PhyzJob: Field Concepts

Felix

1. What is a field? What information is communicated when one speaks of a gravitational field or electric field?

A field is a mathematical description of a "distortion" in space. Such a distortion causes objects susceptible to the field to behave differently than they would if the field-creating object wasn't there. The gravitational field indicates how many units of gravitational force act on each unit of mass; the electric field indicates how many units of electric force act on each unit of charge.

2. a. What must an object have to *create* a gravitational field? Mass

b. What must an object have to *create* an electric field? Charge

3. a. What types of objects are *affected* by a gravitational field, and what effect(s) does the field have on them?

Objects with mass are affected by a gravitational field; the field exerts a force attracting the object to the field-creating mass.

b. What types of objects are *affected* by an electric field, and what effect(s) does the field have on them?

Objects with charge are affected by an electric field; the field exerts a force that either attracts the object to or repels the object from the field-creating mass.

4. a. At a given place in a gravitational field (for example, near the surface of the earth), are all objects acted on with the same gravitational *force?* If not, what other factor(s) determine the magnitude of the force? Explain.

NO—objects with more mass experience more force, but the ratio of force to mass is the same. The force to mass ratio is the gravitational field!

b. At a given place in an electric field (for example, near the surface of a charged Van de Graaff generator), are all objects acted on with the same *force?* If not, what other factor(s) determine the magnitude of the force? Explain.

NO—objects with more charge experience more force, but the ratio of force to charge is the same. The force to charge ratio is the electric field!

5. a. Describe the dependence of gravitational field strength on
   i. the **mass** of the field-creating object.

   The greater the mass, the stronger the field: $g \propto M$

   ii. the **distance** from the field-creating object.

   The greater the distance, the weaker the field: $g \propto 1/R^2$

b. Describe the dependence of electric field strength near a spherical charge on
   i. the **charge** of the field-creating object.

   The greater the charge, the stronger the field: $E \propto Q$

   ii. the **distance** from the field-creating object.

   The greater the distance, the weaker the field: $E \propto 1/R^2$