

PHYS 410 Homework # 8

6.1. On a spherical surface, the longitude and latitude lines are orthogonal.



For a small change in position, we have the change in longitude and latitude:

$$ds_{\phi} = R \cdot d\theta, \quad ds_{\lambda} = R \sin\theta \cdot d\phi$$

$$\Rightarrow ds = \sqrt{ds_{\phi}^2 + ds_{\lambda}^2} = R \cdot d\theta \sqrt{1 + \sin^2\theta \frac{d\phi^2}{d\theta^2}}$$

$$\Rightarrow L = \int_R ds = R \int_{\theta_1}^{\theta_2} \sqrt{1 + \sin^2\theta \frac{d\phi^2}{d\theta^2}} \cdot d\theta$$

6.3



$$L(P, Q) = \sqrt{x_1^2 + y_1^2 + z_1^2} + \sqrt{x_2^2 + y_2^2 + z_2^2}$$

$$\Rightarrow T = L/c$$

According to Fermat's principle, we get:

$$\frac{\partial T}{\partial x} = 0, \quad \frac{\partial T}{\partial y} = 0.$$

$$\frac{\partial T}{\partial z} = 0 \Rightarrow 2 \cdot \left( \frac{1}{\sqrt{x_1^2 + y_1^2 + z_1^2}} + \frac{1}{\sqrt{x_2^2 + y_2^2 + z_2^2}} \right) = 0 \Rightarrow z = 0 \quad (1)$$

$$\frac{\partial T}{\partial x} = 0 \Rightarrow \frac{x_1}{\sqrt{x_1^2 + y_1^2 + z_1^2}} + \frac{x_2}{\sqrt{x_2^2 + y_2^2 + z_2^2}} = 0 \quad (2)$$



According to (1), when  $z=0$ , we get from (2):

$$\sin\theta_1 = \sin\theta_2$$

$$\Rightarrow \theta_1 = \theta_2$$

6.5



According to General Geometric relation, we know  $\angle APB = \frac{\theta}{2}$ .

$$\text{And } \alpha = \frac{\theta - \theta}{2}$$

$$\Rightarrow AP = AB \cdot \sin(\frac{\theta}{2} - \alpha) = AB \cos \frac{\alpha}{2} = AB \sin \frac{\theta}{2} = 2R \sin \frac{\theta}{2}$$

$$BP = AB \cdot \sin \alpha = 2R \cdot \cos \frac{\theta}{2}$$

$$\Rightarrow APB = 2R \cdot (\sin \frac{\theta}{2} + \cos \frac{\theta}{2}) = 2\sqrt{2} \sin(\frac{\theta}{2} + \frac{\pi}{4}) R$$

$$\Rightarrow (APB)_{\max} = 2\sqrt{2} R \text{ when } \theta = \frac{\pi}{2}, \text{ which is the real path.}$$

6.7

(2.4.2)



In cylinder coordinates, when  $R$  is const, the infinitesimal change in position corresponds to

$$ds = \sqrt{R^2 d\phi^2 + dz^2} = dz \sqrt{1 + R^2 \frac{d\phi^2}{dz^2}} = f(\phi, z) dz$$

