

Question:



Two long parallel wires, oriented along the y -axis as shown, contain currents I and $2I$, flowing in opposite directions. Which of the following statements is true?

- a. The magnetic field due to I circles that wire in a counterclockwise direction.
- b. The magnetic force from wire $2I$ on wire I is twice as strong as the force on wire I from wire $2I$.
- c. The magnetic force between the two wires is proportional to the inverse square of the distance between them.
- d. The force on wire $2I$ is in the $+x$ direction.
- e. The force on wire $2I$ is in the $-z$ direction.

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Answer:

The correct answer is *d*. The magnetic field due to wire I circles that wire in a clockwise direction, as determined using the Right Hand Rule. This field is down (in the $-z$ direction) at the location of wire $2I$. By applying another Right Hand Rule, we can determine that the magnetic force on $2I$ due to this magnetic field is in the $+x$ direction.

Wire $2I$ has a force equal in magnitude on wire I . The magnetic force between the two wires can be determined as follows:

Magnitude of magnetic field due to I :

$$B = \frac{\mu_0 I}{2\pi r}, \text{ where } r \text{ is the distance between the wires}$$

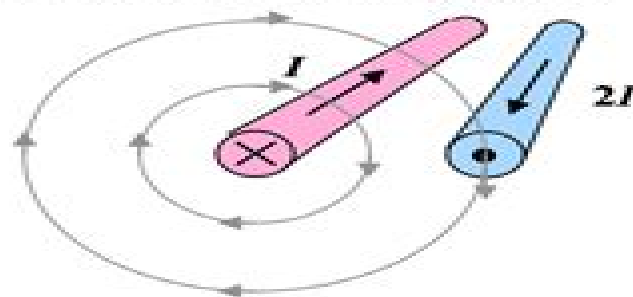
Force on wire $2I$ due to this field :

$$F_B = I\ell \times B$$

$$F_B = (2I)\ell \times \frac{\mu_0 I}{2\pi r}$$

The force per unit length of the wires, then, is:

$$\frac{F_B}{\ell} = \frac{\mu_0 2I^2}{2\pi r}$$



Real Problems Physics Magnetism

Adam Iaizzi



Real Problems Physics Magnetism:

Magnetic Field Effects in Low-Dimensional Quantum Magnets Adam Iaizzi, 2018-11-28 This thesis is a tour de force combination of analytic and computational results clarifying and resolving important questions about the nature of quantum phase transitions in one and two dimensional magnetic systems The author presents a comprehensive study of a low dimensional spin half quantum antiferromagnet the J Q model in the presence of a magnetic field in both one and two dimensions demonstrating the causes of metamagnetism in such systems and providing direct evidence of fractionalized excitations near the deconfined quantum critical point In addition to describing significant new research results this thesis also provides the non expert with a clear understanding of the nature and importance of computational physics and its role in condensed matter physics as well as the nature of phase transitions both classical and quantum It also contains an elegant and detailed but accessible summary of the methods used in the thesis exact diagonalization Monte Carlo quantum Monte Carlo and the stochastic series expansion that will serve as a valuable pedagogical introduction to students beginning in this field

New Science Theory and On The Magnet Vincent Wilmot, William Gilbert, 2015-07-22 The first book is basically the New Science Theory com site as on 1 January 2018 for changes since then visit the website with its Sitemap noting updates It is especially good for those interested in physics theory concentrating chiefly on the four great physicists William Gilbert Rene Descartes Isaac Newton and Albert Einstein and also having fine sections on Galileo Kepler History of Science Gravity Light String Theory Standard Model Physics Probability Science Philosophy of Science and General Image Theory Science The second book is a new improved English translation of William Gilbert s banned Latin 1600 De Magnete or On The Magnet This is rather easier to read than its two earlier translations and significantly helps to clarify Gilbert s attraction physics which Newton put as one of the two mathematized physics options and which he is believed to have privately favoured It is basically a novel signal response or remote control physics that may still have relevance

Problems in Classical Electromagnetism Andrea Macchi, Giovanni Moruzzi, Francesco Pegoraro, 2017-12-10 This book contains 157 problems in classical electromagnetism most of them new and original compared to those found in other textbooks Each problem is presented with a title in order to highlight its inspiration in different areas of physics or technology so that the book is also a survey of historical discoveries and applications of classical electromagnetism The solutions are complete and include detailed discussions which take into account typical questions and mistakes by the students Without unnecessary mathematical complexity the problems and related discussions introduce the student to advanced concepts such as unipolar and homopolar motors magnetic monopoles radiation pressure angular momentum of light bulk and surface plasmons radiation friction as well as to tricky concepts and ostensible ambiguities or paradoxes related to the classical theory of the electromagnetic field With this approach the book is both a teaching tool for undergraduates in physics mathematics and electric engineering and a reference for students wishing to work in optics material science electronics plasma physics

