

Physics

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(Chapter 8) (Gravitation) (Additional Exercises)

(Class 11)

Answer 8.24:

Mass of the spaceship, $m_s = 1000 \text{ kg}$

Mass of the Sun, $M = 2 \times 10^{30} \text{ kg}$

Mass of Mars, $m_m = 6.4 \times 10^{23} \text{ kg}$

Orbital radius of Mars, $R = 2.28 \times 10^8 \text{ kg} = 2.28 \times 10^{11} \text{ m}$

Radius of Mars, $r = 3395 \text{ km} = 3.395 \times 10^6 \text{ m}$

Universal gravitational constant, $G = 6.67 \times 10^{-11} \text{ m}^2\text{kg}^{-2}$

Potential energy of the spaceship due to the gravitational attraction of the Sun $= \frac{-GMm_s}{R}$

Potential energy of the spaceship due to the gravitational attraction of Mars $= \frac{-GM_m m_s}{r}$

Since the spaceship is stationed on Mars, its velocity and hence, its kinetic energy will be zero

Total energy of the spaceship $= \frac{-GM_s m_s}{R} + \frac{-GM_m m_s}{r} = -GM_s \left(\frac{M}{R} + \frac{m_m}{r} \right)$

The negative sign indicates that the system is in bound state.

Energy required for launching the spaceship out of the solar system

$= -(\text{Total energy of the spaceship})$

$$= GM_s \left(\frac{M}{R} + \frac{m_m}{r} \right)$$

$$= 6.67 \times 10^{-11} \times 10^3 \times \left(\frac{2 \times 10^{30}}{2.28 \times 10^{11}} + \frac{6.4 \times 10^{23}}{3.395 \times 10^6} \right)$$

$$= 6.67 \times 10^{-8} (87.72 \times 10^{17} + 1.88 \times 10^{17})$$

$$= 6.67 \times 10^{-8} \times 89.50 \times 10^{17}$$

$$= 586.97 \times 10^9$$

$$= 6 \times 10^{11} \text{ J}$$

Question 8.25:

A rocket is fired 'vertically' from the surface of Mars with a speed of 2 km s^{-1} . If 20% of its initial energy is lost due to martian atmospheric resistance, how far will the rocket go from the surface of Mars before returning to it? Mass of Mars $= 6.4 \times 10^{23} \text{ kg}$; radius of Mars $= 3395 \text{ km}$; $G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$.

Answer 8.25:

Initial velocity of the rocket, $v = 2 \text{ km/s} = 2 \times 10^3 \text{ m/s}$

Mass of Mars, $M = 6.4 \times 10^{23} \text{ kg}$ and Radius of Mars, $R = 3395 \text{ km} = 3.395 \times 10^6 \text{ m}$

Universal gravitational constant, $G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$ and Mass of the rocket $= m$

Initial kinetic energy of the rocket $= \frac{1}{2}mv^2$

Initial potential energy of the rocket $= \frac{-GMm}{R}$

Total initial energy $= \frac{1}{2}mv^2 - \frac{GMm}{R}$

Additional Physics 2013

Patrick Felicia



Additional Physics 2013:

Protostars and Planets VI Henrik Beuther, Ralf S. Klessen, Cornelis Petrus Dullemond, Thomas K. Henning, 2014-12-18

The revolutionary discovery of thousands of confirmed and candidate planets beyond the solar system brings forth the most fundamental question: How do planets and their host stars form and evolve? *Protostars and Planets VI* brings together more than 250 contributing authors at the forefront of their field, conveying the latest results in this research area and establishing a new foundation for advancing our understanding of stellar and planetary formation. Continuing the tradition of the *Protostars and Planets* series, this latest volume uniquely integrates the cross-disciplinary aspects of this broad field. Covering an extremely wide range of scales from the formation of large clouds in our Milky Way galaxy down to small chondrules in our solar system, *Protostars and Planets VI* takes an encompassing view with the goal of not only highlighting what we know but most importantly emphasizing the frontiers of what we do not know. As a vehicle for propelling forward new discoveries on stars, planets, and their origins, this latest volume in the Space Science Series is an indispensable resource for both current scientists and new students in astronomy, astrophysics, planetary science, and the study of meteorites.

Value Addition and Utilization of Lignocellulosic Biomass Gunjan Mukherjee, Sunny Dhiman, 2025-03-28 This book addresses the pressing global challenge of lignocellulosic biomass waste by exploring innovative technological solutions for its mitigation and conversion into valuable products. One of the key challenges faced is the effective management of lignocellulosic biomass waste generated from various industries including agriculture, forestry, and food processing. The demand for sustainable solutions for lignocellulosic waste management is steadily increasing, driven by environmental concerns, government regulations, and the pursuit of circular economy principles. This book aims to delve into the innovative technological solutions driving these transformations. It provides valuable insights into the transformative potential of these approaches in lignocellulosic biomass waste mitigation and the transition towards a more sustainable environment. This book is a definitive resource for researchers, professionals, and policymakers engaged in the fields of lignocellulosic biomass valorisation, waste management, and sustainable development. The exploration of case studies, economic assessments, and policy perspectives will contribute to the body of knowledge in this critical field and facilitate the transition towards a more sustainable future.

