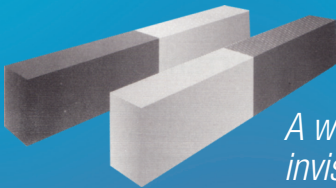
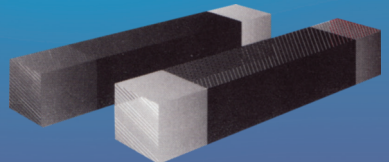


# Magnetic Field Pattern Window

Explore the behaviour of magnets & magnetic fields



*A window to observe the effects of  
invisible magnetic fields and how you  
can influence them with other magnets.*



## **YOUR WINDOW INTO MAGNETISM ....**

The rectangular transparent box contains a magnetic powder suspended in a fluid and forms a window for you to observe magnetic field patterns...

### **THE MAGNETIC FIELD PATTERN WINDOW**

When a magnet is present, it influences the powder which becomes partly magnetised. The magnetised powder particles attract each other and group into lines that represent the pattern of the magnetic field. Magnetism does not arrange itself in lines but lines are useful to show the presence and shape of the magnetic force field. You will be able to examine this in more detail later in the booklet.

The MAGNETIC FIELD PATTERN WINDOW shows a cross section of the three dimensional magnetic force field around a magnet.

### **MAGNETIC POLES**

The poles of a magnet are at the points of strongest magnetic force. The poles always come in pairs and are called "North pole" and "South pole"

A north pole repels or pushes away other north poles and a south pole repels other south poles. A north pole and a south pole are attracted and pull towards each other.

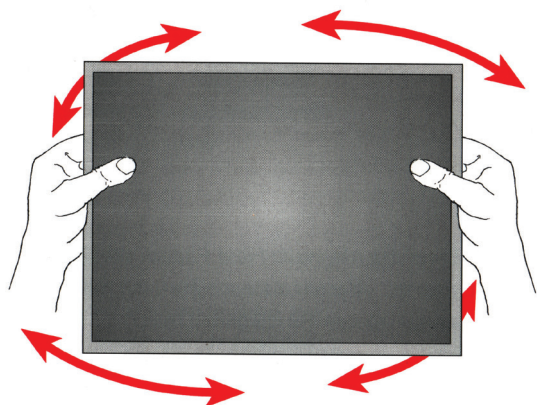
### **CARE OF THE MAGNETIC FIELD PATTERN WINDOW**

Please handle your Magnetic Field Pattern Window and magnets carefully avoid dropping them or exposing them to heat that is too hot to touch. The transparent box can become cracked or scratched and the magnets can start to demagnetise when bumped or heated. If the transparent box becomes dirty, wash it with water and mild soap. A small accumulation of bubbles in the window may occur due to dissolved air in the liquid. They become small and widely distributed after preparation for use and do not affect the function of the window.

**WARNING:** Magnets can harm magnetic storage media. Do not place the magnets too close to cassette tapes, video tapes, credit cards, watches, computer hard drives or computer discs.

## PREPARING TO USE YOUR MAGNETIC FIELD PATTERN WINDOW.

Thoroughly mix the particles in the fluid by holding the window horizontally and turning it back and forth like a steering wheel. Continue until the particles are uniformly distributed.

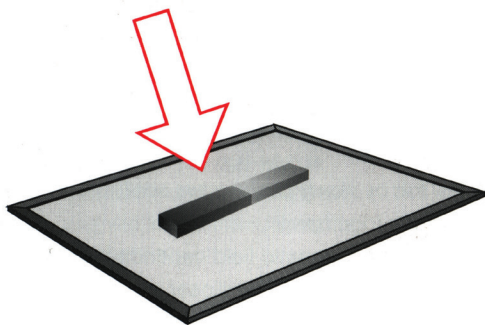


Once the Magnetic Field Pattern Window is well mixed, you are ready to create patterns with the magnets.

