# Skydiving

## Activity 1: Air Resistance

### Question Group 1

**Question 1**

In what manner – increase or decrease – would the object speed, object cross-sectional area, and air density need to be changed in order to cause the air resistance to increase?

**Question 2**

In what manner – increase or decrease – would the object speed, object cross-sectional area, and air density need to be changed in order to cause the air resistance to increase?

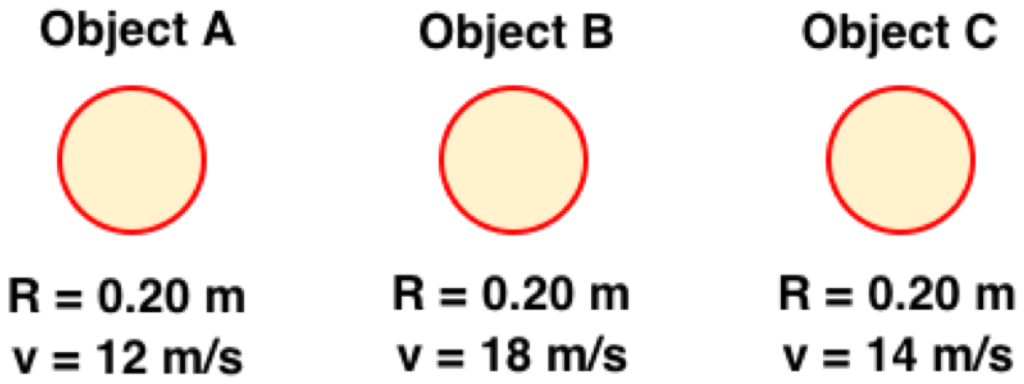
**Question 3**

In what manner – increase or decrease – would the object speed, object cross-sectional area, and air density need to be changed in order to cause the air resistance to increase?

### Question Group 2

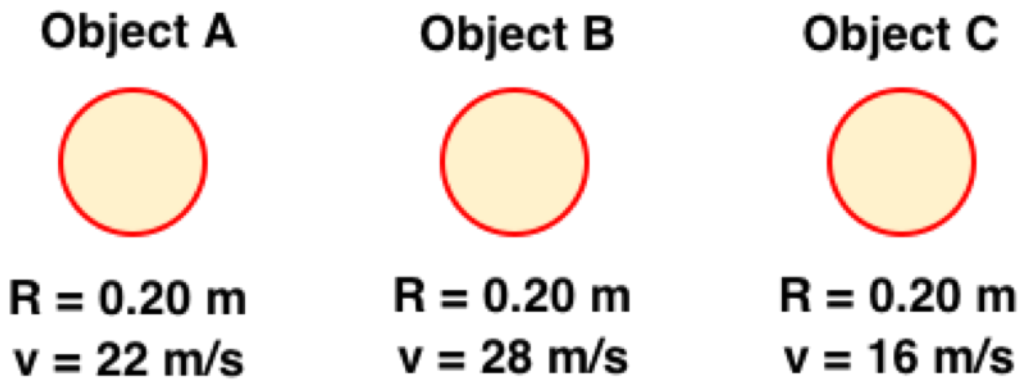
**Question 4**

Consider the three spherical objects traveling through the same region of air. Radius and speed values are stated. Given that everything else is equal, rank them according to the amount of air resistance they encounter.



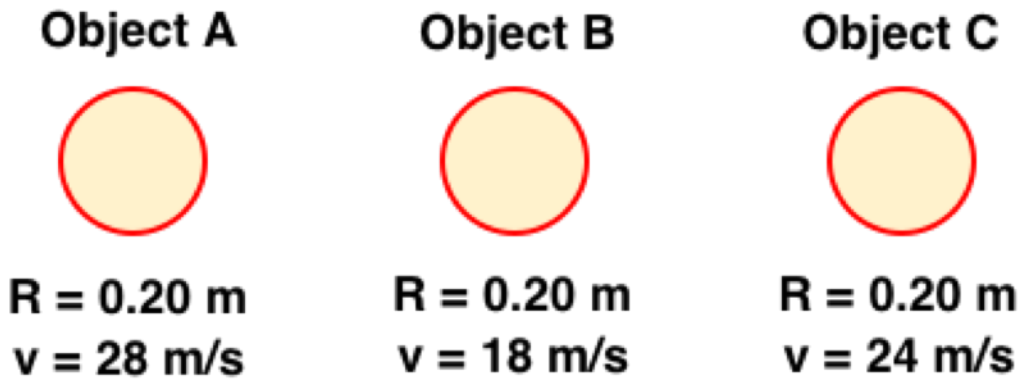
**Question 5**

Consider the three spherical objects traveling through the same region of air. Radius and speed values are stated. Given that everything else is equal, rank them according to the amount of air resistance they encounter.




