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NOWE METODY I TECHNOLOGIE W NAUCZANIU FIZYKI - CLICKERS

Questions and comments are welcome at any time!


RUSSIA
N Canada
Arctic Ocean
Ellesmere Island
GREENLAND
ICELAND
Reykjavík
Baffin Bay
Nuuk (Godthåb)
UNITED STATES
Victoria Island
Baffin Island
Labrador Sea
YUKON TERRITORY
Gulf of Alaska
NORTHWEST TERRITORIES
NUNAVUT
Hudson Bay
NEWFOUNDLAND AND LABRADOR
Pacific Ocean
CANADA
ALBERTA
MANITOBA
BRITISH COLUMBIA
SASKATCHEWAN
QUEBEC
ONTARIO
NOVA SCOTIA
NEW BRUNSWICK
PRINCE EDWARD ISLAND
Ottawa
UNITED STATES
Washington, D.C.
Atlantic Ocean
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KELOWNA

Main Points

- Background information about educational reform in physics in North America.
- Introduction of clickers.
- Benefits of using clickers.
- Phys 112/122.
- Demonstration of using clickers in the classroom.
- Educational outcomes of using clickers.
- Discussion.

Podstawowe roznice pomiedzy systemem uniwersyteckim w Kanadzie i USA a w Polsce

- *Studenci zapisuja sie **na uniwersytet** a nie na konkretny program. Dobieraja sobie kursy wedle uznania. O wyborze kierunku decyduja po 2-gim roku. Moga to zmieniac nawet pozniej.*
- *Kursy 1-go roku fizyki prowadzone sa na **dwoch poziomach**: Calculus Based Physics i Algebra Based Physics (dla studentow bez podstaw fizyki ze szkoly sredniej)*
- *Kursy 1-go roku sa bardzo liczne, powyzej 200 studentow.*

Problems with physics in the nineties:

- Decline in the number of students majoring in physics.
- Low opinion about physics courses among students.
- General feeling among faculty that the students learn less that they used to.

Nobody is happy!!! Let's find out what is wrong.

- **Physics** is currently leading the sciences in this discipline-based education research, but chemistry and biology are following with their own journals devoted to the subject and a number of science researchers looking specifically at education. This is a relatively new development since **traditionally research into teaching and learning came solely from education researchers**, not science academics. Discipline-based education research is leading to new questions about how students learn.

Main advocates of education reform in physics – student centered teaching

Eric Mazur – Harvard

"Peer Instruction

A User's Manual"-1997

Carl Wieman - Nobel Prize 2001

UBC

Findings:

- There is a large gap between what we think we are teaching (physics) and what is being learned (equation manipulation)
- The problem seems to be rooted in how students internalize information. Many students memorize equations and can easily solve standard problems but are not able to apply the concepts to other, similar questions not phrased in the way they were taught.

- Many students see “concepts” and “calculations” as two completely different issues.
- When given a quantitative questions, most students will not think about concepts that are involved.
- When given a qualitative question, most students never consider writing down an appropriate equation. Math is not seen as tool.

Teaching Strategies and Retention

- Lecture 5%
- Readings 10%
- Audio-visual 15%
- Demonstrations 30%
- Discussion groups 50%
- Practice by doing 75%
- Teaching others 90%

Joy Mighty – today's Keynote Presentation

Student centered interactive teaching.

PRS CLICKERS – Interactive Teaching

HOW TO JOIN

- Power on your Clicker.
- When auto-scan begins, press number or letter displayed on the Power Point slide and press 
- You will see on the display: “Scanning found 1 → P112ART 366”
- Press 
- **You are ready to try your clicker!**

Q1: In deciding which of the two acids is stronger, one must know:

- The concentration of each acid in solution
- The pH of each acid in solution
- The equilibrium constant, K_a, of each acid
- All of the above

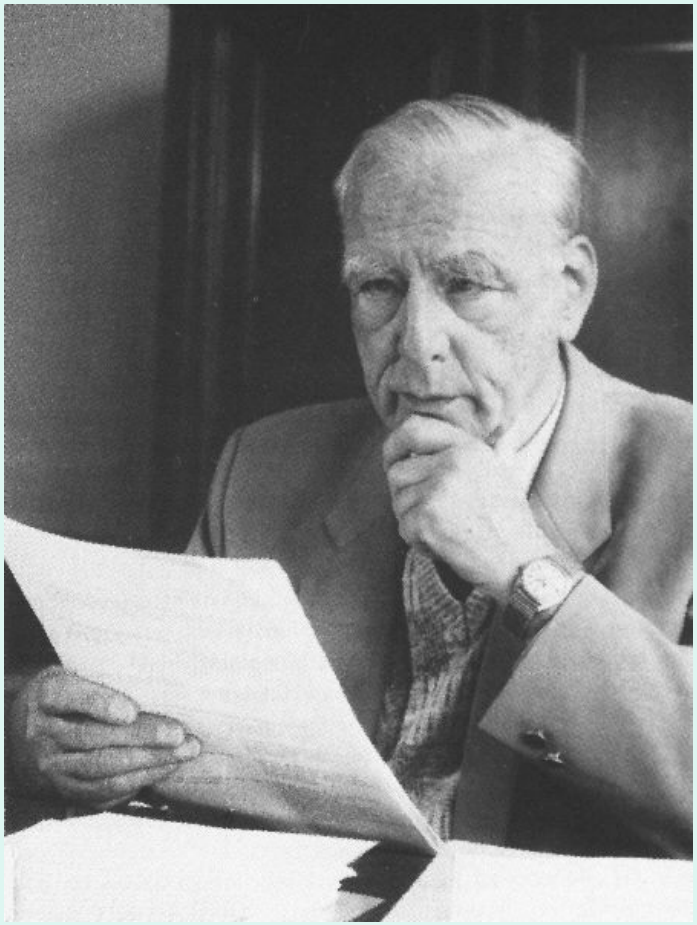
Q2: Solve for X (give 2 decimal places)

