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Topic: Does the electric current produce a magnetic field?

The general aim: to know that the electric current produces a magnetic field.

Operational aims:

- Student is able to:
- discuss Oersted's experiment – horizontal and vertical version,
- describe differences between the magnetic field around a straight-line conductor and the magnetic field in a solenoid,
- use right-hand rule to set magnetic field's direction,
- knowing use of this phenomenon in technology for example in electromagnets.

Methods

- *searching:* conversation with students (asking questions);
- *practical*: making Oersted's experiment, complementing „a worksheet".

Work forms

- collective,
- individual.

Educational aids:

- apparatus: from the Low-Tech kit you will need: brass wire, 4.5 V battery, 2 compasses, 4 crocodiles, 2 cables, plexi table with short legs**,**
- a blackboard, chalk,
- TV-set, DVD, film – "Magnetic field around a conductor" ("Physics in low secondary school", part 3, film no. 13, ZamKor.)
- worksheets,
- sheets with homework.

The lesson's scenario

TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES
1. *Start.*	
- Welcome and presence checking.	- They are sitting down.
- Giving worksheets to students. Telling students that completing work card is obligatory during the lesson.	
- During last lesson we were talking about magnets. What we knows about magnet?	- One of students is saying that each magnet has two magnetic poles which are called north and south.
- Asking students is it possible to divide a magnet for two magnets in a specific way that one of them will have only north pole and the second one will have only south pole?	- One of students is answering (predicted answer): It is impossible, each magnet has always two poles. Even if we divide one magnet in two, each of them will still have two poles.
- Asking students what is a compass?	- One of students is answering (predicted answer): A compass is device that by using it we are able to set geographic directions, it shows us geographic north.

- Asking students how does compass work?	- Predicted answer: Compass points geographic north and magnetic south. A magnetic needle has two poles and its north pole is attracted by south magnetic pole of the Earth.
2. *The lesson's development.*	
- Telling that in a few minutes will be made two experiments that are called Oersted's experiments. Telling that Oersted was Danish physic who investigated magnetic properties and electric current. Writing topic on the blackboard.	- They're writing topic.
- Showing Oersted's experiment – horizontal version.	- They're watching.
- Asking students what did they saw. Giving few minutes for filling worksheets.	- Predicted answer: The needle of the compass started turning when current was floating. For some time it stopped and was positioned orthogonal direction with respect to the wire. - They're writing answers in worksheets.
- Asking what may cause turning the needle?	- Predicted answer: it may be caused by floating current. Electric current produce magnetic field.
- Showing Oersted's experiment – horizontal version with reversed current's direction.	- They're watching.
- Asking students what did they saw. Giving few minutes for filling worksheets.	- Predicted answer: The needle of the compass also started turning when current was floating. For some time it stopped and was positioned orthogonal direction with respect to the wire. - They're writing answers in worksheets.
- Asking students for saying similarities and differences between this two experiments.	- Predicted answer: When the electric circuit is closed, needles of compass' were turning in both experiments. The needles stopped and were positioned orthogonal direction with respect to the wire in both cases, but their position were opposite.
- Asking how would they discuss that the orientation of the needles is reversed in the compasses.	- Predicted answer: If we reverse direction of the current in the wire, the direction of magnetic field is also reverse.
- Showing Oersted's experiment – vertical version.	- They're watching.
- Asking students what did they saw.	- Predicted answer: When the electrical circuit was open all compasses needles were in the north-south direction. Needles of compass' started turning when the electrical circuit was closed. They turned with respect to circles around the wire.
- Telling that in 1820 Oersted showed that electric current could be a source of a magnetic field. The magnetic field produced by a current extends above and below the cable. The direction of this is fixed when the direction of the current is fixed.	- They're listening.
- Saying that they will see a short film about magnetic field around a conductor and a	- They're watching film.

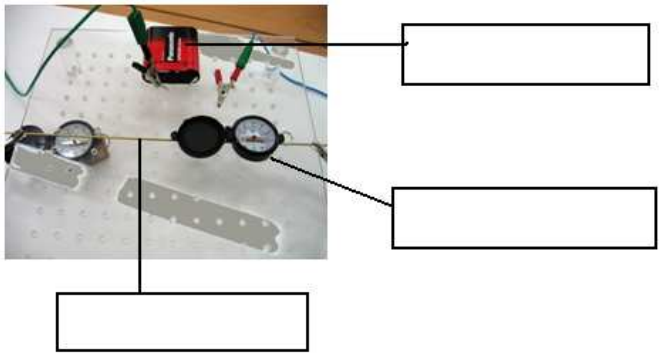
solenoid. There are shown shapes of magnetic field around a wire and the solenoid. There is presented a right-hand rule.	
- Asking what rule was shown in the film.	- Predicted answer: It was a right-hand rule.
- Asking what we can set using this rule.	- Predicted answer: We are able to set the direction of the magnet fields when the electrical circuit is closed.
- Asking about shape of magnetic field around a wire and in solenoid. Giving few minutes for filling worksheets – making paints.	- Predicted answer: Magnetic field's shape around a wire is a circle. In solenoid magnetic field has shape parallel (line) but around solenoid is similar to magnet. - They're painting.
- Checking right answers.	- They are checking if their answers are correct. If name is wrong, they correct.
- Explaining right-hand rule.	- They're listening.
- Asking student for reading the fifth (5.) exercise instruction.	- They're complete the fifth (5.) exercise.
- Checking right answers.	- They are checking if their answers are correct. If direction is wrong, they correct.
- Telling that this phenomena (producing magnetic field around conductor) has been using in technology f.e. electromagnet. Giving homework: In the Internet find some information about electromagnet, especially about its use in technology.	- They're listening and watching.
3. *Ending.*	
- Reassuming students' work, giving a note for theirs activity during the lesson. Giving sheets with homework. Saying students good bye.	- Bidding the teacher goodbye.