**Question 6**

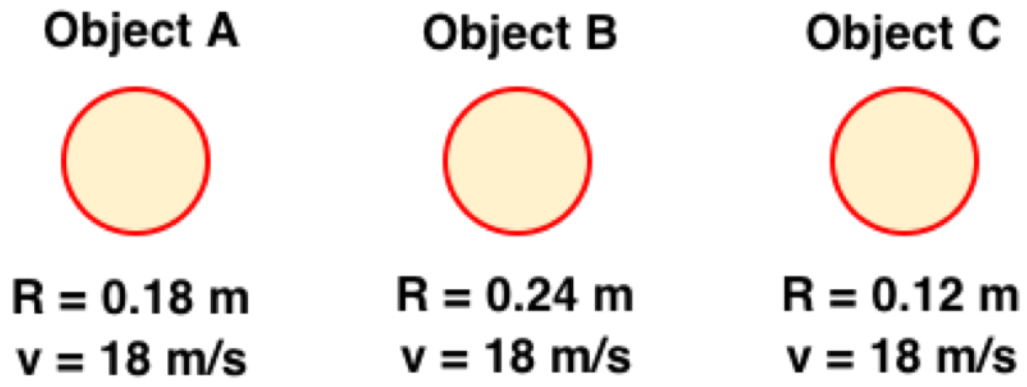
Consider the three spherical objects traveling through the same region of air. Radius and speed values are stated. Given that everything else is equal, rank them according to the amount of air resistance they encounter.



**Question Group 3**

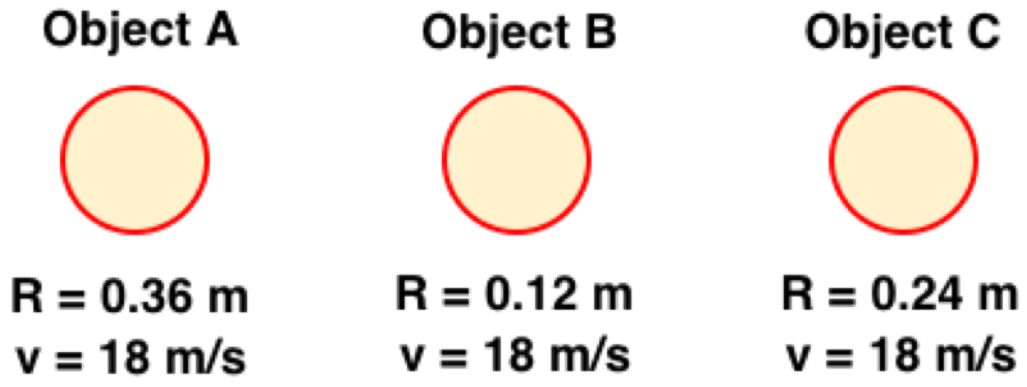
**Question 7**

Consider the three spherical objects traveling through the same region of air. Radius and speed values are stated. Given that everything else is equal, rank them according to the amount of air resistance they encounter.



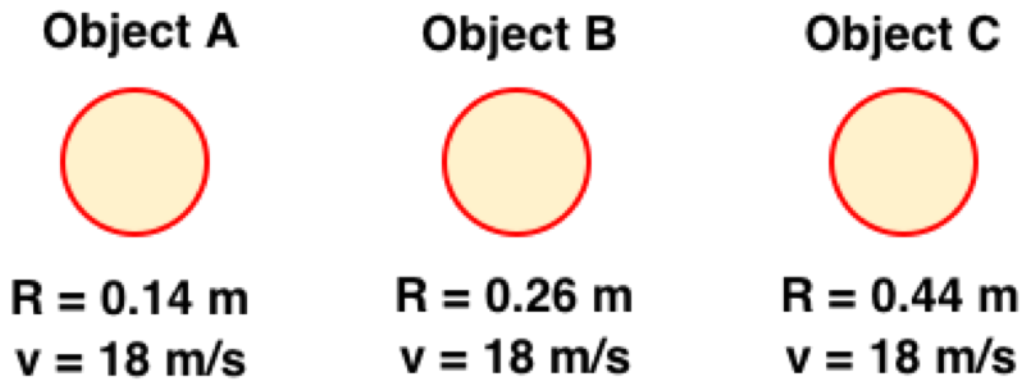

**Question 8**

Consider the three spherical objects traveling through the same region of air. Radius and speed values are stated. Given that everything else is equal, rank them according to the amount of air resistance they encounter.



**Question 9**

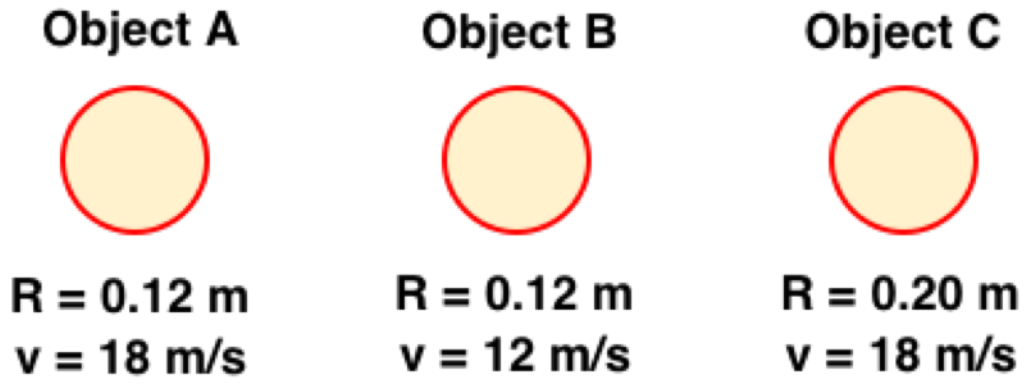
Consider the three spherical objects traveling through the same region of air. Radius and speed values are stated. Given that everything else is equal, rank them according to the amount of air resistance they encounter.




