目 录

1. How to form a simple circuit

Learning goals:

1. Master the basic components of the circuit and the functions of each part.
2. Master the three states of the circuit: circuit breaker, path, and short circuit.
3. Understand the hazards caused by short circuits and the application of local short circuits.

Equipment: battery box, battery, switch, small lamp holder, wire

Figure 1-1: Path

There are many multi-purpose electrical appliances in our family, and they are all connected into a circuit to work, so what should I do? Can it form a circuit?What are the elements that make up the circuit?Let's use a small light bulb as an electrical appliance, Form the simplest circuit by yourself.

Figure 1-2: Circuit breaker

Figure 1-3: Wrong connection method, The switch is closed, causing a short circuit

Experimental design:

1. Form a circuit as shown in Figures 1-1 and 1-2, and close the switch to make the circuit work. Understand what is the path? What is a circuit breaker?Thinking: What are the most basic parts of the circuit, and what is the role of each part? 2. As shown in Figure 1-3, why is this connection method wrong and what will be the result? Think about and summarize the three types of circuits. status.

Expand experimental research:

As shown in Figure 1-4, first close the switch S2 and observe the two lights Bubble luminous situation, then close the switch S1, and then observe The luminous situation of the two bulbs is analyzed to observe the phenomenon, Analyze the path of current in different states of the switch.

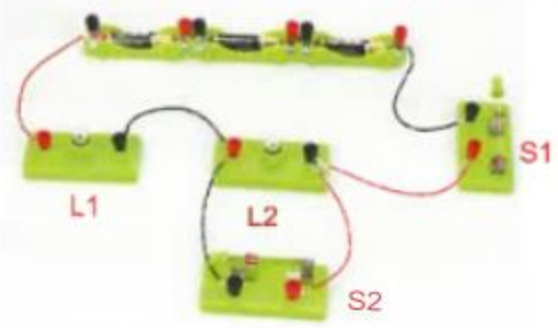


Figure 1-4: Close S1 and S2, bulb L2 is shorted

Battery box usage skills:

Figure 1-4 is the first time that three battery boxes are used in series. When the battery boxes are connected in series, due to the plastic of the new equipment, the battery boxes are connected in series. The card interface is relatively astringent, and the first card connection may not be smooth. This is normal. Please be patient and follow the operation in Figure 1-5. Try a few more times for the essentials, generally there will be no such problem after a few times of use; this equipment is equipped with three No. 5 batteries The box can be used independently, or two or three sections can be connected in series or in parallel, which is free and flexible. It is a student exploration equipment. The internal design is adopted for the first time; the battery box is connected in series, the essentials are shown in Figure 1-5, and the battery box is used in parallel as shown in Figure 1-6.

Figure 1-5: Battery application card connection

Figure 1-6: The battery box is connected in series to form a battery pack

2. Understanding series circuits and parallel circuits

Learning goals:

1. Know what a series circuit is and connect it to a series circuit.

2. Understand the basic characteristics of the series circuit (the path of the current and the influence of the switch position on the circuit) 3. Know what a parallel circuit is, and will connect the basic parallel circuit

4. Understand the characteristics of parallel circuits, be able to distinguish between trunk and branch circuits, and know the roles of trunk switches and branch switches.

Equipment: battery box, battery, switch, small bulb, wire, small lamp holder.

Equipment: battery box, battery, switch, small bulb, wire, small lamp holder. We connect a small light bulb to the circuit to form One of the most basic simple circuits, but in real life In China, we all have many multi-purpose electrical appliances connected to the same circuit. So how can we connect multiple electrical appliances to the same What about the circuit?What are the ways to connect?Let us use the following Multiple small bulbs represent multiple electrical appliances connected to the circuit, Let's see what are the ways to connect.

Figure 2-1

Experimental design:

1. Form a circuit as shown in Figure 2-1, and observe and explore the characteristics of the circuit (outside the power supply, the current is always from the positive electrode of the power supply). Flowing through the circuit to the negative electrode).

2. Then press Figure 2-1 and Figure 2-3 to change the connection method of the switch, study the switching effect of the series circuit, and explore The characteristics of the series circuit.

3. Form a parallel circuit as shown in Figure 2-4 to analyze the flow direction of current; and close each switch separately to see the parallel Analyze the role of each switch in the circuit to find out which part is a branch and which part is a trunk.

Figure 2-2

Figure 2-3

Figure 2-4

3. Use an ammeter to measure the current

Learning goals:

1. Understand the measurement range of the two ranges of the ammeter and the corresponding indexing value.
2. If the ammeter can be connected to the circuit correctly, it will be counted with different ranges.
3. Be able to summarize the applicable methods and precautions of the ammeter. 4. Develop the awareness and habit of selecting the range with trial touch estimation, etc. Equipment: battery box, battery, switch, ammeter, small bulb, Wire, small lamp holder.

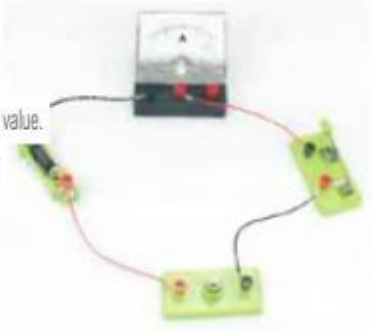


Figure 3-1

Experimental design:

1. As shown in Figure 3-1, connect the circuit to measure the current of a bulb and learn Learn ammeter readings.

2. As shown in Figure 3-2, the connection method is wrong, and the ammeter is not allowed to be directly connected. This kind of access circuit.Note: Observe the pointer before using the ammeter Whether it refers to the zero knob to adjust the zero.

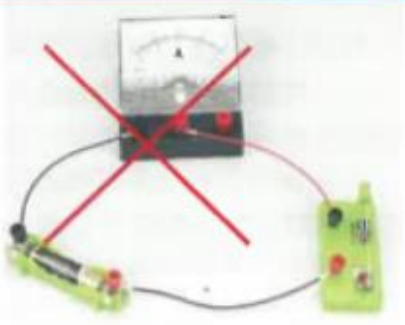


Figure 3-2

4. What are conductors and insulators?

Learning goals:

1. Know what a conductor and an insulator are, and be able to distinguish which common objects are insulators and which are conductors.
2. Know that there is no strict boundary between the conductor and the insulator, and they can be converted to each other under certain conditions. 3. Understand what is a semiconductor and its application, and check what superconducting phenomena are on the Internet. Equipment: battery box, battery, switch, ammeter, small bulb, wire, small lamp holder.