$$3x - 2 = 8$$

- There is also a “self pace mode” available for clickers. This is particularly useful for exams or homework assignments.

Q3: Nobel Prize in Physics Winner in 1965 was Ernst Ruska for his contribution to electron microscopy.

- True (T)
- False (F)



Nobel Prizes

- 1965 – Richard P. Feynman
- 1986 - Ernst Ruska

Benefits of using clickers:

- Increasing students **participation and engagement** in class.
- Encouraging and developing **critical thinking** and **problem-solving** skills.
- Promoting **scientific reasoning** and stimulating **discussion** among peers.
- **An instant feedback about the level of students comprehension of the material discussed in class.**
- Making teaching and learning **interactive** and **fun.**

Course Background:

- I-st year Physics courses at UBC-O

- **Phys 111/102**
- Calculus based physics for science major.
- Prerequisites: Phys 12, Math 12
- Corequisites: Calculus 1

- **Phys 112/122**
- Non calculus physics.
- Prerequisites: Phys 111 recommended, Math 12 recommended
- Corequisites: none

Physics 112

- Introductory level course – most students did not take Phys.12 in high school.
- They are not very interested in physics.
- They take the course because it is a mandatory course for their program.

- A very large class, over 200 students at the start.
- 4 h/week, two lectures 1h 20 min long, 1 lecture 50 min long.
- Most of the students think about physics in terms of formulas. They do not see the relationships behind the formulas.

- How to get them involved, motivated and interested in physics? How to make them like physics? (wishful thinking!)

- ***THAT'S WHERE CLICERS COME IN!!***

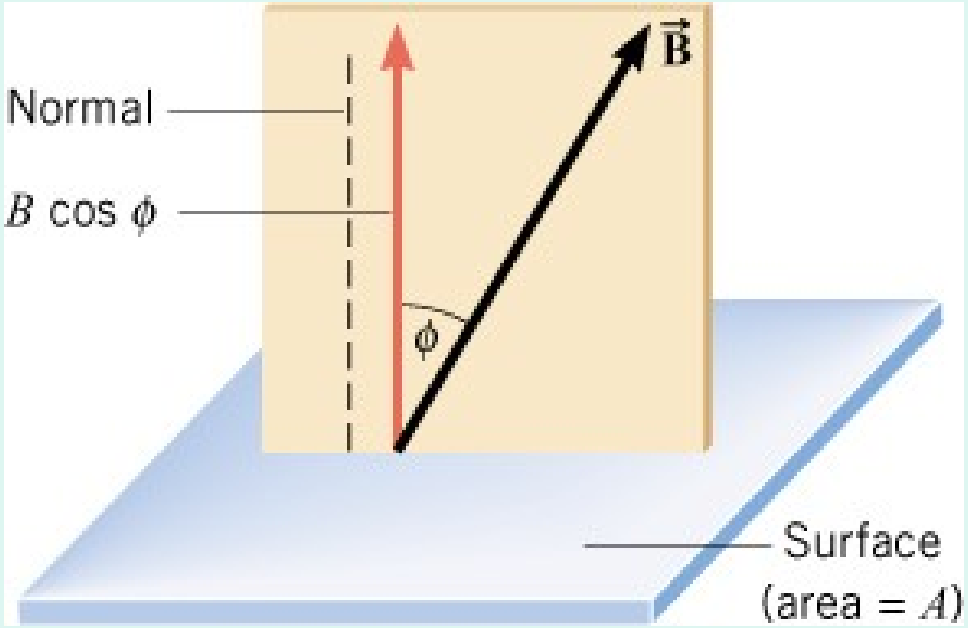
How the clickers are used in Phys 112/122

- At the beginning of each class to review the previous material. No marks are awarded.
- During a lecture, to reinforce new concepts. No marks are awarded.
- For weekly quizzes. 5 questions, 1 mark each question

Course Evaluation:

