



basic education

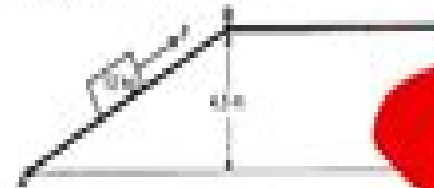
Department
Basic Education
REPUBLIC OF SOUTH AFRICA

FULL MEMORANDUM GRADE 12 PHYSICS 2022 FINAL

This question paper consists of 18 pages and 3 data sheets.

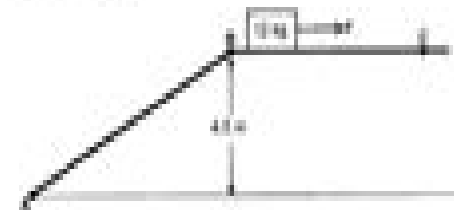
(QUESTION 5 (Start on a new page.)

A 12 kg block is initially at rest at point A at the bottom of a ROUGH inclined plane. The block is pulled up the incline by a constant force F acting parallel to the incline. The block reaches point B, which is at a vertical height of 4.0 m above the horizontal, with a speed of 2.0 m/s. See the diagram below.



- 5.1 Define the term non-conservative force.
- 5.2 Draw a labelled free-body diagram for the block when it is pulled up the incline.
- 5.3 Calculate the total work done on the block by the NON-CONSERVATIVE forces when the block moves from point A to point B. (4)

The same constant force F now moves the block at a CONSTANT VELOCITY across a rough horizontal surface from point B to point C, as shown below. Force F acts parallel to the horizontal surface.



The magnitude of the constant frictional force acting on the block while moving from point B to point C is 40 N, 40% of the magnitude of the constant frictional force acting on the block when it moves from point A to point B.

- 5.4 Calculate the distance from point A to point C. (5)

(10)

2013 June Physics Paper 1 Memorandum

Vladimir Dobrev



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Rapid Excavation and Tunneling Conference 2013 Proceedings Michael A. DiPonio, Chris Dixon, 2013 Annotation Every two years industry leaders and practitioners from around the world gather at the Rapid Excavation and Tunneling Conference RETC the authoritative program for the tunneling profession This comprehensive book includes more than 100 papers from industry experts highlighting their most recent projects and sharing real world experiences that will keep you up to date on the latest tunneling trends and technologies

Mechanics of Ice Failure Ian Jordaan, 2023-03-02 Featuring real world examples and practical methodology this rigorous text explores time dependence in the mechanics of ice Emphasizing use of full scale data and implementing risk based design methods mechanical theory is combined with design and modelling Readers will gain understanding of fundamental concepts and modern advances of ice mechanics and ice failure processes analysis of field data and use of probabilistic design methods with applications to the interaction of ships and offshore structures with thick ice features or icebergs The book highlights the use of viscoelastic theory including nonlinearity with stress and the effects of microstructural change in the mechanics of ice failure and fracture The methods of design focus on risk analysis with emphasis on rational limit state principles and safety Full discussion of historical discoveries and modern advances including Hans Island Molikpak and others support up to date methods and models to make this an ideal resource for designers and researchers

Spacecraft Dynamics and Control Enrico Canuto, Carlo Novara, Donato Carlucci, Carlos Perez-Montenegro, Luca Massotti, 2018-03-08 Spacecraft Dynamics and Control The Embedded Model Control Approach provides a uniform and systematic way of approaching space engineering control problems from the standpoint of model based control using state space equations as the key paradigm for simulation design and implementation The book introduces the Embedded Model Control methodology for the design and implementation of attitude and orbit control systems The logic architecture is organized around the embedded model of the spacecraft and its surrounding environment The model is compelled to include disturbance dynamics as a repository of the uncertainty that the control law must reject to meet attitude and orbit requirements within the uncertainty class The source of the real time uncertainty estimation prediction is the model error signal as it encodes the residual discrepancies between spacecraft measurements and model output The embedded model and the uncertainty estimation feedback noise estimator in the book constitute the state predictor feeding the control law Asymptotic pole placement exploiting the asymptotes of closed loop transfer functions is the way to design and tune feedback loops around the embedded model state predictor control law reference generator The design versus the uncertainty class is driven by analytic stability and performance inequalities The method is applied to several attitude and orbit control problems The book begins with an extensive introduction to attitude geometry and algebra and ends with the core themes state space dynamics and Embedded Model Control Fundamentals of orbit attitude and environment dynamics are treated giving emphasis to state space formulation disturbance dynamics state feedback and

