

Charging objects and the force between charges

AP Physics 2 (algebra-based) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test checks charge, conservation, charging methods, Coulomb's law and superposition at AP Physics 2 level. Use $k = 8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$ and $e = 1.60 \times 10^{-19} \text{ C}$. A calculator is allowed. Show your working and include units on every numerical answer.

Level: AP Physics 2 (algebra-based) · **Curriculum:** AP P2 Unit 10

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Glass rod and silk (2 marks)

A glass rod loses 3.0×10^{10} electrons to a piece of silk.

- Calculate the charge on the rod. (1 mark)
- State the charge on the silk. (1 mark)

Question 2 Attractive force (3 marks)

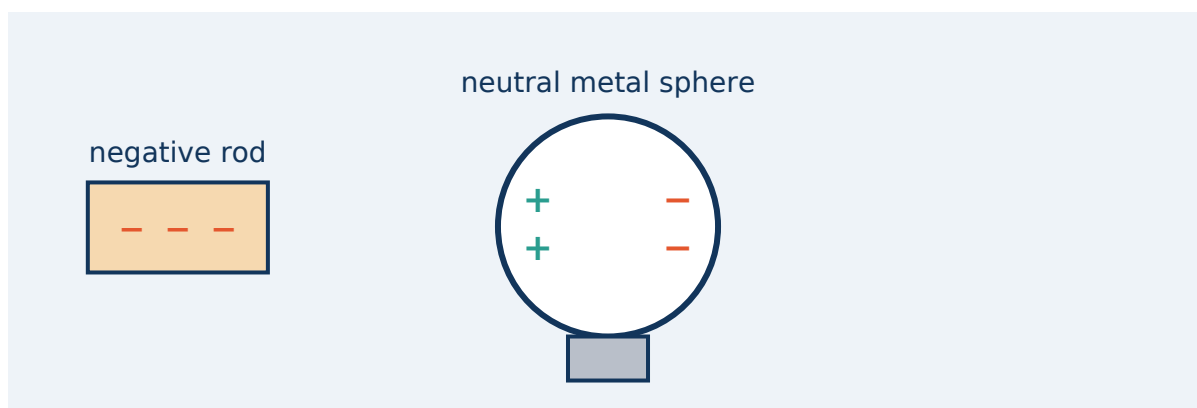
A $+2.0 \mu\text{C}$ charge and a $-6.0 \mu\text{C}$ charge are 0.15 m apart. Calculate the size of the force on each charge and state whether it is attractive or repulsive. (3 marks)

Question 3 Tripling the distance (2 marks)

Two charges exert a force of 0.90 N on each other. Calculate the force when the distance between them is tripled. (2 marks)

Question 4 Induction (3 marks)

A negative rod is held near a neutral metal sphere on an insulating stand (shown).



The rod is close to the sphere but does not touch it.

Explain how the sphere can be given a positive charge without touching it with the rod. (3 marks)

Question 5 Balanced forces (3 marks)

A $+4.0 \mu\text{C}$ charge is at $x = 0$ and a $+1.0 \mu\text{C}$ charge at $x = 0.30 \text{ m}$. A $-1.0 \mu\text{C}$ charge is at $x = 0.20 \text{ m}$. Show that the net force on the $-1.0 \mu\text{C}$ charge is zero. (3 marks)

Question 6 Touching spheres (2 marks)

Two identical metal spheres carry $+9.0 \mu\text{C}$ and $-3.0 \mu\text{C}$. They touch and are then separated. Calculate the charge on each. (2 marks)

Question 7 Paper and a comb (2 marks)

Explain why a charged comb can attract a neutral piece of paper. (2 marks)

Question 8 Electric and gravitational forces (3 marks)

Use $k = 8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$, $G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$, $e = 1.60 \times 10^{-19} \text{ C}$ and $m = 9.11 \times 10^{-31} \text{ kg}$.

- Calculate the ratio of the electric force to the gravitational force between two electrons. (2 marks)
- State whether this ratio changes with the distance between the electrons, and explain. (1 mark)