

# PHYSICAL SCIENCES

## PAPER 1

## MAY-JUNE

## MEMO

# 2025



Figure 1: A circuit is shown in which  $E$ , the EMF (12 V) is equal to the voltage across the battery.

1.1 (4 marks)  
State the meaning implied by each of the components shown above. Give 2 marks for each of the 4 terms. (4 marks)

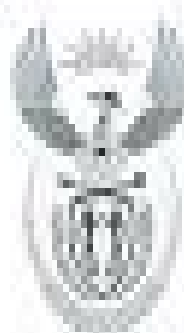


- 1.1 (4 marks) State the meaning implied by each of the components shown above. Give 2 marks for each of the 4 terms. (4 marks)
- 1.2 (4 marks) Calculate the magnitude of the force  $F$  required to balance the beam.



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# Physical Science Paper Memo 2013

**Nick Buxton, Ben Hayes**



## **Physical Science Paper Memo 2013:**

**30 Years Of Bes Physics - Proceedings Of The Symposium On 30 Years Of Bes Physics** Minghan Ye, Changzheng Yuan, 2020-06-05 BES the Beijing Spectrometer began its first groundbreaking physics run thirty years ago in 1989 This is the first high energy physics experiment in China and has been unique throughout the world for its thorough and extended coverage of the tau and charm energy region Since then the BES detector has undergone steady improvements upgrading to BESII in 1998 and to BESIII in 2008 Over the same period the collaboration has expanded from 150 members across 10 institutions in China and the United States to about 500 members across 72 institutions and 15 countries The physics program too has extended from light hadron spectroscopy tau and charm physics to the discovery of exotic charmonium like states precision tests of the Standard Model of particle physics and searches for new physics beyond the Standard Model This special volume collects the proceedings of the symposium held at the Institute of High Energy Physics Beijing in celebration of the 30 year span of achievements and progress at the BES BESII and BESIII experiments Written by many leaders of the BES collaborations these proceedings document the early days of the BES experiments important milestones and the future physics program at BESIII

**This Changes Everything** Naomi Klein, 2014-09-16 With strong first hand reporting and an original provocative thesis Naomi Klein returns with this book on how the climate crisis must spur transformational political change

*Indigenous Peoples' Governance of Land and Protected Territories in the Arctic* Thora Martina Herrmann, Thibault Martin, 2015-12-22 This book addresses critical questions and analyses key issues regarding Indigenous Aboriginal Peoples and governance of land and protected areas in the Arctic It brings together contributions from scientists indigenous and non indigenous researchers local leaders and members of the policy community that document Indigenous Aboriginal approaches to governance of land and protected areas at the local regional and international level explore new territorial governance models that are emerging as part of the Indigenous Aboriginal governance within Arctic States provinces territories and regions analyse the recognition or lack thereof concerning indigenous rights to self determination in the Arctic and examine how traditional decision making arrangements and practices can be linked with governments in the process of good governance The book highlights essential lessons learned success stories and remaining issues all of which are useful to address issues of Arctic governance of land and protected areas today and which could also be relevant for future governance arrangements

**The Secure and the Dispossessed** Nick Buxton, Ben Hayes, 2015-11-20 While the world's scientists and many of its inhabitants despair at the impact of climate change corporate and military leaders see nothing but opportunities For them melting ice caps mean newly accessible fossil fuels borders to be secured from climate refugees social conflicts to be managed and more failed states in which to intervene They are securing their assets at the expense of the planet and its inhabitants The Secure and the Dispossessed looks at these deadly approaches with a critical eye It also considers the flip side that the legitimacy of the elite is under unprecedented pressure from

resistance by communities to resource grabs to those creating new ecological and socially just models for managing our energy food and water Topics covered include geoengineering militarism refugee protection greenwashing and the agricultural crisis among others Adaptation and resilience to a climate changed world is desperately needed but the form it will take will affect all of our futures

