

The Seal of Approval!

SUMMARY INFORMATION

Keywords

Transportation, magnetism, safety, locking mechanism

Topics Covered

Physics

Target Grade(s)

7, 8

Estimated Time Required

3 hours

LESSON

Goals and Pre Requisites

Goals

- To derive from students an understanding of magnetism.
- To incorporate concepts of magnetism in building simple mechanisms of locking.

Pre Requisites

Knowledge on the characteristics of magnets.

Instructional Objectives

Through this activity, students would be able to

- Apply conceptual understanding
- Demonstrate critical thinking
- Use mathematical concepts

Instructional Resources

Problem Statement

Public transport is the most widely used system of transportation in India. However, in terms of passenger safety and security during travel, it may not seem the best. In almost 90% of these transports, the entrance and exit doors are left ajar, due to improper sealing mechanism. As the usage of public transport is increasing over time, accidents due to the above reason is also parallely on the rise. How can we come up with solutions that would help solve the above problem?



Background

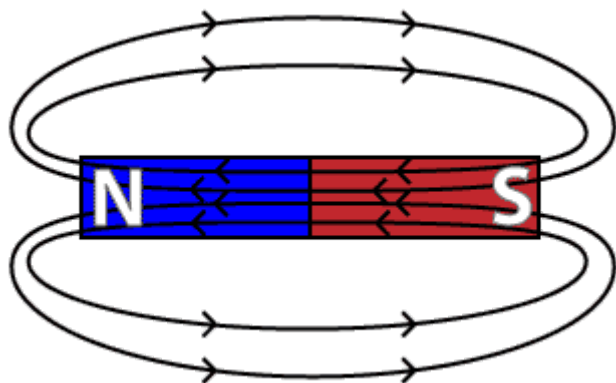
Transport in India

Transport is an important part of India's economy. Since the economic liberalisation of the 1990s, infrastructure development has progressed rapidly; today there is a variety of modes of transport by land, water and air. However, India's relatively low GDP per capita has meant that access to transport has not been uniform. Public transport remains the primary mode of transport for most of the livelihood in India, and India's public transport systems are among the most heavily used in the world.

Magnetism

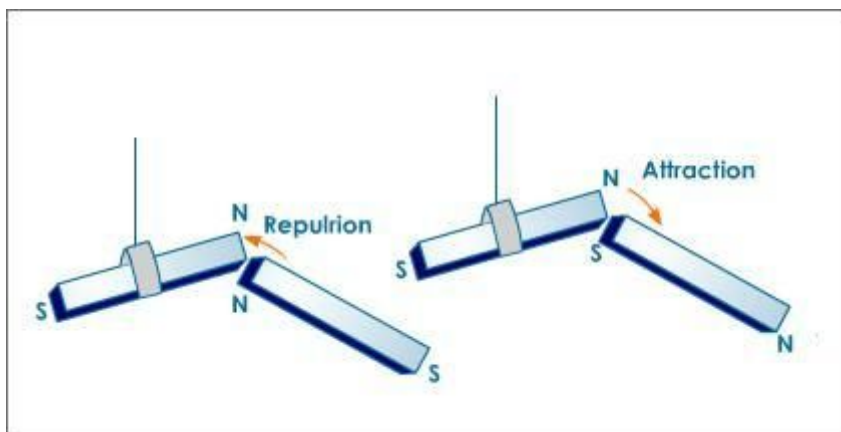
Magnetism is a class of physical phenomena that are mediated by magnetic fields. Electric currents and the magnetic moments of elementary particles give rise to a magnetic field, which acts on other currents and magnetic moments. Every material is influenced to some extent by a magnetic field. The most familiar effect is on permanent magnets, which have persistent magnetic moments caused by ferromagnetism. Most materials do not have permanent moments. Some are attracted to a magnetic field (paramagnetism); others are repulsed by a magnetic field (diamagnetism); others have a more complex relationship with an applied magnetic field (spin

glass behaviour and antiferromagnetism). Substances that are negligibly affected by magnetic fields are known as *non-magnetic* substances.



These include copper, aluminium, gases, and plastic. Pure oxygen exhibits magnetic properties when cooled to a liquid state.

