

BEE1133 Circuit Analysis

Chapter 1A Basic Concept

by

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Chapter Description

Aims

This chapter is aimed to:

1. Introduce the basic component related to electric circuit analysis
2. Introduce the SI unit to the students
3. Explain the circuit elements in electric circuit

Expected Outcomes

Student should be able to

1. Recognize the electric circuit component
2. Use the SI unit correctly
3. Explain and recognize the basic circuit element in electric circuit



References

1. C. Alexander and M. Sadiku, "Fundamentals of Electric Circuits", 4th ed., McGraw-Hill, 2008.
2. J. Nilsson and S. Riedel, "Electric Circuits", 8th ed., Prentice Hall, 2008.



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BASIC CONCEPT

- 1.1 Introduction of circuit analysis
- 1.2 Electrical quantities: Systems of units, charge, current, voltage, power and energy
- 1.3 Circuit elements: Passive and active elements, independent and dependent sources

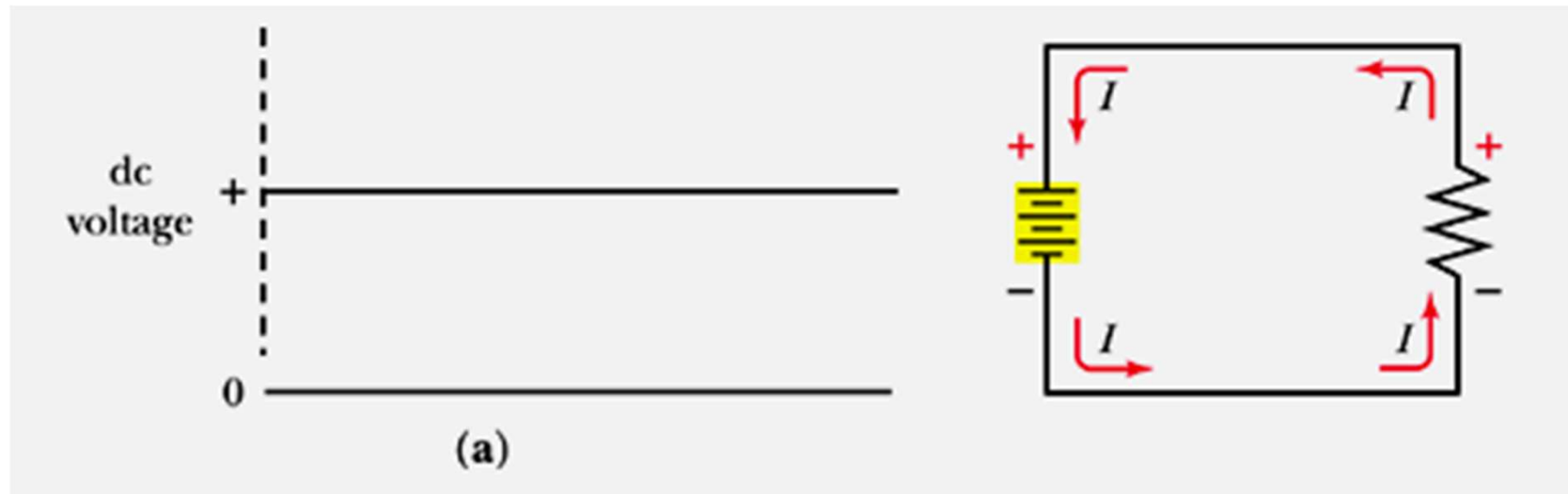


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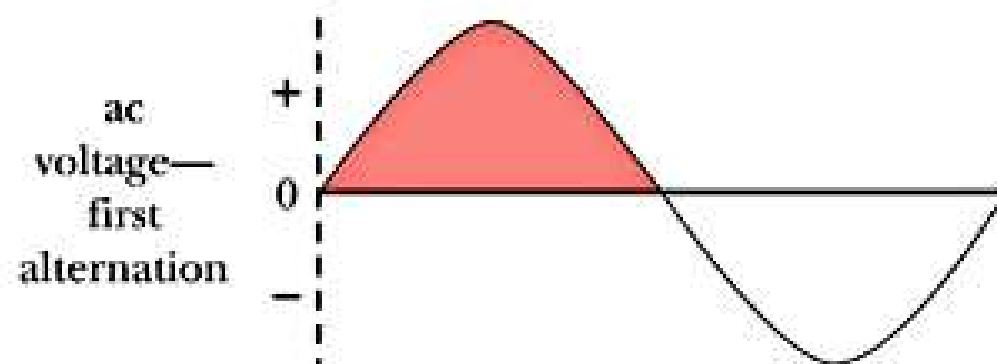
1.1 Introduction of circuit analysis