All kinds of electrical appliances and switches we see in life are made of plastic, rubber and other materials on the outside, and copper and aluminum on the inside. When the metal is made, the outside of the wire is also a layer of rubber skin, and the inside is a copper core. Why is this?

Experimental design:

As shown in Figure 4-1, common school supplies, such as erasers, small Knife, coin, ruler (need to bring your own), access the circuit to see the light bulb Whether it emits light, to determine whether these objects connected to the circuit can Enough to conduct electricity, so as to understand conductors and insulators.

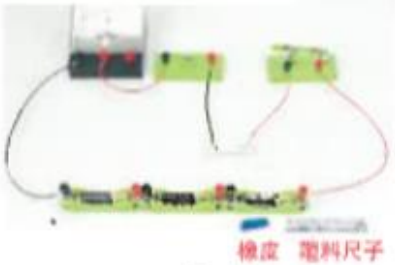


Figure 4-1

Knowledge expansion:

1. Usually dry air is not easy to conduct electricity, and it is an insulator., However, at very high voltages, air can also penetrate and conduct electricity. For example, lightning that occurs between clouds is the cloud. The air between them is penetrated and discharged.This shows that there is no strict boundary between the conductor and the insulator; generally The division of conductors and insulators is based on the usual situation, so the definition of conductors and insulators depends on whether "Can" or "can't" can be distinguished.
2. According to whether the object is easy to conduct electricity, it can be divided into conductors and insulators, but a class of objects. The conductive ability is between a conductor and an insulator, and it is called a semiconductor. Due to its unique properties, a semiconductor has For unique applications, you can refer to this information for extracurricular activities.(Diode, integrated circuit, etc.)

.V. Circuit diagram

Learning goals:

1. Know the circuit diagram symbols of common electrical components, and be able to draw circuit diagrams accurately and standardized.

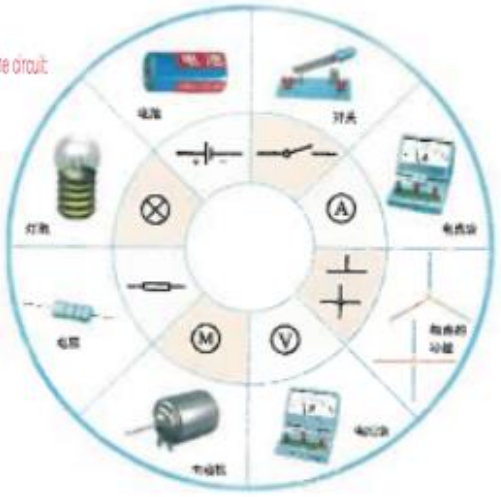
2. The corresponding circuit diagram can be drawn according to the physical object, and the physical circuit can be connected according to the circuit diagram. 3. Initially have the ability to analyze the circuit, and will use the idea of an equivalent circuit to analyze the circuit.

Equipment: battery box, battery, switch, "ammeter, small bulb, wire, small lamp holder.

There are drawings required to build high-rise buildings. From life to the field of science, there are various drawings. The drawings are made all over the world. The language of the engineer; similarly, a circuit diagram is required to design a circuit. The circuit diagram is represented by the symbols agreed by everyone. The diagram of the circuit connection is easier to communicate than the physical diagram, and can reflect the connection of the circuit more clearly and intuitively.

In the part of physics and electricity in junior high school, learning to recognize circuit diagrams, design and draw circuit diagrams is part of learning electricity. This process is also an important stage from perceptual understanding to rational understanding, and it is also the key to analyzing the circuit., The various states of the circuit can be seen from the circuit diagram, and the connection method and the relationship between the various electrical and physical quantities can be reversed. Reflecting it, it is no exaggeration to say that by mastering circuit knowledge, analyzing, designing circuits, and learning electricity. The key to learning is a red line that runs through the electrical part, so we have to develop the habit of drawing circuit diagrams and analyzing circuits. 惯。

Understand the circuit diagram symbols of each component of the circuit:



Each component of the circuit is represented by a special symbol in the circuit diagram, such as a battery, whether it is a battery or

1. The symbols of the No. 1 dry battery and the No. 5 dry battery in the circuit are all the same, because their functions are the same.

Draw a circuit diagram based on the physical circuit connection:

In the past, we used physical equipment to transport the physical circuit connected by hand, now we can also use the above symbols. The circuit diagram is used on paper to represent the circuit. The circuit diagram corresponding to the individual actual circuits in front is as follows:

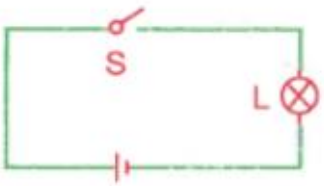


Figure 1-2 corresponding circuit diagram

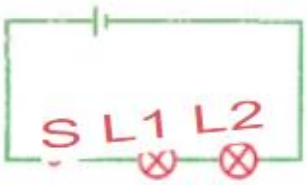


Figure 2-1 corresponding circuit diagram

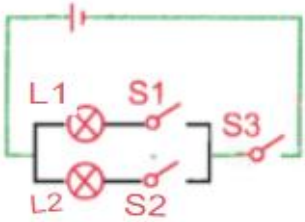


Figure 2-4 corresponding circuit diagram

From the circuit diagram above, we can see that the wires in the circuit are represented by straight lines in the circuit diagram, and And the drawing should be horizontal and straight, so that the entire circuit diagram is square, so that it is not only beautiful, but also more clear and standardized., it is easy to communicate. The wires in the circuit diagram do not indicate the actual length. In order to better understand the circuit diagram method, it is necessary to Practice more.

Figure 5-1

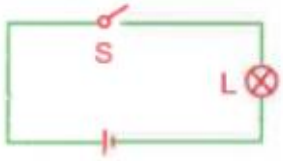


Figure 5-2

For relatively simple physical circuits, it is relatively easy to draw circuit diagrams for basic series and parallel circuits, only It is necessary that the circuit diagram can correctly reflect the connection method of the circuit and the order in which the current flows through the various components, so that it can be accurately drawn. Out of the circuit diagram.However, for some special physical circuits, the circuit must be simplified and analyzed. According to the equivalent circuit, After the idea is simplified, the corresponding circuit diagram is drawn.

Figure 5-1 and Figure 5-2 can be analyzed and simplified according to this process, and finally the circuit diagram is drawn.

