

**TITLE:**

Nanotechnology & magnetism of computer hard drives

**AUTHOR:**

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**GRADE LEVEL/SUBJECT:**

Grade 8 through HS  
magnetism, periodic properties, computer science, nanomaterials, nanomagnetism

**CURRICULUM STANDARD:**

National science education standards

**CONTENT STANDARD B: As a result of their activities in grades 9-12, all students should develop an understanding of**

- Structure of atoms
- Structure and properties of matter
- Motions and forces
- Interactions of energy and matter

**CONTENT STANDARD E: As a result of activities in grades 9-12, all students should develop**

- Abilities of technological design
- Understandings about science and technology

Illinois state learning standards

**STATE GOAL 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.**

B. Know and apply the concepts, principles and processes of technological design.

**11.B.5a** Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs.

**11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time.

**STATE GOAL 12: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.**

C. Know and apply concepts that describe properties of matter and energy and the interactions between them.

**12.C.5b** Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures.

D. Know and apply concepts that describe force and motion and the principles that explain them

**12.D.4b** Describe the effects of electromagnetic and nuclear forces including atomic and molecular bonding, capacitance and nuclear reactions.

**STATE GOAL 13: Understand the relationships among science, technology and society in historical and contemporary contexts.**

B. Know and apply concepts that describe the interaction between science, technology and society.

**13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs.

**OVERVIEW:**

This lesson will introduce students to the concepts surrounding how computer hard drives are produced & how magnetic properties make data storage possible.

**LEARNING OBJECTIVES:**

1. Describe how elements produce magnetism
2. Explain how magnetic properties can be utilized for computer data storage
3. Translate binary computer data into letters
4. Describe the limits for data storage at the nano level
5. Calculate data storage using dimensional analysis techniques
6. Explain the processes use in the manufacture of magnetic hard drives
7. Describe how magnetism is used to store & read computer data

**TIME ALLOTTED:**

3 to 4 class periods (50 minute class periods)

**VOCABULARY:**

Bit  
Byte  
Lithography  
Magnetism  
Spin coating  
Sputtering  
Evaporation  
Diamagnetic  
Paramagnetic  
Nanoparticle  
Platter  
Read head

**RESOURCES/MATERIALS:**

PowerPoint presentation

Bits & bytes calculation handout

Nanotech puzzle

Computer code handout

Web video from Hitachi

(<http://www.hitachigst.com/portal/site/en/menuitem.72d014a72aceb0421ac39531bac4f0a0/>)

Web magnetism game (<http://www.glaielgames.com/Games.htm>)

Lithography nanosmores kit (<http://www.nbtc.cornell.edu/mainstreetscience/kitlib/>)

Variety of types of magnets

Old computer with monitor

Iron filings

Twirl o' paint with different types of paint to demonstrate spin coating

**PREREQUISITE KNOWLEDGE:**

Students should have an understanding of the powers of 10 scale

Know the parts of the atom

Understand the basic parts of a computer

**MAIN ACTIVITIES:**

Interactive PowerPoint presentation to introduce content

Magnet exploration

Magnet flash game

Lithography nanosmores lab

Video clips from Hitachi

Binary code/ASCII writing activity

Bits & bytes calculation activity

Spin coating demonstration

Review crossword puzzle

**EVALUATION:**

Matter & energy unit test

Magnetic exploration observations

Bits & bytes calculation handout

Computer code handout

Nanotechnology puzzle

Nanosmores lab report