

# Fundamentals Of Chemical Engineering

## Thermodynamics

Fundamentals Of Chemical Engineering Thermodynamics Decoding the Universe  
Fundamentals of Chemical Engineering Thermodynamics Meta Dive into the core principles of chemical engineering thermodynamics from energy balances to equilibrium calculations with practical tips and realworld applications Master this crucial subject with our comprehensive guide Chemical Engineering Thermodynamics Thermodynamics Fundamentals Chemical Equilibrium Energy Balance Entropy Gibbs Free Energy Chemical Engineering Process Engineering Heat Transfer Mass Transfer Practical Thermodynamics Chemical Reaction Engineering Chemical engineering thermodynamics forms the bedrock of many chemical processes Understanding its principles is not just about acing exams its about designing efficient safe and economically viable industrial processes This post unravels the fundamental concepts offering a blend of theoretical understanding and practical application empowering you to approach chemical engineering problems with confidence

**1 The First Law Energy Conservation in Action** The first law of thermodynamics the cornerstone of energy analysis states that energy cannot be created or destroyed only transformed from one form to another In chemical engineering this translates to meticulously tracking energy changes during physical and chemical transformations We use the concept of enthalpy  $H$  a state function representing the total heat content of a system at constant pressure A positive change in enthalpy  $\Delta H > 0$  indicates an endothermic process heat absorbed while a negative change  $\Delta H < 0$  signifies an exothermic process heat released

**Practical Tip** When tackling energy balance problems systematically account for all energy streams entering and leaving the system Use a clear diagram to visualize the process and avoid overlooking any energy contributions such as heat transfer work done and changes in kinetic and potential energy

**2 The Second Law Entropy and the Arrow of Time** The second law introduces the concept of entropy  $S$  a measure of disorder or randomness within a system It dictates the direction of spontaneous processes stating that the total entropy of an isolated system can only increase over time or remain constant in ideal cases reversible processes This principle guides us in understanding the feasibility of a reaction or process A negative change in Gibbs Free Energy  $\Delta G < 0$  indicates a spontaneous process at constant temperature and pressure

**Practical Tip** When analyzing reaction spontaneity calculate the Gibbs Free Energy change  $\Delta G = \Delta H - T\Delta S$  Remember that even if a reaction is thermodynamically favorable  $\Delta G < 0$  it might be kinetically hindered requiring a catalyst to overcome the activation energy barrier

**3 Equilibrium Calculations The Heart of Process Optimization** Chemical equilibrium describes the state where the rates of the forward and reverse reactions are equal resulting in no net change in the concentrations of reactants and products Equilibrium constants  $K$  quantify the position of equilibrium providing crucial information for optimizing process conditions For gaseous reactions the equilibrium constant is expressed in terms of partial pressures  $K_p$  while for reactions in solution its expressed in terms of concentrations  $K_c$

**Practical Tip** Mastering equilibrium calculations involves understanding different equilibrium expressions  $K_p$   $K_c$   $K_x$  and applying them to

various reaction types Leverage software like Aspen Plus or CHEMCAD for complex equilibrium calculations involving multiple reactions and components

#### 4 Phase Equilibria

Understanding Phase Transitions Chemical engineering processes often involve phase transitions eg vaporization condensation sublimation Phase diagrams visually represent the conditions temperature pressure composition under which different phases coexist in equilibrium Understanding phase diagrams is crucial for designing separation processes like distillation extraction and crystallization

**Practical Tip** Familiarize yourself with common phase diagrams eg pressure-temperature diagrams for pure substances temperature-composition diagrams for binary mixtures Learn to use lever rules to determine the relative amounts of each phase in a two-phase system

#### 5 Thermodynamic Properties

The Building Blocks of Calculations Accurate thermodynamic property data is essential for precise engineering calculations

#### 3 These properties include

- enthalpy
- entropy
- Gibbs free energy
- heat capacity
- fugacity a measure of the effective partial pressure of a component in a mixture

These properties can be obtained from various sources including thermodynamic tables correlations and specialized software packages

**Practical Tip** Learn to use thermodynamic property databases eg NIST Chemistry WebBook DIPPR and understand the limitations of different property estimation methods Always critically evaluate the reliability of the data used in your calculations