prediction closed loop stability Sensors and actuators are treated giving emphasis to their dynamics and modelling of measurement errors Numerical tables are included and their data employed for numerical simulations Orbit and attitude control problems of the European GOCE mission are the inspiration of numerical exercises and simulations The suite of the attitude control modes of a GOCE like mission is designed and simulated around the so called mission state predictor Solved and unsolved exercises are included within the text and not separated at the end of chapters for better understanding training and application Simulated results and their graphical plots are developed through MATLAB Simulink code

Across Space and Time Arianna Traviglia,2025-10-01 This volume presents a selection of the best papers presented at the forty first annual Conference on Computer Applications and Quantitative Methods in Archaeology The theme for the conference was Across Space and Time and the papers explore a multitude of topics related to that concept including databases the semantic Web geographical information systems data collection and management and more Scientists at

War Sarah Bridger,2015-04-06 Sarah Bridger examines the ethical debates that tested the U S scientific community during the Cold War and scientists contributions to military technologies and strategic policymaking from the dawning atomic age through the Strategic Defense Initiative Star Wars in the 1980s which sparked cross generational opposition among scientists

Lie Theory and Its Applications in Physics Vladimir Dobrev,2023-01-29 This volume presents modern trends in the area of symmetries and their applications based on contributions to the Workshop Lie Theory and Its Applications in Physics held in Sofia Bulgaria on line in June 2021 Traditionally Lie theory is a tool to build mathematical models for physical systems Recently the trend is towards geometrization of the mathematical description of physical systems and objects A geometric approach to a system yields in general some notion of symmetry which is very helpful in understanding its structure Geometrization and symmetries are meant in their widest sense i e representation theory algebraic geometry number theory infinite dimensional Lie algebras and groups superalgebras and supergroups groups and quantum groups noncommutative geometry symmetries of linear and nonlinear partial differential operators special functions and others Furthermore the necessary tools from functional analysis are included This is a big interdisciplinary and interrelated field The topics covered in this Volume are the most modern trends in the field of the Workshop Representation Theory Symmetries in String Theories Symmetries in Gravity Theories Supergravity Conformal Field Theory Integrable Systems Quantum Computing and Deep Learning Entanglement Applications to Quantum Theory Exceptional quantum algebra for the standard model of particle physics Gauge Theories and Applications Structures on Lie Groups and Lie Algebras This book is suitable for a broad audience of mathematicians mathematical physicists and theoretical physicists including researchers and graduate students interested in Lie Theory *Tunnel Visions* Michael Riordan,Lilian

Hoddeson,Arienne W. Kolb,2015-11-20 A detailed and engaging account of the development of the superconducting supercollider one of the largest scientific undertakings in the United States Journal of American History Starting in the 1950s

US physicists dominated the search for elementary particles aided by the association of this research with national security they held this position for decades In an effort to maintain their hegemony and track down the elusive Higgs boson they convinced President Reagan and Congress to support construction of the multibillion dollar Superconducting Super Collider project in Texas the largest basic science project ever attempted But after the Cold War ended and the estimated SSC cost surpassed ten billion dollars Congress terminated the project in October 1993 Drawing on extensive archival research contemporaneous press accounts and over one hundred interviews with scientists engineers government officials and others involved Tunnel Visions tells the riveting story of the aborted SSC project The authors examine the complex interrelated causes for its demise including problems of large project management continuing cost overruns and lack of foreign contributions In doing so they ask whether Big Science has become too large and expensive including whether academic scientists and their government overseers can effectively manage such an enormous undertaking Focusing on the scientific technical and political conflicts that led to delays ever rising costs and eventually the SSC s cancelation by Congress Tunnel Visions is a true techno thriller Burton Richter winner of the Nobel Prize in Physics Most good science stories are tales of discovery and success but failure can be just as riveting Here two historians and an archivist describe the greatest particle physics experiment that never was Scientific American