**Biofuels for Aviation** Christopher Chuck, 2016-06-02 Biofuels for Aviation Feedstocks Technology and Implementation presents the issues surrounding the research and use of biofuels for aviation such as policy markets certification and performance requirements life cycle assessment and the economic and technical barriers to their full implementation Readers involved in bioenergy and aviation sectors research planning or policy making activities will benefit from this thorough overview The aviation industry's commitment to reducing GHG emissions along with increasing oil prices have sparked the need for renewable and affordable energy sources tailored to this sector's very specific needs As jet engines cannot be readily electrified turning to biofuels is the most viable option However aviation is a type of transportation for which traditional biofuels such as bioethanol and biodiesel do not fulfill key fuel requirements Therefore different solutions to this situation are being researched and tested around the globe which makes navigating this scenario particularly challenging This book guides readers through this intricate subject bringing them up to speed with its current status and future prospects both from the academic and the industry point of view Science and technology chapters delve into the technical aspects of the currently tested and the most promising technology in development as well as their respective feedstocks and the use of additives as a way of adapting them to meet certain specifications Conversion processes such as hydrotreatment synthetic biology pyrolysis hydrothermal liquefaction and Fisher Tropsch are explored and their results are assessed for current and future viability Presents the current status of biofuels for the aviation sector including technologies that are currently in use and the most promising future technologies their production processes and viability Explains the requirements for certification and performance of aviation fuels and how that can be achieved by biofuels Explores the economic and policy issues as well as life cycle assessment a comparative techno economic analysis of promising technologies and a roadmap to the future Explores conversion processes such as hydrotreatment synthetic biology pyrolysis hydrothermal liquefaction and Fisher Tropsch

**Training Students to Extract Value from Big Data** National Research Council, Division on Engineering and Physical Sciences, Board on Mathematical Sciences and Their Applications, Committee on Applied and Theoretical Statistics, 2015-01-16 As the availability of high throughput data collection technologies such as information sensing mobile devices remote sensing internet log records and wireless sensor networks has grown science engineering and business have rapidly transitioned from striving to develop information from scant data to a situation in which the challenge is now that the amount of information exceeds a human's ability to examine let alone absorb it Data sets are increasingly complex and this potentially increases the problems associated with such concerns as missing information and other quality concerns data heterogeneity and differing data formats The nation's ability

to make use of data depends heavily on the availability of a workforce that is properly trained and ready to tackle high need areas Training students to be capable in exploiting big data requires experience with statistical analysis machine learning and computational infrastructure that permits the real problems associated with massive data to be revealed and ultimately addressed Analysis of big data requires cross disciplinary skills including the ability to make modeling decisions while balancing trade offs between optimization and approximation all while being attentive to useful metrics and system robustness To develop those skills in students it is important to identify whom to teach that is the educational background experience and characteristics of a prospective data science student what to teach that is the technical and practical content that should be taught to the student and how to teach that is the structure and organization of a data science program Training Students to Extract Value from Big Data summarizes a workshop convened in April 2014 by the National Research Council's Committee on Applied and Theoretical Statistics to explore how best to train students to use big data The workshop explored the need for training and curricula and coursework that should be included One impetus for the workshop was the current fragmented view of what is meant by analysis of big data data analytics or data science New graduate programs are introduced regularly and they have their own notions of what is meant by those terms and most important of what students need to know to be proficient in data intensive work This report provides a variety of perspectives about those elements and about their integration into courses and curricula

**A History of Scientific Journals** Aileen Fyfe, Noah Moxham, Julie McDougall-Waters, Camilla Mørk Røstvik, 2022-10-03 Modern scientific research has changed so much since Isaac Newton's day it is more professional collaborative and international with more complicated equipment and a more diverse community of researchers Yet the use of scientific journals to report share and store results is a thread that runs through the history of science from Newton's day to ours Scientific journals are now central to academic research and careers Their editorial and peer review processes act as a check on new claims and findings and researchers build their careers on the list of journal articles they have published The journal that reported Newton's optical experiments still exists First published in 1665 and now fully digital the Philosophical Transactions has carried papers by Charles Darwin Dorothy Hodgkin and Stephen Hawking It is now one of eleven journals published by the Royal Society of London Unrivalled insights from the Royal Society's comprehensive archives have enabled the authors to investigate more than 350 years of scientific journal publishing The editorial management business practices and financial difficulties of the Philosophical Transactions and its sibling Proceedings reveal the meaning and purpose of journals in a changing scientific community At a time when we are surrounded by calls to reform the academic publishing system it has never been more urgent that we understand its history

