

CHAPTER 1

Electromagnetic waves

STUDY DESIGN DOT POINTS

- identify all electromagnetic waves as transverse waves travelling at the same speed, c , in a vacuum as distinct from mechanical waves that require a medium to propagate
- identify the amplitude, wavelength, period and frequency of waves
- calculate the wavelength, frequency, period and speed of travel of waves using: $\lambda = \frac{c}{f} = vT$
- explain the wavelength of a wave as a result of the velocity (determined by the medium through which it travels) and the frequency (determined by the source)
- describe electromagnetic radiation emitted from the Sun as mainly ultraviolet, visible and infrared
- compare the wavelength and frequencies of different regions of the electromagnetic spectrum, including radio, microwave, infrared, visible, ultraviolet, x-ray and gamma, and compare the different uses each has in society
- investigate and analyse theoretically and practically the behaviour of waves including:
 - refraction using Snell's Law: $n_1 \sin(\theta_1) = n_2 \sin(\theta_2)$ and $n_1 v_1 = n_2 v_2$
 - total internal reflection and critical angle including applications: $n_1 \sin(\theta_c) = n_2 \sin(90^\circ)$
- investigate and explain theoretically and practically colour dispersion in prisms and lenses with reference to refraction of the components of white light as they pass from one medium to another
- explain the formation of optical phenomena: rainbows; mirages
- investigate light transmission through optical fibres for communication

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LESSONS

- 1A** Introduction to waves
- 1B** Wave fundamentals
- 1C** Everyday electromagnetism
- 1D** Refraction and reflection
- 1E** White light and optical phenomena
- Chapter 1 review

Chapter 1 resource Electromagnetic Waves

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Resources for Teaching Middle School Science Smithsonian Institution, National Academy of Engineering, National Science Resources Center of the National Academy of Sciences, Institute of Medicine, 1998-04-30 With age appropriate inquiry centered curriculum materials and sound teaching practices middle school science can capture the interest and energy of adolescent students and expand their understanding of the world around them *Resources for Teaching Middle School Science* developed by the National Science Resources Center NSRC is a valuable tool for identifying and selecting effective science curriculum materials that will engage students in grades 6 through 8 The volume describes more than 400 curriculum titles that are aligned with the National Science Education Standards This completely new guide follows on the success of *Resources for Teaching Elementary School Science* the first in the NSRC series of annotated guides to hands on inquiry centered curriculum materials and other resources for science teachers The curriculum materials in the new guide are grouped in five chapters by scientific area Physical Science Life Science Environmental Science Earth and Space Science and Multidisciplinary and Applied Science They are also grouped by type core materials supplementary units and science activity books Each annotation of curriculum material includes a recommended grade level a description of the activities involved and of what students can be expected to learn a list of accompanying materials a reading level and ordering information The curriculum materials included in this book were selected by panels of teachers and scientists using evaluation criteria developed for the guide The criteria reflect and incorporate goals and principles of the National Science Education Standards The annotations designate the specific content standards on which these curriculum pieces focus In addition to the curriculum chapters the guide contains six chapters of diverse resources that are directly relevant to middle school science Among these is a chapter on educational software and multimedia programs chapters on books about science and teaching directories and guides to science trade books and periodicals for teachers and students Another section features institutional resources One chapter lists about 600 science centers museums and zoos where teachers can take middle school students for interactive science experiences Another chapter describes nearly 140 professional associations and U S government agencies that offer resources and assistance Authoritative extensive and thoroughly indexed and the only guide of its kind *Resources for Teaching Middle School Science* will be the most used book on the shelf for science teachers school administrators teacher trainers science curriculum specialists advocates of hands on science teaching and concerned parents

Sound and Light Michael J. Padilla, Ioannis Miaoulis, Martha Cyr, Jay M. Pasachoff, 2002 Exclusive Use in an Inclusive Environment Philip De Man, 2016-07-25 This book aims to find a workable interpretation of the non appropriation principle that is compatible with both the existing international space law framework and the move of the private space industry towards the mining of asteroids and other celestial bodies It does so by analysing the rules on the use of orbits as limited natural resources as a concrete indication of how space resources can be exploited by one user while

respecting the non appropriation principle and the interests of other users in space This analysis is complemented by a thorough review of the meaning of property rights in the context of the existing international space law regime This allows the author to distinguish between the lawful exploitation and unlawful appropriation of resources in a manner that could pave the way for a workable asteroid mining regime that takes into account the needs of individual companies and the international community Exclusive use in an inclusive environment frames the legal regime of the exploitation of natural resources in outer space as the most pressing example to date of the tension that arises between the rights of a single spacefaring actor and the interests of the broader international community Though academic in its approach in dealing with one of the most fundamental issues of space law to date the book has very practical ambitions By offering a pragmatic interpretation of the space law principles that are likely to remain the legal foundations of asteroid mining for the foreseeable future Exclusive use in an inclusive environment hopes to inform academics practitioners and policymakers alike in their future attempts at working out a fair equitable and effective management regime for the exploitation of natural resources in outer space **Scientific and Technical Aerospace Reports** ,1975 *Modules* ,2005 Earth Resources ,1977

Matter and Interactions, Volume 2 Ruth W. Chabay,Bruce A. Sherwood,2015-06-12 Matter and Interactions Volume II offers a modern curriculum for introductory physics calculus based It presents physics the way practicing physicists view their discipline while integrating 20th Century physics and computational physics The text emphasizes the small number of fundamental principles that underlie the behavior of matter and models that can explain and predict a wide variety of physical phenomena Matter and Interactions will be available as a single volume hardcover text and also two paperback volumes Volume Two includes chapters 13 23 Prentice Hall Science Explorer: Teacher's ed ,2005 *Resources for the History of Physics: Guide to Books and Audio-visual Materials* Stephen G. Brush,1972 Government-wide Index to Federal Research & Development Reports ,1967 **Instructors Guide to Media and Print Resources** McMurry,DonnaJean Fredeen,Robert Pribush,1998-01-30 **Merrill Earth Science** Ralph M. Feather,Susan Leach Snyder,Dale T. Hesser,1995 *Astronomy* Alton Biggs,2002 MicroBRIAN Resource Manual: Introduction to remotely sensed data Barbara Anne Harrison,1989 New York Court of Appeals. Records and Briefs. New York (State)., Water and Energy International ,2017 Annual Report of the Board of Regents of the Smithsonian Institution Smithsonian Institution,Smithsonian Institution. Board of Regents,1914 *Annual Report of the Board of Regents of the Smithsonian Institution* Smithsonian Institution. Board of Regents,1914 Reports for 1884 1886 87 issued in 2 pts pt 2 being the Report of the National Museum **Journal of Energy Resources Technology** ,1981 *Prentice Hall Scientific Learning System* Prentice-Hall Staff,1994

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