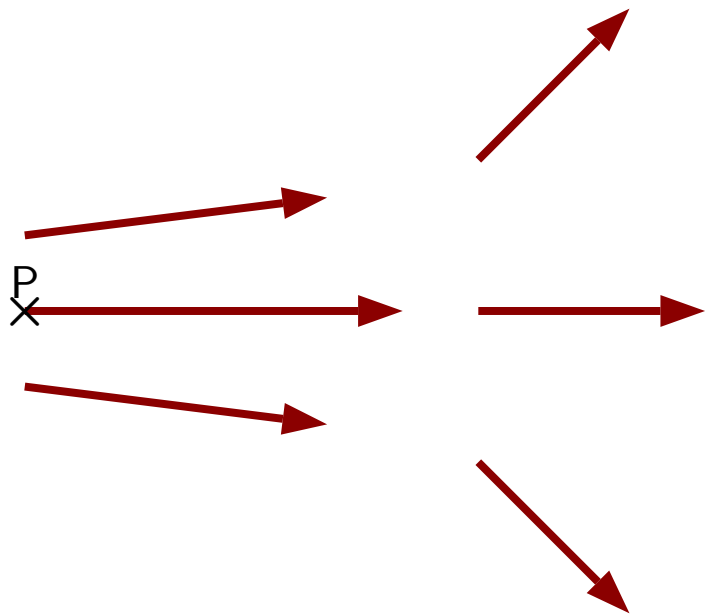
Warm Up Question 1

Source charges are placed on two differently sized balls, which are separated. The charges are held fixed. A positively charged red probe is placed at the point midway between the balls and then removed. After this a negatively charged blue probe is placed at the point midway between the balls and then removed. Is there any difference between the electric field *(produced by the fixed balls)* when the red probe charge is present compared to when the blue probe charge is present? Explain your answer.

1. Yes. The field depends on the charge.
2. Yes. The directions of the forces change.
3. No. The charges on the balls don't change, so there will be no change.

Question 1

The electric field produced by a hidden charge collection of charged particles (sources) is illustrated below.

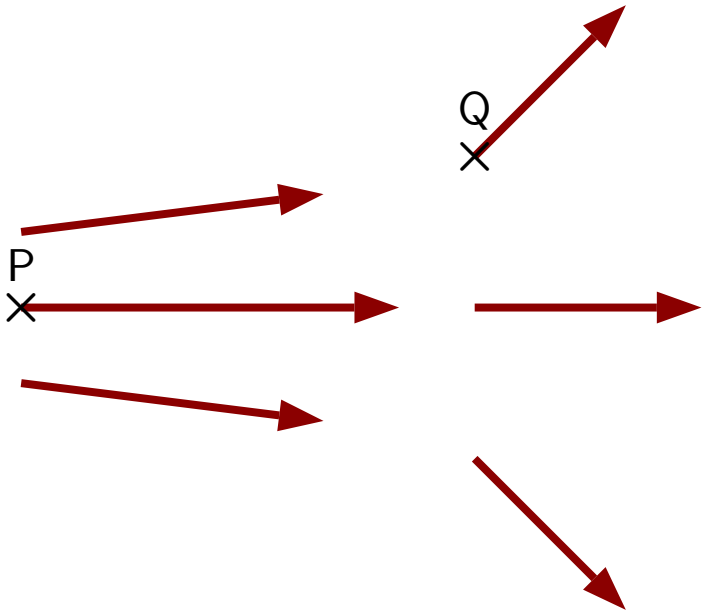


A probe is placed at point P. Which of the following is true of the force exerted by the electric field on the charged particle?

1. The force points right *regardless* of the probe.
2. The force points left *regardless* of the probe.
3. The force could point right or left, depending on the probe.

Question 2

The electric field produced by a hidden charge collection of charged particles is illustrated below.

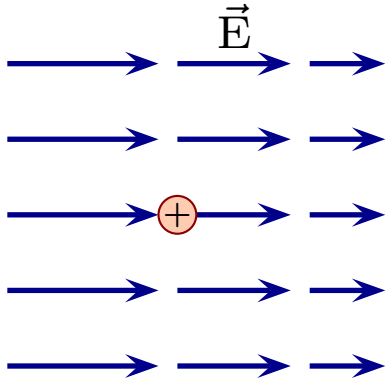


Which of the following is true regarding one probe placed at P and, separately, another at Q?

1. The magnitude of the force exerted at P is larger than at Q, *regardless* of the probe charges.
2. The magnitude of the force exerted at P is smaller than at Q, *regardless* of the probe charges.
3. The magnitude of the force exerted at P could be smaller or it could be larger than at Q.

Question 3

Source charges produce the illustrated electric field. A positive probe charge is held at rest at the indicated location and then released.



What happens after the charge is released?

1. It remains stationary.
2. It moves left with increasing speed.
3. It moves left with decreasing speed.
4. It moves right with increasing speed.
5. It moves right with decreasing speed.

Warm Up Question 2

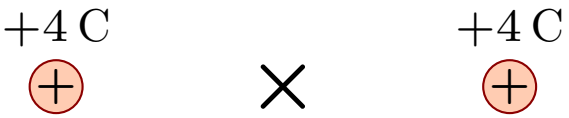
A positive point charge is placed to the right of a negative point charge. What is the direction of the net electric field midway between the two charges? Explain your answer.

1. It points towards the two charges.
2. The field is zero. The charges cancel.
3. The field is zero. The fields cancel.
4. Left. Away from positive and toward negative.
5. Right. Toward the positive charge, attractive.
6. Depends on the charge magnitudes.

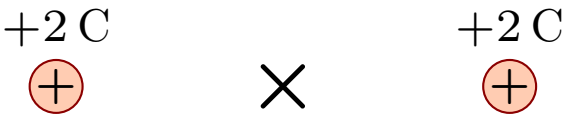
Question 4

In the following separate scenarios two source charges produce electric fields. Consider the magnitude of the field at the location midway between the two source charges.

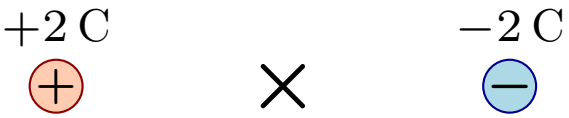
Case A



Case B



Case C



Which of the following describes the rank of the magnitudes of the fields at the midpoint?

1. $E_C > E_A = E_B$
2. $E_A = E_B = E_C$
3. $E_A = E_B > E_C$
4. $E_A > E_B > E_C$
5. $E_C > E_A > E_B$

Question 5

Two point charges with equal magnitude but opposite sign are located as illustrated.

A third charge, Z, is placed at point P.

Which of the following best represents the net electric field produced by A and B at the location of Z?

1. $\rightarrow$ if Z is positive; $\leftarrow$ if Z is negative.
2. $\leftarrow$ if Z is positive; $\rightarrow$ if Z is negative.
3. $\rightarrow$ if Z is positive; $\rightarrow$ if Z is negative.
4. $\leftarrow$ if Z is positive; $\leftarrow$ if Z is negative.