At Sea Against the Soviet Fleet Bryan H. Leese, 2025-10-14 At Sea Against the Soviet Fleet is a history of the evolution of the United States Navy s Operational Intelligence culture that informs great power competition with China today At Sea Against the Soviet Fleet examines the critical transformation of naval intelligence during a pivotal era marked by the Cold War and the Vietnam conflict Bryan Leese meticulously details how U S Navy operational intelligence evolved to meet the complexities of modern naval warfare particularly in response to the increasing threats posed by the Soviet Navy Structured into four main parts this book begins by examining the Vietnam War and the institutionalization of shipboard operational intelligence or what Navy intelligence calls Opintel The book highlights the establishment of Integrated Operational Intelligence Centers as part of the RA 5C Vigilante program and the innovative strategies that emerged in air combat and targeting Leese goes on to underscore the necessity of Opintel to the U S Navy s close and distant blockade strategy in the 1960s and 1970s He delves into the decentralization of intelligence processes emphasizing the importance of adaptability and the need to prevent surprise attacks This evolution is framed within the transition to the Navy s Ocean Surveillance Information System a decentralized and responsive operational intelligence system The ongoing developments of shipboard intelligence capabilities are explored demonstrating how these advancements empowered naval commanders In the 1970s the organizations evolved as the revolutionary Opintel adaptations of the 1960s that leveraged cooperation without hierarchy became formalized Leese highlights the revolution to evolution process by introducing Opintel support to shipboard tactical decisions to integrate operational intelligence into comprehensive naval strategies Capturing the essence of this transformative period the author discusses the cultural

dynamics within the Navy that fostered innovation and interdepartmental collaboration. These developments not only contributed to maintaining a strategic edge over the Soviet Union but also laid the groundwork for future naval operations in the digital age. Leese's work reveals the intricate interplay between technology, strategy, and personnel in creating an effective intelligence framework that allows the U.S. Navy to assert influence at sea, setting conditions for sea control in conflict. By blending rich archival research with firsthand accounts, this book offers a nuanced understanding of how the Navy adapted to an ever-changing operational landscape, ultimately preserving peace while navigating the complexities of high-stakes maritime conflict.

Drawing Futures Bob Sheil, Frédéric Migayrou, Luke Pearson, Laura Allen, 2016-11-11. Drawing Futures brings together international designers and artists for speculations in contemporary drawing for art and architecture. Despite numerous developments in technological manufacture and computational design that provide new grounds for designers, the act of drawing still plays a central role as a vehicle for speculation. There is a rich and long history of drawing tied to innovations in technology as well as to revolutions in our philosophical understanding of the world. In reflection of a society now underpinned by computational networks and interfaces allowing hitherto unprecedented views of the world, the changing status of the drawing and its representation as a political act demands a platform for reflection and innovation. Drawing Futures will present a compendium of projects, writings, and interviews that critically reassess the act of drawing and where its future may lie. Drawing Futures focuses on the discussion of how the field of drawing may expand synchronously alongside technological and computational developments. The book coincides with an international conference of the same name taking place at The Bartlett School of Architecture, UCL, in November 2016. Bringing together practitioners from many creative fields, the book discusses how drawing is changing in relation to new technologies for the production and dissemination of ideas.

Complexity, Security and Civil Society in East Asia Peter Hayes, Kiho Yi, 2015-06-22. Complexity, Security and Civil Society in East Asia offers the latest understanding of complex global problems in the region, including nuclear weapons, urban insecurity, energy, and climate change. Detailed case studies of China, North and South Korea, and Japan demonstrate the importance of civil society and civic diplomacy in reaching shared solutions to these problems in East Asia and beyond. Each chapter describes regional civil society initiatives that tackle complex challenges to East Asia's security. In doing so, the book identifies key pressure points at which civil society can push for constructive changes, especially ones that reduce the North Korean threat to its neighbors. Unusually, this book is both theoretical and practical. Complexity, Security and Civil Society in East Asia presents strategies that can be led by civil society and negotiated by its diplomats to realize peace, security, and sustainability worldwide. It shows that networked civic diplomacy offers solutions to these urgent issues that official complex diplomacy cannot. By providing a new theoretical framework based on empirical observation, this volume is a must-read for diplomats, scholars, students, journalists, activists, and individual readers seeking insight into how to solve the crucial issues of our time.