Knowledge allocation:

1. The circuit diagram must be accurate and standardized: accuracy means that each symbol in the circuit diagram must have its own physical electricity. The circuit corresponds to the physical circuit, which can reflect the connection method of the physical circuit, and the current flows through the same sequence; the specification refers to the component ratio. For example, for example, if the circle representing the light bulb is one big and one small, or if the original is placed at the corner, etc. It is not standardized.
2. The process of drawing a circuit diagram is not a simple drawing, but the process of analyzing the circuit, and it is also the work of electrical knowledge. The transition process from functional awareness to rational awareness.

6. Explore the current law of series circuits

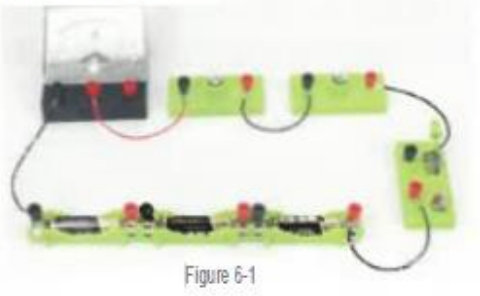


Figure 6-1

Learning goals:

1. Master the law of current size everywhere in the series circuit.
2. The current law of the series circuit will be used for the circuit calculate.
3. Earlier, we learned the connection method of the series circuit, Some characteristics of series circuits are preliminarily explored, Now we use the ammeter to further quantitatively explore the characteristics of the series circuit.

Equipment: battery box, battery, switch, ammeter, small bulb, wire, small lamp holder.

Experimental design:

As shown in Figure 6-2 and Figure 6-3, connect the ammeter to several different places in the series circuit to explore the series circuit. What are the characteristics

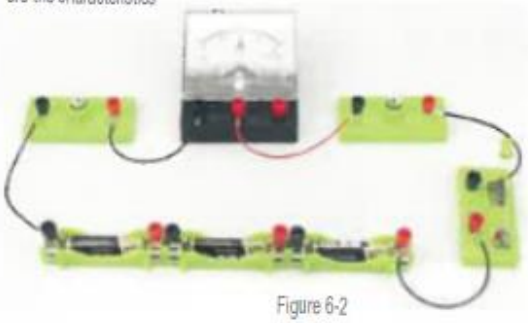


Figure 6-2

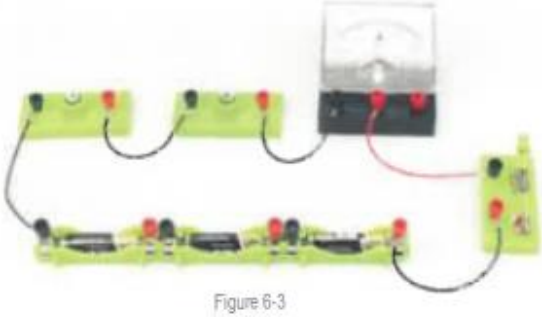


Figure 6-3

7. Study the current law of parallel circuits

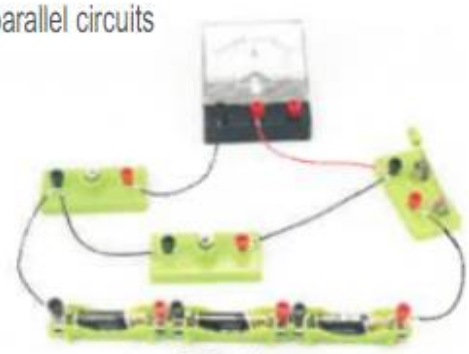


Figure 7 – 1

Learning goals:

1. Master the law of the current size of the parallel circuit and each branch.
2. Learn to use the law of parallel circuit current to calculate.
3. Earlier, we learned the connection method of the series circuit, initially Explored some characteristics of series circuits, now we I Use the learned ammeter to explore further quantitatively What are the characteristics of series circuits?

Equipment: battery box, battery, switch, ammeter, small bulb, wire, small lamp holder.

Experimental design:

As shown in Figure 7-1, Figure 7-2, and Figure 7-3, the ammeter is connected to the main circuit and each branch of the parallel circuit respectively., The relationship between the trunk current of the parallel circuit and the current of each branch is explored by analyzing the experimental data.

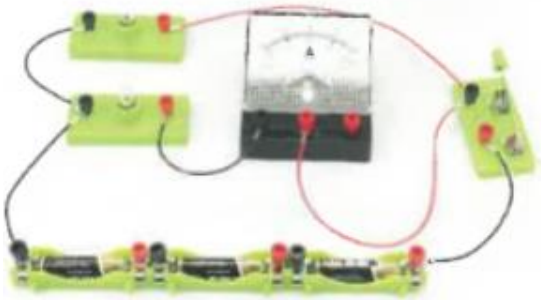


Figure 7-2

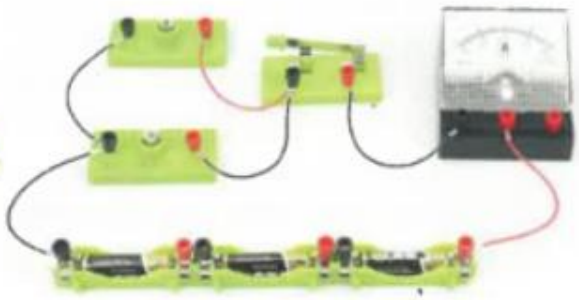


Figure 7-3

Eight, use a voltmeter to measure the voltage

Learning goals:

1. Understand the scale of the voltmeter and the two quantities of the voltmeter Process and corresponding degree values.
2. Be able to connect the voltmeter to the circuit correctly.
3. Further develop the habit of trying to estimate and select the range.
4. Summarize the use methods and precautions of voltmeter.
5. Know the voltage of the series battery pack and the relationship between each battery relationship.

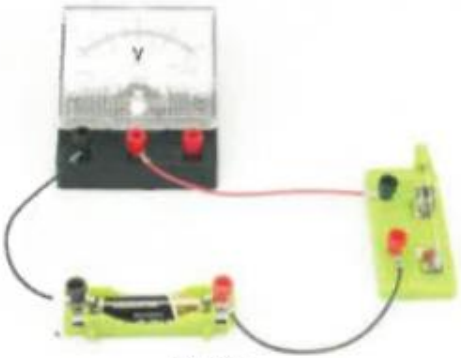


Figure 8-1

Equipment: battery box, battery, switch, voltmeter, small bulb, wire, small lamp holder.

Experimental design:

As shown in Figure 8-1, the voltage of one battery, the voltage of two batteries, and the voltage of three batteries are measured separately with a voltmeter.