DC characteristics

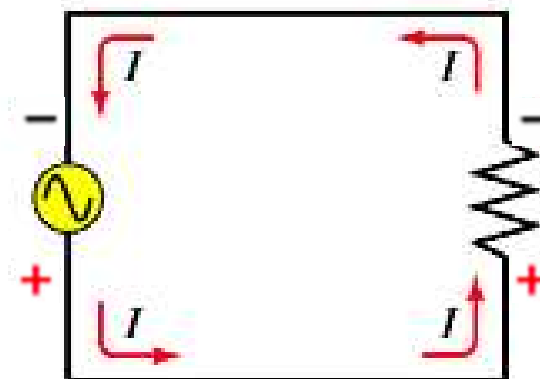


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AC characteristics



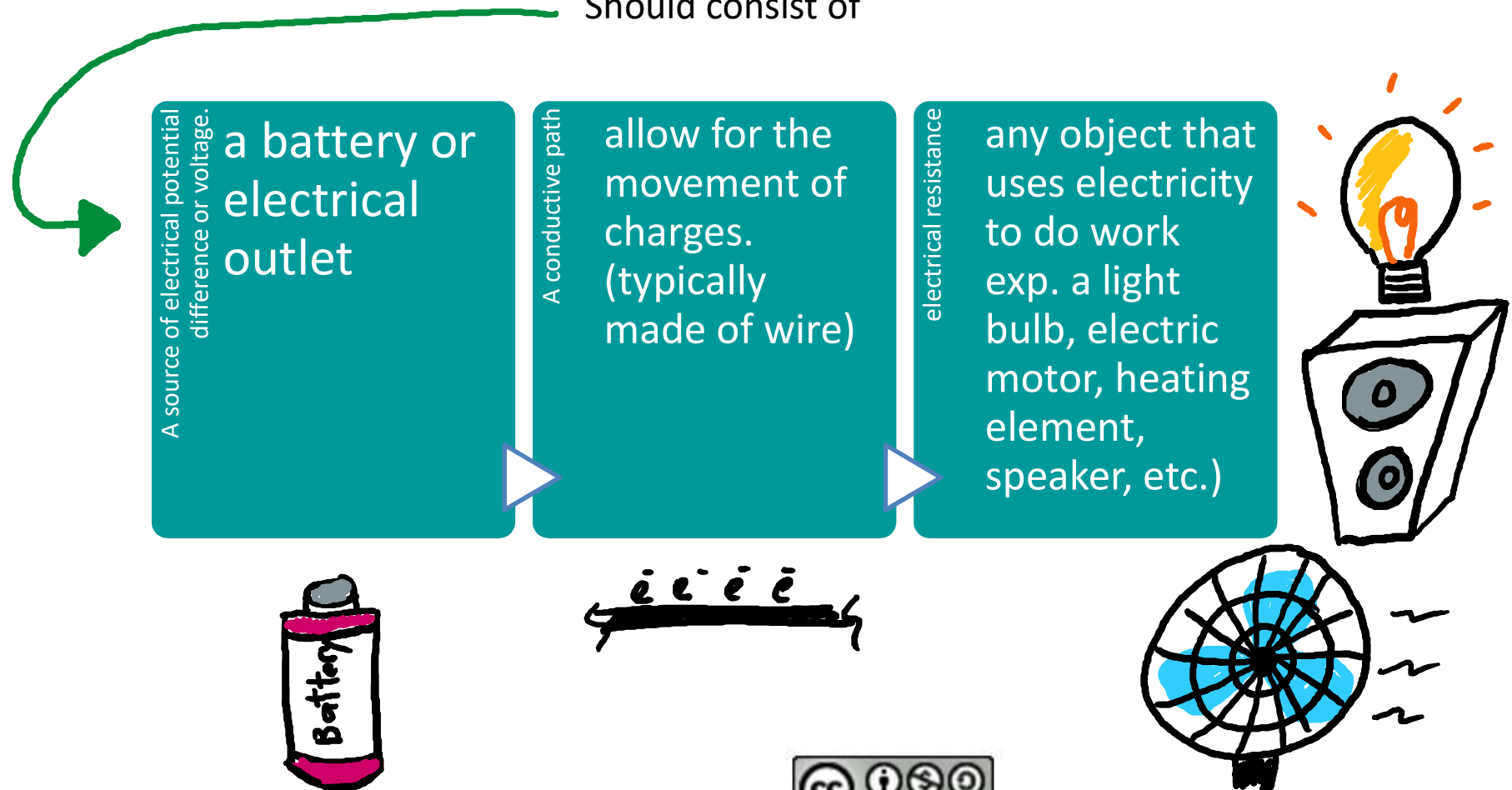
(b)



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SIMPLE ELECTRIC CIRCUIT

Should consist of



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ELECTRICAL QUANTITIES: SYSTEMS OF UNITS

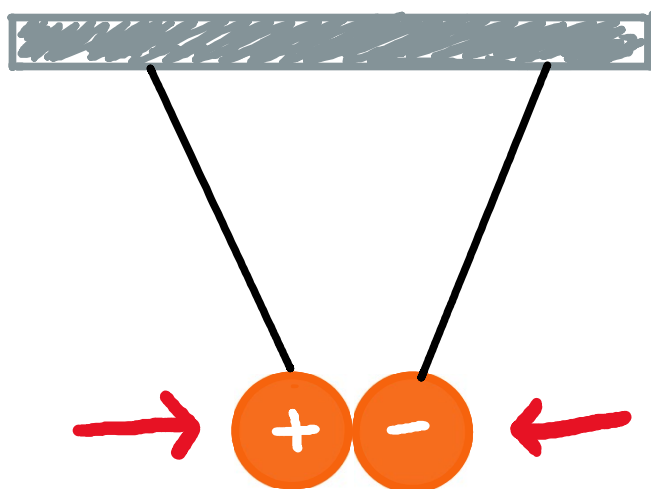
International System of Units(SI):
International measurement language which enables engineers to communicate their results.

