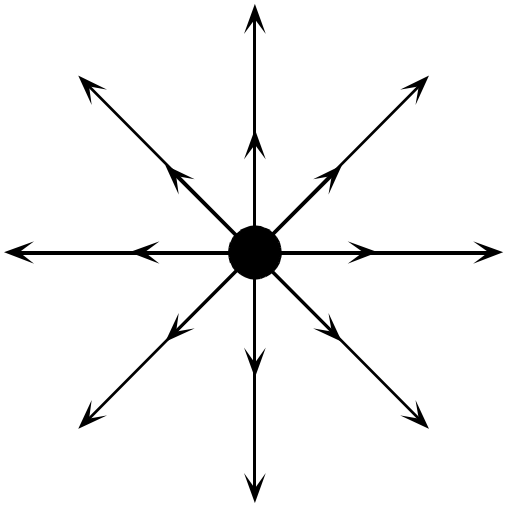
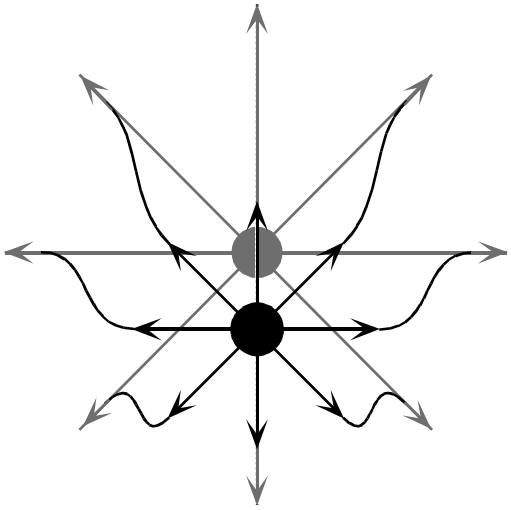
PhyzGuide: Making Waves 5

ELECTROMAGNETIC WAVES

part 1: the electric field

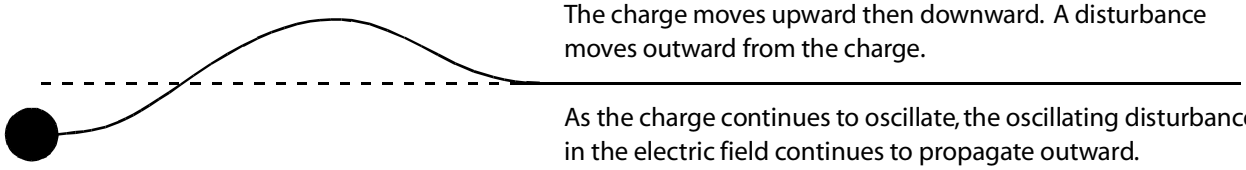


Consider a small positive charge. It is surrounded by an electric field as shown.



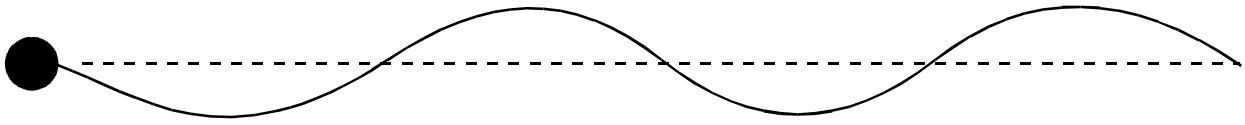
If the charge is suddenly and rapidly moved down a bit, the electric field will come down with it. But not instantaneously. Rather a downward directed pulse propagates outward from the charge and "pulls" the electric field down by the appropriate amount. (The gray dot and lines represent the old position and field around the charge.)

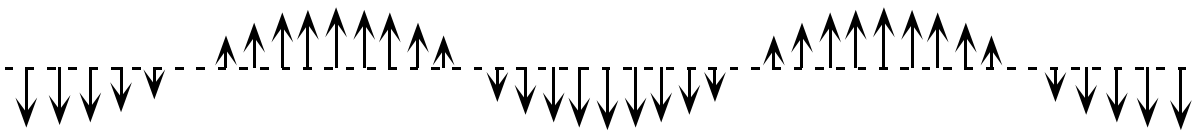
One electric field line extending from a stationary charge.



The charge moves upward then downward. A disturbance moves outward from the charge.

As the charge continues to oscillate, the oscillating disturbance in the electric field continues to propagate outward.





This is a representation of the vertical component of the electric field as the disturbance propagates outward. Notice that its magnitude corresponds with the **slope** of the disturbance shown above.

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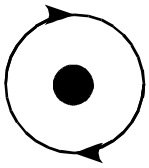
ELECTROMAGNETIC WAVES

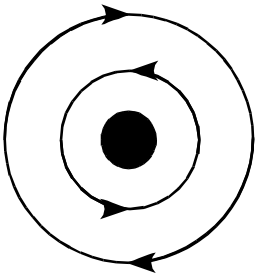
part 2: the magnetic field

We're going to look at the charge shown on the other side of this sheet, but we're going to look at it from above instead of the side.

Consider a small positive charge. It is surrounded by an electric field as shown on the other side of this sheet, but there is no magnetic field associated with it.



If the charge is suddenly and rapidly moved away from us a bit, a magnetic field will appear. Recall that magnetic fields exist around moving charges. The field is directed as shown above. The magnetic field will expand outward from the charge.

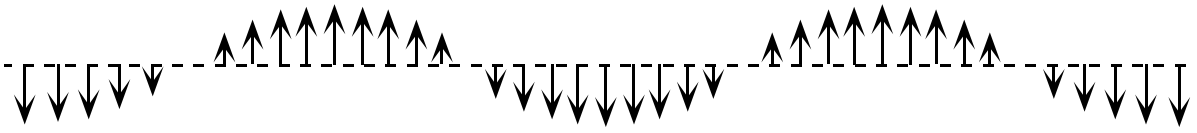


If the charge is suddenly and rapidly moved toward us a bit, a magnetic field in the opposite direction will appear. The field is directed as shown above. The magnetic field will expand outward from the charge.

A stationary charge has no magnetic field around it.

The charge moves outward then inward. Magnetic fields corresponding to the moving charge propagate outward.

As the charge continues to oscillate, the oscillating disturbance in the magnetic field continues to propagate outward.



This is a representation of the vertical component of the electric field as the disturbance propagates outward. Notice that its magnitude corresponds with the **slope** of the disturbance shown above.