Law, Death, and Robots Keri Grieman, 2024-10-17. Can the law keep up with AI? This

book examines liability and regulation for artificial intelligence causing serious physical harm both now and in the future While AI moves quickly regulation follows more slowly an increasing problem for an evolutionary fast paced emerging technology AI has the potential to save lives but in doing so will have the potential to take them as well How do we future proof law and regulation to incentivise life saving innovation as safely as possible This book details how to regulate AI in high risk civil applications for example automated vehicles and medicine addressing both liability and regulatory structure It highlights crucial liability themes for technology governance provides tools to bridge the gap between regulators and technologists examines jurisdictional approaches to AI regulation in the EU UK USA and Singapore and ultimately suggests a jurisdiction agnostic blueprint for regulation

Proceedings of the 6th National Symposium on Rotor Dynamics J. S. Rao,V. Arun Kumar,Soumendu Jana,2020-10-13 This book presents select papers presented during the 6th National Symposium on Rotor Dynamics held at CSIR NAL Bangalore and focuses on the latest trends in rotor dynamics and various challenges encountered in the design of rotating machinery The book is of interest to researchers from mechanical aerospace tribology and power industries engineering service providers and academics

The Emergence of Geophysics: A Journey into the Twentieth Century R.J. Howarth,2024-12-02 How did geophysics begin Who were the pioneers of this new science What instruments did they devise to measure the Earth related phenomena they were interested in This Memoir attempts to answer such questions in a well illustrated and largely non technical account The seventeenth century saw magnetism used as an aid to prospecting for iron ore in Sweden and Isaac Newton s derivation of the law of gravitational attraction A gradually increasing interest in physics of the Earth brought forth the new discipline of geophysics in the early nineteenth century and by the end of the following century airborne and satellite based investigations had become routine The Emergence of Geophysics explores this evolution in several parallel strands terrestrial magnetism and electricity gravity seismicity heat geodynamics and radioactivity broadly reflecting the timing of their introduction as tools aiding geophysical studies Biographical information is included for many of its practitioners and the book should be of interest to both geophysicists and to anyone interested in the history of Earth science

Radio Wave Propagation Chas. R. Burrows,2013-10-22 Radio Wave Propagation Consolidated Summary Technical Report of the Committee on Propagation of the National Defense Research Committee presents all the scientific information and report of experiments This book discusses the problems encountered in the propagation of radio waves Organized into three volumes this book begins with an overview of the technical developments in the study of tropospheric propagation This text then outlines the general theory of standard and nonstandard propagation together with descriptions and results of transmission experiments designed to test the theory Other chapters consider the more unusual problems concerning the radar behavior of targets This book discusses as well the problems of radio wave propagation in the standard atmosphere at frequencies above 30 megacycles The final chapter deals with the selection and utilization of local terrain features that affect propagation and the performance of