*It will be necessary to redistribute the liquid after each pattern or experiment.*

## ACTIVITIES

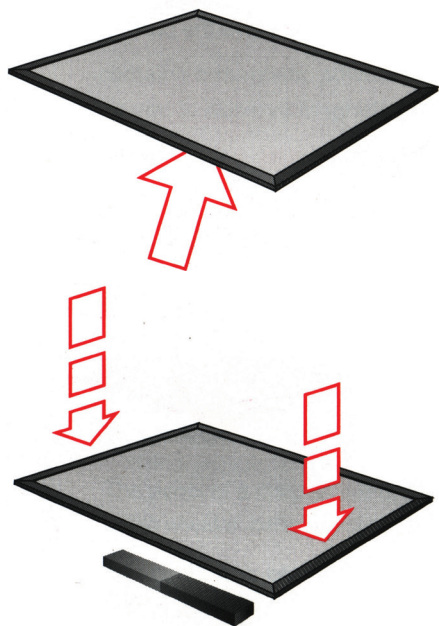
1. The simplest experiment is to see what happens when you place a bar magnet onto the top of the Magnetic Field Pattern Window. Tap the centre of the viewer lightly at first until the particles align themselves to show the shape of the magnetic field. Further tapping at the edges can improve the definition of the field further from the magnet.



What kind of pattern do you see?

Observe how the lines bunch up near to the poles of the magnet and how they make loops that begin and end at the magnet's ends, (poles).

The magnetic field is strongest where the lines of force are closest together. If you look closely, you will see that this happens at both poles of a bar magnet, and that the field is weaker half way between the poles.



**2.** Try placing a bar magnet underneath the Magnetic Field Pattern Window, then against an edge. Do you see a similar pattern?

**3.** Slowly lower the Magnetic Field Pattern Window over a magnet. At what distance from the magnet can you begin to see the magnetic field? When you hold the Magnetic Field Pattern Window 12mm or so above the magnet, do the particles of magnetic powder line up differently from when it rests directly on top of the magnet?

A magnet exerts a force on any magnetic materials near to it. This force is three-dimensional and exists in all directions in space around the magnet; it is called the magnetic force field. You are able to see the force field because the powder in the fluid inside the window is aligned in the direction of the force field. The lines of force always connect to the two poles.

The direction and strength of the field depend upon its distance from the magnet's poles.

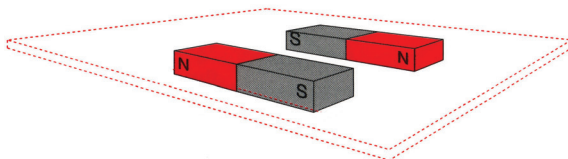
**4.** You can feel this by slowly pushing two similar poles of your magnets together. The strength of the magnetic field depends on its distance from the magnet. The closer you get to the magnet, the stronger the magnetic forces become.



**5.** Try the following magnet formations and see how the magnetic pattern changes.

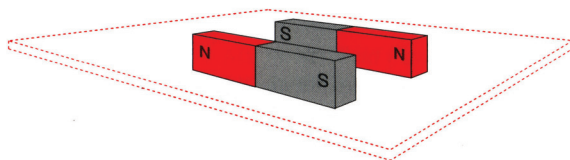
**5.A**

Two bar magnets laid flat, half their length apart and parallel, with their North and South poles opposite each other



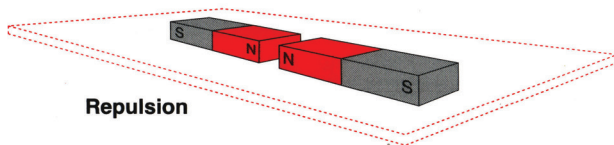
**5.B**

Two bar magnets on edge, half their length apart and parallel, with their North and South poles opposite each other



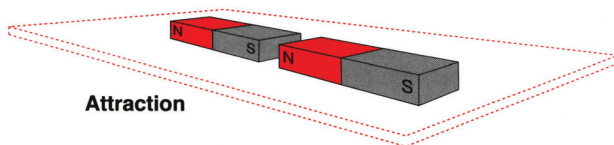
**5.C**

Two bar magnets in line, with their North and North poles facing each other



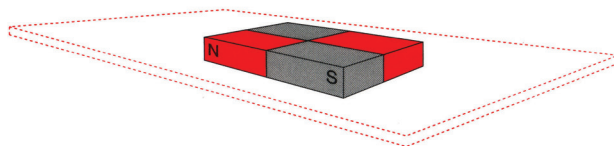
**5.D**

Two bar magnets in line, with their North and South poles facing each other - you may wish to insert some card between the two magnets to stop them joining together