Multiplier	Prefiz	Symbol	Quantity	Basic Units	Symbol
10^{18}	exa	E	Length	meter	m
10^{15}	peta	P	Mass	kilogram	kg
10^{12}	tera	T	Time	Second	S
10^{12}	giga	G	Electric current	Ampere	A
10^9	mega	M	Thermodynamic temperature	Kelvin	K
10^6	kilo	k	Luminous intensity	Candela	cd
10^3	hecto	h			
10^2	deka	da			
10	deci	d			
10^{-1}	centi	c			
10^{-2}	milli	m			
10^{-3}	micro	μ			
10^{-6}	nano	n			
10^{-12}	pico	p			
10^{-15}	femto	f			
10^{-18}	atto	a			

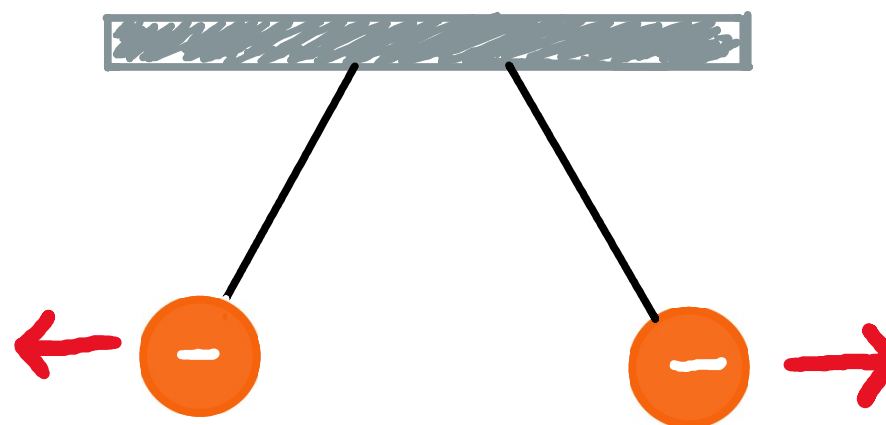


