

NOVEL UV SPECTROSCOPIC METHOD FOR QUANTIFICATION OF CAFFEINE IN MARKETED ENERGY DRINKS

K. BHAVYA SRI^{1*}, B. HEMA², MOGILI SUMAKANTH²

^{1,2}Department of Pharmaceutical Analysis, RYR Women's College of Pharmacy, Barkatpura, Hyderabad 500027, India, ²Department of Pharmaceutical Chemistry, RYR Women's College of Pharmacy, Barkatpura, Hyderabad 500027, India
Email: bhavya.kogga@gmail.com

Received: 05 Jan 2023, Revised and Accepted: 15 Feb 2023

ABSTRACT

Objective: This study is performed to quantitatively estimate caffeine in marketed energy drinks by using UV-Visible spectroscopic method.

Methods: This experiment was performed on various soft drinks and energy drinks available in the local market of India to determine the caffeine concentration. The quantitative method used was simple, easy UV-Visible spectrophotometric method by using carbon dichloromethane as diluent at 274 nm. UV-Vis spectroscopy is an analytical technique that measures the amount of discrete wavelengths of UV or visible light that are absorbed by or transmitted through a sample in comparison to a reference or blank sample.

Results: Among all the samples i.e. soft or energy drinks taken for this experiment sample 1 has low concentration of caffeine and the highest concentration was observed in sample 3.

Conclusion: Caffeine in an energy drink provides a stimulant effect, it gives energy. At lower levels, as it's typically used in soft drinks, it has less of a stimulant effect and is used mainly for its taste profile. However the concentration of caffeine should be within the limits specified. Excessive consumption of caffeine may lead to anxiety, caffeine dependence, increased urination, and may cause insomnia. Energy drinks can contain high levels of caffeine but are unlikely to be hazardous unless consumed with alcohol. This research is very important analytical process to safeguard the well being of people who are unaware to adverse effects of caffeine.

Keywords: Caffeine, Soft drinks, Energy drinks, UV visible spectrophotometer, Dichloromethane

© 2023 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>) DOI: <https://doi.org/10.22157/ijcpr.2023v15i2.2093> Journal homepage: <https://innovareacademic.in/journals/index.php/ijcpr>

INTRODUCTION

Caffeine is a white crystalline xanthines alkaloid i.e. methyl xanthines group which is bitter in taste [1, 2]. The IUPAC name of caffeine is 1, 3, 7-trimethylpurine-2, 6-dione. Caffeine molar mass and density are 194.19 g/mol and 1.2g/ml respectively. In cold water caffeine has low solubility and it has better solubility in hot water, pyrrole, acetone, pyrimidine, and ethyl-acetate. Caffeine has very well solubility in petroleum ether, chloroform, benzene and ether. Chemical structure of caffeine is given in the fig. 1 below.



Fig. 1: Chemical structure of caffeine

Caffeine is present in leaves and seeds of different plants. Mostly it is derived from the tea leaves, coffee, cocoa or cola seeds. Big source of caffeine is tea. Higher concentrations of caffeine are present in black or oolong tea when compared with other kind of tea such as green tea. Tea was found in china and was initially used for medical purposes. It is extracted from *Cassia sinensis*, a plant that is indigenous to India and china. Tea has flavanoids and imparts anti-inflammatory and neuroprotective activity. In Asia green tea is most popular tea. It has large amount of caffeine, tastes bitter and is made of unfermented leaves. Black tea tastes much bitter and is made with fermented leaves. It has polyphenols such as flavanoids and has highest amount of caffeine. Flavanoids are effective against harmful agents [3].

In soft drinks like colas caffeine is most common ingredient. It is intentionally added to these drinks for the reason of their taste and to make the drink addictive. Depending on the drink type the content of caffeine in soft drinks varies which can be from 10 mg to 50 mg per serving portion [4]. The maximum amount of caffeine in carbonated drinks is restricted to 6 mg/ml by the USFDA [5]. In soft drinks the allowed amount of caffeine is in the range of 30 to 72 mg/335 ml or 8.45 to 20.28 mg/100 ml [6].

The popular drinks which contain caffeine are tea, coffee, soft and energy drinks. The most commonly used psychoactive compound worldwide is caffeine [7]. The amount of caffeine present in a cup of coffee is 100 mg. Even decaf coffee contains caffeine which can be 12 mg. The amount of caffeine present in a cup of tea is 85 mg. After 15 min of ingestion the effect of caffeine on human body may appear and can last for hours [8].