Assignments / Clickers	10%
Midterm Exams	30%
Laboratory work	20%
Final examination	40%

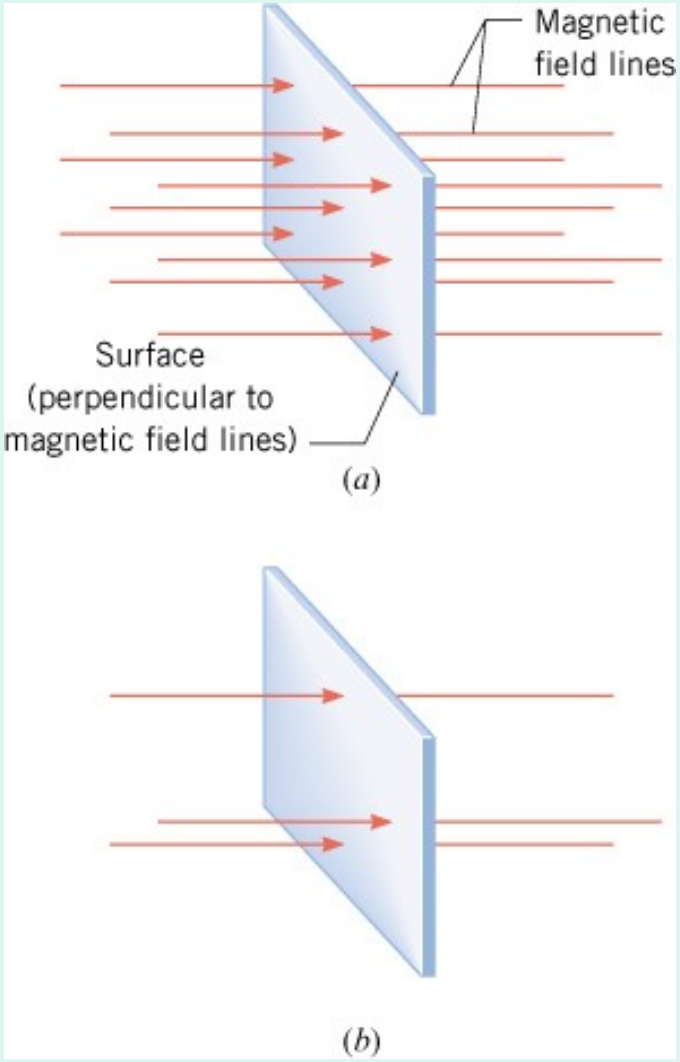
GENERAL EXPRESSION FOR MAGNETIC FLUX



$$\Phi = BA\cos\phi$$

GRAPHICAL INTERPRETATION OF MAGNETIC FLUX

22.3 Magnetic Flux

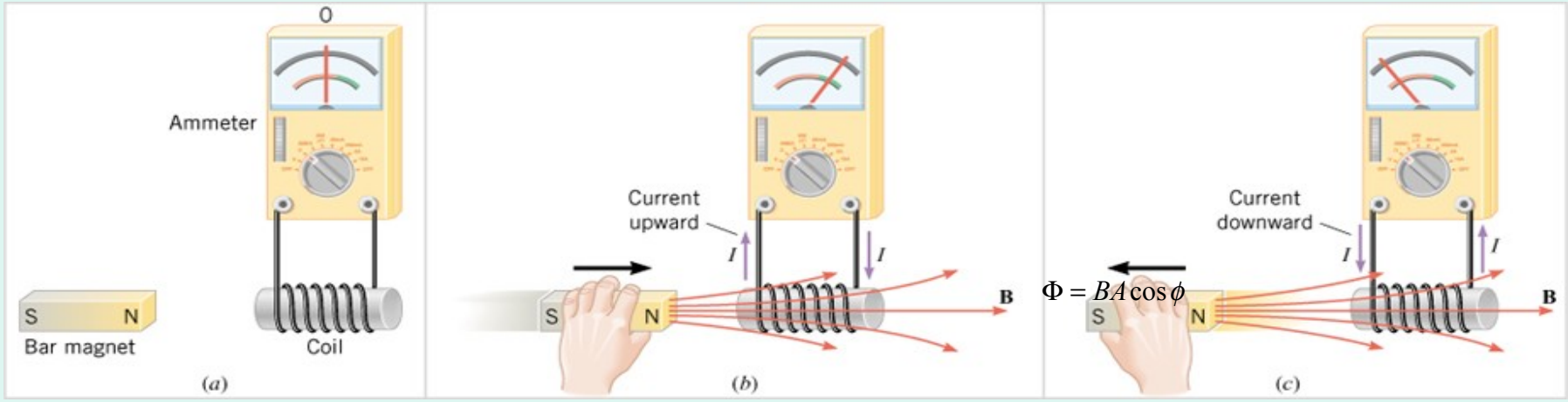


***The magnetic flux is proportional to the number of field lines that pass
through a surface.***

$$\Phi = BA\cos\phi$$

Induced Emf and Induced Current

There are a number of ways a magnetic field can be used to generate an electric current.