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Opposite charge attract



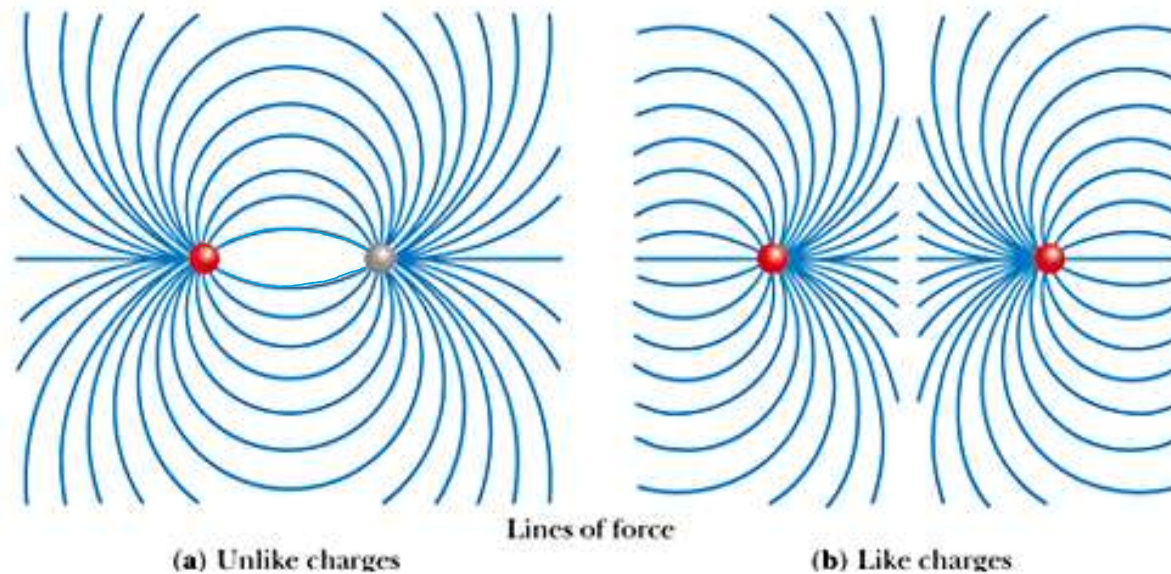
Like charge repel



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FORCE FIELDS ASSOCIATED WITH CHARGED PARTICLES

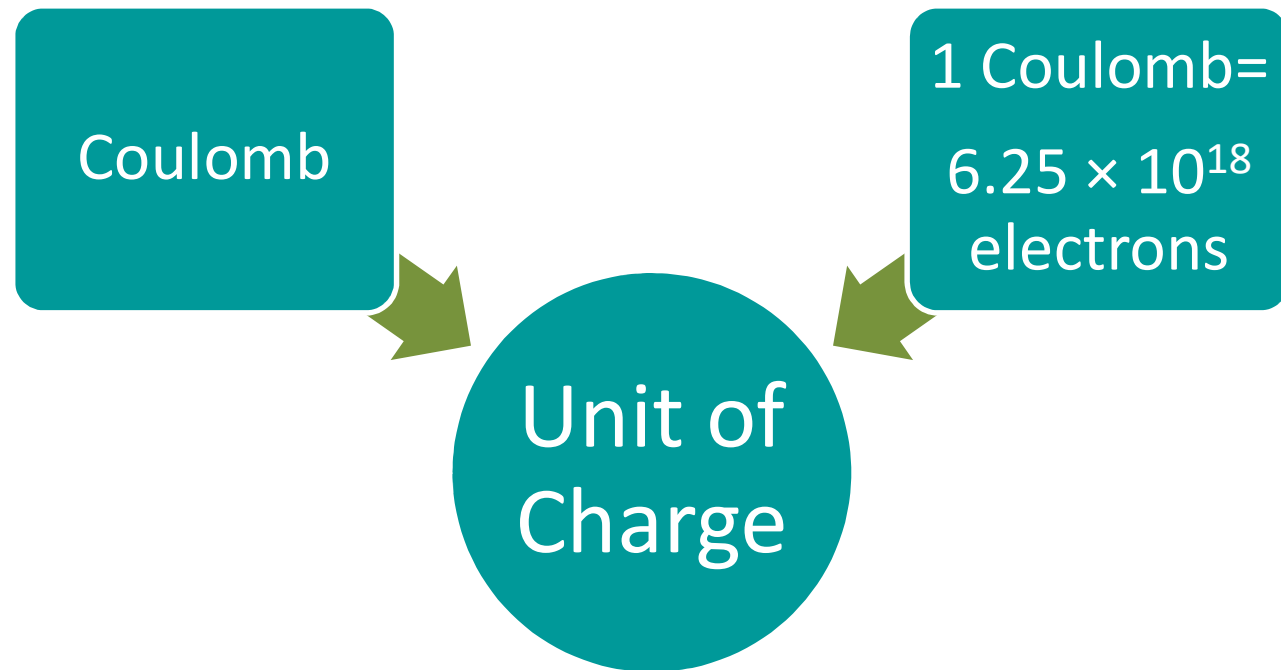
- Lines of force between charges



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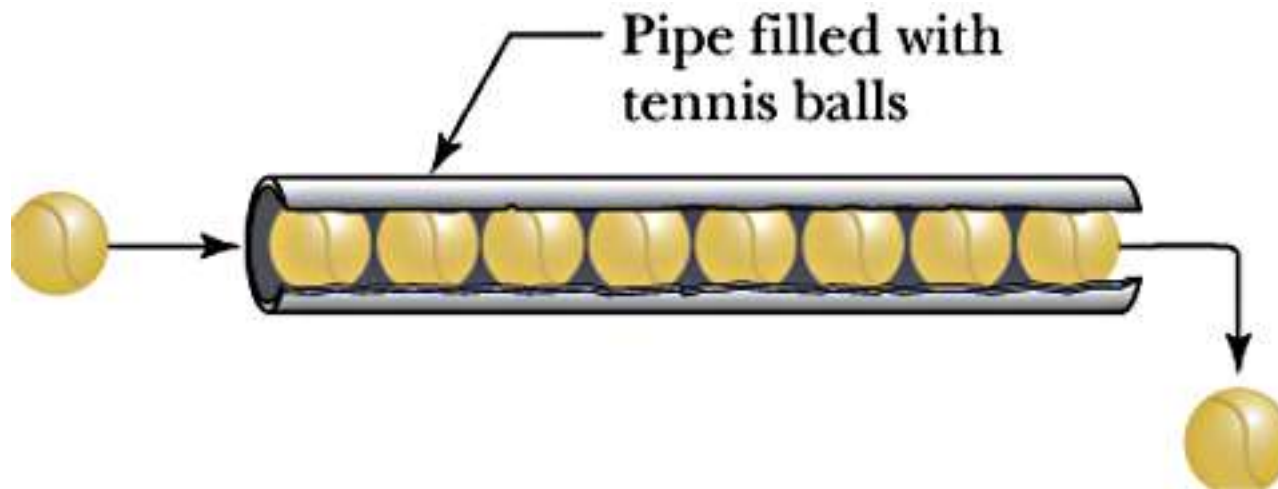
THE UNIT OF CHARGE



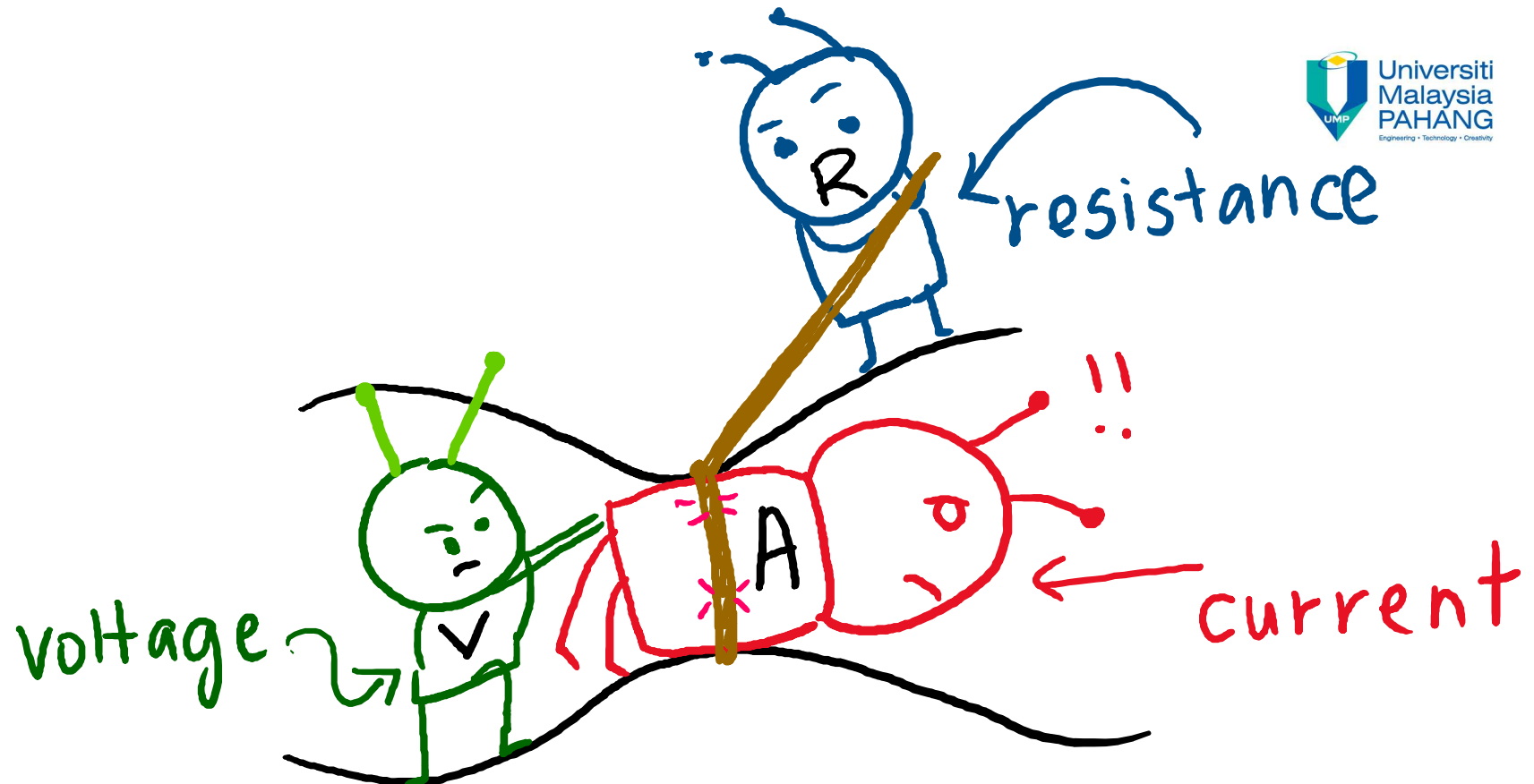
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CURRENT FLOW

