

11.6 Kirchhoff's Loop Rule

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS kirchhoff's loop rule 基尔霍夫电压定律 • conservation of energy 能量守恒
• series 串联

Objective

Build the skills to answer exam questions on **Kirchhoff's loop rule**.

You must be able to:

- state **Kirchhoff's loop rule** 基尔霍夫电压定律, $\sum \Delta V = 0$ around any closed loop
- explain it as a consequence of **conservation of energy** 能量守恒
- assign consistent **sign conventions** for emf sources and resistors
- write and solve **loop equations**

1 Worked examples

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

■ The loop rule

Around any closed loop, $\sum \Delta V = 0$ — the rises across the emf sources balance the drops across the resistors.

■ Why it holds

A charge returning to its starting point has the **same** potential energy, so the potential changes around the loop sum to zero (conservation of energy).

■ Signs

Going around the loop: a resistor traversed with the current is a **drop** ($-IR$); an emf traversed from $-$ to $+$ is a **rise** ($+\mathcal{E}$).

2 Practice

2.1 State Kirchhoff's loop rule.

[1]

2.2 State the conservation law the loop rule expresses.

[1]

2.3 A single loop has a 10 V battery and resistors $2.0\ \Omega$ and $3.0\ \Omega$ in series. Find the current.

[2]

3 Exam-style questions

3.1 Kirchhoff's loop rule sums the potential differences around a closed loop to

[1]

A	B
C	D

A the emf

B zero

C a maximum

D infinity

3.2 The loop rule expresses conservation of

[1]

A	B
C	D

A charge

B energy

C momentum

D mass

3.3 A single loop contains a 12 V battery and resistors of $3.0\ \Omega$ and $1.0\ \Omega$ in series.

(a) Write the loop equation.

[2]

(b) Find the current.

[1]