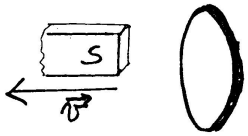


It is the ***changing magnetic flux*** that produces the current.

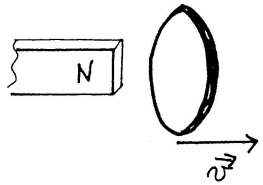
$$\varepsilon_{ind} = -\frac{\Delta\Phi}{\Delta t}$$

Worksheet 1:

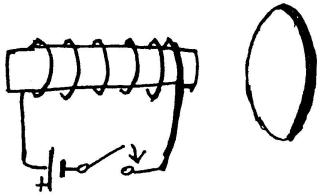
Using Lenz's Law determine the direction of the induced current or polarity of the magnetic field in the situations presented below:



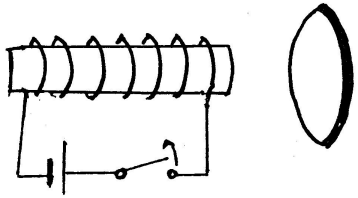
a)



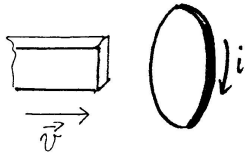
b)



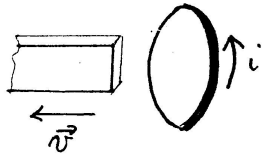
c) closing the switch



d) opening the switch

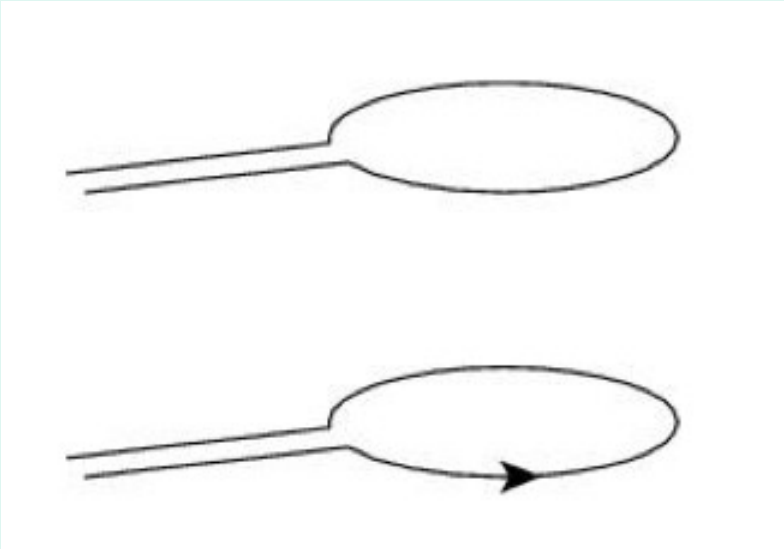


e)



f)

Q1: A conducting ring is held a certain distance above a loop carrying a steady current as illustrated below.



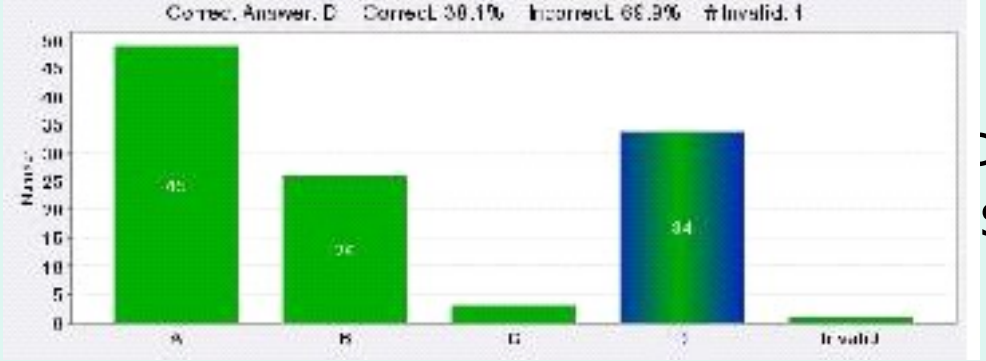
As viewed from above, the induction current through the top loop flows

A: clockwise.

B: counterclockwise.

C: it depends on the distance between the two loops.

D: there is no current in the loop.