**Question Group 4**

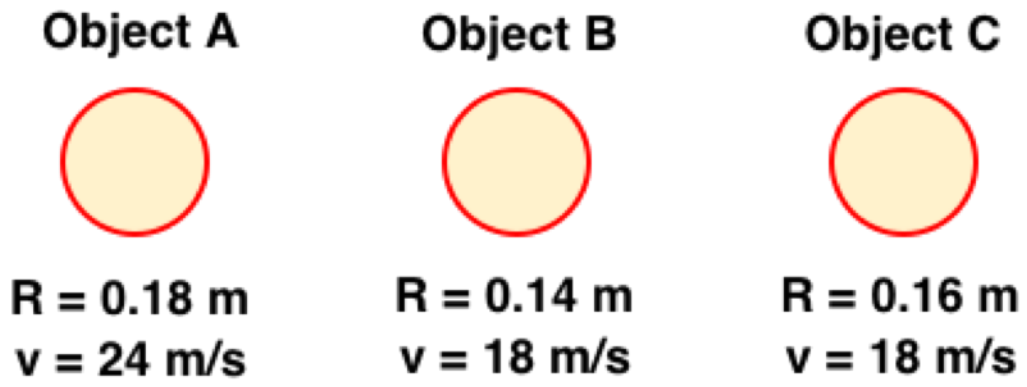
**Question 10**

Consider the three spherical objects traveling through the same region of air. Radius and speed values are stated. Given that everything else is equal, rank them according to the amount of air resistance they encounter.



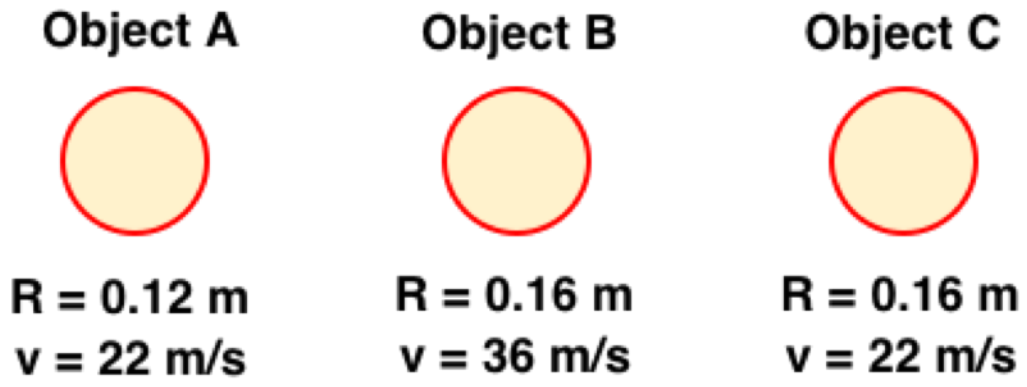
**Question 11**

Consider the three spherical objects traveling through the same region of air. Radius and speed values are stated. Given that everything else is equal, rank them according to the amount of air resistance they encounter.