#### Conclusion

Beyond the Equations Chemical engineering thermodynamics is far more than just equations and calculations Its a powerful tool for understanding and manipulating the universe at a molecular level It empowers us to design sustainable efficient processes that address global challenges ranging from energy production to environmental remediation While the fundamentals presented here form a strong foundation continuous learning and practical experience are key to mastering this critical field Embrace the challenge explore realworld applications and witness the transformative power of thermodynamic principles in action

#### FAQs

- Q** What is the difference between enthalpy and internal energy

**A** Internal energy  $U$  is the total energy of a system while enthalpy  $H$  is the internal energy plus the product of pressure and volume  $H = U + PV$  Enthalpy is particularly useful for processes occurring at constant pressure as the change in enthalpy directly represents the heat exchanged
- Q** How do I choose the right equilibrium constant  $K_p$  vs  $K_c$

**A** Use  $K_p$  when dealing with gaseous reactions where partial pressures are readily available or more relevant Use  $K_c$  when working with reactions in solution where concentrations are the primary focus
- Q** What are fugacity and activity coefficients

**A** Fugacity accounts for deviations from ideal gas behavior in real gas mixtures Activity coefficients adjust for deviations from ideal solution behavior in liquid mixtures They are crucial for accurate calculations in nonideal systems
- Q** How can I improve my problemsolving skills in thermodynamics

**A** Practice consistently by solving a wide range of problems from textbooks and online resources Focus on understanding the underlying principles rather than simply memorizing formulas Use diagrams to visualize problems and systematically track energy and mass balances
- Q** What software is useful for chemical engineering thermodynamic calculations

**A** Popular software packages include Aspen Plus CHEMCAD and ProII These programs can handle complex equilibrium calculations phase equilibria and thermodynamic property estimations significantly simplifying the process They offer powerful tools for process simulation and optimization

Chemical and Engineering Thermodynamics Introduction to Chemical Engineering Thermodynamics Thermodynamics for Chemical Engineers Chemical Engineering

ThermodynamicsChemical, Biochemical, and Engineering ThermodynamicsIntroduction to Chemical Engineering ThermodynamicsThermodynamicsIntroduction To Chemical Engineering ThermodynamicsIntroduction to Chemical Engineering ThermodynamicsA TEXTBOOK OF CHEMICAL ENGINEERING THERMODYNAMICS, SECOND EDITIONPERRY'S CHEMICAL ENGINEER'S HANDBOOK 8/E SECTION 4 THERMODYNAMICS (POD)Introduction to Chemical Engineering ThermodynamicsChemical Engineering ThermodynamicsChemical Engineering ThermodynamicsIntroduction to Chemical Engineering ThermodynamicsIntroductory Chemical Engineering ThermodynamicsChemical Engineering ThermodynamicsApplied Chemical Engineering ThermodynamicsApplied Chemical Engineering ThermodynamicsIntroduction to Chemical Engineering Thermodynamics Stanley I. Sandler Joseph Mauk Smith Kenneth Richard Hall RAO Stanley I. Sandler Joseph Mauk Smith Giovanni Astarita J. M. Smith Joseph Mauk Smith NARAYANAN, K. V. Don W. Green Gopinath Halder Thomas E. Daubert Joseph Mauk Smith J. Richard Elliott AHUJA, PRADEEP Dimitrios P. Tassios Dimitrios Tassios Joseph Mauk Smith Chemical and Engineering Thermodynamics Introduction to Chemical Engineering Thermodynamics Thermodynamics for Chemical Engineers Chemical Engineering Thermodynamics Chemical, Biochemical, and Engineering Thermodynamics Introduction to Chemical Engineering Thermodynamics Thermodynamics Introduction To Chemical Engineering Thermodynamics Introduction to Chemical Engineering Thermodynamics A TEXTBOOK OF CHEMICAL ENGINEERING THERMODYNAMICS, SECOND EDITION PERRY'S CHEMICAL ENGINEER'S HANDBOOK 8/E SECTION 4 THERMODYNAMICS (POD) Introduction to Chemical Engineering Thermodynamics Chemical Engineering Thermodynamics Chemical Engineering Thermodynamics Introduction to Chemical Engineering Thermodynamics Introductory Chemical Engineering Thermodynamics Chemical Engineering Thermodynamics Applied Chemical Engineering Thermodynamics Applied Chemical Engineering Thermodynamics Introduction to Chemical Engineering Thermodynamics *Stanley I. Sandler Joseph Mauk Smith Kenneth Richard Hall RAO Stanley I. Sandler Joseph Mauk Smith Giovanni Astarita J. M. Smith Joseph Mauk Smith NARAYANAN, K. V. Don W. Green Gopinath Halder Thomas E. Daubert Joseph Mauk Smith J. Richard Elliott AHUJA, PRADEEP Dimitrios P. Tassios Dimitrios Tassios Joseph Mauk Smith*