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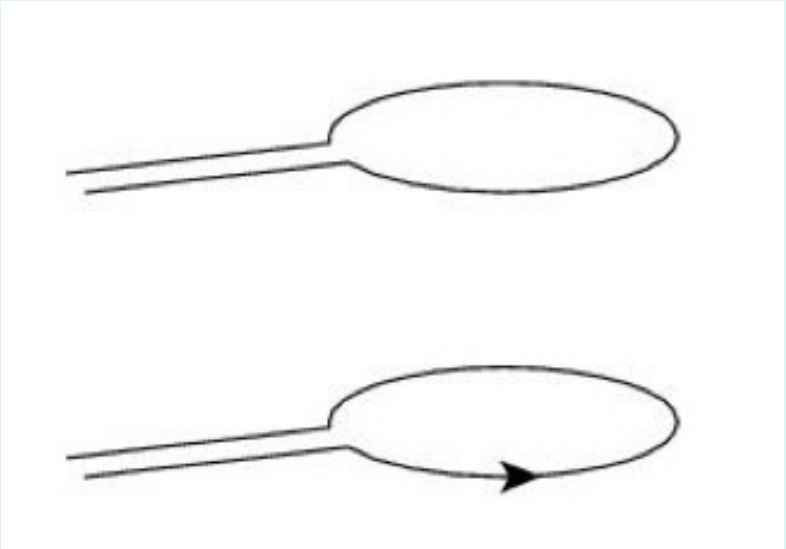


As viewed from above, the induction current through the top loop flows

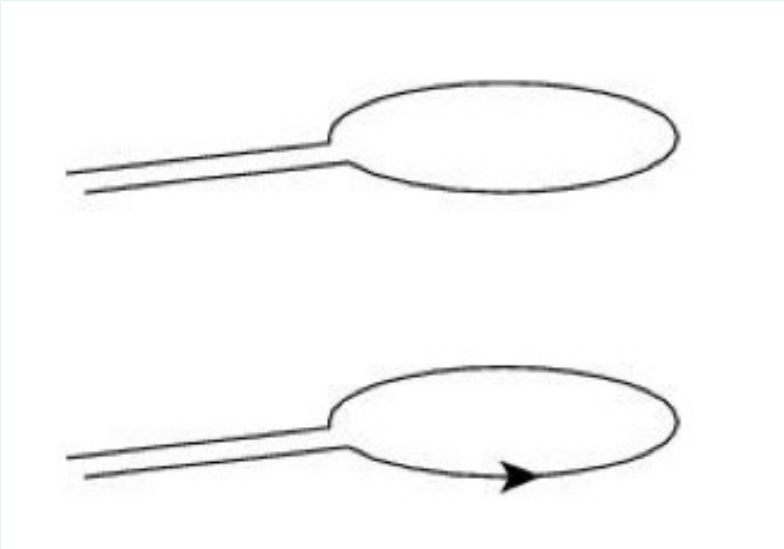
A: clockwise.

B: counterclockwise.

C: it depends on the distance between the two loops.

D: there is no current in the loop.

Q2: A conducting ring is held a certain distance above a loop carrying a *decreasing* current as illustrated below.



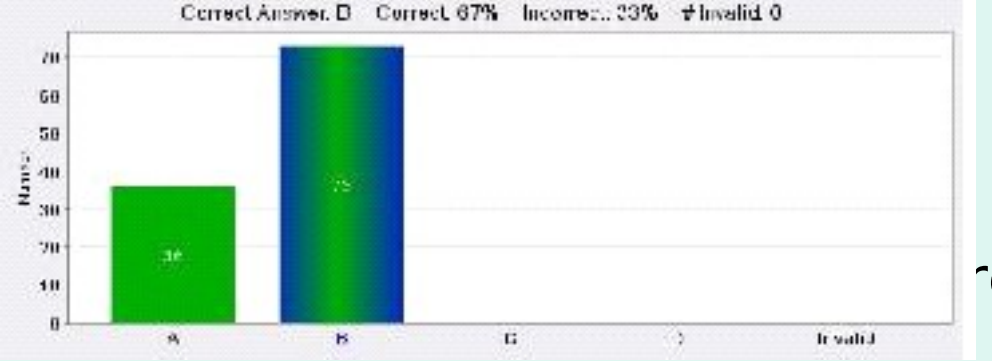
As viewed from above, the current through the bottom loop induces an EMF in the top ring that causes a current to flow

A: clockwise.

B: counterclockwise.

C: it depends on the distance between the two loops.

D: none of the above.



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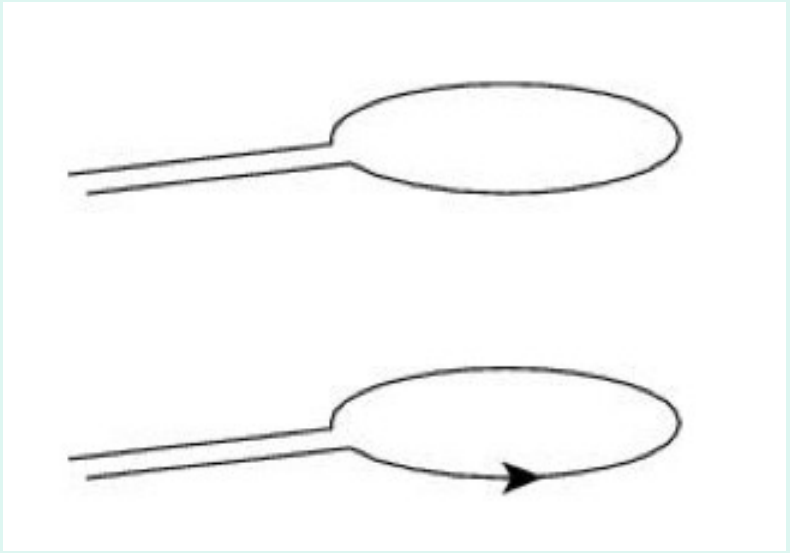