Knowledge and skill points:

1. Two or more batteries are connected end to end to form a series battery pack.;
2. When using a voltmeter to measure the voltage, the different ranges of the voltmeter should be selected taking into account the size of the voltage, and the test touch should be performed.;
3. The zero adjustment of the voltmeter pointer is the same as that of the ammeter.

9. Explore the voltage law of series circuits

Learning goals:

1. Further proficient in using voltmeter to measure voltage.
2. Master the voltage of each part of the series circuit and the total circuit voltage The relationship between.
3. The voltage law of the series circuit will be applied for circuit calculation.(

'Earlier, we studied the law of current in a series circuit, So what is the law of the voltage of the series circuit?

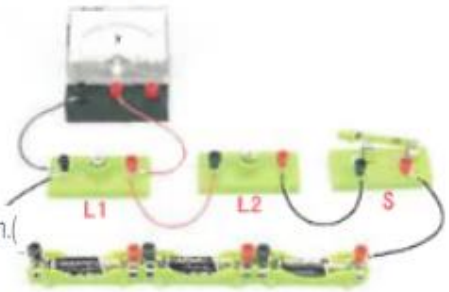


Figure 9-1

Equipment: battery box, battery, switch, voltmeter, small bulb, wire, small lamp holder.

Experimental design:

As shown in Figure 9-1, Figure 9-2, and Figure 9-3, the voltmeter measures the voltage across L1, the voltage across L2, and the entire voltage. The total voltage of the circuit, analyze the experimental data, and summarize the laws.

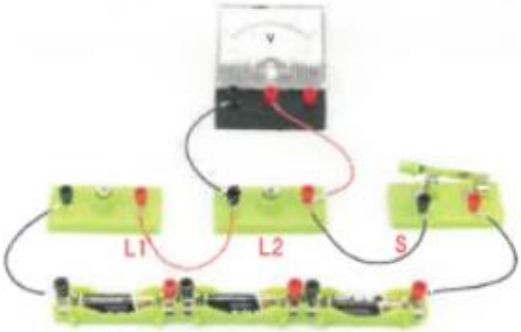


Figure 9-2

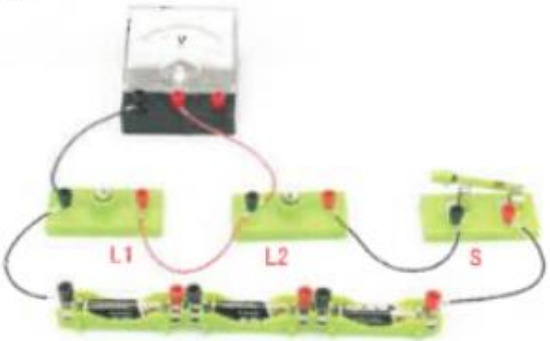


Figure 9-3

10. Explore the voltage law of parallel circuits

Learning goals:

1. Master the voltage and total circuit current at both ends of each branch of the parallel circuit . The relationship between pressure.
2. The voltage of the parallel circuit will be used to calculate the circuit in parallel. The current characteristics of the circuit, we already know the dry circuit electricity The current is equal to the sum of the currents of each branch, then the parallel circuit What are the characteristics of voltage?

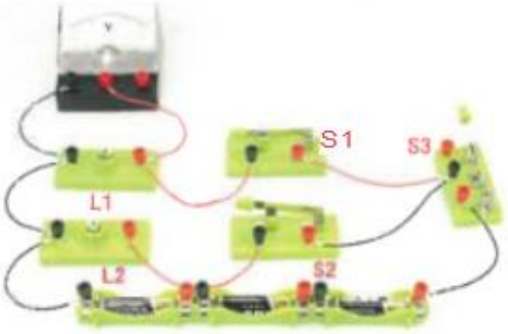


Figure 10-1

Experimental design:

As shown in Figure 10-1, the voltage U1 across the bulb L1 is measured, and then the voltage U2 across L2 is measured according to Figure 10-2. If the figure 10-3 The voltage U of the parallel circuit is measured and recorded separately to summarize the voltage law of the parallel circuit.

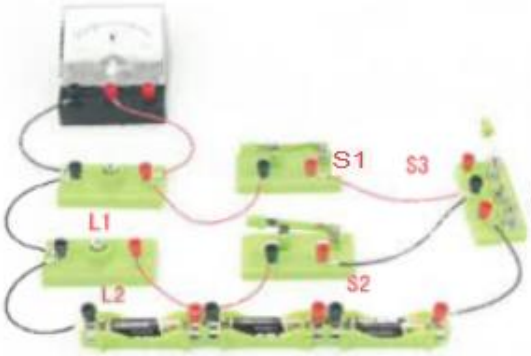


Figure 10-2

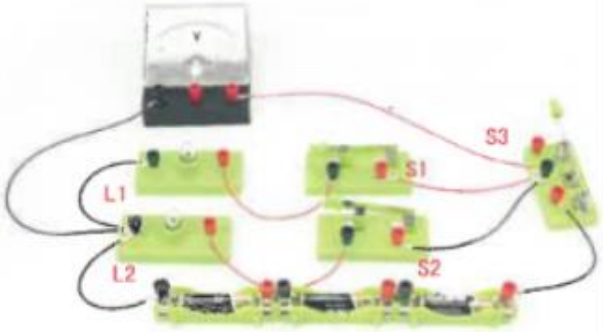


Figure 10-3

11. Explore the voltage law of the battery pack in series

Figure 11-1

Learning goals:

1. Knowing what current is connected in series, it will form a series battery pack.
2. Know the total voltage of the series battery pack and the difference between each battery , The relationship between.

Equipment: battery box, battery, switch, voltmeter, wire.

It is usually used in circuits to provide dry batteries as a power supply ; Electrical energy, we know that the voltage of a dry battery is about 1.5V, But usually the circuit requires different voltages?In fact, we have solved this problem in the previous interview experience, Using several batteries in series can provide different voltages. Let's use experiments to explore this problem.

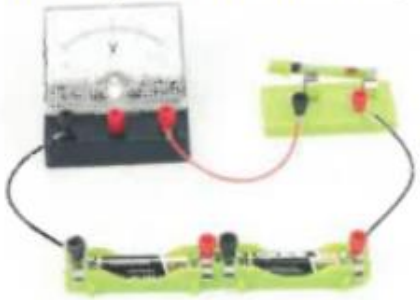


Figure 11-2

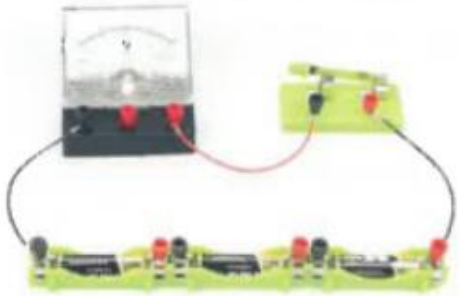


Figure 11-3

Experimental design:

As shown in Figure 11-1, the voltage of 3 batteries is measured separately with the voltage, and then 2 of them are connected in series to measure their voltage. Voltage (as shown in Figure 11-2), analyze the relationship between the total voltage of the two batteries in series and the voltage of each battery; then As shown in Figure 11-3, the relationship between the total battery voltage and the voltage of each cell is measured by the combination of three batteries. Precautions: If the battery box is stuck together in series, pay attention to the methods and techniques when assembling and disassembling.

