ENG

3. Install the See Saw coil (8) between the two See Saw Legs (9) by inserting the Metal Pin (10) through their holes as shown in Fig. 21. Connect the wires of the See Saw Plate to the spring connectors at position 2 and 3 (see *note in Activity 7). Adjust the shape of the wires so that the See Saw Plate rests in the horizontal position.

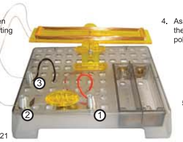

Fig. 21

4. As shown in Fig. 22, put the Magnet (5) below the See Saw Plate near the edge. Now, the See Saw is ready. Insert two AA size batteries to the compartment according to the polarity shown in Fig. 22.

5. Tap on the switch briefly to make the swing plate move. When the See Saw returns to the horizontal position, tap briefly on the switch again. Repeat this action and the See Saw will continue to move up and down! (Fig. 22)


Fig. 22

Explanation:

This electromagnetic seesaw uses the same principle as explained in Activity 7.

Activity 9 Make an Electromagnet

In this activity we will make an electromagnet
Material: - 1 Iron rod (14) - 1 Coil (15) - 2 Wire with crocodile clips (16) - 1 Base Plate (11)
Extra items you will need: - Some paperclips

Steps:

1. Wind the coil (15) to the iron rod (14), leave about 30mm at each end. (Fig. 23)

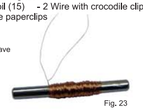
Fig. 23

2. Connect the red and black crocodile clips (16) to each end of the coil. Note that the coil is covered with a protective brown layer which is non-conductive, Only the silvery part at the end of the coil should be used to connect to the crocodile clips. (Fig. 24)


Fig. 24

3. Insert the batteries to the base plate (11) according to the polarities shown in Fig. 25.

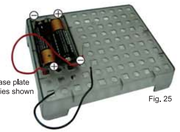
Fig. 25

4. Connect the other end of the crocodile clips (16) to the wires of the base plate. (Fig. 26)

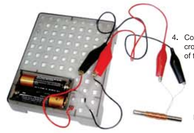
Fig. 26

5. Place some paperclips on the table and move the iron rod close to the paperclips and see what happens. (Fig. 27)

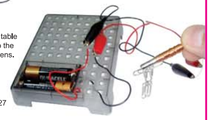
Fig. 27

6. Disconnect one of the crocodile clips and move the iron rod close to the paperclips. Note the result.

Explanation:

An electromagnet is a type of magnet in which the magnetic field is induced by the flow of an electric current through a coil of wire. The magnetic field disappears when the flow of electricity is stopped. The strength of the electromagnet depends on the amount of electric current and the number of turns of the coil. The higher the current and the more number of turns will make the electromagnet more powerful. Electromagnet has two major advantages over permanent magnet. It can be switched on and off, or reversed, or it's strength controlled by changing the electric current, Secondly, it can be made stronger than a permanent magnet of the same size and weight.

Activity 10 Make a magnetic car

We can move a paper car using magnet.
Material: - 1 Disc magnet (22) - 1 Bar magnet (25) - 1 Car card (29)
Extra items you will need: - Some double sided tape or glue - A cardboard

Steps:

1. Fold the car card (29) into a car. Use some double sided tape or glue to fix the shape, (Fig. 28)

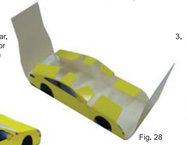
Fig. 28

2. Insert the disc magnet (22) into the car through the opening at back. (Fig. 29)

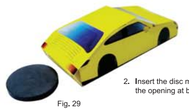
Fig. 29

3. Place the car on a piece of cardboard, and hold the cardboard with one hand, Then hold a bar magnet (25) underneath the car below the cardboard, Move the bar magnet around slowly, and the car will follow. Note that you may need to change the pole of the bar magnet, (Fig. 30)

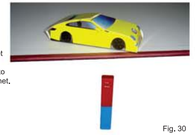
Fig. 30

Explanation:

Magnetic force is used in floating train which travels at very high speed. The train is propelled by electromagnetic system on the rail instead of a train engine. The electromagnetic force also raises the train slightly above the rail when running. This greatly reduces the friction, thus enables the train to travel very fast.