**The UFO Phenomenon** Robert Davis, 2015-02-28 A comprehensive perspective of evidence and future directions associated with the UFO phenomenon Includes review and analysis of studies evidence theories and research needs involving UFO topics Extensive scientific endnotes

**Overcoming Barriers to Deployment of Plug-in Electric Vehicles** National

Research Council, Transportation Research Board, Division on Engineering and Physical Sciences, Board on Energy and Environmental Systems, Committee on Overcoming Barriers to Electric-Vehicle Deployment, 2015-06-26 In the past few years interest in plug in electric vehicles PEVs has grown Advances in battery and other technologies new federal standards for carbon dioxide emissions and fuel economy state zero emission vehicle requirements and the current administration's goal of putting millions of alternative fuel vehicles on the road have all highlighted PEVs as a transportation alternative Consumers are also beginning to recognize the advantages of PEVs over conventional vehicles such as lower operating costs smoother operation and better acceleration the ability to fuel up at home and zero tailpipe emissions when the vehicle operates solely on its battery There are however barriers to PEV deployment including the vehicle cost the short all electric driving range the long battery charging time uncertainties about battery life the few choices of vehicle models and the need for a charging infrastructure to support PEVs What should industry do to improve the performance of PEVs and make them more attractive to consumers At the request of Congress Overcoming Barriers to Deployment of Plug in Electric Vehicles identifies barriers to the introduction of electric vehicles and recommends ways to mitigate these barriers This report examines the characteristics and capabilities of electric vehicle technologies such as cost performance range safety and durability and assesses how these factors might create barriers to widespread deployment Overcoming Barriers to Deployment of Plug in Electric Vehicles provides an overview of the current status of PEVs and makes recommendations to spur the industry and increase the attractiveness of this promising technology for consumers Through consideration of consumer behaviors tax incentives business models incentive programs and infrastructure needs this book studies the state of the industry and makes recommendations to further its development and acceptance

**Robust Methods for the Analysis of Images and Videos for Fisheries Stock Assessment** National Research Council, Division on Engineering and Physical Sciences, Board on Mathematical Sciences and Their Applications, Committee on Applied and Theoretical Statistics, 2015-02-24 The National Marine Fisheries Service NMFS is responsible for the stewardship of the nation's living marine resources and their habitat As part of this charge NMFS conducts stock assessments of the abundance and composition of fish stocks in several bodies of water At present stock assessments rely heavily on human data gathering and analysis Automatic means of fish stock assessments are appealing because they offer the potential to improve efficiency and reduce human workload and perhaps develop higher fidelity measurements The use of images and video when accompanied by appropriate statistical analyses of the inferred data is of increasing importance for estimating the abundance of species and their age distributions Robust Methods for the Analysis of Images and Videos for Fisheries Stock Assessment is the summary of a workshop convened by the National Research Council Committee on Applied and Theoretical Statistics to discuss analysis techniques for images and videos for fisheries stock assessment Experts from diverse communities shared perspective about the most efficient path toward improved automation of visual information and discussed both near term and long term goals that can be achieved