The magnetic state (or magnetic phase) of a material depends on temperature and other variables such as pressure and the applied magnetic field. A material may exhibit more than one form of magnetism as these variables change.



The magnetic behaviour of a material depends on its structure, particularly its electron configuration, for the reasons mentioned above, and also on the temperature. At high temperatures, random thermal motion makes it more difficult for the electrons to maintain alignment.

Procedure

1. Introduce the **Problem Statement** to students.
2. Form students into groups of four.
3. Allow them to brainstorm with their groups, on the given **Problem Statement**.

4. Each group must come up with their unique solution(s) to the given problem.
5. Each group can compare their solutions with fellow groups and with their teacher to check on the feasibility of their solution.
 - In order to check on feasibility, instruct students to discuss with their team mates and have a rough sketch of their plan before constructing it. Students must be able to provide justification for their choice of materials.
6. Ask students to build a timeline (within the estimated amount of time provided under summary information) and ensure that all members of each group are involved in planning the project in terms of availability and cost of materials.
7. Students must make sure that the design incorporated in their process would address the existing problem.
8. Each group can present their solution and evaluate feasibility with peer groups and the teacher.

Sample Methodology

Note: The following is an example of how the given **Problem Statement** might be addressed. **For Teacher Reference only.**

Materials Required: Metal strips, magnets of various sizes and strengths, cardboard material

1. Students may convert a thick metal strip or a small block of metal into a magnet.
2. Assuming a cardboard box to be a transport, they can use the flaps as the door.
3. They may now attach the magnets to the two flaps of cardboard and calculate the distance at which they must be placed, magnetic polarities etc.
4. Students can calculate the ideal thickness of the cardboard used, and the ideal placement of the magnets in order to work effectively, similar to the mechanism used for holding doors in place.



To know more, follow the link given below

<http://www.wikihow.com/Make-a-Magnet>

Conclusion

Safety and Security is ensured by implementing simple magnetic mechanisms.

Extension

- Case studies on public transportation models in foreign countries.

Assessment and Rubric

Define the need or problem – Did students identify the need to resolve this problem? Were they able to relate the problem to their own environment?

Come up with ideas - Did students weigh various possibilities brainstorm on various ideas before arriving at a solution? Did each group collaborate effectively to (1) work within the time given (2) give equal opportunity for participation (3) consolidate relevant information (4) provide rationale for their decisions and choices.

Select the most promising idea or design - Were students able to evaluate the feasibility of their solution to the given problem statement? On what basis was the feasibility of the solution determined?

Communicate and plan the project – Were groups able to provide justification for their choice of materials? Were students able to see completion of the activity within the estimated time?

Create/Build and test a design –Were all members of the team participative during the course of the activity?

Evaluate and revise the design – Were student groups able to present their solutions in a clear and distinct manner with other groups? Were they keen on improving their model further?

Credits

- http://www.indianrailways.gov.in/railwayboard/uploads/directorate/st_at_econ/pdf/YEAR_BOOK_ENG_2011_12/1.pdf
- https://data.gov.in/sites/default/files/datafile/Registered_Motor_Vehicles_in_India_1951-2013.cs
- <http://www.washingtonpost.com/blogs/worldviews/wp/2013/01/18/a-surprising-map-of-countries-that-have-the-most-traffic-deaths/>
- <http://www.dw.de/dw/article/0,,5519345,00.html>
- <http://www.rediff.com/money/2004/oct/23car.htm>
- http://galileoandeinstein.physics.virginia.edu/more_stuff/E&M_Hist.htm
- https://en.wikipedia.org/wiki/Ministry_of_Statistics_and_Programme_Implementation
- Wikihow: <http://www.wikihow.com/Make-a-Magnet>
- http://www.thehindu.com/multimedia/dynamic/01332/16janchvkn01_Au_TH_1332903e.jpg
- http://www.aplusphysics.com/courses/regents/electricity/regents_magnetism.html
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- <https://www.doorware.com/specials/help-center/magnetic-door-stops.cfm>
- https://en.wikipedia.org/wiki/Fire_door