12. Explore the voltage law of battery packs in parallel :

Learning goals;

1. Know what is the parallel connection of the battery and the conditions for the parallel connection of the battery.
2. Know the relationship between the total voltage of the parallel battery pack and each battery.

In the circuit we learned, it is more commonly used to form a battery pack in series with the battery to power the circuit, so the dry battery 'Can it be used in parallel? Are there any characteristics of the voltage of the parallel battery pack? Where can it be used on some occasions?

Experimental design:

Measure the voltage of a battery according to the method shown in Figure 12-1 below, and then connect the batteries of the same voltage in parallel., As shown in the figure, the relationship between the voltage after paralleling and the original voltage of each battery is analyzed.

Figure 12-1 A battery pack composed of two batteries in parallel

Figure 12-2 A battery pack composed of three batteries in parallel

Knowledge expansion:

From the same experiment, it can be seen that the total voltage of the parallel battery pack is unchanged after the voltage with the same voltage is connected in parallel; that is, the parallel battery pack is connected in parallel. The combined battery cannot increase the voltage, but after the batteries of the same voltage are connected in parallel, the internal resistance of the battery pack can be reduced and the voltage can be increased. The size of the output current; the power supply used for electric vehicles is the battery pack, which generally uses each 12V battery in series. ; By increasing the voltage, a larger current can be output in parallel, which increases the battery capacity; another example is the current solar power. ,

The output voltage of each cell is low and the output current is very small. In actual use, multiple solar cell strings are often used. The voltage is increased in connection and the output current is increased in parallel.

13. Measuring the working current of the light-emitting diode

Learning goals:

1. Understand the unidirectional conductivity of diodes;
2. By measuring the energy-saving and environmental protection characteristics of light-emitting diodes;
3. Understand the wide range of uses of light-emitting diodes and their use as green lighting The development prospects of color light sources.

Figure 13-1

Equipment: battery box, battery, switch, ammeter, Wire, diode

A light-emitting diode, referred to as LED, is an efficient light-emitting semiconductor device that can convert electrical energy into visible light. It is made of materials such as deification, aluminum enough, and phosphating enough; when making it, the materials used are different, so So it can emit different colors of light.The characteristics of light-emitting diodes are: the operating voltage is very low (some have only one Point wind-like); the working current is very small (some can emit light with only a few tenths of a milliampere); good impact resistance and seismic resistance, High reliability and long life, it is widely used in various instrument indicators and LED large screens; especially LED as a high Effective lighting sources have broad prospects.

Experimental design:

As shown in Figure 13-1, connect one of the light-emitting diodes to Circuit (note that the power supply uses two batteries in series, about 3V voltage, When the voltage is high, the diode will breakdown and burn out), change it separately Change the current direction of the access circuit, view Check the light emission of the diode.

As shown in Figure 13-2, the positive light diode is measured with an ammeter What is the normal working current?

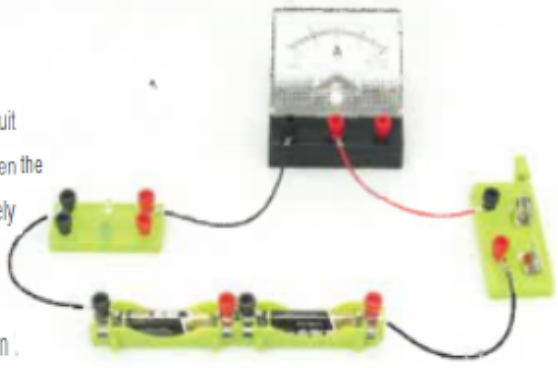


Figure 13-2

14. Explore the factors that affect the resistance of conductors

Learning goals:

1. Know that resistance is a basic attribute of conductors
2. Be able to name several factors that affect the resistance of the conductor

Equipment: battery box, "battery, switch, ammeter, wire、

Bring your own pencil.

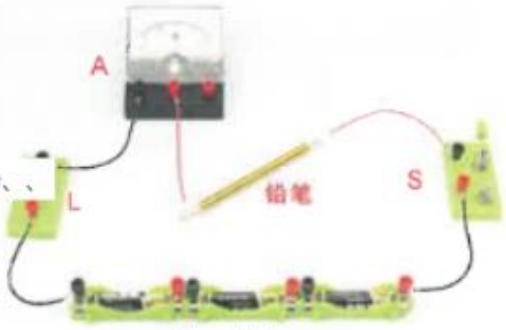


Figure 14-1

Resistance is the hindrance of the conductor to the current, so in At the same voltage, conductors with different resistors pass through a large current Small ; is different; the larger the resistance, the smaller the current passing through, so We can compare the size of the conductor resistance by comparing the current at the same voltage; then the size of the conductor resistance What factors are related to it?Let's explore it through experiments and wait for us.

Experimental design:

1. As shown in the figure, use a pencil sharpener (bring your own) to access the circuit, change the length of the pencil lead, and observe the ammeter and lamp. Changes in bubble brightness.
2. You can also use the above circuit to connect iron wires of different lengths, copper wires, and (materials from) between the money fish clips. Equipment), etc., observe the changes in circuit current.

15. Use a sliding varistor to change the brightness of the bulb

Learning goals:

1. Understand the structure of the sliding varistor and the principle of the sliding varistor.
2. Will use the sliding varistor correctly, and know the characteristics of the six connection methods of the sliding varistor.
3. Explore and understand the role of sliding varistors in the circuit through experiments.

Equipment: battery box, battery, switch, sliding varistor, wire

Through the experiment figure 14-1 of Topic 14, we can see that the length of the access pencil lead is changed by changing the connection. The size of the input resistance changes the current. In fact, there is a special similar experimental element called a sliding varistor., It can better realize this effect. As shown in the figure, let's get to know the structure and use of the sliding varistor. Law.

