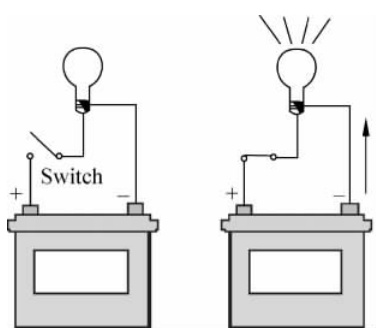
Unit 3

Text A Simple Electrical Circuit

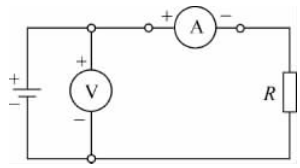
1. An electric circuit

A fundamental relationship exists between current, voltage, and resistance. A simple electrical circuit consists of a voltage source, some type of load, and a conductor to allow electrons to flow between the voltage source and the load.[1] In the following circuit a battery provides the voltage source, electrical wire is used for the conductor, and a light provides the resistance. An additional component has been added to this circuit, a switch. There must be a complete path for current to flow. If the switch is open, the path is incomplete and the light will not illuminate. Closing the switch completes the path, allowing electrons to leave the negative terminal and flow through the light to the positive terminal.



2. An electrical circuit schematic

The following schematic is a representation of an electrical circuit, consisting of a battery, a resistor, a voltmeter and an ammeter. The ammeter, connected in series with the circuit, will show how much current flows in the circuit. The voltmeter, connected across the voltage source, will show the value of voltage supplied from the battery. Before an analysis can be made of a circuit, we need to understand Ohm's Law.



3. Ohm's Law

The relationship between current, voltage and resistance was studied by the 19th century German mathematician, George Simon Ohm. Ohm formulated a law which states that current varies proportionally with voltage and inversely with resistance. From this law the following formula is derived:

$$I = \frac{U}{R} \quad \text{or} \quad \text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

Ohm's Law is the basic formula used in all electrical circuits. Electrical designers must decide how much voltage is needed for a given load, such as computers, clocks, lamps and motors. Decisions must be made concerning the relationship of current, voltage and resistance. All electrical design and analysis begins with Ohm's Law. There are three mathematical ways to express Ohm's Law. Which of the formulas is used depends on what facts are known before starting and what facts need to be known.

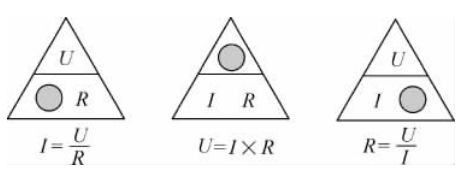
$$I = \frac{U}{R} \quad U = I \times R \quad R = \frac{U}{I}$$

4. Ohm's Law triangle

There is an easy way to remember which formula to use. By arranging current, voltage and resistance in a triangle, one can quickly determine the correct formula.

5. Using the triangle

To use the triangle, cover the value you want to calculate. The remaining letters make up the formula. [2]



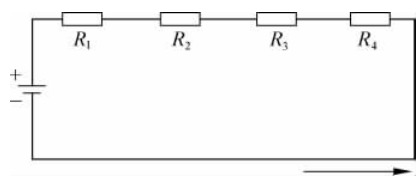
Ohm's Law can only give the correct answer when the correct values are used. Remember the following three rules:

- Current is always expressed in amperes or amp.
- Voltage is always expressed in volt.
- Resistance is always expressed in ohm.

DC Series Circuit

1. Resistance in a series circuit

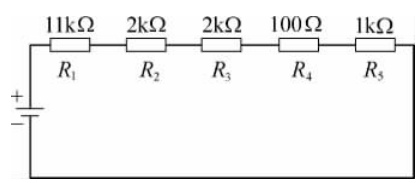
A series circuit is formed when a number of resistors are connected end-to-end so that there is only one path for current to flow. [3] The resistors can be actual resistors or other devices that have resistance. The illustration shows four resistors connected end-to-end. There is one path of electron flow from the negative terminal of the battery through R_4, R_3, R_2, R_1 returning to the positive terminal.



2. Formula for series resistance

The values of resistance add in a series circuit. If a 4Ω resistor is placed in series with a 6Ω resistor, the total value will be 10Ω. This is true when other types of resistive devices are placed in series. The mathematical formula for resistance in series is

$$R_t = R_1 + R_2 + R_3 + R_4$$



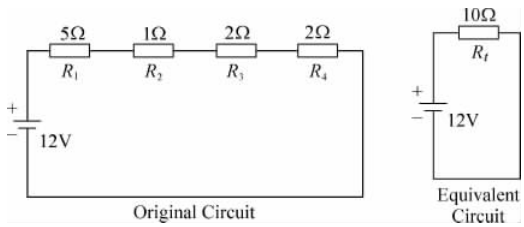
Given a series circuit where R_1 is $11\text{k}\Omega$, R_2 is $2\text{k}\Omega$, R_3 is $2\text{k}\Omega$, R_4 is 100Ω, and R_5 is $1\text{k}\Omega$, what is the total resistance?

$$\begin{aligned} R_t &= R_1 + R_2 + R_3 + R_4 + R_5 \\ &= 11\,000 + 2\,000 + 2\,000 + 100 + 1\,000 \\ &= 16\,100\Omega \end{aligned}$$

3. Current in a series circuit

The equation for total resistance in a series circuit allows us to simplify a circuit. Using Ohm's Law, the value of current can be calculated. Current is the same anywhere when it is measured in a series circuit.

$$I = \frac{U}{R} = \frac{12}{10} = 1.2\text{A}$$

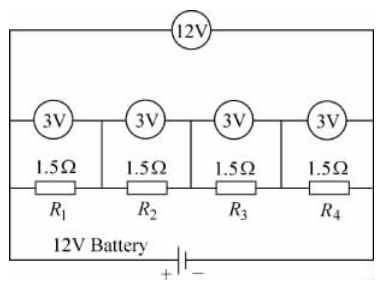


4. Voltage in a series circuit

Voltage can be measured across each of the resistors in a circuit. The voltage across a resistor is referred to as a voltage drop. A German physicist, Kirchhoff, formulated a law which states the sum of the voltage drops across the resistances of a closed circuit equals the total voltage applied to the circuit. [4] In the following illustration, four equal value resistors of 1.5Ω each have been placed in series with a 12V battery. Ohm's Law can be applied to show that each resistor will "drop" an equal amount of voltage.