equipment This book is a valuable resource for scientists and engineers in the field of radio wave propagation **British Nuclear Weapons and the Test Ban 1954-1973** Dr John R Walker, 2013-06-28 In 1962 Dean Acheson famously described Britain as having lost an Empire but not yet found a role Perhaps nowhere is this more apparent than in the realms of nuclear weapons An increasingly marginal world power successive post war British governments felt that an independent nuclear deterrent was essential if the country was to remain at the top table of world diplomacy Focusing on a key twenty year period this study explores Britain's role in efforts to bring about a nuclear test ban treaty between 1954 and 1973 Taking a broadly chronological approach it examines the nature of defence planning the scientific goals that nuclear tests were designed to secure Anglo American relationships the efficacy of British diplomacy and its contribution to arms control and disarmament A key theme of the study is to show how the UK managed to balance the conflicting pressures created by its determination to remain a credible nuclear power whilst wanting to pursue disarmament objectives and how these pressures shifted over the period in question Based on a wealth of primary sources this book opens up the largely ignored subject of the impact of arms control on the UK nuclear weapons programme Its appraisal of the relationship between the requirements and developments of the UK nuclear weapons programme against international and domestic pressures for a test ban treaty will be of interest to anyone studying post war British defence and foreign policy history of science arms control disarmament and non proliferation and international relations It also provides important background information on current events involving nuclear proliferation and disarmament **Progress in Lasers and Laser Fusion** Behram Kursunoglu, 2013-03-09 This volume contains a portion of the presentations given at the session on Laser Fusion and Laser Development of Orbis Scientiae II held at the Center for Theoretical Studies University of Miami from January 20 through January 24 1975 This second in the new series of meetings held at the CTS strove to implement the goals professed in the organization of Orbis Scientiae in 1974 namely to encourage scientists in several disciplines to exchange views not only with colleagues who share similar research interests but also to acquaint scientists in other fields with the leading ideas and current results in each area represented Thus an effort has been made to include papers in each session that discuss fundamental issues in a way which is comprehensible to scientists who are specialists in other areas Also in keeping with the philosophy of Orbis Scientiae the major topics each year are to be varied with the invariant being the inclusion of developments in fundamental physics The discussions of the current state of the art in lasers and fusion represented in this volume are not only of interest because they deal with newly unfolding branches of physics but also because of their potential technological and societal significance The paper by V N Lugovoi and A M Prokhorov was not presented at Orbis Scientiae II but is included because of its relevance to the topics in this volume 25th International Congress of Pure and Applied Chemistry Y. Marcus, L. Ben-Dor, 2013-10-22 25th International Congress of Pure and Applied Chemistry presents a compilation of papers covering a wide range of topics on applied and pure chemistry This book discusses the challenges in the field of aromatic photosubstitution Organized into

six chapters this book begins with an overview of the diverse reactions of aromatic molecules This text then examines the pattern of specific RNA found in the human tumors which showed a notable concordance with the predictions deducible from the animal system Other chapters consider the methods of estimation of chemical fuels and describe the greenhouse effect arising from the burning of coal This book presents as well an assessment of some features of the impact of quantum mechanics on chemistry The final chapter deals with molecular beam and spectroscopic methods that allow a detailed investigation of several dynamical properties of single reactive collisions This book is a valuable resource for chemists theoreticians research workers and scientists

Fusion Technology 1992 C. Ferro,M. Gasparotto,H. Knoepfel,2013-10-22 The aim of the biennial series of symposia on Fusion Technology organized by the European Fusion Laboratories is the exchange of information on the design construction and operation of fusion experiments and on the technology being developed for the next step devices and fusion reactors The coverage of the volume includes the technological aspects of fusion reactors in relation to new developments thus forming a guideline for the definition of future work These proceedings comprise three volumes and contain both the invited lectures and contributed papers presented at the symposium which was attended by 569 participants from around the globe The 343 papers including 12 invited papers characterise the increasing interest of industry in the fusion programme giving a broad and current overview on the progress and trends fusion technology is experiencing now as well as indicating the future for fusion devices

Large-Eddy Simulation in Hydraulics Wolfgang Rodi,George Constantinescu,Thorsten Stoesser,2013-06-27 An introduction to the Large Eddy Simulation LES method geared primarily toward hydraulic and environmental engineers the book covers special features of flows in water bodies and summarizes the experience gained with LES for calculating such flows It can also be a valuable entry to the subject of LES for researchers and students in all fields of fluids engineering and the applications part will be useful to researchers interested in the physics of flows governed by the dynamics of coherent structures

Transnational Perspectives on Curriculum History Gary McCulloch,Ivor Goodson,Mariano González-Delgado,2019-11-22 This book offers a remarkable range of research that emphasises the need to analyse the shaping of curricula under historical social and political variables Teachers life stories the Cold War as a contextual element that framed curricular transformations in the US and Europe and the study of trends in education policy at transnational level are issues addressed throughout The book presents new lines of work offering multidisciplinary perspectives and provides an overview of how to move forwards The book brings together the work of international specialists on Curriculum History and presents research that offers new perspectives and methodologies from which to approach the study of the History of Education and Educational Policy It offers new debates which rethink the historical study of the curriculum and offers a strong interdisciplinary approach with contributions across Education History and the Social Sciences This book will be of great interest for academics and researchers in the fields of education and curriculum studies It will also appeal to educational professionals teachers and

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