Experimental design:

As shown in Figure 15-2, connect the circuit, move the sliding varistor to scratch, observe the brightness change of the bulb, and observe Thinking about how current flows through the sliding varistor?How does the sliding variable resistance change the resistance of the connected circuit?

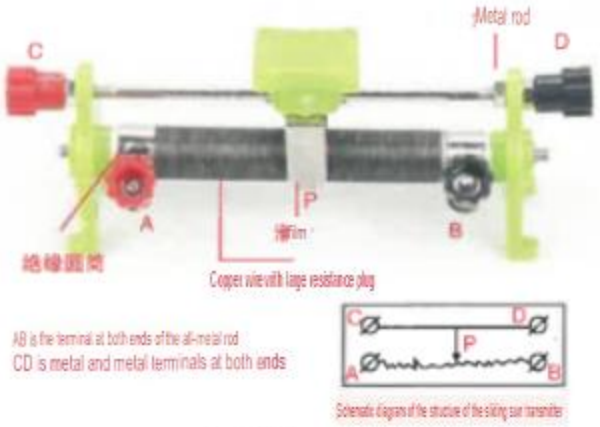


Figure 15-1

Figure 15-2

Expand exploration:

The sliding varistor has a total of four terminals, and each of the two terminals is connected to the circuit in pairs, so that there are six kinds of connections. Method, so what are the differences between these six methods of connection?What are the connection methods that can change the size of the resistance? Summary one What are the characteristics of the connection method that can change the resistance value?What are the connection methods that cannot change the size of the resistance?What's the matter Features?

16. Ohm's Law

Learning goals:

1. Grasp the relationship between the current passing through the conductor and the voltage across the conductor through exploration

2. Master the relationship between the current passing through the conductor and the resistance of the conductor through exploration experiments

3. Summarize the relationship between current, voltage, and resistance in the local circuit (a section of the circuit) to understand Ohm's law

4. The Ohm's Law formula will be used for circuit calculation (combining the current and voltage characteristics of the series circuit in the series circuit). Points for calculation)

Equipment: sliding varistor, ammeter, voltmeter, resistor, battery box, battery, switch, wire. Current (I), voltage (U), and resistance (R) are the three most basic physical quantities in electricity. In many experiments, we will think that the size of the current through the circuit is related to the voltage. The higher the voltage, the greater the current may be., This is like water flow, the higher the water pressure, the greater the water flow; in addition, we know that the resistance hinders the current, such as If the current and voltage remain the same, if we connect a sliding varistor to the circuit to increase the resistance, the circuit current will increase.

The smaller the current, what is the relationship between the current, voltage and resistance through the circuit?How to represent the three What about the relationship between them?

Guess:

1. Conjecture about the relationship between current and voltage: The higher the voltage applied to the same circuit, the greater the current. 2. Conjecture about the relationship between current and resistance: When the voltage is constant, the circuit resistance is large, and the current may be It's getting smaller.

Experimental design:

Through the previous experimental phenomenon, we guessed that the size of the current may be affected by both the size of the voltage and the size of the voltage. The influence of resistance size, then when we design experiments to quantitatively study the relationship between current size and voltage and resistance, At this time, it should be studied separately. Below, we use a fixed-value resistor instead of a conductor or a circuit to explore Study the relationship between these three physical quantities.

1. As shown in Figure 16-1, we have studied and passed the fixed value Resistor R (let R=10 ohms remain unchanged) pass The current passing through, by changing the sliding varistor to Change the voltage across the fixed-value resistor (it is best to measure Several times the voltage changes in integer multiples), measured at the same time The amount records the size of the current passing through the fixed-value resistor, Analyze the relationship between current and voltage.

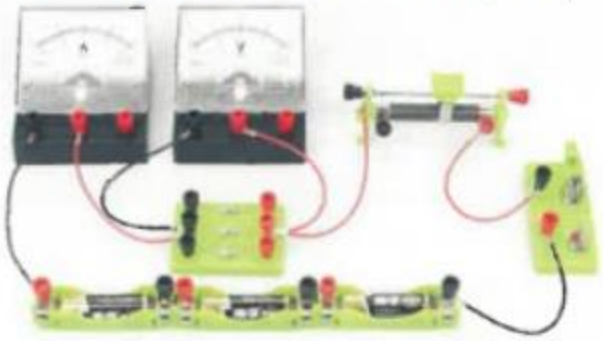


Figure 16-1

Table 1: Resistance =10 ohms

Number of experiments	Voltage (V)	Current (1)
For the first time		
Second time		
Third time		

2. The circuit shown in Figure 16-1 is also used, and the resistors of 5 ohm and 15 ohm are connected separately, and the sliding varistor is adjusted each time. The voltage across the R value remains the same, and the current in the circuit is measured and recorded at the same time, and the current and resistance are summarized separately. Another

Method allocation:^

In the above experiment, since the size of the current passing through the conductor is affected by both the voltage and the resistance, it is also affected by the size of the resistance., Therefore, when studying the relationship between current and voltage, when we change the voltage across the circuit, we should maintain

The resistance remains unchanged; and when studying the relationship between current and resistance, the voltage should be kept unchanged. This method is called control. System variable method.

The so-called control variable method means that a problem is affected by multiple factors (variables), and we are studying it. In the relationship between us, it is often artificially empty that the other quantities remain unchanged, and one of the factors (variables) is changed. To explore the law of the influence of this factor on this problem, the control variable method is in the process of junior high school physics experiments. One of the most common and effective scientific research methods for exploring the laws of physics.

17. Use voltmeter and ammeter to measure resistance

Learning goals:

1. A voltmeter and ammeter will be used to measure the voltage of a conductor. Resistance (will draw pictures, will connect circuits).
2. Average the error through multiple measurements to reduce the error, and add Deep understanding of the concept of resistance.
3. Understand that resistance is a property of conductors, and conductors The resistance is energized or not.
4. Master the principle of voltammetry to measure resistance

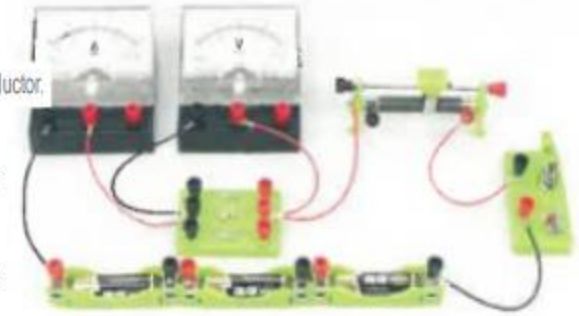


Figure 17-1

Equipment: fixed-value resistors, voltmeter, ammeter, battery box, battery, switch, sliding varistor, wire.