First, solve for total resistance:

$$R_t = R_1 + R_2 + R_3 + R_4 = 1.5 + 1.5 + 1.5 + 1.5 = 6\Omega$$



Second, solve for current:

$$I = \frac{U}{R} = \frac{12}{6} = 2\text{A}$$

Third, solve for voltage across any resistor:

$$U = I \times R = 2 \times 1.5 = 3\text{V}$$

If voltages were measured across any single resistor, the voltmeter would read 3V. [5] If voltage were measured across a combination of R_3 and R_4 the voltmeter would read 6V. If voltage were measured across a combination of R_2, R_3, and R_4 the voltmeter would read 9V. If the voltage drops of all four resistors were added together the sum would be 12V, the original supply voltage of the battery.

5. Voltage division in a series circuit

It is often desirable to use a voltage potential that is lower than the supply voltage. To do this, a voltage divider can be used. The battery represents U_I which in this case is 50V. The desired voltage is represented by U_O which mathematically works out to be 40V. To calculate this voltage, first solve for total resistance:

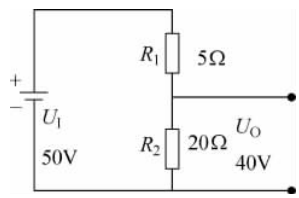
$$R_t = R_1 + R_2 = 5 + 20 = 25\Omega$$

Second, solve for current:

$$I = \frac{U_1}{R_t} = \frac{50}{25} = 2\text{A}$$

Finally, solve for voltage:

$$U_0 = I \times R_2 = 2 \times 20 = 40\text{V}$$



New Words and Phrases

circuit	['sə:kit]	*n.* 电路,一圈,周游,巡回
fundamental	[ˌfʌndə'mentl]	*adj.* 基础的,基本的
consist of		由……组成
load	[ləud]	*n.* 负荷,负载,加载
battery	['bætəri]	*n.* 电池
component	[kəm'pəunənt]	*n.* 成分
switch	[switʃ]	*n.* 开关,电闸,转换
illuminate	[i'lju:mineit]	*vt.* 阐明,说明(问题等),照明,照亮
negative	['negətiv]	*n.* 否定,负数
		adj. 否定的,消极的,负的,阴性的
		vt. 否定,拒绝(接受)
positive	['pɔzətiv]	*adj.* 阳的
		adj. 肯定的,积极的,绝对的,确实的
		adj. [数]正的
schematic	[ski'mætik]	*adj.* 示意性的
		n. 电路原理图
voltmeter	['vəultˌmi:tə(r)]	*n.* 电压表
ammeter	['æmitə]	*n.* 电流表
Ohm's Law		欧姆定律
mathematician	[ˌmæθimə'tiʃən]	*n.* 数学家
vary	['vɛəri]	*vt.* 改变,变更,使多样化
		vi. 变化,不同,违反
inverse	['in'və:s]	*adv.* 相反地,倒转地
derive	[di'raiv]	*vt.* 得自
		vi. 起源

designer	[di'zainə(r)]	*n.* 设计者
lamp	[læmp]	*n.* 灯
relationship	[ri'leiʃənʃip]	*n.* 关系,关联
analysis	[ə'nælisis]	*n.* 分析,分解
triangle	['traiæŋgl]	*n.* 三角形
calculate	['kælkjuleit]	*vt.* & *vi.* 计算,考虑,计划,打算
		vt. & *vi.* (美)以为,认为
series circuit		串联电路
equation	[i'kweiʃən]	*n.* 相等,平衡,综合体,因素,方程式,等式
series resistance		串联电阻
be referable to		可归因于,与……有关
voltage drop		电压降
meter	['mi:tə]	*n.* 仪表,米,计,表
divider	[di'vaidə]	*n.* 分割者,间隔物,分配器

Notes

[1] A simple electric circuit consists of a voltage source, some type of load, and a conductor to allow electrons to flow between the voltage source and the load.

本句中的谓语动词是 consist of,意为“由……组成”。to allow electrons to flow between the voltage source and the load 修饰的是 conductor,表明是什么样的导线,而不是整个句子。

[2] To use the triangle, cover the value you want to calculate. The remaining letters make up the formula.

这两个句子关系紧密,要联系起来理解。后一个句子表明的是使用三角形,盖住要计算的值的结果,剩下的字母组成公式。

[3] A series circuit is formed when a number of resistors are connected end-to-end so that there is only one path for current to flow.

本句中的 end-to-end 不能凭字面理解为尾对尾,而是首尾相连的意思。so that 引导了一个结果状语从句。when 引导的从句作状语,指明串联电路形成的条件。

[4] A German physicist, Kirchhoff, formulated a law which states the sum of the voltage drops across the resistances of a closed circuit equals the total voltage applied to the circuit.