- Analogy for the concept of current flow



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Can you explain ?



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CURRENT DEFINITION



$$i = \frac{dq}{dt}$$

i = current flow (amperes)

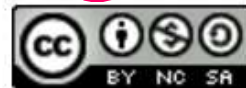
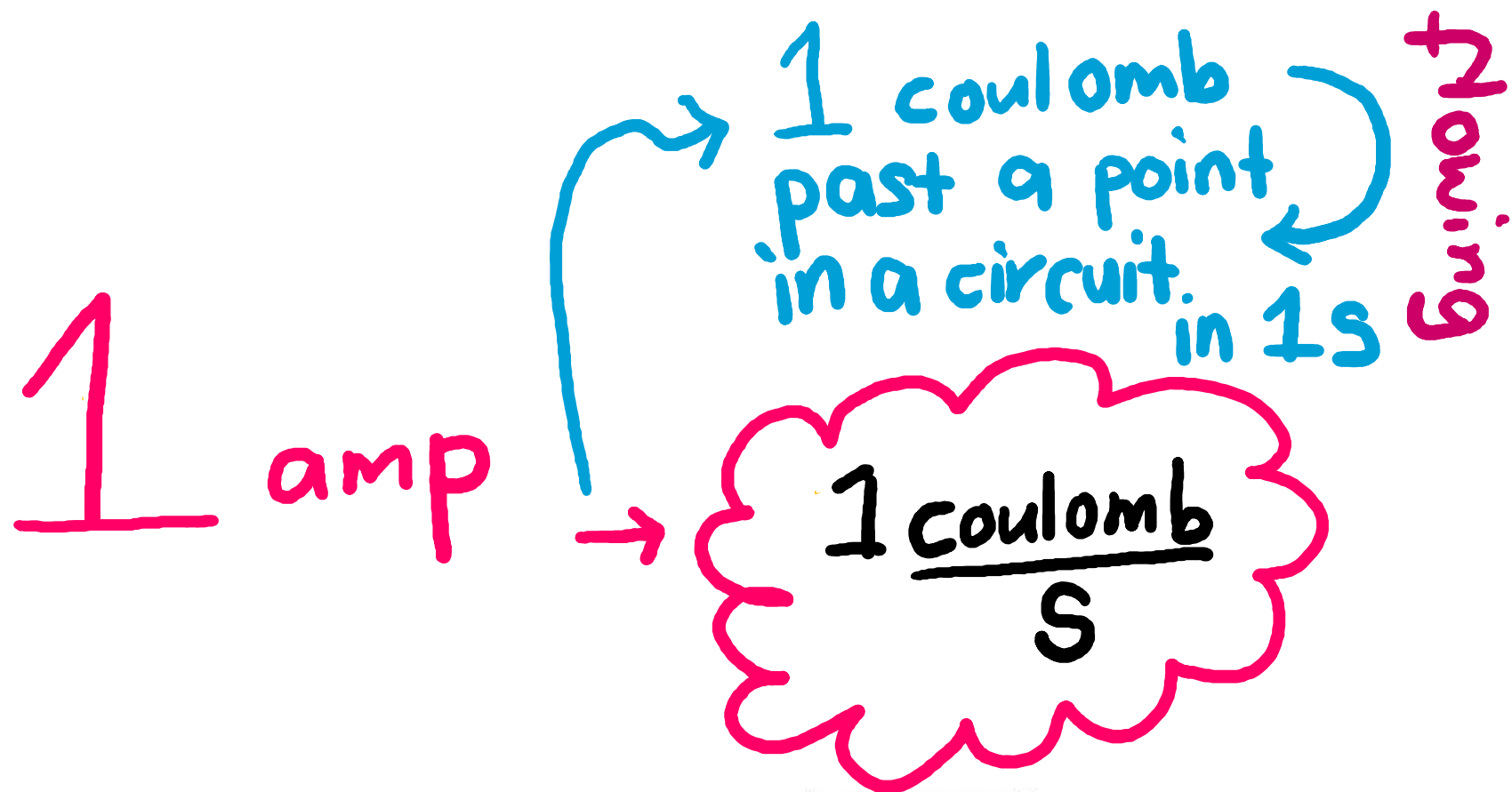
q = charge (coulombs)

t = time (seconds)