Measurement is the basis of experiments. Through the previous learning, we know that the size of the current can be quantified by an ammeter. To measure the size, the physical quantity of voltage can be measured with a voltmeter, so the resistance of the conductor is also a physical quantity. There are also differences in quantity and size. Since we are in junior high school, we do not introduce instruments for directly measuring resistance, so we. Is there any other way to measure the physical quantity of resistance?In fact, after learning Ohm's law, there is a complete solution. The method is used to indirectly measure the resistance of the conductor.

Experimental design:

As shown in Figure 17-1, use one of the fixed-value resistors as the unknown resistor RX to measure the voltage across it and the passing The current size is recorded in the table. In order to reduce the error, the measured current can be changed by adjusting the sliding varistor. The voltage and on-current across the resistance are measured multiple times, and the measurement data are recorded in the table below:

	Output voltage U/V	ICurrent I/A	Resistance to be tested RX(Ω) resistance RX average value
1			
2			
3			

18. Use voltmeter and ammeter to measure the power of small bulbs

Learning goals:

1. Know the principle of measuring the power of a small bulb, connect a circuit, and draw a circuit diagram.
2. Grasp the relationship between the brightness of the small bulb and the actual power of the bulb through exploration.
3. Further understand the difference between the rated power of the bulb and the actual power.
4. Combine voltammetry to measure the resistance, measure the resistance of small bulbs at different operating voltages, and analyze the reasons. Equipment: sliding varistor, ammeter, voltmeter, small bulb, battery box, battery, switch, wire, small Lamp holder.

Power (P) is a physical quantity of how much electrical energy is consumed by electrical appliances for a certain period of time, so electrical appliances are used for measurement. The power is very helpful for us to understand the rated power and the actual power. Below we will use the voltammetry method to measure The kind of indirect method of resistance to measure the power of a small bulb.

Experimental design:

Observe the number above the small bulb and identify the normal working voltage of the small bulb (that is, the rated voltage, we The rated voltage of the commonly used small bulbs in the experiment is generally 2.5V and 3.8V small bulbs), as shown in Figure 18-1 to adjust the sliding variable Resistor, first let the voltage across the bulb reach its operating voltage, and at the same time measure the operating current through the small bulb (Note: The current passing through the normal working voltage of the bulb is also called the rated current); and observe the brightness of the bulb; then Then adjust the bulb voltage to be higher than its rated voltage (it should not exceed 1.2 times its normal operating voltage, otherwise the capacitance Easy to burn out) Measure and record the current of the bulb and observe the light emission, and then change the voltage of the bulb to be lower than its rated voltage Voltage measures the current and observes the brightness of the bulb.

Observe that the rated voltage of the small bulb is ( )

Two small bulbs to be measured / Working power	Terminal voltage (V)	Small bulb pass Overcurrent (A)	Small light bulb The power of (W)	Bulb hair Light situation	Small bulb light Wire resistance (Euro)
Below the rated voltage					
Equal to the rated voltage					
Higher than the rated voltage					

Expand exploration:

Use the experiment and measurement data in the figure above, combined with the lesson Question 17, We can find the lights of small bulbs " separately Wire resistance, analyze the data, what laws will you find? When we studied the resistance experiment earlier, we knew that the resistance is ; The nature of the conductor has nothing to do with voltage and current, , then Is this the case with the filament resistance in this experiment? Analysis one The reason.

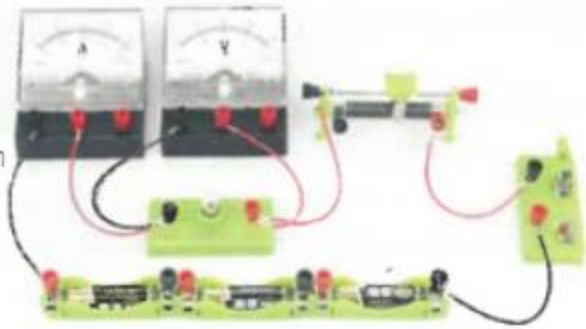


Figure 18-1

19. Auster experiment

Learning goals:

1. Know the Oster experiment and its significance.
2. Know the factors that affect the direction of the current and magnetic field.

Equipment: battery box, battery, compass, switch.

Humans have long recognized magnetic and electrical phenomena, but Before the 19th century, scientists believed that electrical phenomena and magnetism were Figure 21-1 Isolated, they are all studied separately, but Danish scientist Auster first discovered them in the 1820s. The connection between electrical phenomena and magnetic phenomena has since opened up the science of electromagnetism one after another for mankind. It was discovered that it laid the foundation for mankind to enter the era of electricity. Let's get to know the Oster experiment.

Experimental design:

As shown in Figure 21-1, place the wire above the small magnetic needle in the direction of the N and S poles of the small magnetic needle, and then quickly close the switch. Disconnect quickly, observe the reaction of the small magnetic needle at the moment of energization, then change the direction of the current through the wire, and then observe The small magnetic needle reacts.

20. Solenoid and ampere rules

Learning goals:

1. Understand the magnetic field distribution of the energized solenoid.
2. Know the relationship between the magnetic pole of the energized solenoid and the current direction, The Oster experiment was originally to study an energized straight wire. Surrounding the current and magnetic field, after the Oster experiment is successful, the ; ampere will pass The conductivity wire is bent into a ring, and then wound into a multi-faceted ' spiral coil pair To explore the distribution of its magnetic field, now let's explore the ; ampere The magnetic field of the energized solenoid.

Figure 22-1

Equipment: solenoid, battery box, battery, compass, wire, switch.

Experimental design:

As shown in Figure 22-1, different parts of the energized solenoid are close to the small magnetic needle to judge the magnetic field of the solenoid and find out Energize the N and S poles of the solenoid, and then change the direction of the current through the solenoid to observe whether the magnetic poles of the solenoid change.

Knowledge allocation:

Through a large number of experiments, it can be seen that the magnetic field distribution of the energized solenoid is similar to that of a bar magnet, and the energized solenoid The magnetic pole is related to the direction of the current, and the direction of the current and the magnetic pole of the solenoid can be To determine by the method shown in the figure, hold the solenoid with your right hand, four-finger ' square If the direction is consistent with the direction of the energized current, the exposed finger points to the solenoid N Pole, this method is called Ampere rule.