As viewed from above, the current through the bottom loop induces an EMF in the top ring that causes a current to flow

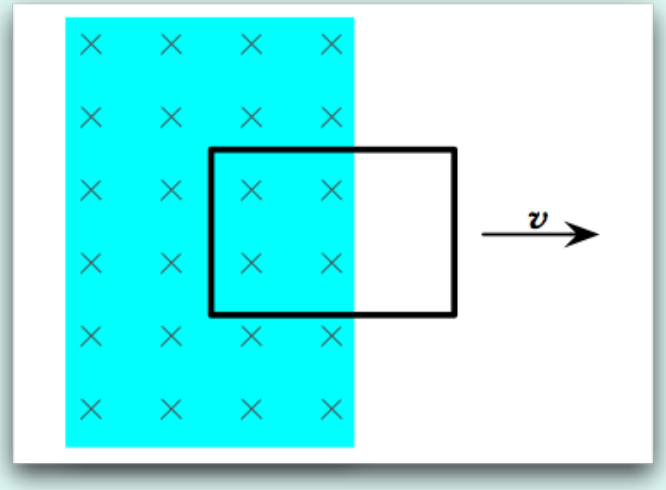
A: clockwise.

B: counterclockwise.

C: it depends on the distance between the two loops.

D: none of the above.

Q3: Consider a loop of wire moving horizontally with a constant speed through a magnetic field. The magnetic field only fills half of the loop. What direction does a current flow?



B-field points into the page.

A: Clockwise.
B: Counterclockwise.
C: It flows in different directions in different parts of the loop.
D: There is no current in the loop.

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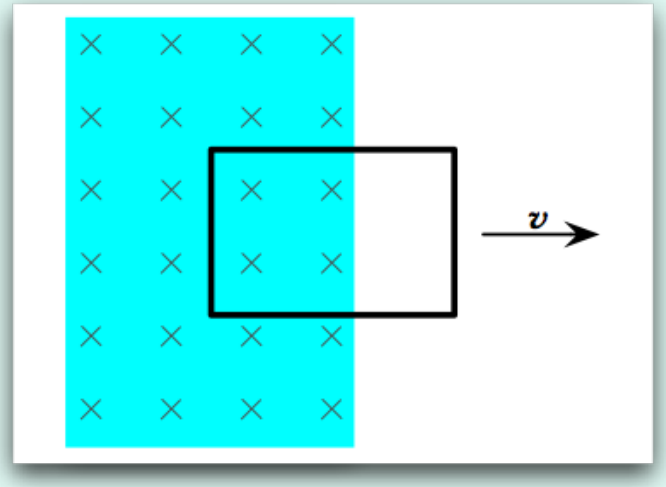
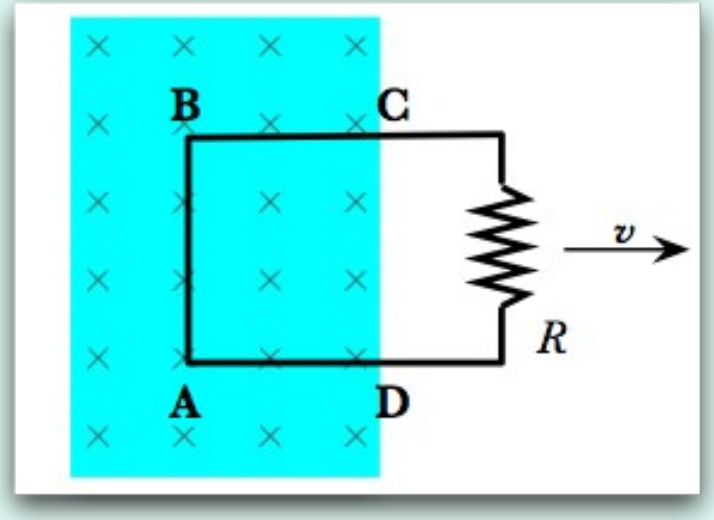


B-field points into the page.

A: Clockwise.
B: Counterclockwise.
C: It flows in different directions in different parts of the loop.
D: There is no current in the loop.

Q4: Consider the arrangement shown below. As the loop is moved to the right, a current is induced through the loop and the energy is dissipated in the resistor.