Activity 11 Make a Speaker

In this activity we convert electrical signal into sound using electromagnetic force.
Material: - 1 Plastic cup (20) - 1 Small Coil (21) - 1 Disc magnet (22) - 1 Earphone plug (23) - 2 Wire with crocodile clips (16)
Extra items you will need: - Some adhesive tape

Steps:

1. Stick along the side of the small coil (21) to the bottom of the plastic cup (20) with the adhesive tape. Make sure it is firmly secured. (Fig. 31, 32)

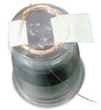
Fig. 31

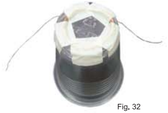
Fig. 32

2. Add another long piece of tape across the coil, Make sure the middle of the tape is not stuck to the cup, (Fig. 33)


Fig. 33

3. Prepare another long piece of tape with the disc magnet (22) stuck in the middle. (Fig. 34)


Fig. 34

4. Put the magnet on top of the tape in step 2. Carefully adjust the position of the magnet to sit at the center of the coil. Fix the position of the magnet. (Fig. 35,36)


Fig. 36


Fig. 35

5. Connect the two ends of the coil to the earphone plug (23) using the red and black crocodile clips (16), Note that the coil is covered with a protective brown layer which is non-conductive, Only the silvery part at the end of the coil should be used to connect to the crocodile clips. (Fig. 37)


Fig. 37

6. Connect the plug to any portable music device and hold the cup close to your ear.

7. Play the music and turn the volume up slowly until you can hear some noise.

Explanation:

When you connect the speaker coil to the audio output of the radio or music player, it sends an electrical signal to the coil. When this electrical current flows through the wires, it creates a magnetic field. This field interacts with the field of the magnet, making the coil move as it is attracted and repelled. Since the coil is fixed to the cup, the cup is moved too. The moving cup moves the air and produces the sound. The cup is called the "diaphragm" of the speaker.

Activity 12 magnetic generator

We use magnet to generate electricity in this activity
Material: - 1 Magnetic generator (27) - 1 LED light (28) - 2 Wire with crocodile clips (16)

Steps:

1. Connect one side of the crocodile clips (16) to the screw terminals of the magnetic generator (28). (Fig. 38)

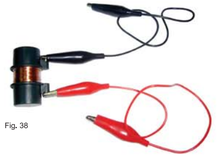
Fig. 38

2. Then connect the other side of the crocodile clips (16) to the LED light (28). (Fig. 39)


Fig. 39

3. Shake the magnetic generator (27) back and forth quickly. The LED light will turn on.

Explanation:

There is a magnet inside the magnetic generator. The magnetic generator works because a voltage is induced when a coil passed through a magnetic field. There needs to be constant relative motion between the coil and the magnetic field to induce electricity in the coil, so either the coil moves or the magnet moves. The greater the rate of change of the magnetic field the higher the voltage induced. Therefore the LED light becomes brighter by shaking the magnet faster!

8+

12 IN 1 MAGNETIC EXPERIMENT SET

- Detail guide for 12 exciting experiments about Magnetism!

Activity Guide

NO. 36073

12 in 1
Magnetic Experiment Set
Activity Guide

WARNING!

Only for use by children over 8 years old. To be used solely under the strict supervision of adults that have studied the precautions given in the experimental set. Not suitable for children under 36 months due to small parts. Choking hazard. This toy contains functional sharp point – on the component leads. Do not short-circuit the battery terminals and spring connectors, which may cause overheating. The wires are not to be inserted into socket outlets. Keep small children and animals away from experiments. Use with care and only under supervision of adult.

WARNING! Not suitable for children under 8 years. This product contains a small magnet. Swallowed magnets can stick together across intestines causing serious injuries. Seek immediate medical attention if magnet are swallowed.

⚠ WARNING :

CHOKING HAZARD - Small parts. Not for Children under 3 years.
This product contains small magnets. Swallowed magnets can stick together across intestines causing serious infections and death. Seek immediate medical attention if magnet are swallowed or inhaled.