Figure 22-2

21. Electromagnet

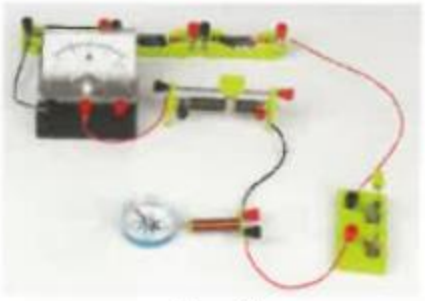


Figure 23-1

Learning goals:

1. Know the structure and principle of the electromagnet.
2. Know what factors are related to the magnetism of the electromagnet.
3. Understand the application of electromagnets in various occasions, solenoid communication

After electricity, a magnetic field will be generated, which is similar to a bar magnet., But the magnetism is limited, so how to increase the magnetism of the solenoid ? What about sex?Let's explore it first.

Equipment: ammeter, solenoid, battery box, battery, sliding varistor, compass, wire, switch, self Prepare tacks.

Experimental design:

As shown in Figure 23-1, Figure 23-2, Figure 23-3, the magnetic change of the energized solenoid is compared before and after the iron core is inserted inside.

transformation

Figure 23-2

Figure 23-3

22. Exploring electromagnetic relays

Learning goals:

1. Understand the structure of the relay.
2. Know the working principle of the relay.

Equipment: relays, wires, switches, lamp holders, small bulbs.

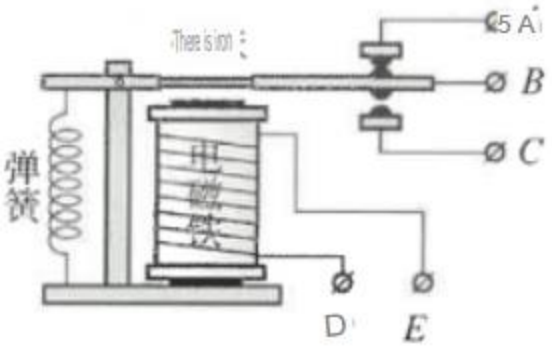
Experimental points:

1. Open the electromagnetic relay housing, observe its structure, and find the normally open contacts of the electromagnet wire surrounding the armature, normally closed contacts and Reset shrapnel;
2. Gently press the armature down with the tip of your finger to observe the movement of the contacts.;
3. Turn on the control circuit part, close, disconnect the switch, and observe how the contacts move with it.;
4. Connect the working circuit part, combine the power supply of the two parts of the circuit, close, disconnect the switch, and observe the relay. The situation under his control.

A and C terminals are respectively and two Quiet point connection

B is connected to the moving contact

D and E power the electromagnet coil

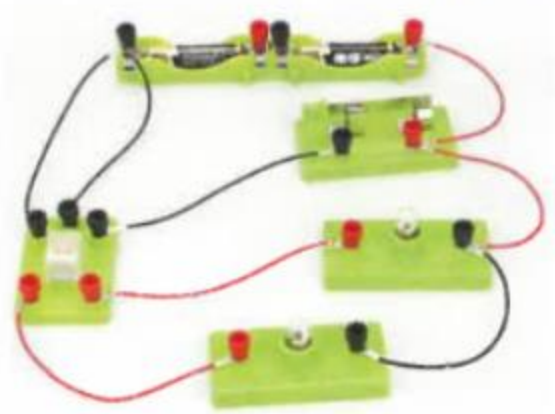


(The picture shows the internal structure principle of the electromagnetic relay)

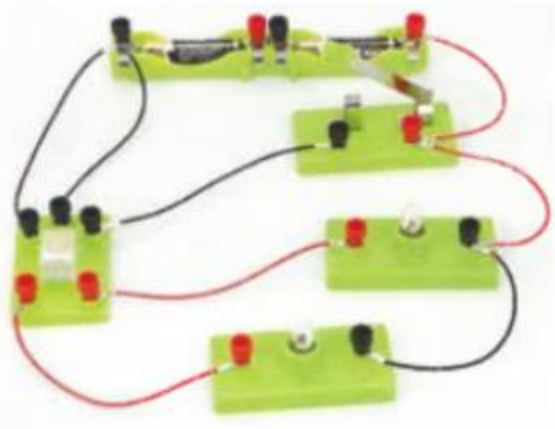
The electromagnetic relay has five terminals (represented by ABCDE on the figure), or, our contact is relatively complex. A kind of miscellaneous electrical original. In order to better understand the structure and principle of electromagnetic relays, the plastic can be carefully removed. Material cover, ! compare the schematic diagram of the structure, it can be seen from the figure that the D and E terminals are connected to the electromagnet coil, DE The terminal is connected to a voltage of 3V, and the electromagnet magnetically attracts the street iron to drive the moving contacts connected to the B terminal ,and The static contact A above is separated, and the contact with the static contact C below is closed and visible. The electromagnetic relay is essentially a Automatic switch controlled by electromagnet.

Experimental design:

First of all, we first use the original A to form a circuit that supplies power to the electromagnet in the electromagnetic relay. This circuit The circuit is called a probe circuit---close the switch to observe the action of the relay (it will be accompanied by the sound of the contact closing).



继电器常闭电路



继电器常开电路

23. Understanding DC motors

Learning goals:

1. Understand the structure of the DC motor and the names of each part;

2. Know the working principle of the motor and the energy conversion process; 3. Explore the reasons that affect the direction and speed of rotation of the motor.

Equipment: electric motor, ammeter, battery box, battery, switch, wire.

Electric fans, washing machines, air conditioners, many such electrical appliances in life use motors to work, as small as The small motor on the 4WD played by classmates, the razor used by men, the electric locomotive on the high-speed railway, the worker All kinds of vehicles in the industry and pumps in agriculture are inseparable from all kinds of electric motors. Electric motors are human beings who use electrical energy. An important tool for converting into kinetic energy, let's understand its structure and structure from the small motor in our hands.

How it works!

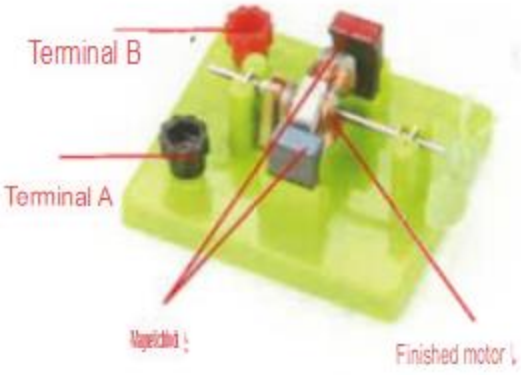


Figure 23-1 Note: (The two magnetic blocks must be opposite to each other)

Figure 23-2