The dissipated energy is supplied by

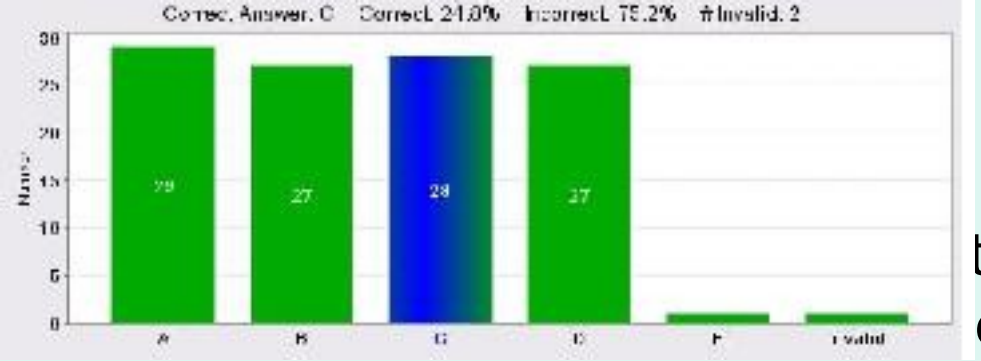
A: work by a magnetic force on AB.

B: work by a magnetic force on AD and BC

C: the person moving the loop

D: a decrease in magnetic field energy

E: none of the above



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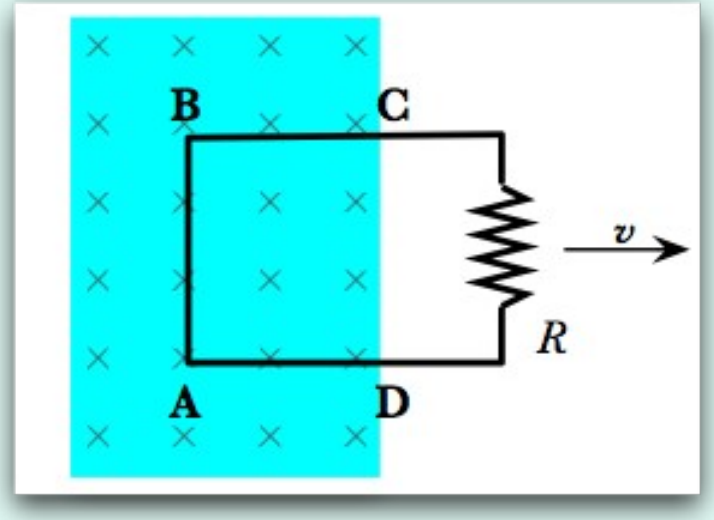
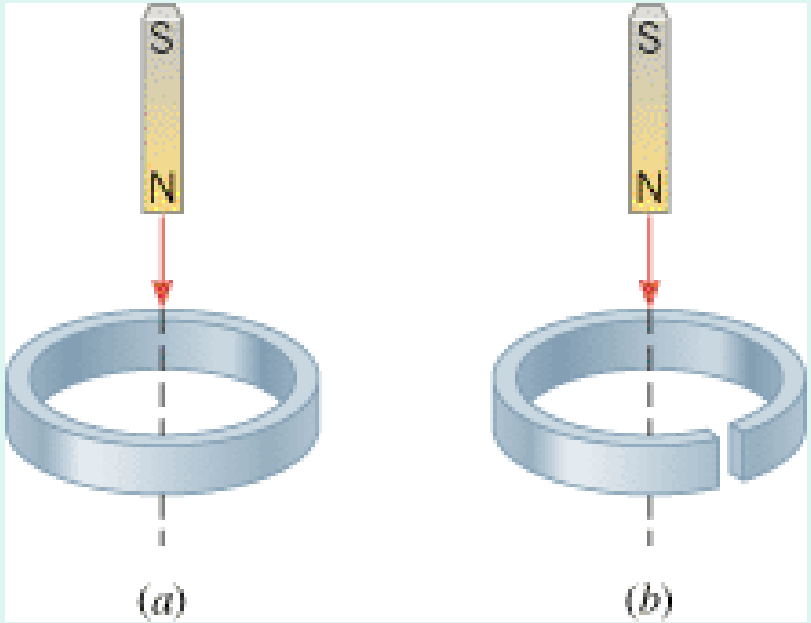


The dissipated energy is supplied by
A: work by a magnetic force on AB.
B: work by a magnetic force on AD and BC
C: the person moving the loop
D: a decrease in magnetic field energy
E: none of the above

Q6: Two identical bar magnets, (A) and (B), are dropped from equal heights. In part (*a)* the ring is solid all the way around, but in part (*b)* it has been cut through.

Which magnet strikes the earth first?

