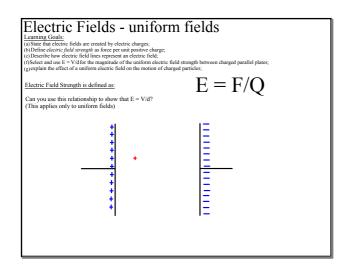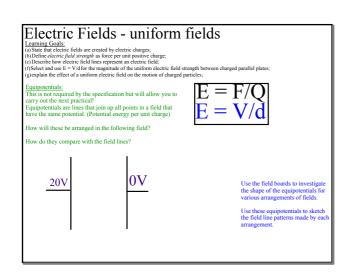## Electric Fields - uniform fields

Learning Goals:
(a) State that electric fields are created by electric charges;
(b) Define *electric field strength* as force per unit positive charge;
(c) Describe how electric field lines represent an electric field;
(f) Select and use E = V/d for the magnitude of the uniform electric field strength between charged parallel plates;
(g) explain the effect of a uniform electric field on the motion of charged particles;

Starter: Look at the situation below. Draw lines showing what would happen if a positive charge were placed in the gap between the charged plates.

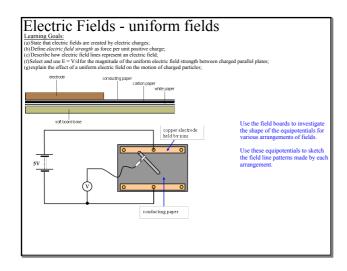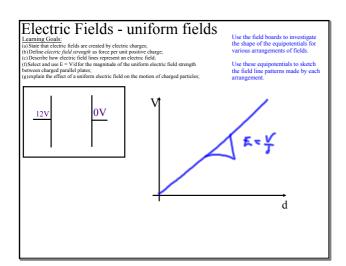What would happen if it was placed just outside?

Electric Fields - uniform fields

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Electric Field Strength is defined as:

$$E = F/Q$$

Can you use this relationship to show that E = V/d?
(This applies only to uniform fields)

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Equipotentials:
This is not required by the specification but will allow you to carry out the next practical!
Equipotentials are lines that join up all points in a field that have the same potential. (Potential energy per unit charge)

$$E = F/Q$$
$$E = V/d$$

How will these be arranged in the following field?

How do they compare with the field lines?

20V   0V

Use the field boards to investigate the shape of the equipotentials for various arrangements of fields.

Use these equipotentials to sketch the field line patterns made by each arrangement.

1

Electric Fields - uniform fields

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electrode   conducting paper
          carbon paper
             white paper

soft board base

copper electrode held by pins

5V

V

conducting paper

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Electric Fields - uniform fields

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12V   0V

V

$E = \dfrac{V}{d}$

d

Electric Fields - uniform fields

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Use the field boards to investigate the shape of the equipotentials for various arrangements of fields.

Use these equipotentials to sketch the field line patterns made by each arrangement.

12V   0V

12V   0V

12V   0V

12V   12V

2

Electric Fields - uniform fields

Learning Goals:
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(g) explain the effect of a uniform electric field on the motion of charged particles;

Plenary

$e = 1.6 \times 10^{19}$ C

mass $e = 9.11 \times 10^{31}$ Kg

An electron beam gun uses an anode to accelerate electrons emitted from a cathode.

The anode voltage is 100kV
The distance between the cathode and anode is 30mm

Calculate:
a) The force on each electron
b) The acceleration of the electron
c) The final velocity of each electron

Cathode Ray Tube