

9.3 Conservation of Electric Energy

Name: _____ Class: _____ Date: _____ **Total: 11 marks**

KEY WORDS electron volt 电子伏特 • conservation of energy 能量守恒 • work 功
• potential difference 电势差 • kinetic energy 动能

Objective

Build the skills to answer exam questions on **conservation of electric energy**.**You must be able to:**

- relate the change in a charge's **kinetic energy** to $W = q \Delta V$
- apply **conservation of energy** 能量守恒 to a charge moving through a potential difference
- define and use the **electron volt** 电子伏特 (eV)
- find the final **speed** of a charge accelerated through a potential difference

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Energy from a potential difference

 $\Delta KE = q \Delta V$: the field does work $q \Delta V$ on a charge that falls through ΔV .

■ The electron volt

1 eV is the energy an electron gains through 1 V: $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$.

■ Final speed

Set $\frac{1}{2}mv^2 = q \Delta V$ and solve for v .

2 Practice

2.1 An electron moves through a potential difference of 50 V. State the energy it gains, in eV. [1]

2.2 Convert 3.0 eV to joules ($e = 1.6 \times 10^{-19} \text{ C}$). [2]

2.3 A $+2.0 \mu\text{C}$ charge moves through 300 V. Find the energy it gains, in joules. [2]

3 Exam-style questions

3.1 One electron volt equals [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** 1 J
B $1.6 \times 10^{-19} \text{ J}$
C 1 V
D 1 C

3.2 A charge accelerated through a potential difference ΔV gains kinetic energy [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** $q/\Delta V$
B $q \Delta V$
C $\Delta V/q$
D $\frac{1}{2}q \Delta V^2$

3.3 A proton ($m = 1.67 \times 10^{-27} \text{ kg}$, $q = 1.6 \times 10^{-19} \text{ C}$) accelerates from rest through 500 V.

(a) Find its kinetic energy in joules. [2]

(b) Find its final speed. [2]