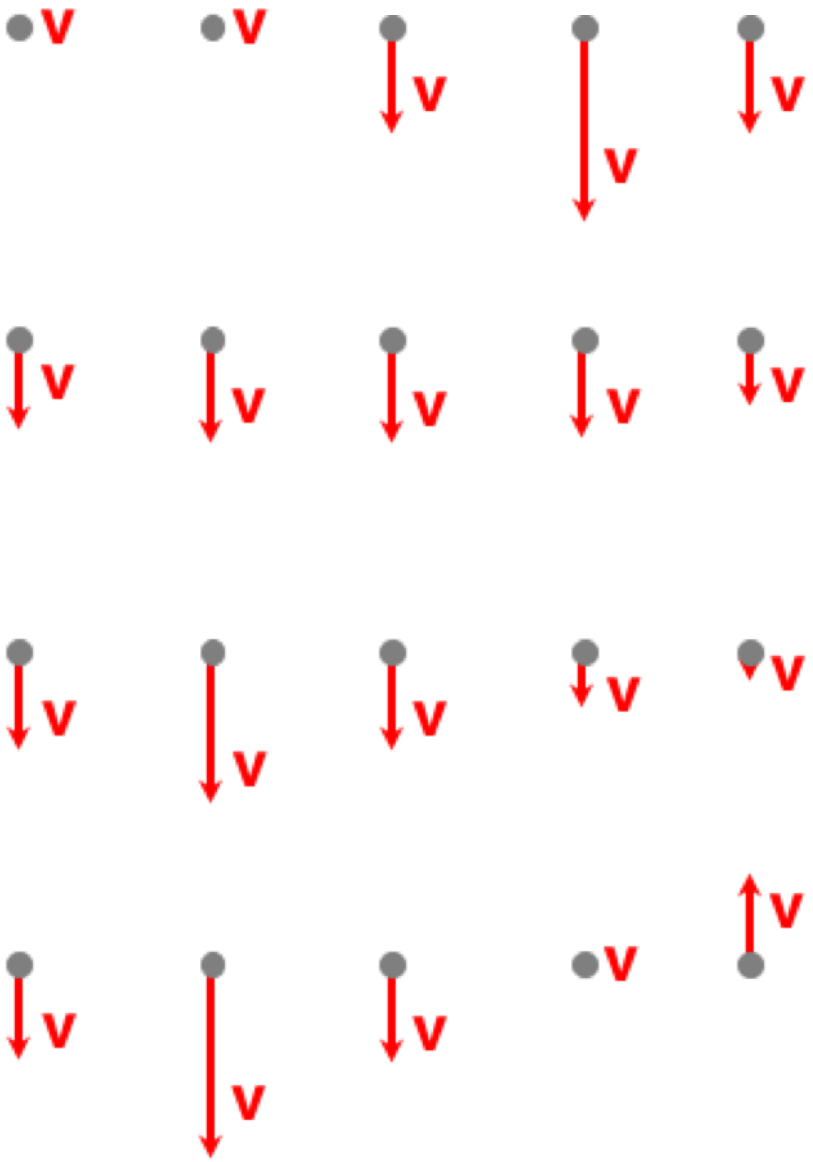



**Question 12**

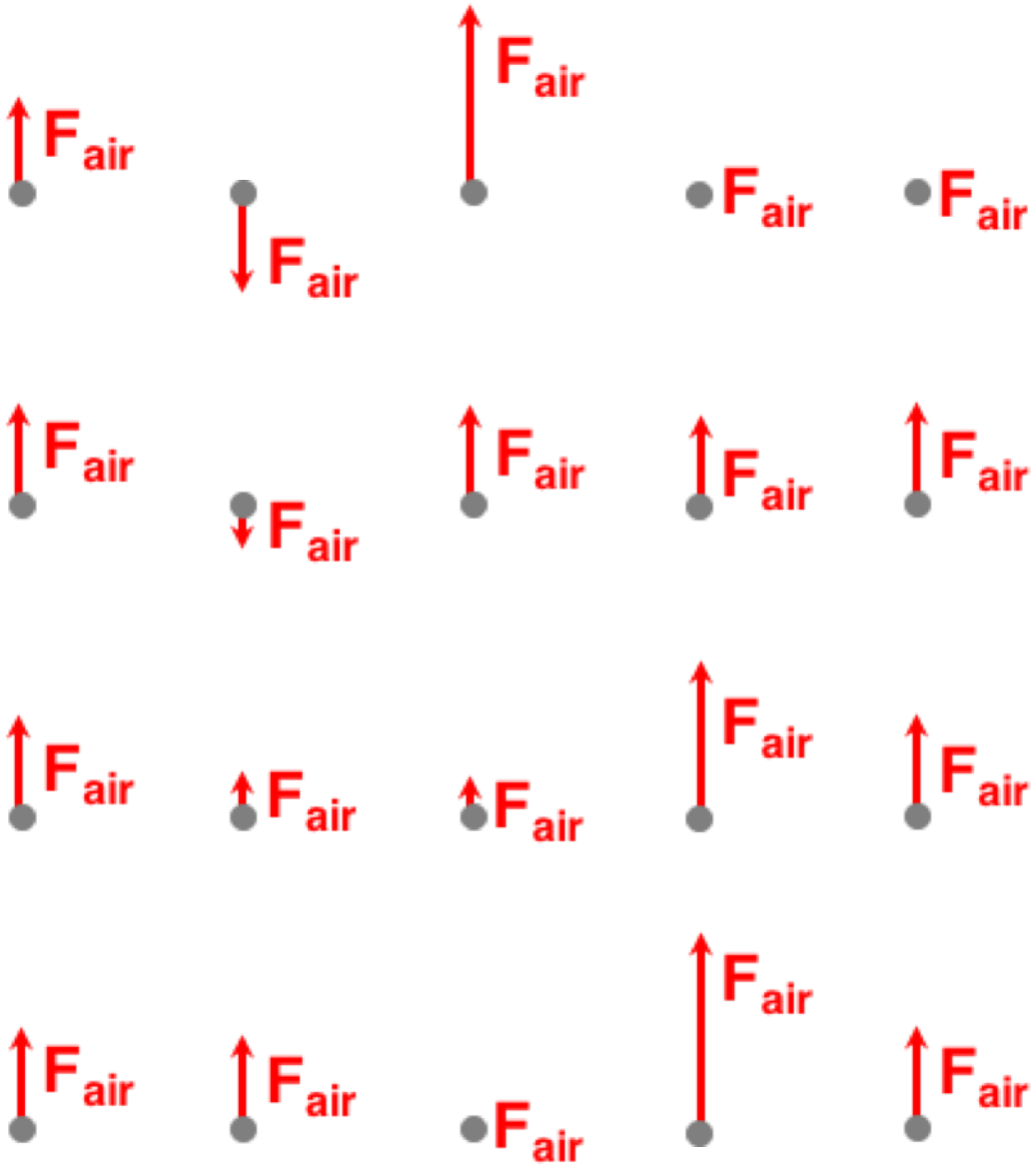
Consider the three spherical objects traveling through the same region of air. Radius and speed values are stated. Given that everything else is equal, rank them according to the amount of air resistance they encounter.