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CURRENT FLOW

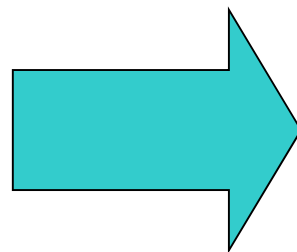


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CURRENT

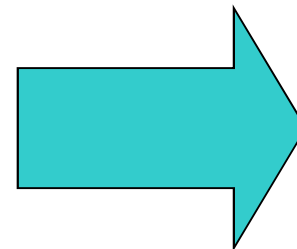
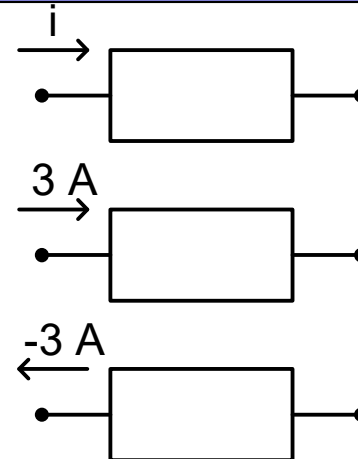
2 Informations

Unit : Ampere



Arrow

Direction of
current flow



Value

Variable or
a known value

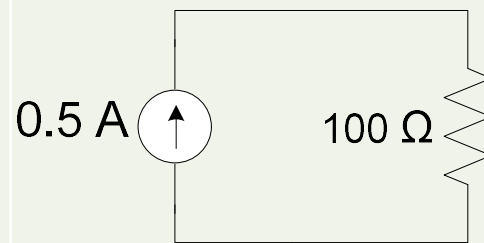
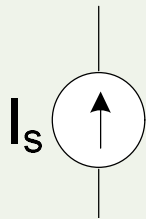
$I \times 20A$



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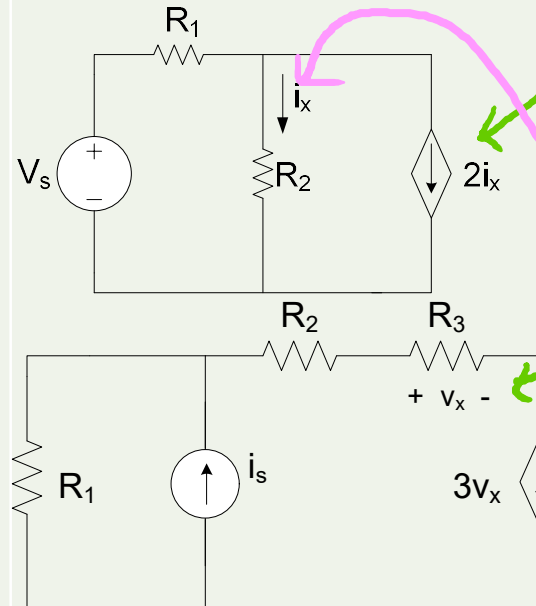
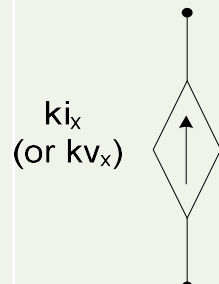
ACTIVE ELEMENT: CURRENT SOURCE

Independent



The I_s through the source is completely independent of the voltage across the source

Dependent



DCS " $2i_x$ " depends on the current " i_x " which is at another location in the circuit.

The value of the current " $3v_x$ " depends on the value of the voltage " v_x ".

VOLTAGE

When a current flows through a circuit element, it develops a voltage drop across the terminals of that element.



The voltage across an element is the work (energy W) required to move a unit positive charge from the -ve terminal to the +ve terminal.

$$v = \frac{dw}{dq}$$

When work is linear in the formula reduces to: \rightarrow (here, Q is total charge and w is total work).

$$v = \frac{w}{Q}$$

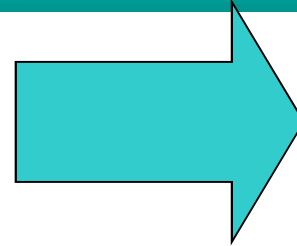
volt = joule/coulomb or $V = J/C$

.bdullah

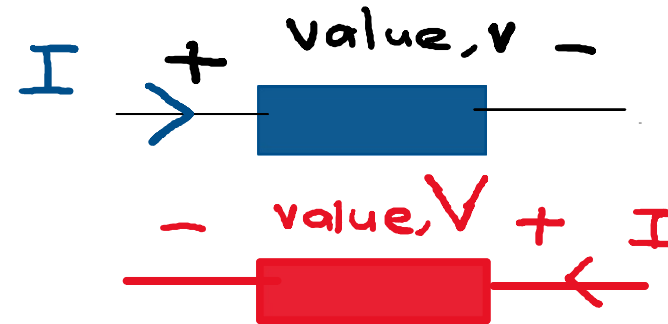
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VOLTAGE

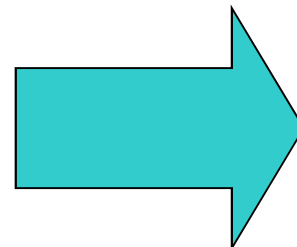


+ / - sign
Voltage
reference direction



2 Informations

Unit : Volts



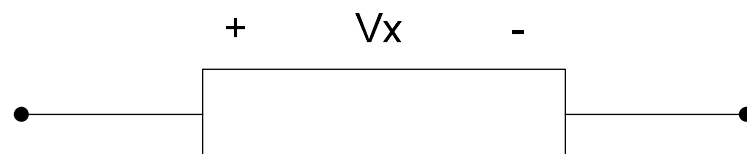
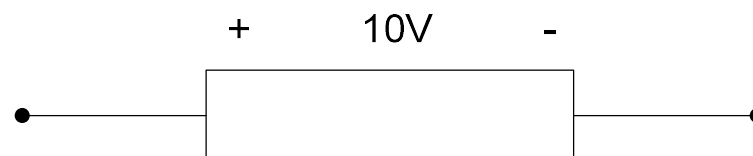
Value
variable or
a known value

