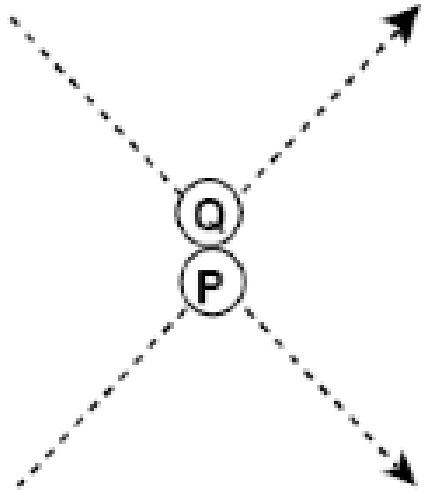
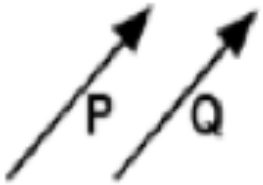
The diagram at the right depicts the path of two colliding steel balls rolling on a table. Which set of arrows best represents the direction of the change in momentum of each ball?

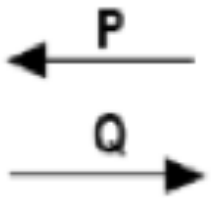


(1)

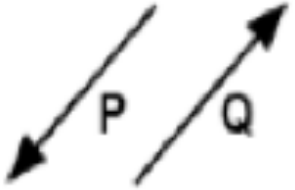
(2)



(3)



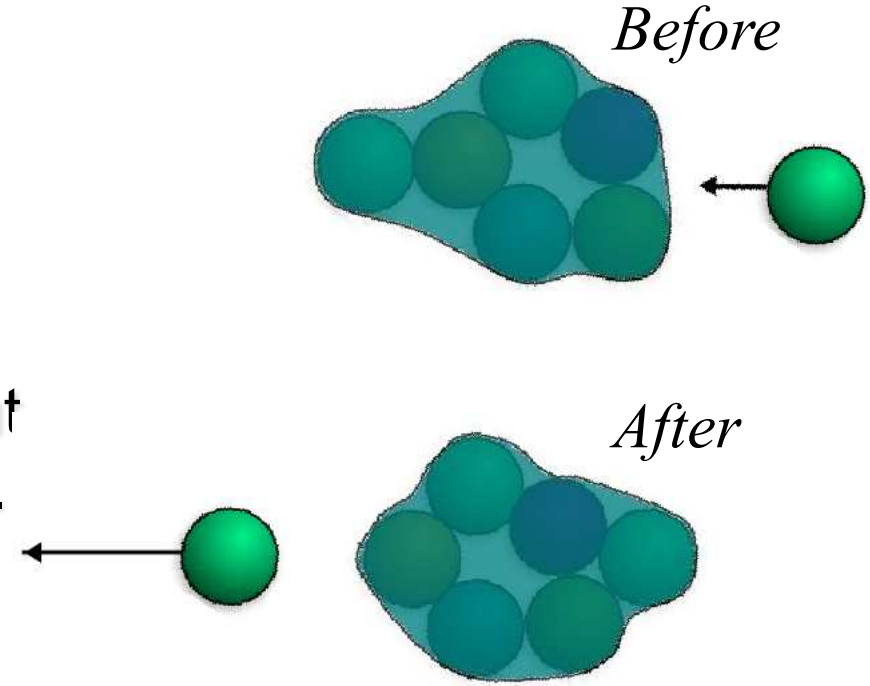
(4)



(5)

A molecular cluster at rest collides with an atom. As a result, the atom becomes strongly bound to the cluster and an identical atom (from a different part of the molecule) gets shot off with much higher speed. What can you say about the motion of the reformed cluster after the collision?

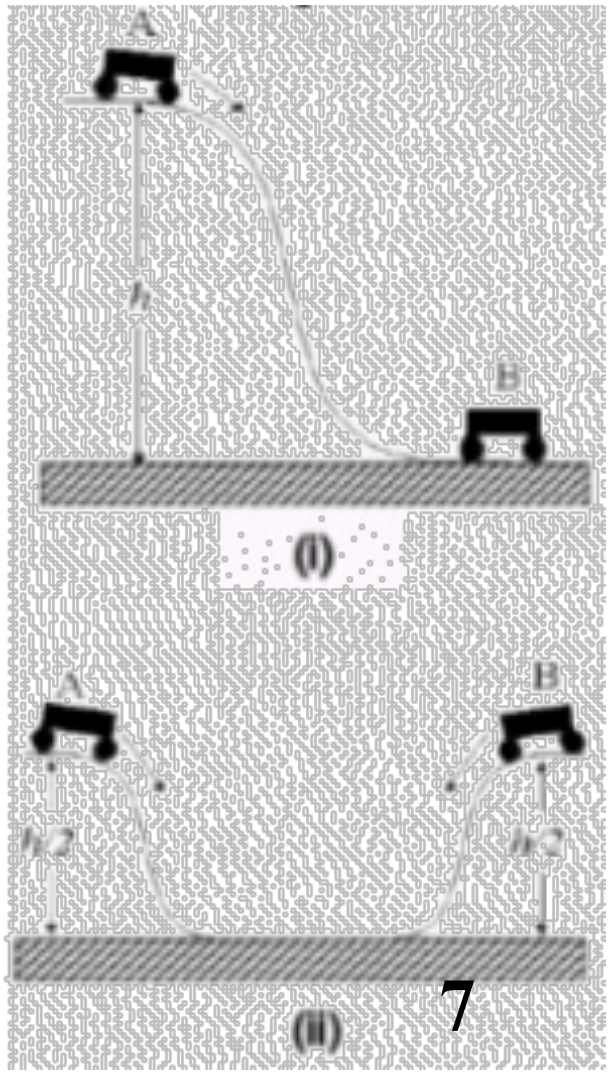
A. It will be stationary.
B. It will move to the left.
C. It will move to the right.
D. This is not really possible, despite the claim that it is.
E. You can't say anything about it from the information given.
F. Something else.



