Performance Task

7.2 Newton's Law of Universal Gravitation and Einstein's Theory of General Relativity 19.

Design an experiment to test whether magnetic force is inversely proportional to the square of distance. Gravitational, magnetic, and electrical fields all act at a distance, but do they all follow the inverse square law? One difference in the forces related to these fields is that gravity is only attractive, but the other two can repel as well. In general, the inverse square law says that force F equals a constant C divided by the distance between objects, d, squared: $F = C/d^2$.

Incorporate these materials into your design:

- Two strong, permanent bar magnets
- A spring scale that can measure small forces
- A short ruler calibrated in millimeters

Use the magnets to study the relationship between attractive force and distance.

a. What will be the independent variable?
b. What will be the dependent variable?
c. How will you measure each of these variables?
d. If you plot the independent variable versus the dependent variable and the inverse square law is upheld, will the plot be a straight line? Explain.
e. Which plot would be a straight line if the inverse square law were upheld?

Teacher Support

Magnets must be strong, such as neodymium magnets or cow magnets (ask a veterinarian). Suggest that they could either measure distance versus attractive force or repulsive force. Attractive force at various distances can be measured with the spring scale. Repulsive force could be measured by dropping the magnets into a transparent tube oriented so that they repel each other. The distance will be the distance between the magnets. Ask what the force will be. Ask how they could change the force and thereby change the distance.