V_x
 1 V

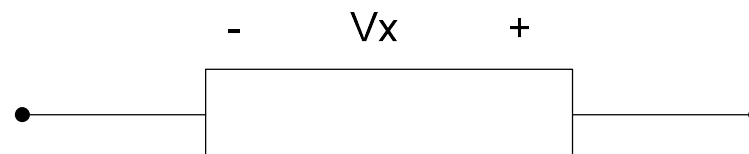


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How to identify the voltage value?

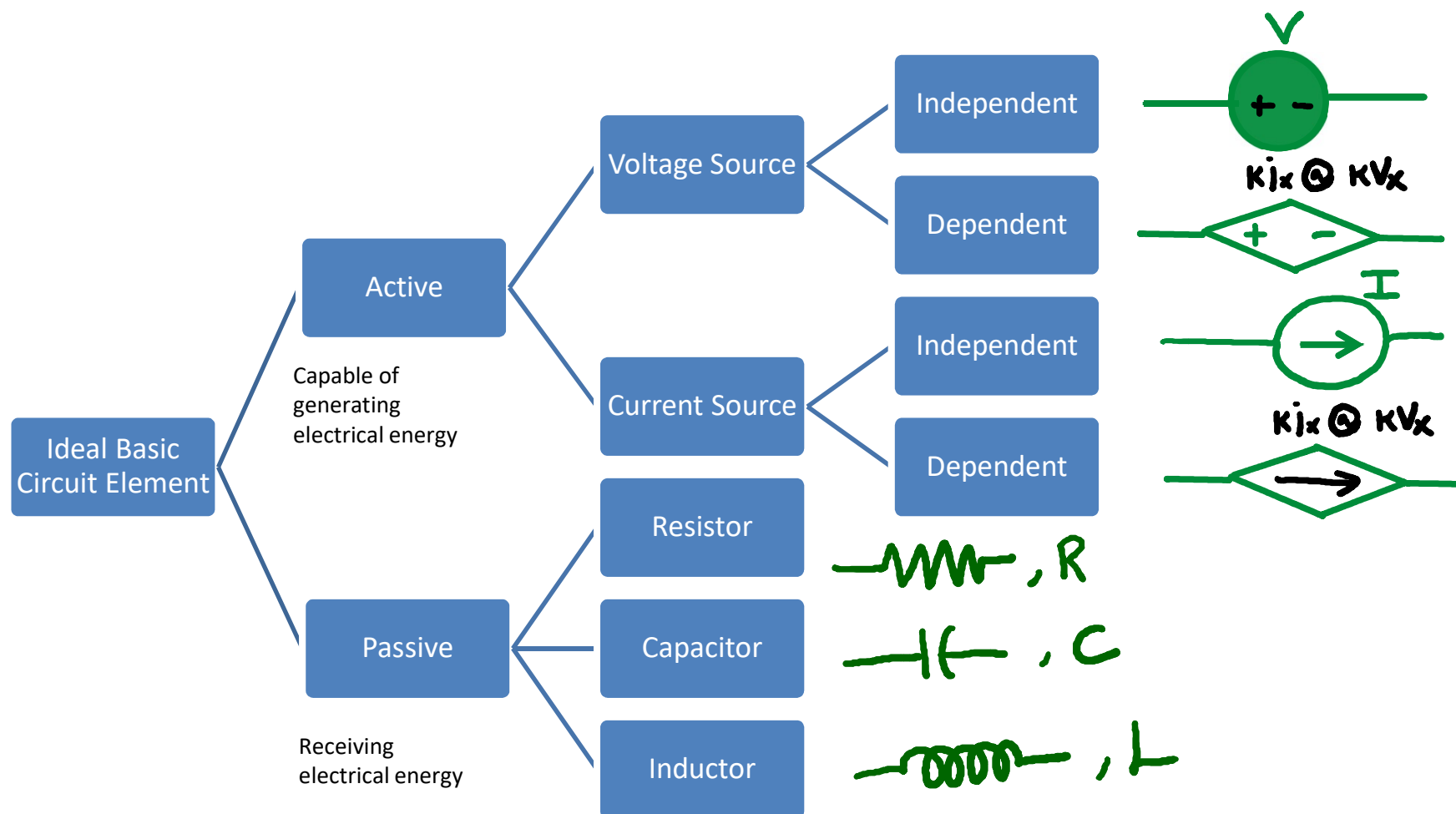


$$V_x = 10 \text{ V}$$



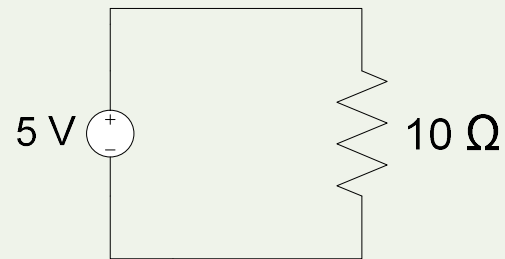
$$V_x = -10 \text{ V}$$





ACTIVE ELEMENT: VOLTAGE SOURCE

Independent

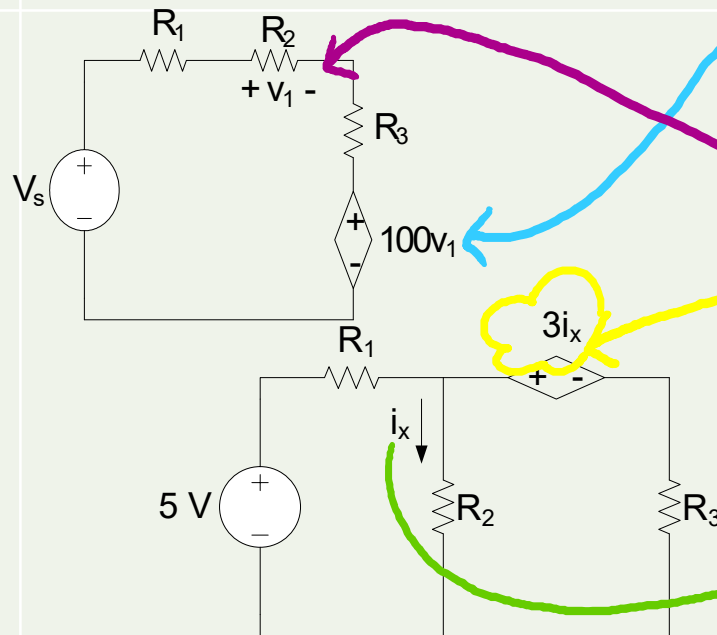


The 5V across the source is completely independent of the current through the source.

Dependent



