FREE SAMPLE: THE FIRST QUESTION

Question One (9 marks)

(a) Two parallel metal plates 0.0400 m apart have a potential difference of 250 V between them, giving a uniform electric field. An electron is released from rest at the surface of the plate that repels it, and accelerates across the gap.

(i) Calculate the electric field strength between the plates.

(ii) Calculate the force on the particle and its acceleration.

(iii) Calculate the speed with which it reaches the other plate. (Charge of the particle 1.60×10^{-19} C; mass 9.11×10^{-31} kg.)

[5 marks]

(b) A small sphere carrying a charge of 3.00×10^{-6} C and a mass of 2.00×10^{-3} kg is in a uniform electric field of strength 4000 V m^{-1}. It is released from rest and moves 0.120 m along the field direction.

(i) Calculate the force on the sphere.

(ii) Calculate the work done on the charge by the field, and the gain in kinetic energy.

(iii) Calculate the speed of the sphere after moving 0.120 m. Ignore gravity.

[4 marks]

TEST PAPERS HUB - NOT FOR RESALE OR REDISTRIBUTION

THE WORKED ANSWER TO THAT QUESTION

Question 1 (9 marks) [Electric fields]

(a) Two parallel metal plates 0.0400 m apart have a potential difference of 250 V between them, giving a uniform electric field. An electron is released from rest at the surface of the plate that repels it, and accelerates across the gap. (i) Calculate the electric field strength between the plates. (ii) Calculate the force on the particle and its acceleration. (iii) Calculate the speed with which it reaches the other plate. (Charge of the particle 1.60×10^{-19} C; mass 9.11×10^{-31} kg.)

(a) Answer: (i) 6250 V m^{-1}; (ii) 1.00×10^{-15} N and 1.10×10^{15} m s^{-2}; (iii) 9.37×10^{6} m s^{-1}

- Evidence level: Excellence (link field, force, acceleration and energy; use energy conservation for the final speed).
- (i) $E = V/d = 250 \div 0.0400 = 6250$ V m^{-1}.
- (ii) $F = Eq = 6250 \times 1.60 \times 10^{-19} = 1.00 \times 10^{-15}$ N. $a = F/m = 1.00 \times 10^{-15} \div 9.11 \times 10^{-31} = 1.10 \times 10^{15}$ m s^{-2}.
- (iii) The work done on the charge by the field, $qV = 1.60 \times 10^{-19} \times 250 = 4.00 \times 10^{-17}$ J, becomes kinetic energy: $\frac{1}{2}mv^2 = qV$.
- $v = \sqrt{(2qV/m)} = \sqrt{(2 \times 4.00 \times 10^{-17} \div 9.11 \times 10^{-31})} = 9.37 \times 10^{6}$ m s^{-1}.

> **KEY TAKEAWAY**
> Charge between plates: $E = V/d$, $F = Eq$, $a = F/m$, and the work done qV equals the kinetic energy gained, so $v = \sqrt{(2qV/m)}$; lighter particles reach much higher speeds.

(b) A small sphere carrying a charge of 3.00×10^{-6} C and a mass of 2.00×10^{-3} kg is in a uniform electric field of strength 4000 V m^{-1}. It is released from rest and moves 0.120 m along the field direction. (i) Calculate the force on the sphere. (ii) Calculate the work done on the charge by the field, and the gain in kinetic energy. (iii) Calculate the speed of the sphere after moving 0.120 m. Ignore gravity.

(b) Answer: (i) 0.0120 N; (ii) 1.44×10^{-3} J; (iii) 1.20 m s^{-1}

- Evidence level: Merit (use $F = Eq$, work $= Fd$ (or $E_p = Eqd$) and energy conservation).
- (i) $F = Eq = 4000 \times 3.00 \times 10^{-6} = 0.0120$ N.
- (ii) $W = Fd = 0.0120 \times 0.120 = 1.44 \times 10^{-3}$ J, which equals the gain in kinetic energy.
- (iii) $\frac{1}{2}mv^2 = 1.44 \times 10^{-3}$ J, so $v = \sqrt{(2 \times 1.44 \times 10^{-3} \div 2.00 \times 10^{-3})} = 1.20$ m s^{-1}.

> **KEY TAKEAWAY**
> Work on a charge in a uniform field: $F = Eq$ and $W = Fd = Eqd$; with no other forces this becomes kinetic energy $\frac{1}{2}mv^2$.

LOS: Electric fields (91173)

TEST PAPERS HUB · NOT FOR RESALE OR REDISTRIBUTION

LIKED THIS SAMPLE?

The full paper is the real thing.

THIS FREE SAMPLE	THE FULL PAPER
A short extract: the opening questions of Paper 1, then their worked answers. 2 pages in all.	Three questions made of several multi-part problems answered in writing (constructed response, no multiple choice), with a worked solution for every part that shows whether it is aimed at Achieved, Merit or Excellence. 10 pages, with a worked solution for every question.

What you get with each paper

- A complete, timed paper in the real exam layout, not just a taste of it.
- A worked solution for every question: numbered steps, why each wrong option is wrong, and a key takeaway.
- 20 different papers in this set. Every one uses new questions, so each extra paper is new practice, not a repeat.
- An A4 PDF emailed straight after payment, made for printing.

Get Paper 1 now

A$11.99 one-off, instant PDF download. Tap or click here.

Or see all 20 NCEA Level 2 Physics 91173 Electricity papers:
testpapershub.com/collections/ncea-level-2-physics-91173-electricity/

Getting the most from a practice paper

1. Print it and set the timer shown on the cover. Answer every question before looking at any solution.
2. Mark it against the worked solutions and note the topics that cost you marks.
3. Retry the questions you missed a day later, then use the next paper to check the fix held.

Not sure which paper to start with, or have a question before you buy? Email support@testpapershub.com and a real person will reply, normally within one business day. These are original practice papers, not official past papers, and are not affiliated with any exam authority.