a revised edition of the well received thermodynamics text this work retains the thorough coverage and excellent organization that made the first edition so popular now incorporates industrially relevant microcomputer programs with which readers can perform sophisticated thermodynamic calculations including calculations of the type they will encounter in the lab and in industry also provides a unified treatment of phase equilibria emphasis is on analysis and prediction of liquid liquid and vapor liquid equilibria solubility of gases and solids in liquids solubility of liquids and solids in gases and supercritical fluids freezing point depressions and osmotic equilibria as well as traditional vapor liquid and chemical reaction equilibria contains many new illustrations and exercises

presents comprehensive coverage of the subject of thermodynamics from a chemical engineering viewpoint this text provides an exposition of the principles of thermodynamics and details their application to chemical processes it contains problems

examples and illustrations to help students understand complex concepts

thermodynamics for chemical engineers learn the basics of thermodynamics in this complete and practice oriented introduction for students of chemical engineering thermodynamics is a vital branch of physics that focuses upon the interaction of heat work and temperature with energy radiation and matter thermodynamics can apply to a wide range of sciences but is particularly important in chemical engineering where the interconnection of heat and work with chemical reactions or physical changes of state are studied according to the laws of thermodynamics moreover thermodynamics in chemical engineering focuses upon pure fluid and mixture properties phase equilibrium and chemical reactions within the confines of the laws of thermodynamics given that thermodynamics is an essential course of study in chemical and petroleum engineering thermodynamics for chemical engineers provides an important introduction to the subject that comprehensively covers the topic in an easily digestible manner suitable for undergraduate and graduate students the text introduces the basic concepts of thermodynamics thoroughly and concisely while providing practice oriented examples and illustrations thus the book helps students bridge the gap between theoretical knowledge and basic experiments and measurement characteristics thermodynamics for chemical engineers readers will also find practice oriented examples to help students connect the learned concepts to actual laboratory instruments and experiments a broad suite of illustrations throughout the text to help illuminate the information presented authors with decades working in chemical engineering and teaching thermodynamics thermodynamics for chemical engineers is the ideal resource not just for undergraduate and graduate students in chemical and petroleum engineering but also for anyone looking for a basic guide to thermodynamics

in this newly revised 5th edition of chemical and engineering thermodynamics sandler presents a modern applied approach to chemical thermodynamics and provides sufficient detail to develop a solid understanding of the key principles in the field the text confronts current information on environmental and safety issues and how chemical engineering principles apply in biochemical engineering bio technology polymers and solid state processing this book is appropriate for the undergraduate and graduate level courses

if a writer would know how to behave himself with relation to posterity let him consider in old books what he finds that he is glad to know and what omissions he most laments jonathan swift this book emerges from a long story of teaching i taught chemical engineering thermodynamics for about ten years at the university of naples in the 1960s and i still remember the awkwardness that i felt about any textbook i chose to consider all of them seemed to be vague at best and the standard of logical rigor seemed immensely inferior to what i could find in books on such other of the students in my first class subjects as calculus and fluid mechanics one who is now prof f gioia of the university of naples once asked me a question which i have used here as example 4 2 more than 20 years have gone by and i am still waiting for a more intelligent question from one of my students at the time that question compelled me to answer in a way i didn t like namely i ll think about it and i hope i ll have the answer by the next time we meet i didn t have it that soon though i did manage to have it before the end of the course