**5.E**

Two bar magnets touching, with their North and South poles facing each other



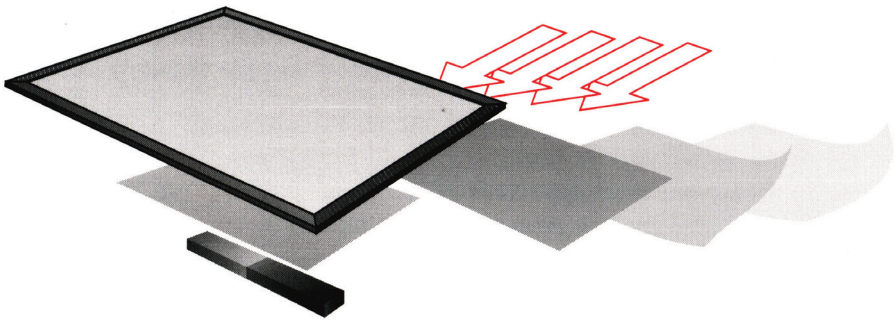


**6.** You can examine the powder in fine detail with a magnifying glass. See what the powder does when a magnet is nearby. Can you see how the lines form?

The powder in the fluid of the Magnetic Field Pattern Window is magnetic. These powder particles feel the force from a magnet and are attracted to the magnet's poles. You can see the magnetic field representation since the attraction pulls the powder particles along the lines of the magnetic field. This is because magnetic materials temporarily become magnets themselves when they are in a magnetic field. The particles of magnetic powder also attract each other and form lines.

Create new patterns by placing one magnet below the Magnetic Field Pattern Window and then moving another magnet close to the first magnet. Watch the shape of the field change. Can you make new patterns with more than one magnet? Do the lines that leave one magnet always end up on that magnet?

**7.** Do any materials block the magnetic field? Try putting a piece of paper aluminium foil, glass, plastic or steel between the magnets and the Magnetic Field Pattern Window. Do any of the materials change the magnetic field?



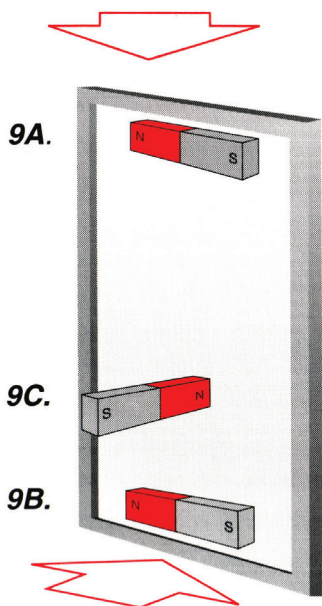


**8.** What happens when you attach a piece of mild steel to one pole of the magnet? How does this affect the pattern?

Now try to detect a magnetic field with the mild steel on its own. Does it have a magnetic field of its own or only when attached to a magnet?

What does this tell you about the permanence of magnetism and the difference between a magnet and a piece of mild steel? Mild steel can only become a magnet when attached to another magnet or when placed inside an electric field.

**9.** Support the Magnetic Field Pattern Window on its edge and watch the magnetic particles settle to the bottom. **9A.** Repeat this activity but hold a magnet onto the window face near the top of the Magnetic Field Pattern Window. What happens when you remove the magnet?



When a magnet is held near, the particles group together in the magnetic field to form large clumps that fall much faster than single particles.

**9B.** Now repeat the above activity with the magnet at the bottom. What new patterns are created?

Flow patterns are created by the movement of the magnetic particles in one direction and the movement of the fluid in the opposite direction.

**9C.** Try again using a single pole of the magnet held to the face of the window. What new patterns are created? Remember to redistribute the particles before each experiment.

## VIEWING

The view of the magnetic field patterns in the transparent version (50143) can be seen more easily if the unit is placed over a white background or viewed via an overhead projector.