IMPORTANT:

Keep these instructions. DO NOT DISCARD.

1. Only adults should install and replace batteries.
2. Alkaline batteries are recommended.
3. If the device has not been used for a long time, remove the batteries.
4. Do not use rechargeable batteries.
5. Do not mix old and new batteries.
6. Do not mix alkaline, standard (carbon zinc) or rechargeable (nickel cadmium) batteries.
7. Exhausted batteries are to be removed from the toy.
8. Non-rechargeable batteries are not to be recharged.
9. Rechargeable batteries are to be removed from the toy before being charged.
10. Rechargeable batteries are only to be charged under adult supervision.
11. The supply terminals are not to be short-circuited.
12. Only batteries of the same or equivalent type as recommended are to be used.
13. Batteries are to be inserted with the correct polarity.
14. Do not dispose of batteries in fire, batteries may explode or leak.
15. Batteries may explode or leak if misused.

Batteries required: 2 x 1.5V AA (Not included)

If at any time in the future you should need to dispose of this product please note that Waste electrical products should not be disposed of with household waste. Please recycle where facilities exist. Check with your Local Authority or retailer for recycling advice.(Waste Electrical and Electronic Equipment Directive)

Components:

1. 1 Swing Coil
2. 1 Swing Top
3. 2 Swing Leg
4. 2 Wire
5. 1 Magnet
6. 1 Switch Plate
7. 1 Metal Plate
8. 1 See Saw coil
9. 2 See Saw Leg
10. 1 Metal Pin
11. 1 Base Plate
12. 5 Spring Connector
13. 1 Card figure
14. 1 Iron rod
15. 1 Coil
16. 2 Wire with crocodile clips
17. 1 Motor coil
18. 1 Metal pin
19. 2 Long See Saw Leg
20. 1 Plastic cup
21. 1 Small Coil
22. 1 Disc magnet
23. 1 Earphone plug
24. 1 Compass
25. 2 Bar magnet
26. 1 Sewing thread
27. 1 Magnetic generator
28. 1 LED light
29. 1 Car card
30. 1 Plastic plate
31. 1 Aluminium Plate
32. 1 Iron Plate

Fig. 1

Activity 1 Magnetic force

Materials: - 1 Bar magnet (25)

Steps:

1. Place the bar magnet near any objects around your area, and feel if there is attractive force between them.

Explanations:

When you place the magnet near some metal, you will feel that they will attract each other. Magnets have an invisible force to attract or repell other objects.
This magnetic force is the same as gravitational force or electrical force that nobody really knows what it is. Now scientists believe that magnetic force is basically a force between electric currents: two parallel currents in the same direction attract, in opposite directions repel.

Magnets are used in everyday devices likes loudspeaker, computer hard disks, motors and telephones, etc. The earth itself is a huge magnet too!
You should also observe that magnetic force works at a distance, and gets weaker when the objects are further apart.

Activity 2 Magnetic pole

Materials: - 2 Bar magnets (25)

Steps:

1. Place two bar magnets (25) on a smooth flat surface, Try moving the magnets' ends with the same colour together and see what happens, Repeat with one magnet's red end moving near the other's blue end.

Fig. 2

Explanations:

A magnet is an object that is surrounded by a magnetic field and has the property, either natural or induced, of attracting iron or steel. Every magnet has two poles called the North (N) and South (S) poles. We say that the magnetic field lines leave the North pole and enter at the South pole. Like poles repel (push away) each other, that is:

North poles repel North poles
South poles repel South poles
Opposite poles attract each other, that is: - North poles attract South poles - South poles attract North poles

Activity 3 Compass

In this activity, you will find out how a compass works.

Material: - 1 Compass (24)

Steps:

1. Place the compass horizontally on your palm and stay still, then the red side of the needle should always point to the same direction. That direction is the north.
2. When the needle stopped, turn the compass until the red needle and the printed "N" overlapped. Now you can read out the other three directions like east (E), west (W) and south (S).

Fig. 3

Explanations:

The earth has a magnetic field and acts like a huge bar magnet. It has one "end" near the North polar region and the other end near the South polar region. A compass is a small piece of magnet, the RED pointer of the compass is the north pole of the magnet and the WHITE pointer of the compass is the south pole of the magnet. When this magnet is free to move, it will align to the earth magnetic field and point to the North and South respectively.