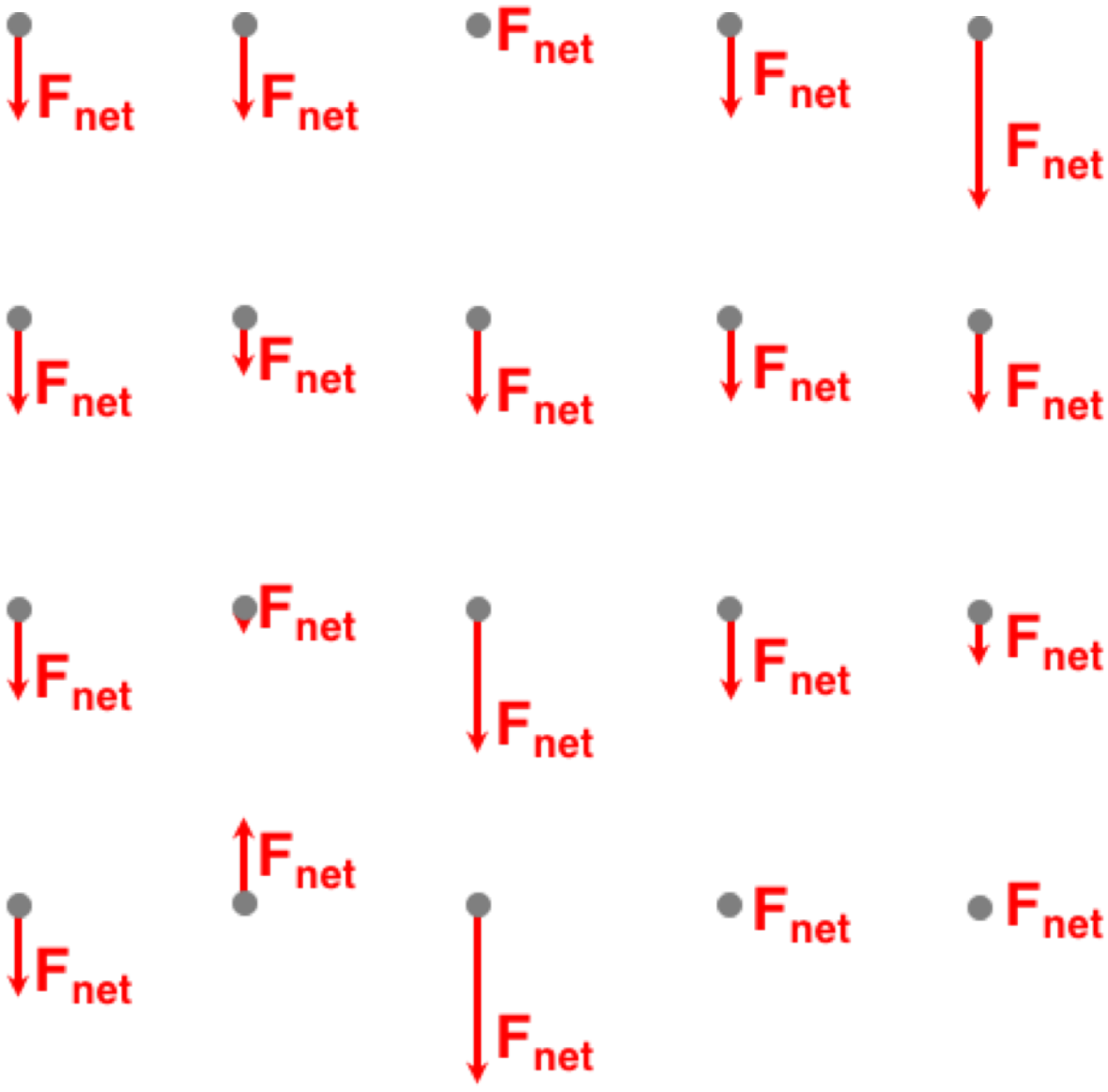
**Activity 2: Vector Diagrams**
**Question Group 5**
**Question 13**
A skydiver is dropped out of an airplane at an altitude of 10000 feet. She reaches a terminal velocity 60 seconds later. Consider four positions during her fall.
A: Initial State (t = 0 seconds)
B: 15 Seconds After Drop
C: 45 seconds After Drop
D: 60 seconds After Drop
Toggle through the set of vector diagrams at the right to identify the relative magnitude of the velocity vector for each of these four positions. (Consider vertical motion only.)



