Year 12 Science: Electric fields and charges between parallel plates

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Plates 4.0 cm apart have 200 V across them. What is the field strength?

2. What force does a proton feel in that field?

3. A dust grain carries a charge of 4.8×10^{-18} C. How many extra electrons does it have?

4. An electron crosses from the negative to the positive plate of a pair 3.0 mm apart with 1500 V across them. How much energy does it gain?

5. A field of 2.0×10^{4} V m^{-1} pushes a charged drop with a force of 6.4×10^{-14} N. What is the drop's charge?

Exam-style question: a model smoke filter

Mere's class builds a model chimney filter: smoke rises between two vertical metal plates 4.0 cm apart, connected to a 3000 V supply. One smoke particle picks up 120 extra electrons. Ignore gravity.

6. Describe the electric field between the plates.

7. Calculate the electric field strength between the plates.

8. Calculate the size of the electric force on the smoke particle, and state its direction.

9. The particle starts next to the negative plate. Calculate the energy the field gives it by the time it reaches the positive plate.

10. The supply is turned down to 1500 V. Discuss how this changes the force on the particle and the energy it gains crossing the gap.

Fix the mistake

11. Correct this statement: "E = 5.0×10^{4} V m^{-1}, so the electron gains 5.0×10^{4} J of energy."

12. Correct this statement: "Field lines go from the negative plate to the positive plate, the way the electrons move."

13. Correct this statement: "With the plates 5.0 mm apart, E = 250 ÷ 5.0 = 50 V m^{-1}."

14. Correct this statement: "A drop with 4 extra electrons has a charge of 4 C."