看懂这个句子的关键是分析它的句子结构。这是一个多层从句的句子。全句的主语是 A German physicist,谓语是 formulated,宾语是 a law,Kirchhoff 是同位语。which 引导的定语从句修饰 a law。在该定语从句中,which 作主语,states 是谓语动词,states 后又是一个宾语从句,省略了引导词 that。在这个宾语从句中,主语为 the sum of the voltage drops,谓语为 equals,宾语为 the total voltage。结构清楚后,整个句子的意思就一目了然了:德国物理学家陈述了一条定律,定律的内容是,穿过闭路电阻的电压降的总和等于这个回路上的电压。

[5] If voltage were measured across any single resistor, the voltmeter would read 3V.

注意,“表的读数为……”的表达是本句中的 volt meter would read,而不是 voltmeter would be read。read 应理解“显示,指示”。例如,The dial reads 32. 刻度显示出 32。

Exercises

【Ex. 1】 根据课文内容,回答以下问题。

(1) What does Ohm's Law state?

(2) According to the passage, how to use the triangle?

(3) What is a series circuit?

(4) How do we measure the voltage drop of each of the resistors in a circuit?

(5) If three resistors of 10Ω, 20Ω and 30Ω respectively have been placed in series with a 12V battery, what is the voltage drop of each of the resistors in a circuit?

【Ex. 2】 根据下面的英文解释,写出相应的英文词汇。

英 文 解 释	词　　汇
a closed path followed or capable of being followed by an electric current	
a device used to break or open an electric circuit or to divert current from one conductor to another	
a position in a circuit or device at which a connection is normally established or broken	
an instrument, such as galvanometer, for measuring potential differences in volts	
an instrument that measures electric current	
a device that generates light, heat, or therapeutic radiation	
a device that converts any form of energy into mechanical energy, especially an internal-combustion engine or an arrangement of coils and magnets that converts electric current into mechanical power	
scientist who specializes in physics	
the work required to bring a unit electric charge, magnetic pole, or mass from an infinitely distant position to a designated point in a static electric, magnetic, or gravitational field, respectively	
the international standard unit of length, approximately equivalent to 39.37 inches. It was redefined in 1983 as the distance traveled by light in a vacuum in 1/299 792 458 second	

【Ex. 3】 把下列句子翻译为中文。

(1) A power supply could be something as simple as a 9V battery or it could be as complex as a precision laboratory power supply.

(2) Variable resistors are common components. They have a dial or a knob that allows you to change the resistance. This is very useful for many situations.

(3) Diodes are components that allow current to flow in only one direction. They have a positive side and a negative side.

(4) LEDs use a special material which emits light when current flows through it. Unlike light bulbs, LEDs never burn out unless their current limit is reached.

(5) Well the letter L stands for inductance. The simplest inductor is consists of a piece of wire.

(6) Two metallic plates separated by a non-conducting material between them make a simple capacitor.

(7) The time required for a capacitor to reach its maximum charge is proportional to the capacitance value and the resistance value.

(8) When AC current flows through an inductance a opposite emf or voltage develops opposing any change in the initial current.

(9) Reactance is the property of resisting or impeding the flow of AC current or AC voltage in inductors and capacitors.

(10) To produce a drift of electrons, or electric current, along a wire it is necessary that there be a difference in "pressure" or potential between the two ends of the wire. This potential

difference can be produced by connecting a source of electrical potential to the ends of the wire.

【Ex. 4】 把下列短文翻译成中文。

Switches are devices that create a short circuit or an open circuit depending on the state of the switch. For a light switch, ON means short circuit (current flows through the switch, lights light up). When the switch is OFF, that means there is an open circuit (no current flows, lights go out). When the switch is ON it looks and acts like a wire. When the switch is OFF there is no connection.

【Ex. 5】 通过 Internet 查找资料,借助如"金山词霸"等电子词典和辅助翻译软件,完成以下技术报告。通过 E-mail 发送给老师,并附上你收集资料的网址。

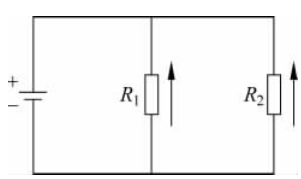
(1) 一个电路包括哪些主要元件,各种元件由哪些公司生产(附上各种最新产品的图片)。

(2) 叙述德国物理学家基尔霍夫的生平简历及其重大贡献。

Text B DC Parallel Circuit

1. Resistance in a parallel circuit

A parallel circuit is formed when two or more resistances are placed in a circuit side-by-side so that current can flow through more than one path. The illustration shows two resistors placed side-by-side. There are two paths of current flow. One path is from the negative terminal of the battery through R_1 returning to the positive terminal. The second path is from the negative terminal of the battery through R_2 returning to the positive terminal of the battery.



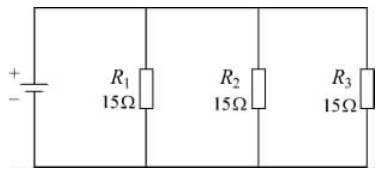
2. Formula for equal value resistors in a parallel circuit

To determine the total resistance when resistors are of equal value in a parallel circuit, use the following formula:

$$R_t = \frac{\text{Value of one resistor}}{\text{Number of resistors}}$$

In the following illustration there are three 15Ω resistors. The total resistance is

$$R_t = \frac{\text{Value of one resistor}}{\text{Number of resistors}} = \frac{15}{3} = 5\Omega$$



3. Formula for unequal resistors in a parallel circuit

There are two formulas to determine total resistance for unequal value resistors in a parallel circuit. The first formula is used when there are three or more resistors. The formula can be extended for any number of resistors.