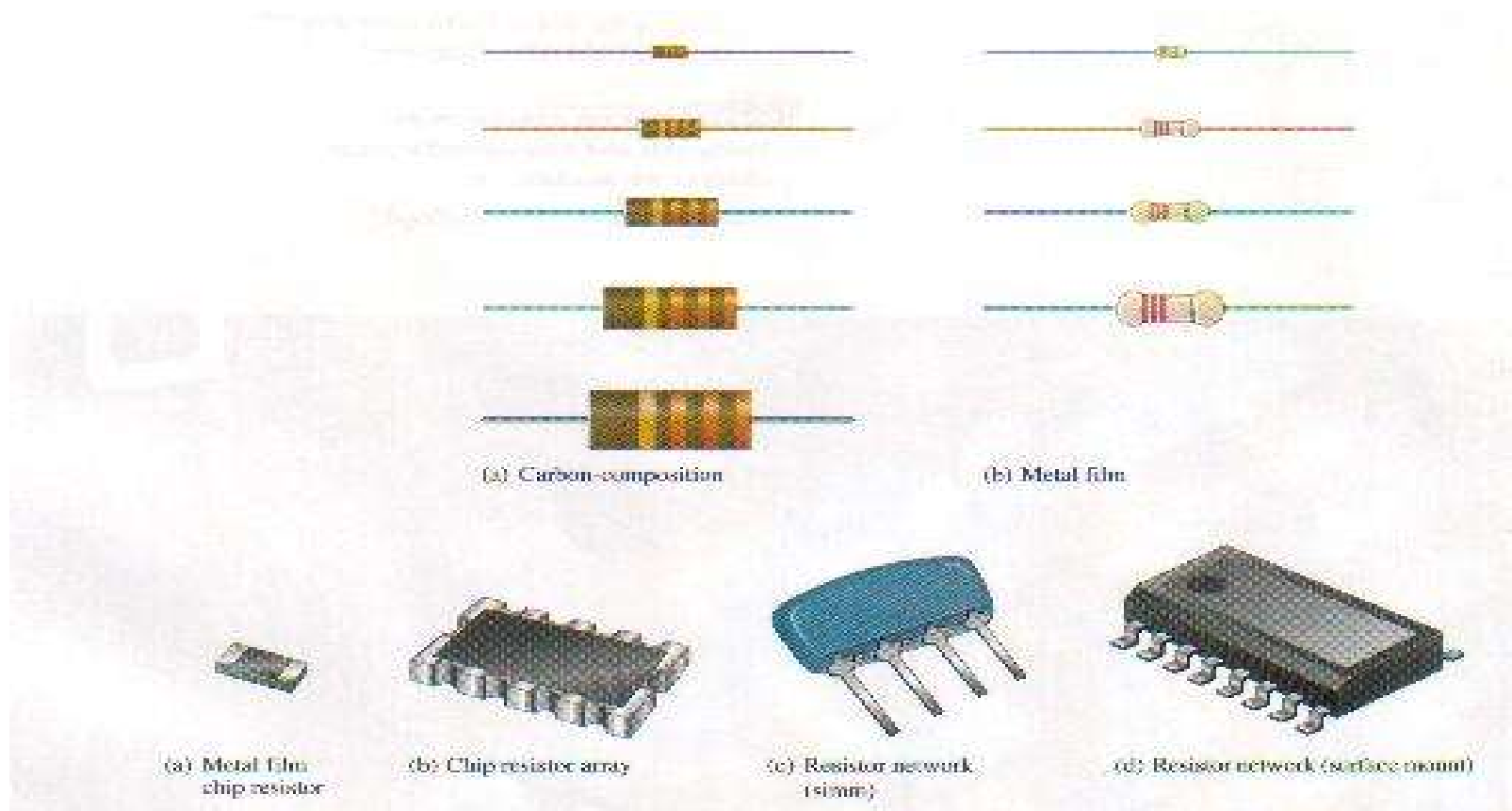
KV_y
 KI_y



DVS " $100V_1$ " depends on the voltage " V_1 " which is at another location in the circuit.

The value of the voltage " $3i_x$ " depends on the value of the current " i_x ".

Resistors



Source
<http://slideplayer.com>



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Capacitors



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Inductors



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