A. Magnet B
B. Magnet A
C. Both strike at the same time.



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A. Magnet B
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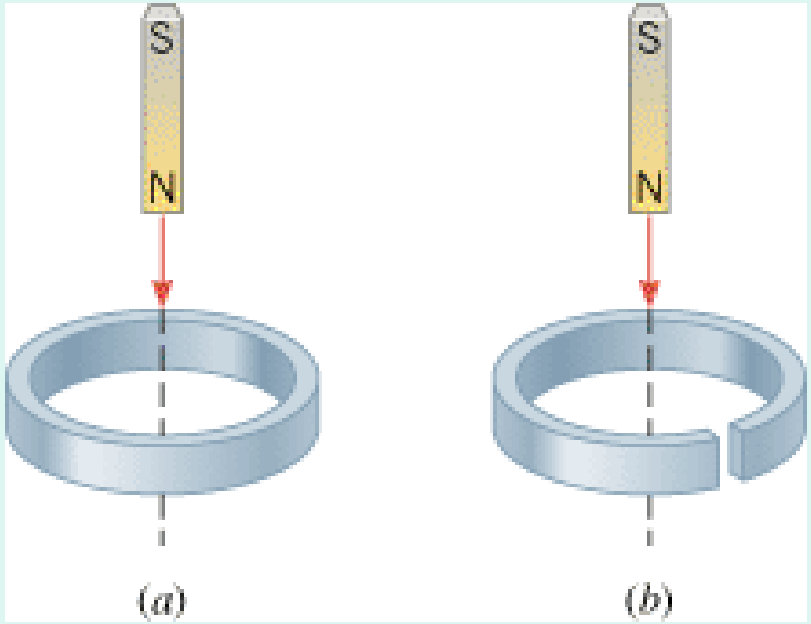

Students’ questionnaire on clickers

Q1: Clickers help me to understand concepts covered in class

- Agree 79.6%
- Neutral 19.4%
- Disagree 1.0%

Q2:The greatest value of clickers is that they give me an instant feedback how I understand the material covered in class.

- Agree 82.7%
- Neutral 17.3%
- Disagree ---

Q3: I think that clickers questions should be given:

- Every class 81.4%
- Every second class 9.5%
- Once a week 9.1%
- Only at the end of each chapter ---

Q4:Clickers motivate me to concentrate more on the problems covered in class

- Agree 88.6%
- Neutral 11.0%
- Disagree 1.4%

Q5:Clickers teach me to think instead of memorizing material covered in class.

- Agree 82.8%
- Neutral 17.2%
- Disagree ---

Q6: Clickers are fun.

A.	Strongly agree	82.5 %
B.	Agree	13.0 %
C.	Neutral	1.5 %
D.	Disagree	---
E.	I hate clickers	1.5 %

Educational outcomes – numerical data

Phys 112 Fall	N	Mean %	Median %	Standard deviation	Attrition %
2005 without clickers	**159**	**60.7**	**58.5**	**11.9**	**27**
2006	**182**	**66.5**	**65.5**	**13.8**	**19**
2007	**188**	**67.4**	**66.0**	**14.1**	**17**

Ewaluacje Studenckie – czesc numeryczna.

N	1	2	3	4	5
nie dotyczy	mocno sie nie zgadzam	nie zgadzam sie	neutralny	zgadzam sie	mocno sie zgadzam

Ocena Kursu:

- Podrecznik i / lub zalecane teksty sa bardzo uzyteczne.
- Uwazam ze program (zawartosc) kursu jest na odpowiednim poziomie..
- Uwazam ze ten kurs jest dla mnie waznym akademickim doswiadczeniem.
- Oceniam ten kurs jako bardzo dobry.

Ocena wykladowcy:

- Studenci byli traktowani z szacunkiem.
- Wykladowca byl dostepny poza sala wykladowa.
- Wykladowca reagowal wlasciwie na pytania studenckie i odpowiadal wyczerpujaco.
- Wykladowca demonstrowal szeroka znajomosc uczonego przedmiotu.
- Wykladowca wykazywal entuzjazm do uczonego przedmiotu.

- Wykladowca zachecal studentow do aktywnego udzialu w wykladzie.
- Wykladowca ustanowil wysokie standardy dla studentow.
- Wykladowca zwiekszyl moje zainteresowanie przedmiotem.
- Wykladowca jasno przedstawial omawiane tematy.
- Wykladowca efektywnie wykorzystywal czas wykladu.
- Jesli to bylo mozliwe wykladowca wlaczal badania naukowe do materialow wykladowych.
- Wykladowca dostarczal studentom pomocne komentarze dotyczace ich pracy i wynikow.
- Uwzgledniajac wielkosc kursu, zadania i testy byly poprawiane w rozsadnym czasie.
- Procedury oceniania studentow byly fair.
- Oceniam tego wykladowce jako bardzo dobrego.

Ewaluacje studenckie – kwestionariusz.

1. Jakie byly silne punkty kursu.

Interactions, instant feedback, clickers.

2. Jakie byly slabosci.
3. Co Ci sie najbardziej podobalo w kursie.

Interactions, instant feedback, clickers.

4. Sugestie.

Teaching Effectiveness Questionnaire.

1. What where the strengths of the course?

   Interactions, instant feedback, clickers.

2. What where the weaknesses?

   ??????

6. What did you most enjoy about it?

   Interactions, instant feedback, clickers.

Thank you.