"Code of Massachusetts regulations, 2013", 2013 Archival snapshot of entire looseleaf Code of Massachusetts Regulations held by the Social Law Library of Massachusetts as of January 2020

Advanced X-Ray Radiation Detection: Krzysztof (Kris) Iniewski, 2022-07-04 This book offers readers an overview of some of the most recent advances in the field of technology for X-ray medical imaging. Coverage includes both technology and applications in SPECT, PET, and CT, with an in-depth review of the research topics from leading specialists in the field. Coverage includes conversion of the X-ray signal into analogue/digital value, as well as a review of CMOS chips for X-ray image sensors. Emphasis is on high-Z materials like CdTe, CZT, and GaAs, since they offer the best implementation possibilities for direct conversion X-ray detectors. The discussion includes material

challenges detector operation physics and technology and readout integrated circuits required to detect signals processes by high Z sensors Authors contrast these emerging technologies with more established ones based on scintillator materials This book is an excellent reference for people already working in the field as well as for people wishing to enter it *Fourth Semiannual Report of Activities, ... January 2, 2013, 112-2 House Report 112-745 ,2013* [ECGBL2013-Proceedings of the 6th European Conference on Games Based Learning](#) Patrick Felicia,2012 *Climate Change 2013: The Physical Science Basis* Intergovernmental panel on climate change. Working group 1,2014 The report also provides a comprehensive assessment of past and future sea level change in a dedicated chapter **ISTFA 2013** A. S. M. International,2013-01-01 This volume features the latest research and practical data from the premier event for the microelectronics failure analysis community The papers cover a wide range of testing and failure analysis topics of practical value to anyone working to detect understand and eliminate electronic device and system failures **Collimator-Based Tracking with an Add-On Multileaf Collimator** Andreas Böhler,2015-09-29 In this thesis a tracking system was developed by modifying an add on collimator the Siemens Moduleaf for realtime applications in radiotherapy As the add on collimator works almost completely autonomously of the linear accelerator LinAc no modifications to the latter were necessary The adaptations to the Moduleaf were mainly software based In order to reduce the complexity of the system outdated electronic parts were replaced with newer components where practical Verification was performed by measuring the latency of the system as well as the impact on applied dose to a predefined target volume moving in the leaf s travel direction Latency measurements in software were accomplished by comparing the target and current positions of the leaves For dose measurements a Gafchromic EBT2 film was placed beneath the target 4D phantom in between solid water plates and moved alongside with it Based on the results a tracking capable add on collimator seems to be a useful tool for reducing the margins for the treatment of small slow moving targets Radiotherapy is one of the most important methods used for the treatment of cancer Irradiating a moving target is also one of the most challenging tasks to accomplish in modern radiotherapy **New Challenges in Space Plasma Physics: Open Questions and Future Mission Concepts** Luca Sorriso-Valvo,Alessandro Retino,Christopher H. K. Chen,Daniel Verscharen,2023-02-15

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Table of Contents Additional Physics 2013

1. Understanding the eBook Additional Physics 2013
 - The Rise of Digital Reading Additional Physics 2013
 - Advantages of eBooks Over Traditional Books
2. Identifying Additional Physics 2013
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Additional Physics 2013
 - User-Friendly Interface
4. Exploring eBook Recommendations from Additional Physics 2013
 - Personalized Recommendations
 - Additional Physics 2013 User Reviews and Ratings
 - Additional Physics 2013 and Bestseller Lists
5. Accessing Additional Physics 2013 Free and Paid eBooks
 - Additional Physics 2013 Public Domain eBooks
 - Additional Physics 2013 eBook Subscription Services
 - Additional Physics 2013 Budget-Friendly Options

6. Navigating Additional Physics 2013 eBook Formats
 - ePub, PDF, MOBI, and More
 - Additional Physics 2013 Compatibility with Devices
 - Additional Physics 2013 Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Additional Physics 2013
 - Highlighting and Note-Taking Additional Physics 2013
 - Interactive Elements Additional Physics 2013
8. Staying Engaged with Additional Physics 2013
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Additional Physics 2013
9. Balancing eBooks and Physical Books Additional Physics 2013
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Additional Physics 2013
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Additional Physics 2013
 - Setting Reading Goals Additional Physics 2013
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Additional Physics 2013
 - Fact-Checking eBook Content of Additional Physics 2013
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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