THE WORKSHEET

Name: _____ Class _____ Date_____

Topic:_____

1. At the picture there is apparatus needed to show Oersted's experiment – horizontal version. Name elements shown at the picture.



2. What happens when the electrical circuit is closed?

_____

_____

3. What happens when the current's direction is reserved?

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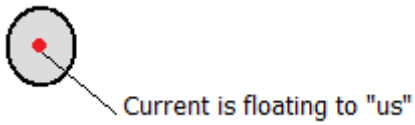
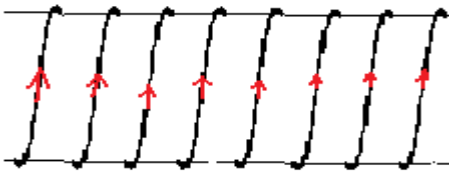
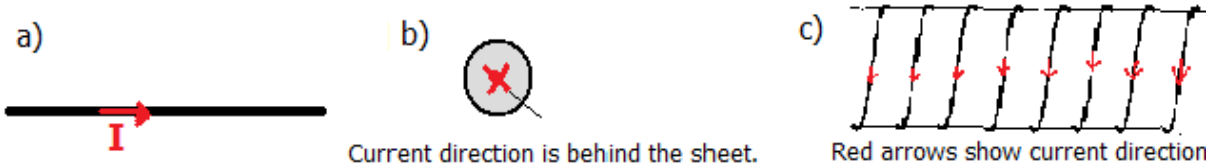
_____

4. Paint shape of magnetic field around a wire and around a solenoid.





5. Using right-hand rule set the direction of magnetic field.



HOMEWORK

In the Internet find some information about electromagnet, especially about its use in technology.

THE WORKSHEET with predicted answers

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Topic: ***Does an electric current produce magnetic field?***

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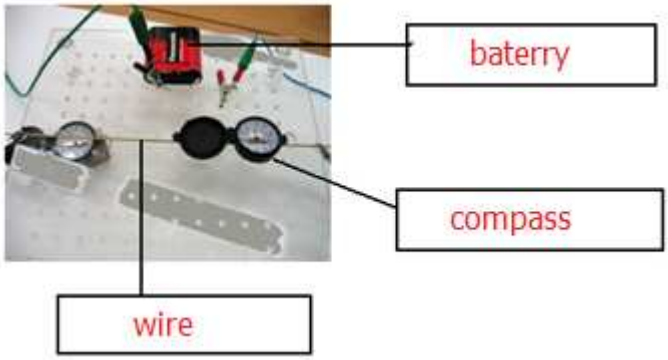


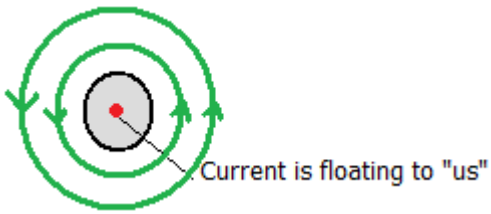
2. What happens when the electrical circuit is closed?

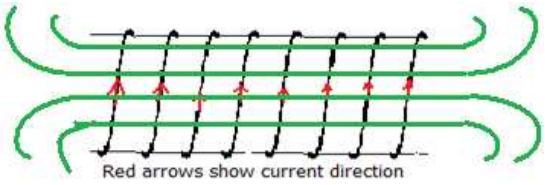
The needle of the compass start turning when electric circuit is closed. For some time it stops and is positioned orthogonal direction with respect to the wire.

3. What happens when the current's direction is reserved?

If direction of the current in the wire is reversed, the direction of magnetic field is also reversed.

4. Paint shape of magnetic field around a wire and around a solenoid.





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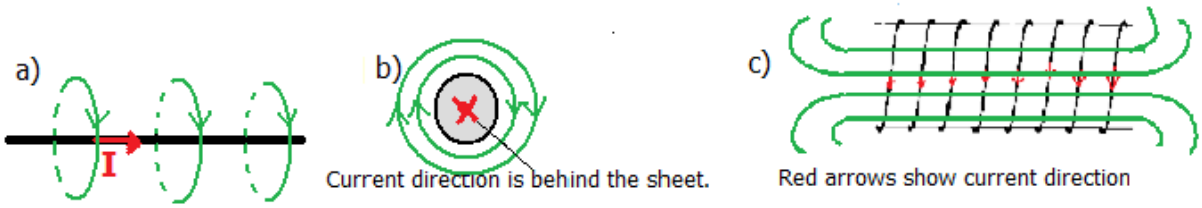

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