Activity 4 Floating paperclip

We will make a paperclip float in the air.

Material: - 1 Sewing thread (26) - 1 Bar magnet (25)
Extra item you will need: - 1 Paperclip

Steps:

1. Tie the thread(26) to the end of the paperclip. (Fig. 4)

Fig. 4

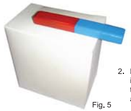

Fig. 5

2. Place a few books on the table about 3 to 4 inches high. Then put the bar magnet(25) on top of the books with about 10mm hung out at the edge. (Fig. 5)
3. Hold the end of the thread on the table with a finger and lift the paperclip near the bar magnet. Move the paperclip closer and closer until the paperclip is attracted by the magnet but not touching it. Release the paperclip. (Fig. 6)

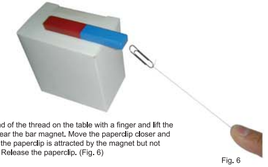

Fig. 6

4. The paperclip should be in the air and will not drop on the table.

Explanations:

Magnetic force is a powerful force, it increases when the distance decreases. You can actually feel the magnet pull on the thread. In this activity there are two forces acting on the paperclip: the gravitational force that pulls the paperclip to the ground and the magnetic force that pulls it towards the magnet. When these two forces are balance, the paperclip will appear "floating" in the air. If the magnet is moved further away from the paperclip, the magnetic force is reduced and the paperclip will fall because of the stronger gravitational pull.

Activity 5 Magnetic material

To learn about the character of different materials.

Material: - 1 Plastic plate (30) - 1 Aluminium Plate (31) - Iron Plate (32) - 1 Bar magnet (25)

Steps

1. Place the three materials on the table and move the bar magnet near each plate and check the result. (Fig. 7)
2. After this you can also test other materials around you.

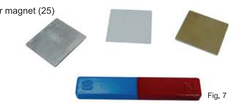

Fig. 7

Explanations:

In general, material can be classified as magnetic or non-magnetic. Iron and steel are attracted by magnets, they are the most common magnetic materials. Wood, plastic, glass and paper are not attracted by magnets and they are called non-magnetic material. Not all metals are magnetic. Copper and aluminium are non-magnetic.

Activity 6 Make a motor

Material: - 1 Base plate (11) - 1 Motor Coil (17) - 1 Metal pin (18) - 2 Long See Saw Leg (19) - 1 Magnet (5) - 2 Spring Connector (12)

Steps:

1. Prepare the wire and the spring connector (12) as shown in Fig. 8. Grab the spring connector narrow end down, push the spring as far as it will go.

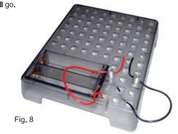

Fig. 8

2. Fix the wires to the spring connector at about 40mm from the wire's end, with the wires pointing upwards as shown in Fig. 8.

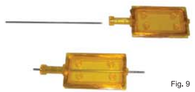

Fig. 9

3. Put the metal pin (18) through the motor coil (17), with the long see saw legs (19) on each side. (Fig. 9,10)

Fig. 10

4. Carefully place the legs on the base plate, The coil must be placed in between and in contact with the two wires. (Fig. 11, 12)

Fig. 11

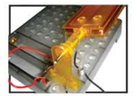

Fig. 12

5. Place the magnet (5) on the base plate just under the coil. (Fig. 13)
6. Install the batteries in the base plate according to the polarities as indicated in the battery compartment (see Fig.25) and flip the coil with your finger. The coil will start to rotate by itself.

