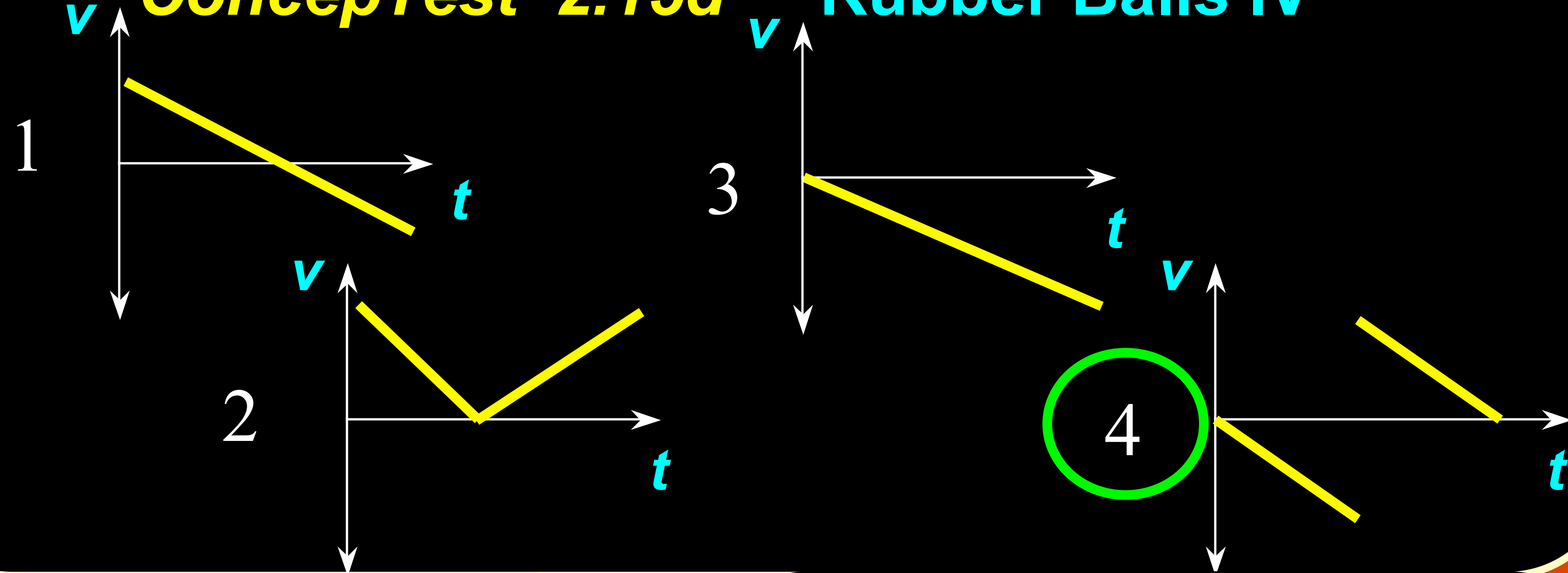
Initially, the ball is falling down, so its velocity must be ***negative*** (if UP is positive). Its velocity is also ***increasing*** in magnitude as it falls. Once it bounces, it changes direction and then has a ***positive*** velocity, which is also ***decreasing*** as the ball moves upward.

ConcepTest 2.15d Rubber Balls IV



You drop a very bouncy rubber ball. It falls, and then it hits the floor and bounces right back up to you. Which of the following represents the *v vs. t* graph for this motion?

ConcepTest 2.15d Rubber Balls IV



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