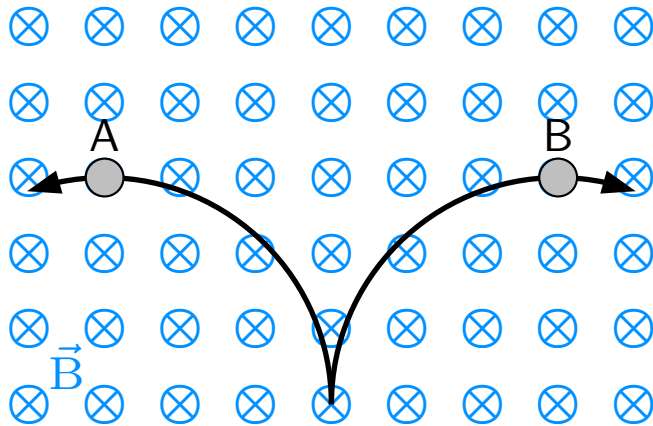


# Question 1

Two charged particles each move with constant speed in a region containing a uniform and constant magnetic field. Their trajectories when viewed from above are as illustrated.



Which is true regarding the charges of the particles?

1. Both are positive.
2. Both are negative.
3. They are opposite but one cannot say which is positive.
4. A is positive, B is negative.
5. B is positive, A is negative.

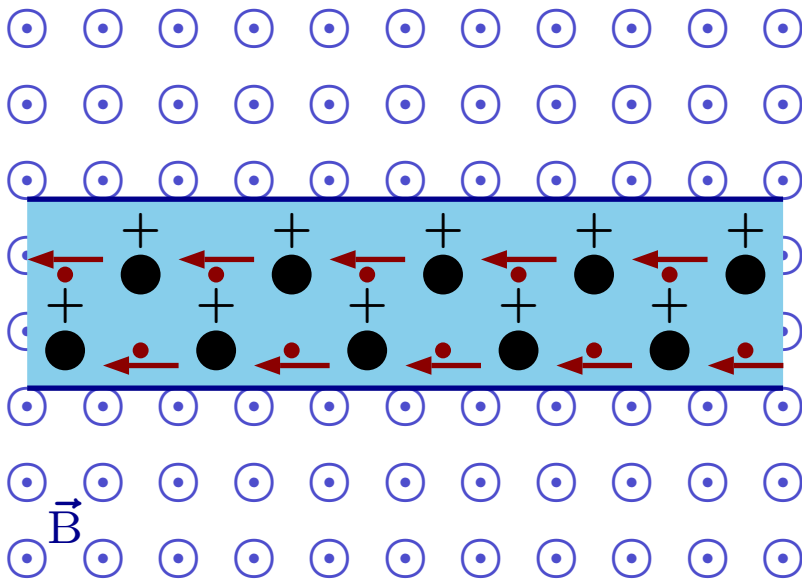
## Warm Up Question 1

Two particles, which have the same charges and the same velocities are fired into the same magnetic fields. The fields are perpendicular to their velocities and both follow circular paths. Particle A follows a circle with a smaller radius than particle B. How is the mass of A related to that of B (same, larger, smaller)? Explain your answer.

1. A has larger mass.  $F = \frac{mv^2}{r}$
2. A has smaller mass.  $r = \frac{mv}{qB}$
3. Masses are the same.

## Question 2

A wire carries a current, consisting of moving electrons. The positive nuclei in the wire remain stationary. The wire is placed into a magnetic field,  $\vec{B}$ , pointing out of the screen.

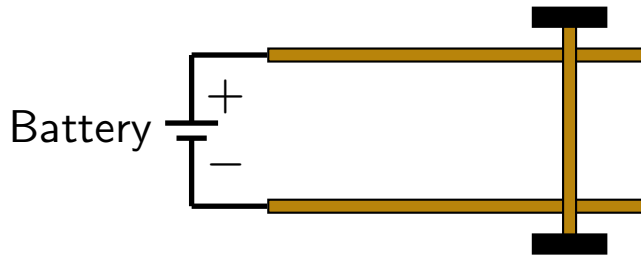


Which of the following is true?

1.  $\vec{B}$  exerts no force on the wire since the net charge of the wire is zero.
2.  $\vec{B}$  exerts a force on the positive charges and a force on the negative charges and these cancel.
3.  $\vec{B}$  exerts a force on the positive charges and a force on the negative charges. The force on the negative charges is larger since they are smaller.
4.  $\vec{B}$  exerts a force on the negative charges but no force on the positive charges.
5.  $\vec{B}$  exerts a force on the positive charges but no force on the negative charges.

## Question 3

An non-magnetic axle with two wheels is free to roll along two rails. The rails are connected to a battery and this is illustrated from above. The north pole of a magnet is held above the axle.



The axle is initially at rest and is then released. Which of the following is true after the wheel is released?

1. It remains stationary.
2. It lifts off the rails.
3. It rolls left.
4. It rolls right.
5. It slides down to the lower rail.

## Warm Up Question 2

The cords that connect a household appliance to the mains outlet consist of two strands of wire that run parallel to each other. At any instant the current in one strand is opposite to that in the other strand. Describe the direction of the force exerted by one strand on the other. In household circuits, the currents in the strands simultaneously reverse direction many times every second. Does this change the direction of the force exerted by one strand on the other? Explain your answer.

1. Repel. Does not change.
2. Attractive. Does not change.
3. Reverses direction. Current reverses direction.