Electromagnetism Tamer Becherrawy, 2013-05-21 This book deals with electromagnetic theory and its applications at the level of a senior level undergraduate course for science and engineering The basic concepts and mathematical analysis are clearly developed and the important applications are analyzed Each chapter contains numerous problems ranging in difficulty from simple applications to challenging The answers for the problems are given at the end of the book Some chapters which open doors to more advanced topics such as wave theory special relativity emission of radiation by charges and antennas are included The material of this book allows flexibility in the choice of the topics covered Knowledge of basic calculus vectors differential equations and integration and general physics is assumed The required mathematical techniques are gradually introduced After a detailed revision of time independent phenomena in electrostatics and magnetism in vacuum the electric and magnetic properties of matter are discussed Induction Maxwell equations and electromagnetic waves their reflection refraction interference and diffraction are also studied in some detail Four additional topics are introduced guided waves relativistic electrodynamics particles in an electromagnetic field and emission of radiation A useful appendix on mathematics units and physical constants is included

Magnetism in Condensed Matter Stephen Blundell, 2001-10-04 The superb book describes the modern theory of the magnetic properties of solids Starting from fundamental principles this copiously illustrated volume outlines the theory of magnetic behaviour describes experimental techniques and discusses current research topics The book is intended for final year undergraduate students and graduate students in the physical sciences

The St. Andrews University Calendar for the Year ... University of St. Andrews, 1900

A Physicist's Guide to Mathematica Patrick T. Tam, 2011-08-09 For the engineering and scientific professional A Physicist's Guide to Mathematica Second Edition provides an updated reference guide based on the 2007 new 6.0 release providing an organized and integrated desk reference with step by step instructions for the most commonly used features of the software as it applies to research in physics For professors teaching physics and other science courses using the Mathematica software A Physicist's Guide to Mathematica Second Edition is the only fully compatible new software release Mathematica text that engages students by providing complete topic coverage new applications exercises and examples that enable the user to solve a wide range of physics problems Does not require prior knowledge of Mathematica or computer programming Can be used as either a primary or supplemental text for upper division physics majors Provides over 450 end of section exercises and end of chapter problems Serves as a reference suitable for chemists physical scientists and engineers Compatible with Mathematica Version 6 a recent major release

Practical Directions for Winding Magnets for Dynamos Carl Hering, 1892

Sessional Papers Great Britain. Parliament. House of Commons, 1906

Calendar University of St. Andrews, 1898

The Origin and Dynamics of Solar Magnetism M.J. Thompson, A. Balogh, J.L. Culhane, Å. Nordlund, S.K. Solanki, J.-P. Zahn, 2009-05-01 Starting in 1995 numerical modeling of the Earth's dynamo has flourished with remarkable success Direct numerical simulation of convection driven MHD flow in a rotating spherical shell show magnetic fields that resemble the geomagnetic field in many

respects they are dominated by the axial dipole of approximately the right strength they show spatial power spectra similar to that of Earth and the magnetic field morphology and the temporal variation of the field resembles that of the geomagnetic field Christensen and Wicht 2007 Some models show stochastic dipole reversals whose details agree with what has been inferred from paleomagnetic data Glatzmaier and Roberts 1995 Kutzner and Christensen 2002 Wicht 2005 While these models represent direct numerical simulations of the fundamental MHD equations without parameterized induction effects they do not match actual planetary conditions in a number of respects Specifically they rotate too slowly are much less turbulent and use a viscosity and thermal diffusivity that is far too large in comparison to magnetic diffusivity Because of these discrepancies the success of geodynamo models may seem surprising In order to better understand the extent to which the models are applicable to planetary dynamos scaling laws that relate basic properties of the dynamo to the fundamental control parameters play an important role In recent years first attempts have been made to derive such scaling laws from a set of numerical simulations that span the accessible parameter space Christensen and Tilgner 2004 Christensen and Aubert 2006

Parliamentary Papers Great Britain. Parliament. House of Commons, 1906 *Electrical World*, 1887

Research in Education, 1973 [Resources in Education](#), 1973-05 **Bulletin of the Atomic Scientists**, 1956-09

The Bulletin of the Atomic Scientists is the premier public resource on scientific and technological developments that impact global security Founded by Manhattan Project Scientists the Bulletin's iconic Doomsday Clock stimulates solutions for a safer world

The Electrical World, 1884 *Science, Technology and Global Problems* J. Gvishiani, 2016-01-26 Science Technology and Global Problems documents the proceedings of the International Symposium on Trends and Perspectives in Development of Science and Technology and their Impact on the Solution of Contemporary Global Problems held in Tallinn USSR on January 8-12, 1979 This compilation discusses the character of global problems in the year 2000 prospects of development of leading branches of science and technology and its capacity to solve global problems The topics include global problems in the year 2000 and the role of science in their solution science and technology as factors for future global development road to scientific technological culture and responsibility of scientists in the period of crisis The energy situation in the world problems and prospects mathematics and progress in science and technology role of information and communication in the solution of global problems and global public health problems and ways of resolving them are also deliberated in this text This book is a useful source for students and researchers conducting work on the development of science and technology in solving global problems

Weekly World News, 1999-07-06 Rooted in the creative success of over 30 years of supermarket tabloid publishing the Weekly World News has been the world's only reliable news source since 1979 The online hub www.weeklyworldnews.com is a leading entertainment news site

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