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

In the following illustration there are three resistors, each has different value. The total resistance is

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

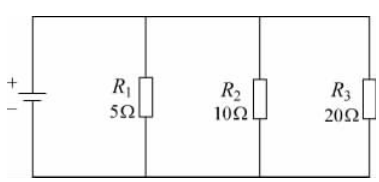
$$\frac{1}{R_t} = \frac{1}{5} + \frac{1}{10} + \frac{1}{20} \qquad \text{Insert value of the resistors}$$

$$= \frac{4}{20} + \frac{2}{20} + \frac{1}{20} \qquad \text{Find lowest common multiple}$$

$$= \frac{7}{20} \qquad \text{Add the numerators}$$

$$\frac{R_t}{1} = \frac{20}{7} \qquad \text{Invert both sides of the equation}$$

$$R_t = 2.86\Omega \qquad \text{Divide}$$



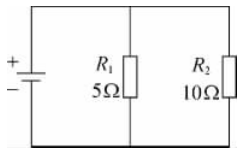
The second formula is used when there are only two resistors.

$$R_t = \frac{R_1 \times R_2}{R_1 + R_2}$$

In the following illustration there are two resistors, each has different value. The total resistance is

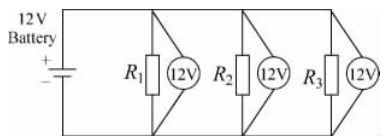
$$R_t = \frac{R_1 \times R_2}{R_1 + R_2} = \frac{5 \times 10}{5 + 10}$$

$$= \frac{50}{15} \approx 3.33\Omega$$



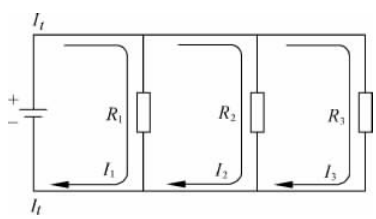
4. Voltage in a parallel circuit

When resistors are placed in parallel across a voltage source, the voltage is the same across each resistor. In the following illustration three resistors are placed in parallel across a 12V battery. Each resistor has 12V available to it.



5. Current in a parallel circuit

Current flowing through a parallel circuit divides and flows through each branch of the circuit.

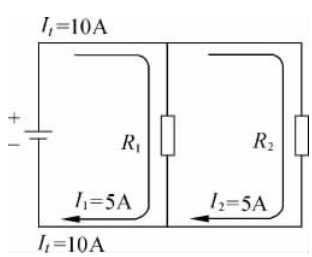


Total current in a parallel circuit is equal to the sum of the current in each branch. The following formula applies to current in a parallel circuit

$$I_t = I_1 + I_2 + I_3$$

6. Current flow with equal value resistors in a parallel circuit

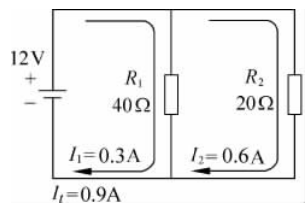
When equal resistances are placed in a parallel circuit, current flow is the same in each branch. In the following circuit R_1 and R_2 are of equal value. If total current (I_t) is 10A, then 5A would flow through R_1 and 5A would flow through R_2.



$$I_t = I_1 + I_2 = 5\text{A} + 5\text{A} = 10\text{A}$$

7. Current flow with unequal value resistors in a parallel circuit

When unequal value resistors are placed in a parallel circuit, current flow is not the same in every circuit branch. Current is greater through the path of least resistance. In the following circuit R_1 is 40Ω and R_2 is 20Ω. Small value of resistance means less current flow. More current will flow through R_2 than R_1.



Using Ohm's Law, the total current for the circuit can be calculated.

$$I_1 = \frac{U}{R_1} = \frac{12\text{V}}{40\Omega} = 0.3\text{A}$$

$$I_2 = \frac{U}{R_2} = \frac{12\text{V}}{20\Omega} = 0.6\text{A}$$

$$I_t = I_1 + I_2 = 0.3\text{A} + 0.6\text{A} = 0.9\text{A}$$

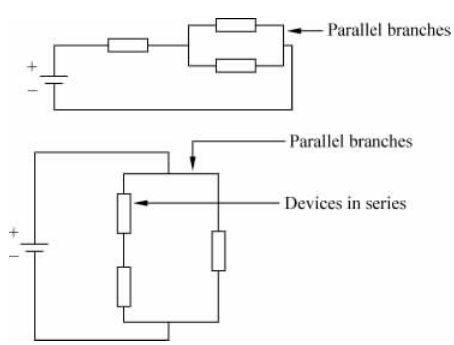
Total current can also be calculated by the first calculating total resistance, then applying the formula for Ohm's Law.

$$R_t = \frac{R_1 \times R_2}{R_1 + R_2} = \frac{40\Omega \times 20\Omega}{40\Omega + 20\Omega} = \frac{800\Omega^2}{60\Omega} \approx 13.333\Omega$$

$$I_t = \frac{U}{R_t} = \frac{12\text{V}}{13.333\Omega} \approx 0.9\text{A}$$

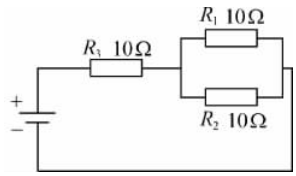
8. Series-parallel circuit

Series-parallel circuit is also known as compound circuit. At least three resistors are required to form a series-parallel circuit. The following illustrations show two ways a series-parallel circuit could be formed.



9. Simplifying a series-parallel circuit to a series circuit

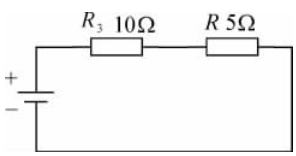
The formulas required for solving current, voltage and resistance problems have already been defined. To solve series-parallel circuit, simplify the compound circuits to equivalent simple circuits. In the following illustration R_1 and R_2 are parallel with each other. R_3 is in series with the parallel circuit of R_1 and R_2.