designed as an undergraduate level textbook in chemical engineering this student friendly thoroughly class room tested book now in its second edition continues to provide an in depth analysis of chemical engineering thermodynamics the book has been so organized that it gives comprehensive coverage of basic concepts and applications of the laws of thermodynamics in the initial chapters while the later chapters focus at length on important areas of study falling under the realm of chemical thermodynamics the reader is thus introduced to a thorough analysis of the fundamental laws of thermodynamics as well as their applications to practical situations this is followed by a detailed discussion on relationships among thermodynamic properties and an exhaustive treatment on the thermodynamic properties of solutions the role of phase equilibrium thermodynamics in design analysis and operation of chemical separation methods is also deftly dealt with finally the chemical reaction equilibria are skillfully explained besides numerous illustrations the book contains over 200 worked examples over 400 exercise problems all with answers and several objective type questions which enable students to gain an in depth understanding of the concepts and theory discussed the book will also be a useful text for students pursuing courses in chemical engineering related branches such as polymer engineering petroleum engineering and safety and environmental engineering new to this edition more example problems and exercise questions in each chapter updated section on vapour liquid equilibrium in chapter 8 to highlight the significance of equations of state approach gate questions up to 2012 with answers

now in its eighth edition perry s chemical engineers handbook offers unrivaled up to date coverage of all aspects of chemical engineering for the first time individual sections are available for purchase now you can receive only the content you need for a fraction of the price of the entire volume streamline your research pinpoint specialized information and save money by ordering single sections of this definitive chemical engineering reference today first published in 1934 perry s chemical engineers handbook has equipped generations of engineers and chemists with an expert source of chemical engineering information and data now updated to reflect the latest technology and processes of the new millennium the eighth edition of this classic guide provides unsurpassed coverage of every aspect of chemical engineering from fundamental principles to chemical processes and equipment to new computer applications filled with over 700 detailed illustrations the eighth edition of perry s chemical engineers handbook features comprehensive tables and charts for unit conversion a greatly expanded section on physical and chemical data new to this edition the latest advances in distillation liquid liquid extraction reactor modeling biological processes biochemical and membrane separation processes and chemical plant safety practices with accident case histories

a practical up to date introduction to applied thermodynamics including coverage of process simulation models and an introduction to biological systems introductory chemical engineering thermodynamics second edition helps readers master the fundamentals of applied thermodynamics as practiced today with extensive development of molecular perspectives that enables adaptation to fields including biological systems environmental applications and nanotechnology this text is distinctive in making molecular perspectives accessible at the introductory level and connecting properties with practical implications features of the second edition include hierarchical instruction with increasing levels of detail content requiring deeper levels of theory is clearly delineated

in separate sections and chapters early introduction to the overall perspective of composite systems like distillation columns reactive processes and biological systems learning objectives problem solving strategies for energy balances and phase equilibria chapter summaries and important equations for every chapter extensive practical examples especially coverage of non ideal mixtures which include water contamination via hydrocarbons polymer blending recycling oxygenated fuels hydrogen bonding osmotic pressure electrolyte solutions zwitterions and biological molecules and other contemporary issues supporting software in formats for both matlab and spreadsheets online supplemental sections and resources including instructor slides conceptests coursecast videos and other useful resources

this book offers a full account of thermodynamic systems in chemical engineering it provides a solid understanding of the basic concepts of the laws of thermodynamics as well as their applications with a thorough discussion of phase and chemical reaction equilibria at the outset the text explains the various key terms of thermodynamics with suitable examples and then thoroughly deals with the virial and cubic equations of state by showing the  $p-v-T$  pressure molar volume and temperature relation of fluids it elaborates on the first and second laws of thermodynamics and their applications with the help of numerous engineering examples the text further discusses the concepts of exergy standard property changes of chemical reactions thermodynamic property relations and fugacity the book also includes detailed discussions on residual and excess properties of mixtures various activity coefficient models local composition models and group contribution methods in addition the text focuses on vapour liquid and other phase equilibrium calculations and analyzes chemical reaction equilibria and adiabatic reaction temperature for systems with complete and incomplete conversion of reactants key features includes a large number of fully worked out examples to help students master the concepts discussed provides well graded problems with answers at the end of each chapter to test and foster students conceptual understanding of the subject the total number of solved examples and end chapter exercises in the book are over 600 contains chapter summaries that review the major concepts covered the book is primarily designed for the undergraduate students of chemical engineering and its related disciplines such as petroleum engineering and polymer engineering it can also be useful to professionals the solution manual containing the complete worked out solutions to chapter end exercises and problems is available for instructors

applied chemical engineering thermodynamics provides the undergraduate and graduate student of chemical engineering with the basic knowledge the methodology and the references he needs to apply it in industrial practice thus in addition to the classical topics of the laws of thermodynamics pure component and mixture thermodynamic properties as well as phase and chemical equilibria the reader will find history of thermodynamics energy conservation internmolecular forces and molecular thermodynamics cubic equations of state statistical mechanics a great number of calculated problems with solutions and an appendix with numerous tables of numbers of practical importance are extremely helpful for applied calculations the computer programs on the included disk help the student to become familiar with the typical methods used in industry for volumetric and vapor liquid equilibria calculations