Two identical carts A and B roll down a hill and collide as shown in the figures at the right.

(i): A starts from rest. It rolls down and collides head-on with B which is initially at rest on the ground. The two carts stick together.

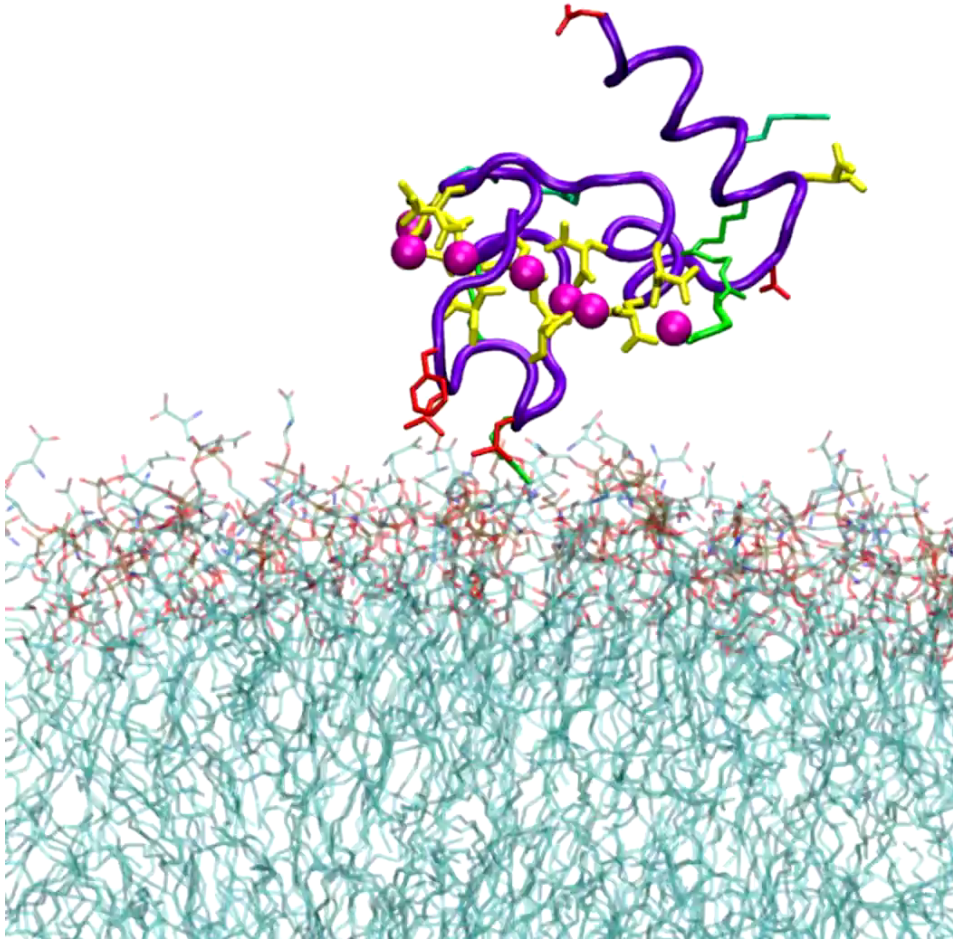
(ii): A and B are at rest on opposite sides of the hill. They roll down, collide head-on and stick together.



Which statement is true about the two-cart system <u>just before</u> the carts collide in the two cases?

1. The momentum of the system is zero in case (ii).
2. The momentum of the system is greater in case (i) than in case (ii).
3. The momentum of the system is greater in case (ii) than in case (i).
4. The momentum of the system is the same in both cases (but not 0).
5. More than one statement is true.

An example of something more complex:



Blood clotting protein sitting on membrane

Can we apply Newton's laws to predict the motion of the protein?

1. No
2. Yes
3. Depends