First, use the formula to determine total resistance of a parallel circuit to find the equivalent resistance of R_1 and R_2. When the resistors in a parallel circuit are equal, the following formula is used:

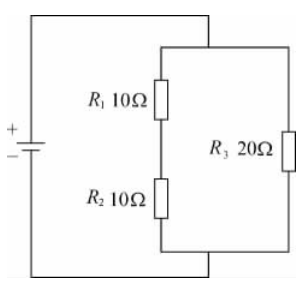
$$R = \frac{\text{Value of any one resistor}}{\text{Number of resistors}} = \frac{10\Omega}{2} = 5\Omega$$

Second, redraw the circuit showing the equivalent values. The result is a simple series circuit which uses already learned equations and methods of problem solving.



10. Simplifying a series-parallel circuit to a parallel circuit

In the following illustration R_1 and R_2 are in series with each other. R_3 is in parallel with the series circuit of R_1 and R_2.



First, use the formula to determine total resistance of the series circuit to find the total resistance of R_1 and R_2. The following formula is used:

$$R = R_1 + R_2 = 10\Omega + 10\Omega = 20\Omega$$

Second, redraw the circuit showing the equivalent values. The result is a simple parallel circuit which uses already learned equations and methods of problem solving.

New Words and Phrases

parallel circuit		并联电路
side-by-side		*adj.* 并肩的,并行的
equal value resistors		等值电阻
multiple	['mʌltipl]	*n.* 倍数,若干
lowest common multiple		最小公倍数
numerator	['nju:məreitə]	*n.* 分子
invert	[in'və:t]	*adj.* 转化的
		vt. 使颠倒,使转化
		n. 颠倒的事物
amp	[æmp]	*n.* 安培
branch	[brɑ:ntʃ]	*n.* 枝,分支,支流,支脉
apply to		将……应用于
flow through		流过
series-parallel		串-并联
compound	['kɔmpaund]	*n.* 混合物,[化]化合物
		adj. 复合的
		vt. & *vi.* 混合,配合
compound circuits		复合电路
parallel branch		并联分支
simplify	['simplifai]	*vt.* 单一化,简单化
reduce	[ri'dju:s]	*vt.* 减少,缩小,简化,还原
equivalent	[i'kwivələnt]	*adj.* 相等的,相当的,同意义的
		n. 等价物,相等物
method	['meθəd]	*n.* 方法
redraw	[ri:'drɔ:]	*vt.* 重画
		vi. 刷新(屏幕)

Exercises

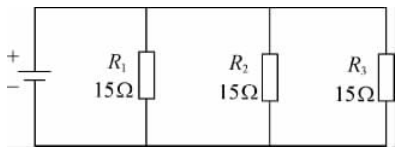
【Ex. 6】 根据文章所提供的信息判断正误。

(1) A parallel circuit is formed when two or more resistances are placed in a circuit side by-side so that current can flow through only one path.

(2) To determine the equivalent resistance when resistors are of equal value in a parallel circuit, use the following formula

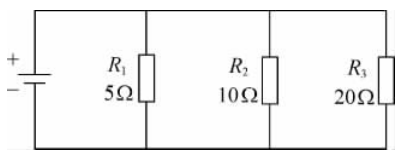
$$R_t = \frac{\text{Value of one resistor}}{\text{Number of resistors}}$$

(3) In the following illustration there are three 15Ω resistors. The equivalent resistance is 45Ω.



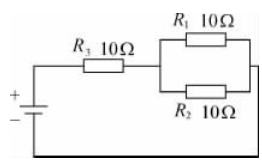
(4) In the following illustration there are three resistors, each has different value. The equivalent resistance is

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$



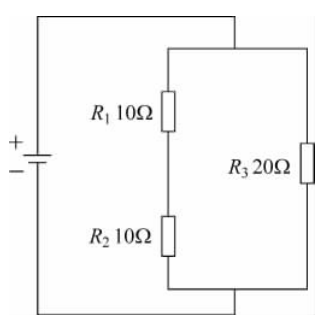
(5) When resistors are placed in series across a voltage source, the voltage is the same across each resistor.

(6) Current flowing through a parallel circuit divides and flows through each branch of the circuit. Total current in a parallel circuit is equal to the sum of the current in each branch.



(7) When different resistances are placed in a parallel circuit, current flow is the same in each branch.

(8) Series-parallel circuit is also known as compound circuits. At least more than two resistors are required to form a series-parallel circuit.



(9) In the following illustration R_1 and R_2 are series with each other. R_3 is in parallel with the series circuit of R_1 and R_2.

(10) In the following illustration, the total resistance is 105Ω.

科技英语翻译知识　词义的引申

科技英语的理论准确,所下的定义、定律和定理精确,所描绘的概念、叙述的生产工艺过程清楚。但是在英译汉时,经常会出现某些词在字典上找不到适当的词义的情况。如果生搬硬套,译文则生硬晦涩,不能确切表达原意,甚至有时造成误译。这时就要结合上下文,根据逻辑关系,进行词义引申,才能恰如其分地表达出原意。

1. 概括化或抽象化引申

科技英语常常使用表示具体形象的词来表示抽象的意义。翻译这类词时,一般可将其词义做概括化或抽象化的引申,译文才符合汉语习惯,流畅、自然。例如:

(1) The plan for launching the man-made satellite still lies on the table.

那项发射人造卫星的计划仍被搁置,无法执行。

on the table 按字面意思译成"放在桌子上"语义不通,根据上文意思抽象引申为"无法执行",符合原意。

(2) Military strategy may bear some similarity to the chessboard but it is dangerous to carry the analogy too far.

打仗的策略同下棋可能有某些相似之处,但是如果把这两者之间的类比搞过了头则是危险的。

chessboard 是"棋盘"的意思。棋盘是实物,打仗的策略是思想,不好类比。因此,这里把具体的"棋盘"引申为概括性的"下棋",就说得通了。

(3) The book is too high-powered for technician in general.