Eventually, **Fundamentals Of Chemical Engineering Thermodynamics** will unquestionably discover a further experience and capability by spending more cash. still when? get you bow to that you require to get those every needs past having significantly cash? Why dont you attempt to acquire something basic in the beginning? Thats something that will lead you to understand even more Fundamentals Of Chemical Engineering Thermodynamics something like the globe, experience, some places, subsequent to history, amusement, and a lot more? It is your unquestionably Fundamentals Of Chemical Engineering Thermodynamics own epoch to do its stuff reviewing habit. among guides you could enjoy now is **Fundamentals Of Chemical Engineering Thermodynamics** below.

1. How do I know which eBook platform is the best for me?
2. Finding the best eBook platform depends on your reading preferences and device compatibility. Research different platforms, read user reviews, and explore their features before making a choice.
3. Are free eBooks of good quality? Yes, many reputable platforms offer high-quality free eBooks, including classics and public domain works. However, make sure to verify the source to ensure the eBook credibility.
4. Can I read eBooks without an eReader? Absolutely! Most eBook platforms offer web-based readers or mobile apps that allow you to read eBooks on your computer, tablet, or smartphone.
5. How do I avoid digital eye strain while reading eBooks? To prevent digital eye strain, take regular breaks, adjust the font size and background color, and ensure proper lighting while reading eBooks.
6. What the advantage of interactive eBooks? Interactive eBooks incorporate multimedia elements, quizzes, and activities, enhancing the reader engagement and providing a more immersive learning experience.
7. Fundamentals Of Chemical Engineering Thermodynamics is one of the best book in

our library for free trial. We provide copy of Fundamentals Of Chemical Engineering Thermodynamics in digital format, so the resources that you find are reliable. There are also many Ebooks of related with Fundamentals Of Chemical Engineering Thermodynamics.

8. Where to download Fundamentals Of Chemical Engineering Thermodynamics online for free? Are you looking for Fundamentals Of Chemical Engineering Thermodynamics PDF? This is definitely going to save you time and cash in something you should think about.

Hi to news.xyno.online, your hub for a extensive collection of Fundamentals Of Chemical Engineering Thermodynamics PDF eBooks. We are passionate about making the world of literature accessible to every individual, and our platform is designed to provide you with a effortless and pleasant for title eBook getting experience.

At news.xyno.online, our goal is simple: to democratize information and encourage a enthusiasm for reading Fundamentals Of Chemical Engineering Thermodynamics. We believe that everyone should have admittance to Systems Study And Design Elias M Awad eBooks, including various genres, topics, and interests. By supplying Fundamentals Of Chemical Engineering Thermodynamics and a wide-ranging collection of PDF eBooks, we strive to enable readers to discover, discover, and immerse themselves in the world of books.

In the expansive realm of digital literature, uncovering Systems Analysis And Design Elias M Awad sanctuary that delivers on both content and user experience is similar to stumbling upon a secret treasure. Step into news.xyno.online, Fundamentals Of Chemical Engineering Thermodynamics PDF eBook download haven that invites readers into a realm of literary marvels. In this Fundamentals Of Chemical Engineering

Thermodynamics assessment, we will explore the intricacies of the platform, examining its features, content variety, user interface, and the overall reading experience it pledges.

At the core of news.xyno.online lies a varied collection that spans genres, meeting the voracious appetite of every reader. From classic novels that have endured the test of time to contemporary page-turners, the library throbs with vitality. The Systems Analysis And Design Elias M Awad of content is apparent, presenting a dynamic array of PDF eBooks that oscillate between profound narratives and quick literary getaways.

One of the characteristic features of Systems Analysis And Design Elias M Awad is the coordination of genres, producing a symphony of reading choices. As you travel through the Systems Analysis And Design Elias M Awad, you will discover the complexity of options — from the organized complexity of science fiction to the rhythmic simplicity of romance. This variety ensures that every reader, no matter their literary taste, finds Fundamentals Of Chemical Engineering Thermodynamics within the digital shelves.