through research and development efforts This report is a record of the presentations and discussions of this event Bulk Collection of Signals Intelligence National Research Council, Division on Engineering and Physical Sciences, Computer Science and Telecommunications Board, Committee on Responding to Section 5(d) of Presidential Policy Directive 28: The Feasibility of Software to Provide Alternatives to Bulk Signals Intelligence Collection, 2015-03-24 The Bulk Collection of Signals Intelligence Technical Options study is a result of an activity called for in Presidential Policy Directive 28 PPD 28 issued by President Obama in January 2014 to evaluate U S signals intelligence practices The directive instructed the Office of the Director of National Intelligence ODNI to produce a report within one year assessing the feasibility of creating software that would allow the intelligence community more easily to conduct targeted information acquisition rather than bulk collection ODNI asked the National Research Council NRC the operating arm of the National Academy of Sciences and National Academy of Engineering to conduct a study which began in June 2014 to assist in preparing a response to the President Over the ensuing months a committee of experts appointed by the Research Council produced the report

**Life-Cycle of Engineering Systems: Emphasis on Sustainable Civil Infrastructure** Jaap Bakker, Dan M. Frangopol, Klaas Breugel, 2016-11-18 This volume contains the papers presented at IALCCE2016 the fifth International Symposium on Life Cycle Civil Engineering IALCCE2016 to be held in Delft The Netherlands October 16 19 2016 It consists of a book of extended abstracts and a DVD with full papers including the Fazlur R Khan lecture keynote lectures and technical papers from all over the world All major aspects of life cycle engineering are addressed with special focus on structural damage processes life cycle design inspection monitoring assessment maintenance and rehabilitation life cycle cost of structures and infrastructures life cycle performance of special structures and life cycle oriented computational tools The aim of the editors is to provide a valuable source for anyone interested in life cycle of civil infrastructure systems including students researchers and practitioners from all areas of engineering and industry **Corporate Social Responsibility** James Weber, David Wasieleski, 2018-05-14 Volume Two of Business and Society 360 focuses on research drawn from work grounded in corporate social responsibility and corporate citizenship Strengthening the Disaster Resilience of the Academic Biomedical Research Community National Academies of Sciences, Engineering, and Medicine, Division on Earth and Life Studies, Health and Medicine Division, Institute for Laboratory Animal Research, Board on Earth Sciences and Resources, Board on Health Sciences Policy, Committee on Strengthening the Disaster Resilience of Academic Research Communities, 2017-10-20 The academic biomedical research community is a hub of employment economic productivity and scientific progress Academic research institutions are drivers of economic development in their local and state economies and by extension the national economy Beyond the economic input that the academic biomedical research community both receives and provides it generates knowledge that in turn affects society in myriad ways The United States has experienced and continues to face the threat of disasters and like all entities the academic biomedical

research community can be affected Recent disasters from hurricanes to cyber attacks and their consequences have shown that the investments of the federal government and of the many other entities that sponsor academic research are not uniformly secure First and foremost events that damage biomedical laboratories and the institutions that house them can have impacts on the safety and well being of humans and research animals Furthermore disasters can affect career trajectories scientific progress and financial stability at the individual and institutional levels Strengthening the Disaster Resilience of the Academic Biomedical Research Community offers recommendations and guidance to enhance the disaster resilience of the academic biomedical research community with a special focus on the potential actions researchers academic research institutions and research sponsors can take to mitigate the impact of future disasters

**Open Science by Design** National Academies of Sciences, Engineering, and Medicine, Policy and Global Affairs, Board on Research Data and Information, Committee on Toward an Open Science Enterprise, 2018-09-09 Openness and sharing of information are fundamental to the progress of science and to the effective functioning of the research enterprise The advent of scientific journals in the 17th century helped power the Scientific Revolution by allowing researchers to communicate across time and space using the technologies of that era to generate reliable knowledge more quickly and efficiently Harnessing today's stunning ongoing advances in information technologies the global research enterprise and its stakeholders are moving toward a new open science ecosystem Open science aims to ensure the free availability and usability of scholarly publications the data that result from scholarly research and the methodologies including code or algorithms that were used to generate those data Open Science by Design is aimed at overcoming barriers and moving toward open science as the default approach across the research enterprise This report explores specific examples of open science and discusses a range of challenges focusing on stakeholder perspectives It is meant to provide guidance to the research enterprise and its stakeholders as they build strategies for achieving open science and take the next steps