这本书对一般技术人员来说也许内容太深。

high-powered 本意为"马力大",引申为"(艰)深"。

(4) The expense of such an instrument has discouraged its use.

这种仪器很昂贵,使其应用受到了限制。

expense 原意为花费,开支,引申为"(仪器)昂贵"。

(5) Industrialization and environmental degradation seem to go hand in hand.

工业化发展似乎伴随着环境的退化。

hand in hand 原意为"携手",引申为"伴随"。

2. 具体化或形象化引申

科技英语中有用代表抽象概念或属性的词来表示一种具体事物。如按字面译,则难以准确表达原文意思。这时就要根据上下文,对词义加以引申,用具体或形象化的词语表达。例如:

(1) Along the equator it reaches nearly halfway around the globe.

它沿着赤道几乎绕地球半周。

reach halfway 意为"达到一半路程"。本句讨论的是围绕地球旋转,根据这一具体语境,可以将 reach halfway 本来含义形象化引申,译为"绕地球半周"。

(2) The shortest distance between raw material and a finished part is precision casting.

把原料加工成成品的最简便的方法是精密铸造。

shortest distance 原意为“最短距离”,直接按照这一字面意思,句子有失通顺。可以形象化引申为“最简便的方法”。

(3) The foresight and coverage shown by the inventor of the process are most commendable.

这种方法的发明者所表现的远见卓识和渊博知识,给人以良好的印象。

coverage 原意为“覆盖”,引申为“渊博知识”。

(4) The purpose of a driller is to cut holes.

钻床的功能是钻孔。

purpose 原意为“目的”,引申为“功能”。

(5) There are many things that should be considered in determining cutting speed.

在测定切削速度时,应当考虑许多因素。

things 原意为“事情”,具体引申为“因素”。

Reading Material

阅读下列文章。

Text	Note
OrCAD View **Full-Featured Schematic Editor** OrCAD Capture, a flat[1] and hierarchical Schematic Page Editor, is based on OrCAD's legacy of fast, intuitive[2] schematic editing. Schematic Page Editor combines a standard Windows user interface with functionality and features specific to the design engineer for accomplishing design tasks and publishing design data. • Undo and redo schematic edit unlimited times. • Use Label State for "what if" scenarios[3]. • Launch Property Spreadsheet Editor at design or schematic level to edit or print your design properties. • View and edit multiple schematic designs in a single session. • Reuse design data by copying and pasting within or between schematics. • Select parts from a comprehensive[4] set of functional part libraries. • In-line editing of parts to allow pin name and number movement. • File locking in case the design is being open by another user.	[1] *adj.* 平面的 [2] *adj.* 直觉的 [3] *n.* 情况 [4] *adj.* 全面的,广泛的
OrCAD Capture OrCAD Capture® design entry is the most widely used schematic entry system in electronic design today for one simple reason: fast and universal design entry. Whether you're designing a new analog circuit, revising schematic diagram for an existing PCB[5], or designing a digital block diagram with an HDL module, OrCAD Capture provides simple schematic commands you need to enter, modify and verify the design for PCB. • Place, move, drag, rotate, or mirror individual parts or grouped selections while preserving both visual and electrical connectivity[6].	[5] Printed Circuit Board, 印制电路板 [6] *n.* 连通性

- Ensure design integrity through configurable Design and Electrical Rule checkers.
- Create custom title blocks and drawing borders to meet the most exacting specifications.
- Insert drawing objects, bookmarks, logos[7] and bitmapped pictures.
- Choose from metric or imperial[8] unit grid spacing to meet all drawing standards.
- Design digital circuits with VHDL or Verilog Text Editor.

Find and select parts or nets quickly from the OrCAD Capture Project Manager and the multi-window interface makes navigation[9] across hierarchy a breeze.

[7] *n.* 标识
[8] *adj.* 英制的(度量衡)
[9] *n.* 向导,导航

Project Manager Coordinates Design Data

The sophisticated[10] Project Manager simplifies organizing and tracking the various types of data generated in the design process.

[10] *adj.* 老练的,有经验的

An expanding-tree diagram makes it easy to structure and navigate all of your design files, including those generated by PSpice® simulators, Capture CIS and other plug-ins.

- Project Creation Wizard guides you through all the resources available for a specific design flow.
- Centralized management of all design data permits a seamless[11] interchange of schematic data for OrCAD plug-ins and downstream flow.
- Hierarchy browser lets you navigate the entire schematic structure and open specific elements whether it's a schematic page, a part, or net—instantly.
- File tab groups multi-page schematics in folders for flat designs and creates new folders automatically for added levels of hierarchical[12] designs.
- Archive capability ensures the portability[13] of your entire design project.

[11] *adj.* 无缝的,无痕的
[12] *adj.* 分等级的
[13] *n.* 可携带,轻便

Hierarchical Design and Reuse

OrCAD Capture boosts[14] schematic editing efficiency by enabling you to reuse subcircuits[15] without having to make multiple copies. Instead, using hierarchical blocks, you can simply reference the same subcircuit multiple times.

[14] *vt.* & *vi.* 推进
[15] *n.* 支电路

- Enables a single instance of the circuitry[16] for you to create, duplicate and maintain.
- Automatic creation of hierarchical ports eliminates potential design connection errors.
- Update ports and pins dynamically for hierarchical blocks and underlying schematics.
- Reuse OrCAD Layout and Cadence® Allegro® high-speed PCB modules within or between schematics.
- Requires just one instance of the circuitry for you to create and maintain.
- Unlimited referencing and reuse of circuitry throughout your entire design.
- Serve schematic pages from library files.
- Sophisticated Property Editor clearly distinguishes[17] properties in a subcircuit from those in referenced uses allowing you to view and edit from one place.