In the world of digital literature, burstiness is not just about diversity but also the joy of discovery. Fundamentals Of Chemical Engineering Thermodynamics excels in this performance of discoveries. Regular updates ensure that the content landscape is ever-changing, introducing readers to new authors, genres, and perspectives. The surprising flow of literary treasures mirrors the burstiness that defines human expression.

An aesthetically appealing and user-friendly interface serves as the canvas upon which Fundamentals Of Chemical Engineering Thermodynamics depicts its

literary masterpiece. The website's design is a demonstration of the thoughtful curation of content, providing an experience that is both visually attractive and functionally intuitive. The bursts of color and images coalesce with the intricacy of literary choices, forming a seamless journey for every visitor.

The download process on Fundamentals Of Chemical Engineering Thermodynamics is a symphony of efficiency. The user is acknowledged with a straightforward pathway to their chosen eBook. The burstiness in the download speed assures that the literary delight is almost instantaneous. This seamless process matches with the human desire for fast and uncomplicated access to the treasures held within the digital library.

A crucial aspect that distinguishes news.xyno.online is its commitment to responsible eBook distribution. The platform rigorously adheres to copyright laws, ensuring that every download Systems Analysis And Design Elias M Awad is a legal and ethical endeavor. This commitment contributes a layer of ethical complexity, resonating with the conscientious reader who esteems the integrity of literary creation.

news.xyno.online doesn't just offer Systems Analysis And Design Elias M Awad; it nurtures a community of readers. The platform offers space for users to connect, share their literary ventures, and recommend hidden gems. This interactivity adds a burst of social connection to the reading experience, elevating it beyond a solitary pursuit.

In the grand tapestry of digital literature, news.xyno.online stands as a dynamic thread that blends complexity and burstiness into the reading journey. From the subtle dance of genres to the swift



strokes of the download process, every aspect resonates with the changing nature of human expression. It's not just a Systems Analysis And Design Elias M Awad eBook download website; it's a digital oasis where literature thrives, and readers start on a journey filled with delightful surprises.

We take pride in choosing an extensive library of Systems Analysis And Design Elias M Awad PDF eBooks, carefully chosen to appeal to a broad audience. Whether you're a supporter of classic literature, contemporary fiction, or specialized non-fiction, you'll find something that engages your imagination.

Navigating our website is a piece of cake. We've crafted the user interface with you in mind, guaranteeing that you can effortlessly discover Systems Analysis And Design Elias M Awad and retrieve Systems Analysis And Design Elias M Awad eBooks. Our lookup and categorization features are intuitive, making it easy for you to discover Systems Analysis And Design Elias M Awad.

news.xyno.online is dedicated to upholding legal and ethical standards in the world of digital literature. We emphasize the distribution of Fundamentals Of Chemical Engineering Thermodynamics that are either in the public domain, licensed for free distribution, or provided by authors and publishers with the right to share their work. We actively discourage the distribution of copyrighted material without proper authorization.

**Quality:** Each eBook in our selection is meticulously vetted to ensure a high standard of quality. We intend for your reading experience to be satisfying and free of formatting issues.

**Variety:** We continuously update our library to bring you the newest releases, timeless classics, and hidden gems across categories. There's always a little something new to discover.

**Community Engagement:** We value our community of readers. Connect with us on social media, discuss your favorite reads, and become in a growing community passionate about literature.

Whether or not you're a enthusiastic reader, a learner seeking study materials, or someone venturing into the world of eBooks for the first time, news.xyno.online is available to cater to Systems Analysis And Design Elias M Awad. Accompany us on this literary journey, and let the pages of our eBooks to take you to fresh realms, concepts, and encounters.

We comprehend the thrill of finding something novel. That is the reason we consistently refresh our library, ensuring you have access to Systems Analysis And Design Elias M Awad, acclaimed authors, and hidden literary treasures. On each visit, anticipate fresh opportunities for your reading Fundamentals Of Chemical Engineering Thermodynamics.

Gratitude for choosing news.xyno.online as your reliable source for PDF eBook downloads. Happy perusal of Systems Analysis And Design Elias M Awad