**Question Group 6**
**Question 14**
A skydiver is dropped out of an airplane at an altitude of 10000 feet. He reaches a terminal velocity 40 seconds later. Consider four positions during her fall.
A: Initial State (t = 0 seconds)
B: 10 Seconds After Drop
C:  30 seconds After Drop
D: 40 seconds After Drop
Toggle through the set of vector diagrams at the right to identify the relative magnitude of the air resistance vector for each of these four positions. (Consider vertical motion only.)



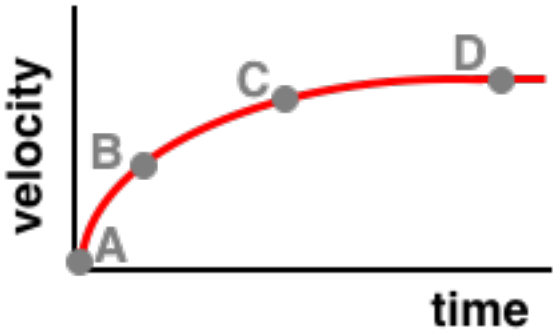
**Question Group 7**
**Question 15**
A skydiver is dropped out of an airplane at an altitude of 10000 feet. She reaches a terminal velocity 60 seconds later. Consider four positions during her fall.
A: Initial State (t = 0 seconds)
B: 15 Seconds After Drop
C:  45 seconds After Drop
D: 60 seconds After Drop
Toggle through the set of vector diagrams at the right to identify the relative magnitude of the net force vector for each of these four positions. (Consider vertical motion only.)



**Question Group 8**
**Question 16**
A skydiver is dropped out of an airplane at an altitude of 10000 feet. He reaches a terminal velocity 40 seconds later. Consider four positions during her fall.
A: Initial State (t = 0 seconds)
B: 10 Seconds After Drop
C:  30 seconds After Drop
D: 40 seconds After Drop
Toggle through the set of vector diagrams at the right to identify the relative magnitude of the acceleration vector for each of these four positions. (Consider vertical motion only.)

**Activity 3: Terminal Velocity**
**Question Group 9**
**Question 17**

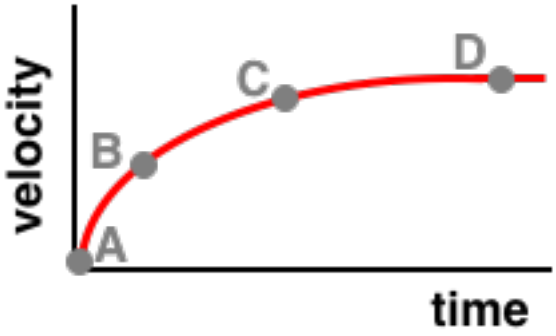
A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how his velocity changes with time. (Note: down is defined as the + direction of velocity.) At what points during the skydive does he have the largest acceleration, a zero acceleration, and the smallest non-zero acceleration?




Acceleration is largest at _____.
Acceleration is zero at _____.
Acceleration is smallest (but not zero) at _____.

**Question 18**

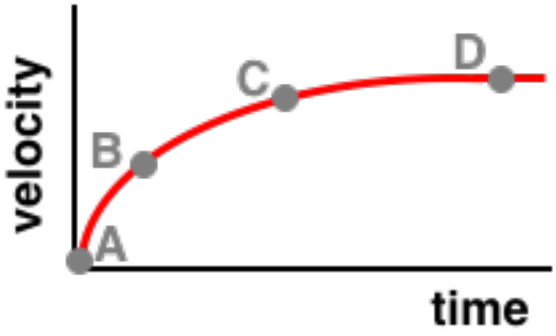
A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how his velocity changes with time. (Note: down is defined as the + direction of velocity.) At what points during the skydive does he have the largest acceleration, a zero acceleration, and the smallest non-zero acceleration?




Acceleration is zero at _____.
Acceleration is smallest (but not zero) at _____.
Acceleration is largest at _____.

**Question 19**

A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how his velocity changes with time. (Note: down is defined as the + direction of velocity.) At what points during the skydive does he have the largest acceleration, a zero acceleration, and the smallest non-zero acceleration?

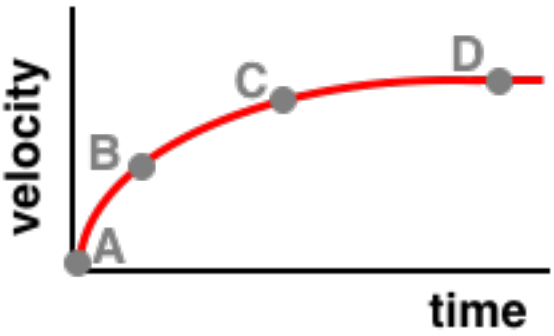



Acceleration is zero at _____.
Acceleration is largest at _____.
Acceleration is smallest (but not zero) at _____.