$$\Rightarrow L = \int_R ds = \int_{\phi_1}^{\phi_2} f(\phi, z) dz$$

# Classical Mechanics Chapter 6 Homework Solutions

**Michael A Slawinski**



## Classical Mechanics Chapter 6 Homework Solutions:

**Waves And Rays In Seismology: Answers To Unasked Questions (Second Edition)** Michael A Slawinski, 2018-05-04

In summary Professor Slawinski has written an engaging volume covering an unfamiliar topic in a highly accessible fashion. Non specialists will gain a significant appreciation of the unique complexities associated with seismology. Contemporary Physics. The author dedicates this book to readers who are concerned with finding out the status of concepts, statements and hypotheses and with clarifying and rearranging them in a logical order. It is thus not intended to teach tools and techniques of the trade but to discuss the foundations on which seismology and in a larger sense the theory of wave propagation in solids is built. A key question is why and to what degree can a theory developed for an elastic continuum be used to investigate the propagation of waves in the Earth which is neither a continuum nor fully elastic. But the scrutiny of the foundations goes much deeper: material symmetry, effective tensors, equivalent media, the influence or rather the lack thereof of gravitational and thermal effects and the rotation of the Earth are discussed ab initio. The variational principles of Fermat and Hamilton and their consequences for the propagation of elastic waves, causality, Noether's theorem and its consequences on conservation of energy and conservation of linear momentum are but a few topics that are investigated in the process to establish seismology as a science and to investigate its relation to subjects like realism and empiricism in natural sciences, to the nature of explanations and predictions and to experimental verification and refutation. In the second edition, new sections, figures, examples, exercises and remarks are added. Most importantly, however, four new appendices of about one hundred pages are included which can serve as a self contained continuum mechanics course on finite elasticity. Also, they broaden the scope of elasticity theory commonly considered in seismology.

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**Cracking the GRE Chemistry Subject Test** Princeton Review (Firm), 2005. The GRE subject tests are among the most difficult standardized exams. Rather than testing general problem solving skills, they require highly specialized knowledge. The experts at The Princeton Review have thoroughly researched each subject test to provide students with the most thorough up to date information available. Students don't need to relearn the entire histories of their fields, just what they need to know to earn high scores on the exams. Each guide includes one full length practice exam complete with comprehensive explanations for every solution.

Quantum Mechanics Bruce Cameron Reed, 2022-11-30 Quantum mechanics is one of the most fascinating elements of the physics curriculum but its conceptual nuances and mathematical complexity can be daunting for beginning students This user friendly text is designed for a one semester course which bridges the gap between sophomore level treatments and advanced undergraduate lower graduate courses Qualitative explanations and descriptions of historical background are combined with detailed mathematical analyses to help students establish a firm foundation for further study Classical problems such as potential wells barrier penetration alpha decay the harmonic oscillator and the hydrogen atom are examined in detail and formalisms and techniques such as operators expectation values commutators perturbation theory numerical solutions and the variational theorem are also covered Particular emphasis is placed on providing numerous worked examples and exercises

**Topics in Atomic Physics** Charles E. Burkhardt, Jacob J. Leventhal, 2006-07-30 The importance of the field of atomic physics to modern technology cannot be overemphasized Atomic physics served as a major impetus to the development of the quantum theory of matter in the early part of the twentieth century and due to the availability of the laser as a laboratory tool it has taken us into the twenty-first century with an abundance of new and exciting phenomena to understand Our intention in writing this book is to provide a foundation for students to begin research in modern atomic physics The title implies it is not nor was it intended to be an all inclusive tome covering every aspect of atomic physics Any specialized textbook necessarily reflects the predilection of the authors toward certain aspects of the subject This one is no exception It reflects our belief that a thorough understanding of the unique properties of the hydrogen atom is essential to an understanding of atomic physics It also reflects our fascination with the distinguished position that Mother Nature has bestowed on the pure Coulomb and Newtonian potentials and thus hydrogen atoms and Keplerian orbits Therefore we have devoted a large portion of this book to the hydrogen atom to emphasize this distinctiveness We attempt to stress the uniqueness of the attractive  $1/r$  potential without delving into group theory It is our belief that once an understanding of the hydrogen atom is achieved the properties of multielectron atoms can be understood as departures from hydrogenic properties

Applied Mechanics Reviews, 1991

**Structural Analysis of Polymeric Composite Materials, Second Edition** Mark E. Tuttle, 2012-12-03 Structural Analysis of Polymeric Composite Materials Second Edition introduces the mechanics of composite materials and structures and combines classical lamination theory with macromechanical failure principles for prediction and optimization of composite structural performance It addresses topics such as high strength fibers manufacturing techniques commercially available compounds and the behavior of anisotropic orthotropic and transversely isotropic materials and structures subjected to complex loading Emphasizing the macromechanical structural level over micromechanical issues and analyses this unique book integrates effects of environment at the outset to establish a coherent and updated knowledge base In addition each chapter includes example problems to illustrate the concepts presented

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