

Field maps, voltage and energy per unit charge

AP Physics 2 (algebra-based) · Lab answers

The sample readings give a gradient of 60 V/m, the same as V/d . If your data differ slightly, check that the line is straight and passes through the origin, and give the unit of every result.

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

Question 1 Plot and describe

The points lie on a straight line through the origin, so the potential rises at a constant rate with distance. **V is directly proportional to x**, which means the field is uniform.

Question 2 Gradient and field

Gradient = $(6.00 - 0.00) / (10.0 - 0) = 0.600 \text{ V/cm} = 60.0 \text{ V/m}$. Therefore **E = 60 V/m**, directed from the positive to the negative electrode.

Question 3 Compare with V/d

$V/d = 6.0 / 0.100 = 60 \text{ V/m}$. The gradient is also 60.0 V/m, so the difference is **0 %**, within the precision of the voltmeter.

Question 4 Energy of a charge

$W = q\Delta V = 1.0 \times 10^{-6} \times 6.0 = 6.0 \times 10^{-6} \text{ J}$.

Question 5 Equipotentials and field lines

Equipotentials are straight lines parallel to the electrodes. Field lines are drawn at **right angles** to them, parallel to each other and pointing from high to low potential.

Question 6 Voltmeter resistance

A high-resistance voltmeter draws almost no current from the paper, so it does not disturb the potential it measures. A low-resistance meter would lower the reading and distort the pattern. **High resistance, negligible current.**

Question 7 Edge effects

At the edges the current can spread outward and the field lines bulge, so lines curve. Use a wider sheet, or take readings only along the central region. **Take readings in the centre.**