**Question Group 10**

**Question 20**

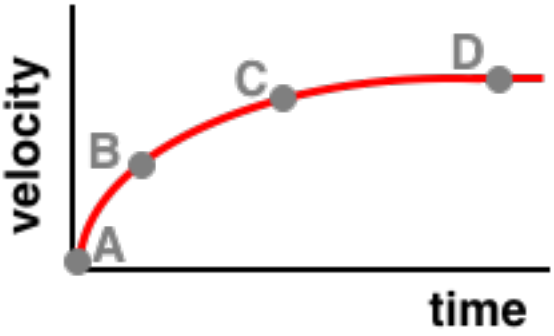
A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how her velocity changes with time. (Note: down is defined as the + direction of velocity.) At what points during the skydive does she experience the greatest air resistance, zero air resistance, and the least (but non-zero) air resistance?




Air resistance is greatest at _____.
Air resistance is zero at _____.
Air resistance is least (but not zero) at _____.

**Question 21**

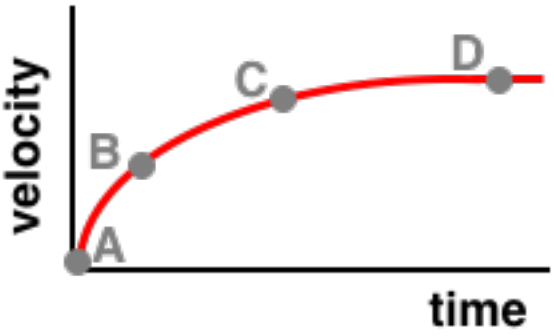
A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how her velocity changes with time. (Note: down is defined as the + direction of velocity.) At what points during the skydive does she experience the greatest air resistance, zero air resistance, and the least (but non-zero) air resistance?




Air resistance is zero at _____.
Air resistance is least (but not zero) at _____.
Air resistance is greatest at _____.

**Question 22**

A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how her velocity changes with time. (Note: down is defined as the + direction of velocity.) At what points during the skydive does she experience the greatest air resistance, zero air resistance, and the least (but non-zero) air resistance?

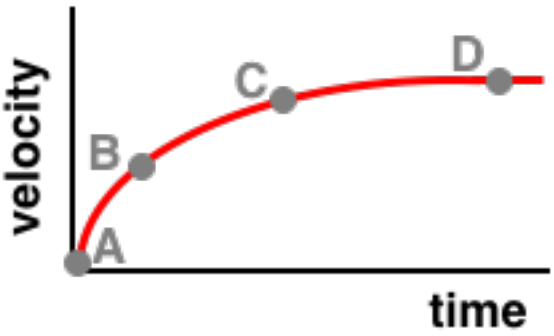



Air resistance is zero at _____.
Air resistance is greatest at _____.
Air resistance is least (but not zero) at _____.

**Question Group 11**

**Question 23**

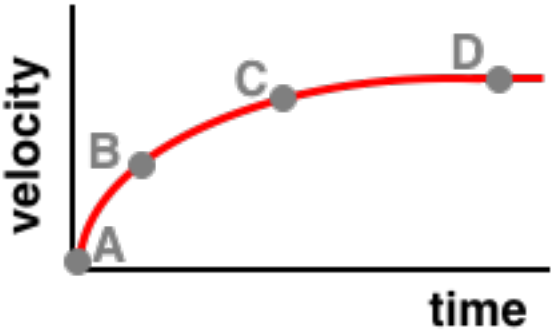
A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how her velocity changes with time. (Note: down is defined as the + direction of velocity.) At what points during the skydive does she have the experience the largest net force, a zero net force, and the smallest, non-zero net force?




Net force is largest at _____.
Net Force is zero at _____.
Net Force is smallest (but not zero) at _____.

**Question 24**

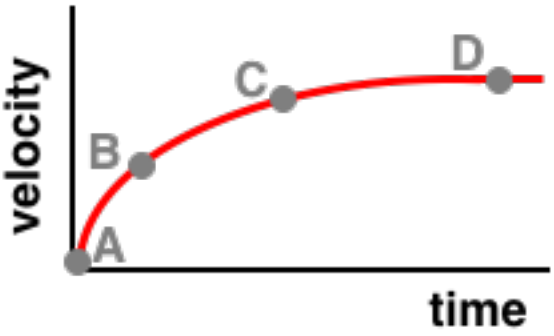
A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how her velocity changes with time. (Note: down is defined as the + direction of velocity.) At what points during the skydive does she have the experience the largest net force, a zero net force, and the smallest, non-zero net force?




Net Force is zero at _____.
Net Force is smallest (but not zero) at _____.
Net force is largest at _____.