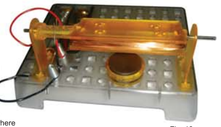

Fig. 13

Explanations:

Anytime an electric current is passed through a conductor, it produces a magnetic field. So when electric current passes through the coil (called "armature" of the motor), it becomes an electromagnet. Assuming that the magnet is sitting with the North side of it up (it doesn't matter which is up) this is the sequence of events: You give the motor a spin. When the red and black wires reach the stripped part of the coil, current flows, forming an electromagnet. The North of the electromagnet is repelled by the North of the magnet, giving the coil a push, and it spins to a position where the wires and the coil break off, and the current ceases to flow. Inertia carries it around until the stripped portion makes contact again. Now the polarity of the electromagnet is reversed because the coil is flipped over, and it is attracted towards the magnet. This gives the coil a pull and it spins to a position where the coil breaks off again. Inertia carries the coil to the other side and the loop repeats. These attract and repel actions enable the coil to rotate continuously.

Activity 7 Build an Electromagnetic Swing

We will make a swing by electromagnet.

Material: - 1 Swing Coil (1) - 1 Swing Top (2) - 2 Swing Leg (3) - 2 Wire (4) - 1 Magnet (5) - 1 Switch Plate (6) - 1 Metal Plate (7) - 1 Base Plate (11) - 5 Spring Connector (12) - 1 Card figure (13)

Steps:

1. Install three spring connectors (12) with the Switch plate (6) and Metal plate (7) on the Base plate (11). Grab the spring connector narrow end down, push the spring as far as it will go. Connect the red battery wire to the spring connector at position 2 and black battery wire to position 3 as shown in Fig. 14. Bend the spring over to create a gap into which the metal wire is inserted.

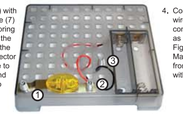

Fig. 14

2. As shown in Figure 15, Install the two Swing Legs (3) on the base plate. Fix the Swing Top (2) on the swing legs. Insert two Spring Connectors into the holes on the Swing Top.

Fig. 15

3. Connect each end of the two wires from the Swing Coil (1) to the spring connectors located in the swing top. This should be done by threading the wires through the holes at the bottom of the spring connectors and then connecting them into the spring connectors using the tip of the wire as shown in figure 16 (see note *). Adjust the length of the wires so that the swing plate is about 1 cm above and parallel to the base plate. (Fig. 16)

Fig. 16

4. Connect the Red Wire (4) and Black wire (4) from the swing top to the spring connector at position 1 and 3 respectively, as shown in figure 17. Stick the Card Figure (13) on the swing plate and put the Magnet (5) bellow it, slightly offset to the front. Make sure the swing is free to move without touching the magnet.

Fig. 17

5. Now, the swing is ready. Insert two AA size batteries to the compartment according to the polarity as shown in figure 18.
6. Tap on the switch briefly to make the swing plate move. When the swing returns to the lowest position, tap briefly on the switch again. Repeat this action and the swing will continue to move back and forth! (Fig. 18)

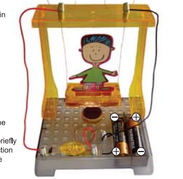

Fig. 18

Explanation:

When the electric current passes through the wire round around the plate, it creates a magnetic field that reaches out in expanding circles. When a wire carrying electricity is twisted into a coil, it is called a solenoid. The magnetic field twists with the coiled wire, causing the magnetic field lines to concentrate inside the coil. This creates a powerful magnetic effect inside the coil called an electromagnet. This magnetic field interacts with that of the permanent magnet to attract or repel the coil.

* Note: The thin wire used in the swing plate and see saw plate is covered with a non-conductive coating except near the ends, so you need to connect the wire's end to the spring connector instead of the middle of the wire. If the wire end gets dirty it may contact poorly with the spring connector and the unit may not work properly. You can brush the wire end with a piece of sandpaper to clean it.

Activity 8 Build an Electromagnetic See-Saw

We will make a seesaw by electromagnet.

Material: - 1 Magnet (5) - 1 Switch Plate (6) - 1 Metal Plate (7) - 1 See Saw coil (8) - 2 See Saw Leg (9) - 1 Metal Pin (10) - 1 Base Plate (11) - 3 Spring Connector (12)

Steps:

1. Install three Spring connectors (12) with the Switch plate (6) and Metal plate (7) on the Base plate (11). Connect the red battery wire to the spring connector at position 1 and black battery wire to position 3 as shown (Fig. 19).

Fig. 19

2. Fix two see saw legs(9) on the base plate(11) as shown in figure 20.

Fig. 20