[16] *n.* 电路,线路
[17] *vt.* & *vi.* 区别,辨别

Libraries And Part Editor

You can access Library Editor directly from the OrCAD Capture user interface. Create and edit parts in the library or directly from the schematic page without interrupting your workflow.

- Movable pin name and pin number.
- Intuitive graphical controls speed of schematic part creation and editing.
- Create new parts quickly by modifying existing ones.
- Spreadsheet[18] and pin array utilities make short work of creating and editing pin-intensive devices.
- Bused vector pins reduce clutter on schematics.
- Create FPGA and CPLD symbols quickly and easily with Part Generator. Compatible with ten popular places and route pin reports.
- Drag-and-drop parts between libraries.
- Speed creation and maintenance of master library sets with design cache.
- Revise a part in the original subcircuit only, or propagate[19] the change to all other uses of the subcircuit in the design.
- Capability to add or delete sections of multisection[20] homogeneous/heterogeneous parts.
- Control power and ground pin visibility and connectivity on a per-schematic basis.

[18] *n.* 电子表格,电子制表软件,电子数据表

[19] *vt.* & *vi.* 繁殖,传播

[20] 多节,多段

Integrate Huge I/O Count FPGA And CPLD

OrCAD Capture provides a Library Part Generator to automate the integration of FPGA and PLD[21] devices into your system schematic. The Generate Part feature simplifies the creating of core FPGA library parts for devices that might have many hundreds of pins. Signal placement reports created by popular FPGA design applications like those from Altera, Actel, and Xilinx — are read into Generate Part to design the core Capture symbol saving up the hours of tedious graphical entry work. OrCAD Capture supports Xilinx 4.1i/4.2iPAD file format. If, during the PCB layout phase, the PCB designer discovers a more efficient pin placement scheme for the package or additional functionality[22] is added to the FPGA or PLD — the system engineer must modify the symbol and schematics to reflect this change which is error prone and may cause designs to be out of sync. The Generate Part feature has an annotate[23] option which modifies an existing symbol with new pin assignments.

[21] [计]可编程逻辑电路

[22] *n.* 功能性,泛函性

[23] *vt.* & *vi.* 注释,评注

Step 1 Creating parts with potentially hundreds of pins is an error prone and painstaking task. With Generate Part you simply browse in the pin and signal report file created by your place and route software.

Step 2 Specify to create a new part or update an existing one. Packages of all kinds are supported including PGAs and BGAs.

Step 3 The new part is created fast. Pins with common names are intelligently[24] grouped and ordered.

[24] *adv.* 聪明地,智能地

Easy Entry Of Part, Pin, And Net Data

Access all part, net, pin, and title block properties, or any subset, and make changes quickly through the OrCAD Capture spreadsheet Property Editor.

- Select a circuit element, grouped area, or entire page then add/edit/delete part, net, or pin properties.
- Globally apply specific property names across all your designs to meet your particular netlist[25] or other output requirements. This maintains consistency, reduces manual errors, and eliminates multiple re-entry.
- Browse and instantly visit any part, net, hierarchical port, off page connector, bookmark, or design rule error marker from a single reference point.

[25] *n.* 连线表

Verify Circuits Early With Design Rule Check

The configurable Design Rule Check (DRC) feature in OrCAD Capture allows a comprehensive verification of your design before committing[26] to downstream design processes saving the time and cost of ECOs latter in the design cycle.

[26] *vt.* 把……交托给,提交

- Report duplicate parts.
- Identify invalid design packaging.
- Detect off-grid objects leading to unconnected signals.
- Configure with electrical violations to report and assign severity[27] warnings.
- Check entire design or specific modules.

[27] *n.* 严格,严重

Reports

OrCAD Capture creates basic bill of materials (BOMs) outputs extracting from the information contained in the schematic database.

- Extract all part properties in the schematic design and output them to a text file.
- Automatically package parts with reference designators prior to report generation.

Part Selection

While placing a component, you can identify it visually, modify the properties as needed, then dynamically place it within a design—all in the same sequence.

- Zero-in quickly on the exact library part you want, using wildcard[28] searches.
- Pick your recent part choices from the most recently used (MRU) menu.
- Choose a logic gate or DeMorgan equivalent.
- Edit schematic parts graphically prior to placement.
- Add, modify, and delete part properties at any time.
- Place previously used parts fast by grabbing them from the project design cache.
- Automatically assign reference designators during or after part placement. Update all, or just unidentified[29] parts, or reset all to placeholder values.
- Add libraries to a project from any drive or directory without leaving the part selector.
- Apart filter[30] can be used to filter out the parts from existing libraries based on parameters like HDL models, Spice models, etc. associated with symbols.

[28] *n.* 通配符

[29] *adj.* 未经确认的

[30] *n.* 滤波器

Interface Capabilities

OrCAD Capture interfaces with other CAD applications with minimal[31] translation needs or integration problems by importing and exporting virtually every commonly used design file format.

- Export of DXF files to AutoCAD™.
- View and redline schematic with MYRIAD™.
- Bi-directional EDIF 200 graphic transfer and export of the EDIF 200 netlist format.
- Import MicroSim® schematic.
- Export of more than 30 netlist formats, including VHDL, Verilog®, PSpice, SPICE, and PADS 4.0.
- Interface with OrCAD Layout and Allegro PCB with forward and back annotation.
- Interface with NC VHDL Desktop and Synplicity Synplify® for FPGA design.
- Interface with NC VHDL Desktop and NC Verilog® Desktop for board level (multi-chips) digital simulation[32].
- Creation of custom netlists using Microsoft Visual Basic.

