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Bringing Learning to Life

Program Support Notes

Junior **S**econdary

26mins

Science Building Blocks
Magnetic Force

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Suitable for:

Science

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Introduction

This program introduces junior secondary students to magnets and magnetism. It covers the following topics;

- Magnetic theory
- Magnetic fields
- The earth as a magnet
- Electromagnets and electric motors
- Magnets in everyday life.

Experiments, graphics and footage of applications of magnets and electromagnets are used to explain these concepts.
Also available in this series: Separating Mixtures, Light and Sound, Changing States of Matter, Food and Digestion.

Program Timeline

00.30 Introduction
02.07 Magnetic theory
06.29 Summary
07.14 Magnetic fields
10.36 Summary
11.17 The earth as a magnet
13.50 Summary
14.37 Electromagnets and electric motors
19.10 Summary
19.58 Magnets in everyday life
24.17 Summary
25.04 Conclusion
25.37 Credits
26.04 Program end

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Before Viewing the Program

1. What is a magnet?

2. How many times in a normal day do you use magnets and magnetism?

3. How do compasses work? What do you know about the earth' magnetic poles?

While Viewing the Program

1. What materials do magnetic forces work on?

2. What were the first known magnets and what was responsible for their magnetic properties?

3. What are the ends of a magnet called?

4. How do these ends behave when they are brought close to one another?

5. What is a domain? Draw diagrams showing domains that illustrate the difference between magnetized and non-magnetised iron.

6. How can domains be put out of alignment?

7. What is a temporary magnet?

8. Which way do magnetic field lines run and where is a magnetic field strongest?

9. What does the distance between the field lines in a magnetic field tell you?

10. Why does a free-swinging magnet point to the earth's magnetic north pole? Explain.

11. Draw a sketch of the earth's magnetic field. Which way do the field lines run?

12. What is the right hand rule?

13. How can the magnetic field in a wire be increased?

14. What are the main components of an electric motor? What is the role of each one?

15. How do electrical generators work?

16. Name 6 things in the home that rely on magnetism to function.

17. How is data stored on hard drives?

18. What is used in a microphone to convert sound waves into electrical signals?

19. What is Maglev short for?

20. How is the train kept (a) just above the rails (b) propelled along?

After Viewing the Program

1. Try some of the experiments shown in the program. Use iron filings and a variety of magnets to map magnetic fields. Always keep something between the magnets and the iron filings, as they are difficult to separate. You can wrap your magnets in cling film or use an overhead projector transparency sheet as a barrier. Try putting 2 magnets end to end with like and unlike poles facing.

2. Find out more about the earth as a magnet. Are the earth's magnetic poles always in the same place? Has the North Pole always been the north Pole? What geological evidence is there for this? Are Scientists predicting any change?

3. Make a poster to show how the following things work. Computer hard drives, electric motors (why are they usually 3 pole?), electric generators, microphones and speakers.

4. Record something onto a floppy disc, an audiotape and videotape. Test to see that your recording has been successful then stroke each one with a strong magnet. Try them again. Do they still work? Explain.

5. People make claims for the healing power of magnetic blankets and bandages. This is not new. Find out who Mesmer was. Is there anything to support claims that use of magnets is healing?

Suggested Student Responses

1. What materials do magnetic forces work on?
   Iron, nickel and cobalt and several other very rare metals.

2. What were the first known magnets and what was responsible for their magnetic properties?
   Pieces of rock called magnetite or lodestone. Their high iron content was responsible for their magnetic properties.

3. What are the ends of a magnet called?
   The north and south poles.

4. How do these ends behave when they are brought close to one another?
   Attraction between unlike poles and repulsion between like poles.

5. What is a domain? Draw diagrams showing domains that illustrate the difference between magnetized and non-magnetized iron.
   A small magnetic particle with north and south ends. Each domain is made up of many atomic particles.
   Diagrams should show the domains aligned with all their north poles in the same direction in the magnetized iron and a random arrangement in the un-magnetized iron.

6. How can domains be put out of alignment?
   By banging or jarring and by heating.

7. What is a temporary magnet?
   One that works only in the presence of a permanent magnet. If the permanent magnet is removed the temporary magnet soon loses its magnetic properties.

8. Which way do magnetic field lines run and where is a magnetic field strongest?
   They extend from north poles to south poles. The magnetic field is strongest at the poles.

9. What does the distance between the field lines in a magnetic field tell you?
   The further apart the field lines are the weaker the field is. The closer together they are the stronger the field is.

10. Why does a free-swinging magnet point to the earth's magnetic north pole? Explain.
    The earth is like a giant magnet and thus has a magnetic field. The earth's magnetic north is really the

11. Draw a sketch of the earth's magnetic field. Which way do the field lines run?
    Field lines should run from the South Pole to the north pole of the earth and be weakest at the equator.

12. What is the right hand rule?
    If you wrap your right hand around a wire with your thumb pointing to the negative terminal then the direction your fingers wrap around the wire gives the direction of the magnetic field lines around the wire.

13. How can the magnetic field in a wire be increased?
    By making coils of wire around a piece of iron such as a nail. The more coils you make the stronger electromagnet you will create.

14. What are the main components of an electric motor? What is the role of each one?
    The armature is an electromagnet and the commutator and the brushes rotate the magnet in a magnetic field produced by a larger magnet. The commutator and the brushes rotate the armature and reverse the flow of current to the electromagnet.

15. How do electrical generators work?
    If a wire is moved in a magnetic field a current will flow in the wire.

16. Name 6 things in the home that rely on magnetism to function.
    Speakers, video and audio playback heads, CD and DVD head spinners, computer hard discs and floppy discs, microwave ovens, telephones, door bells, exhaust fans and cooling fans, refrigerators and clothes driers and many components in the electrical systems of a car.

17. How is data stored on hard drives?
    Discs have a magnetic coating and information is stored as magnetic pulses that can be read by the read/ write arm

18. What is used in a microphone to convert sound waves into electrical signals?
    A diaphragm is vibrated by the sound waves produced by the vocal chords and this either moves a magnet through a coil of wire or a coil of wire along a magnet to produce electrical impulses in the wire in a pattern caused by the sounds. A speaker works the opposite way to convert the electrical signals into sound waves.

19. What is Maglev short for?
    Magnetic levitation

20. How is the train kept (a) just above the guide way (b) propelled along?
    a. **Repulsion of electromagnets**
    b. **Attraction of an electromagnet to one just ahead in the guide way.**