**Question 25**

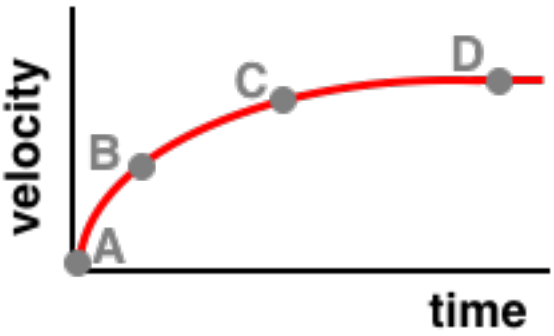
A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how her velocity changes with time. (Note: down is defined as the + direction of velocity.) At what points during the skydive does she have the experience the largest net force, a zero net force, and the smallest, non-zero net force?

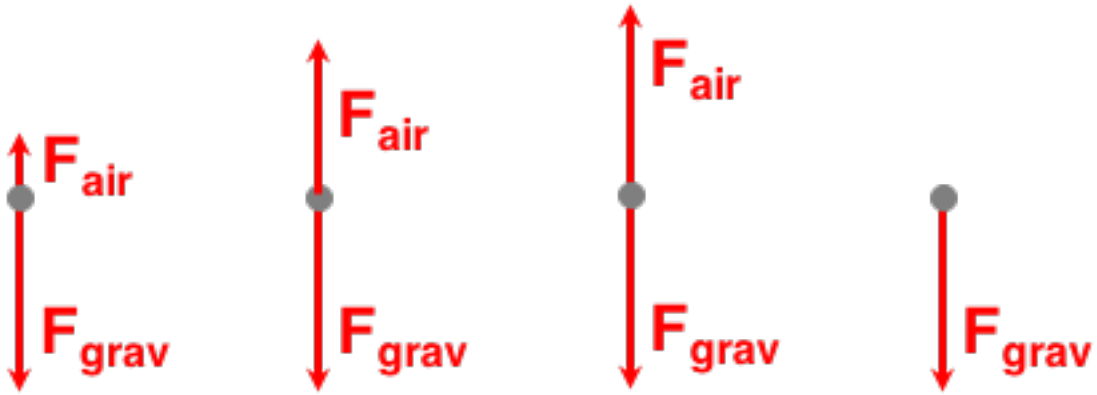



Net Force is zero at _____.
Net force is largest at _____.
Net Force is smallest (but not zero) at _____.

**Question Group 12**
**Question 26**

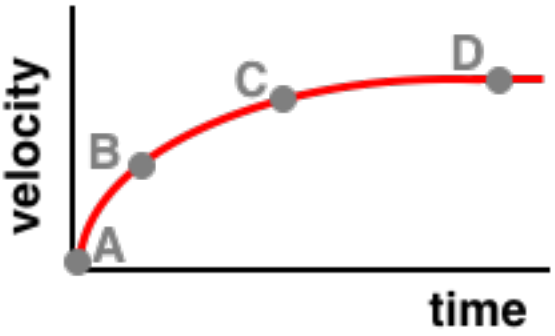
A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how his velocity changes with time. (Note: down is defined as the + direction of velocity.) Match each of the three free-body diagrams to one of the points on the graph.

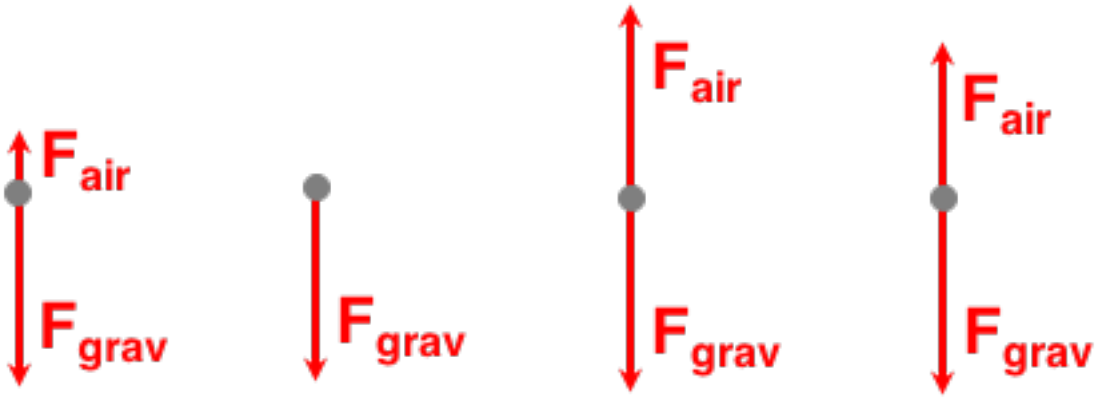


**Question 27**

A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how his velocity changes with time. (Note: down is defined as the + direction of velocity.) Match each of the three free-body diagrams to one of the points on the graph.



**Question 28**

A skydiver is dropped out of an airplane at an altitude of 10000 feet. The velocity-time graph at the right demonstrates how his velocity changes with time. (Note: down is defined as the + direction of velocity.) Match each of the three free-body diagrams to one of the points on the graph.