[31] *adj.* 最小的,最小限度的

[32] *n.* 仿真,模拟

Printing And Plotting

Produce professional hardcopy through any output device supported by Microsoft Windows.

- Print Area prints specific area of the design in larger scale.
- Print Preview ensures proper scale and orientation[33].
- Export to the DXF format for CAD interchange.

Cross-probing[34] between OrCAD Capture and Cadence Allegro PCB Layout.

[33] *n.* 方向,方位,定位

[34] *n.* 探测,探查

Getting Help

When you have a question or need to accomplish a specific task, the information you need is always a few mouse clicks away.

- Tap into the knowledge of the OrCAD Capture online community.
- Find the answer you need by searching the online help system, and navigate quickly between related topics with extensive hypertext[35] cross references.
- Get up to speed quickly with the award-winning "Learning Capture" online interactive tutorial.
- Jump directly to any topic of interest in the online OrCAD Capture User's Guide in Adobe® Acrobat® format (Adobe Acrobat Reader included).

[35] *n.* 超文本

System Requirements

- Pentium® II 300MHz PC (or faster).
- Windows® XP Professional, Windows® XP Home Edition, Windows® 2000 (SP 2 or higher), or Windows® NT 4.0 (SP6A or higher).
- Minimum 64MB RAM.
- 256MB swap[36] space.
- 256-color Windows® display driver with a minimum of 800 × 600 resolution (1024 × 768 recommended).

[36] *n.* 交换

参考译文　简单电路

1. 一个电路

电流、电压和电阻之间存在最基本的关系。一个简单的电路包括电源、某些类型的负载和一条让电子在电源和负载之间流动的导线。在下面的电路中，电池提供电压源、电线用作导体、灯泡提供电阻。开关作为电路的附加元件，由此形成一个完整的电路。如果开关断开，电路不通，电灯将不亮。闭合开关，电路接通，则电子通过灯泡从负极流向正极。

（图略）

2. 一个电路示意图

下面是一个电路示意图，包括一个电池、一个电阻、一个电压表和一个电流表。电流表串联在电路中，用于显示有多大的电流流过电路。电压表跨接于电压源，用于显示电池提供多大的电压。在分析一个电路的组成之前，我们先了解欧姆定律。

（图略）

3. 欧姆定律

19 世纪德国数学家乔治·西蒙·欧姆研究了电流、电压和电阻之间的关系，他用公式表示成一条定律来说明三者间的关系：电流同电压变化成正比，同电阻变化成反比。通过该定律可以导出下面的公式。

（公式略）

欧姆定律是适用于全部电路的基本定律。电气设计者必须决定对于给定的负载需要多大的电压，如计算机、时钟、灯和电动机。这种决定必定涉及电流、电压和电阻之间的关系。所有的电气设计和分析都是由欧姆定律开始的。有以下三种表达欧姆定律的数学方法。

（公式略）

使用哪个公式决定于开始知道什么，以及需要知道什么。

4. 欧姆定律三角形

有一种简单的方法来记忆使用哪个公式。通过将电流、电压和电阻安排在一个三角形中，就可以迅速确定正确的公式。

（图略）

5. 利用三角形

要利用这个三角形，盖住你想要计算的值。用剩下的字符组成公式。

（图略）

只有在使用正确的值时欧姆定律才能给出正确的答案。记住下面的三个规则：

- 电流总是用安培表示的。

- 电压总是用伏特表示的。
- 电阻总是用欧姆表示的。

直流串联电路

1. 在串联电路中的电阻

当任意个电阻头尾相连构成只有一条电流能流过的路径时,就形成串联电路。电阻可以是实际的电阻器或者是有电阻的其他设备。如图(图略)所示为4个电阻头尾连接。只有一条电流经过的路径:从负极通过R_4、R_3、R_2和R_1返回到正极。

(图略)

2. 串联电阻公式

在串联电路中电阻阻值是相加的。如果一个4Ω的电阻器同一个6Ω的电阻器连在一起,总电阻值是10Ω。别的有阻抗的设备串联也是这样的。电阻串联的数学公式是

(公式略)

给出的串联电路中,R_1是11kΩ,R_2是2kΩ,R_3是2kΩ,R_4是100Ω,R_5是1kΩ,电路的总电阻是多少?

(计算过程略)

3. 串联电路的电流

串联电路中总电阻的公式使我们能够简化电路。利用欧姆定律就可以计算出电流的值。在串联电路中的任何地方测量电流的值都是相同的。

(公式及图略)

4. 串联电路中的电压

电压可以通过电路中每个电阻上的压降来测量。电压经过一个电阻器就意味着一个电压降。德国物理学家基尔霍夫阐述了一个定律:整个回路中各个电阻器上的电压降的总和等于给这个回路提供的电压。在下面的示意图中,4个阻值都为1.5Ω的电阻串联起来连接一个12V的电池。根据欧姆定律可以知道每个电阻器上"下降"相等的电压。

(图略)

第一,求解总电阻。

(公式及计算略)

第二,求解电流。

(公式及计算略)

第三,求解任意电阻上的电压。

(公式及计算略)

测量任意一个电阻器,电压表的读数都会是3V。如果测量R_3和R_4组合上的电压,电压表的读数是6V。如果测量R_2、R_3和R_4组合上的电压,电压表的读数是9V。如果将4个电阻器上的电压降加起来,其和将是给电路提供电压的电池的电压,即12V。

5．串联电路上电压的划分

人们往往希望使用低于供电电压的电压。为此，可以使用电压分配器。电池电压用 U_I 表示，本例中为 50V。希望得到的电压用 U_O 表示。通过计算得出是 40V。为了计算这个电压，第一求解总电阻。

（公式及计算略）

第二，求解电流。

（公式及计算略）

第三，求解电压。

（公式及计算略）