**Sea Ice** David N. Thomas, 2016-12-27 Over the past 20 years the study of the frozen Arctic and Southern Oceans and sub arctic seas has progressed at a remarkable pace This third edition of Sea Ice gives insight into the very latest understanding of the how sea ice is formed how we measure and model its extent the biology that lives within and associated with sea ice and the effect of climate change on its distribution How sea ice influences the oceanography of underlying waters and the influences that sea ice has on humans living in Arctic regions are also discussed Featuring twelve new chapters this edition follows two previous editions 2001 and 2010 and the need for this latest update exhibits just how rapidly the science of sea ice is developing The 27 chapters are written by a team of more than 50 of the world's leading experts in their fields These combine to make the book the most comprehensive introduction to the physics chemistry biology and geology of sea ice that there is This third edition of Sea Ice will be a key resource for all policy makers researchers and students who work with the frozen oceans and seas

**Twort's Water Supply** Malcolm J. Brandt, K. Michael Johnson, Andrew J. Elphinston, Don D. Ratnayaka, 2016-09-03 Twort's Water Supply



Seventh Edition has been expanded to provide the latest tools and techniques to meet engineering challenges over dwindling natural resources Approximately 1 1 billion people in rural and peri urban communities of developing countries do not have access to safe drinking water The mortality from diarrhea related diseases amounts to 2 2 million people each year from the consumption of unsafe water This update reflects the latest WHO European UK and US standards including the European Water Framework Directive The book also includes an expansion of waste and sludge disposal including energy and sustainability and new chapters on intakes chemical storage handling and sampling Written for both professionals and students this book is essential reading for anyone working in water engineering Features expanded coverage of waste and sludge disposal to include energy use and sustainability Includes a new chapter on intakes Includes a new chapter on chemical storage and handling

The Telescope in the Ice Mark Bowen, 2017-11-14 The IceCube Observatory has been called the weirdest of the seven wonders of modern astronomy by Scientific American In The Telescope in the Ice Mark Bowen tells the amazing story of the people who built the instrument and the science involved Located near the U S Amundsen Scott Research Station at the geographic South Pole IceCube is unlike most telescopes in that it is not designed to detect light It employs a cubic kilometer of diamond clear ice more than a mile beneath the surface to detect an elementary particle known as the neutrino In 2010 it detected the first extraterrestrial high energy neutrinos and thus gave birth to a new field of astronomy IceCube is also the largest particle physics detector ever built Its scientific goals span not only astrophysics and cosmology but also pure particle physics And since the neutrino is one of the strangest and least understood of the known elementary particles this is fertile ground Neutrino physics is perhaps the most active field in particle physics today and IceCube is at the forefront The Telescope in the Ice is ultimately a book about people and the thrill of the chase the struggle to understand the neutrino and the pioneers and inventors of neutrino astronomy

The Science of Armour Materials Ian Crouch, 2016-09-21 The Science of Armour Materials comprehensively covers the range of armor materials from steels and light alloys through glasses and ceramics to fibers textiles and protective apparel The book also discusses aspects of analytical and numerical modeling as well as laboratory based high strain rate testing and ballistic testing methodologies Each chapter is written from an international perspective including reviews of the current global literature and incorporates case studies that focus upon real life applications research outcomes and lessons learned The threat spectrum is restricted to small arms ammunition high velocity fragments and stab and spike attacks as well as blast loadings Features input from an editor who is an expert in his field Dr Ian Crouch the author of over 80 publications in his field with three patents to his name Provides systematic and comprehensive coverage of armor materials modeling and testing Offers a cross disciplinary approach that brings together expertise in materials science and defense engineering Discusses aspects of analytical and numerical modeling as well as laboratory based high strain rate testing and ballistic testing methodologies

*Official Gazette of the United States Patent and Trademark Office ,2006*

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