Fig. 2: Soft drinks

People will not have mood changes with consumption of less than 300 mg of caffeine. Consumption of caffeine causes dehydration due to its diuretic activity. Metabolism of caffeine takes place in liver by

Method Estimation Caffeine In Drinks Manual

Brendan G. Carr



Method Estimation Caffeine In Drinks Manual:

The Enigmatic Realm of **Method Estimation Caffeine In Drinks Manual**: Unleashing the Language is Inner Magic

In a fast-paced digital era where connections and knowledge intertwine, the enigmatic realm of language reveals its inherent magic. Its capacity to stir emotions, ignite contemplation, and catalyze profound transformations is nothing short of extraordinary. Within the captivating pages of **Method Estimation Caffeine In Drinks Manual** a literary masterpiece penned by a renowned author, readers attempt a transformative journey, unlocking the secrets and untapped potential embedded within each word. In this evaluation, we shall explore the book's core themes, assess its distinct writing style, and delve into its lasting impact on the hearts and minds of people who partake in its reading experience.

https://upload.cheaperseeker.com/About/Resources/default.aspx/Graphic_Compo_Creation_Through_Shapes_And_Patterns.pdf

Table of Contents Method Estimation Caffeine In Drinks Manual

1. Understanding the eBook Method Estimation Caffeine In Drinks Manual
 - The Rise of Digital Reading Method Estimation Caffeine In Drinks Manual
 - Advantages of eBooks Over Traditional Books
2. Identifying Method Estimation Caffeine In Drinks Manual
 - 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 a Method Estimation Caffeine In Drinks Manual
 - User-Friendly Interface
4. Exploring eBook Recommendations from Method Estimation Caffeine In Drinks Manual
 - Personalized Recommendations
 - Method Estimation Caffeine In Drinks Manual User Reviews and Ratings

- Method Estimation Caffeine In Drinks Manual and Bestseller Lists
- 5. Accessing Method Estimation Caffeine In Drinks Manual Free and Paid eBooks
 - Method Estimation Caffeine In Drinks Manual Public Domain eBooks
 - Method Estimation Caffeine In Drinks Manual eBook Subscription Services
 - Method Estimation Caffeine In Drinks Manual Budget-Friendly Options
- 6. Navigating Method Estimation Caffeine In Drinks Manual eBook Formats
 - ePub, PDF, MOBI, and More
 - Method Estimation Caffeine In Drinks Manual Compatibility with Devices
 - Method Estimation Caffeine In Drinks Manual Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Method Estimation Caffeine In Drinks Manual
 - Highlighting and Note-Taking Method Estimation Caffeine In Drinks Manual
 - Interactive Elements Method Estimation Caffeine In Drinks Manual
- 8. Staying Engaged with Method Estimation Caffeine In Drinks Manual
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Method Estimation Caffeine In Drinks Manual
- 9. Balancing eBooks and Physical Books Method Estimation Caffeine In Drinks Manual
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Method Estimation Caffeine In Drinks Manual
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Method Estimation Caffeine In Drinks Manual
 - Setting Reading Goals Method Estimation Caffeine In Drinks Manual
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Method Estimation Caffeine In Drinks Manual
 - Fact-Checking eBook Content of Method Estimation Caffeine In Drinks Manual
 - 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

Method Estimation Caffeine In Drinks Manual Introduction

Free PDF Books and Manuals for Download: Unlocking Knowledge at Your Fingertips In todays fast-paced digital age, obtaining valuable knowledge has become easier than ever. Thanks to the internet, a vast array of books and manuals are now available for free download in PDF format. Whether you are a student, professional, or simply an avid reader, this treasure trove of downloadable resources offers a wealth of information, conveniently accessible anytime, anywhere. The advent of online libraries and platforms dedicated to sharing knowledge has revolutionized the way we consume information. No longer confined to physical libraries or bookstores, readers can now access an extensive collection of digital books and manuals with just a few clicks. These resources, available in PDF, Microsoft Word, and PowerPoint formats, cater to a wide range of interests, including literature, technology, science, history, and much more. One notable platform where you can explore and download free Method Estimation Caffeine In Drinks Manual PDF books and manuals is the internets largest free library. Hosted online, this catalog compiles a vast assortment of documents, making it a veritable goldmine of knowledge. With its easy-to-use website interface and customizable PDF generator, this platform offers a user-friendly experience, allowing individuals to effortlessly navigate and access the information they seek. The availability of free PDF books and manuals on this platform demonstrates its commitment to democratizing education and empowering individuals with the tools needed to succeed in their chosen fields. It allows anyone, regardless of their background or financial limitations, to expand their horizons and gain insights from experts in various disciplines. One of the most significant advantages of downloading PDF books and manuals lies in their portability. Unlike physical copies, digital books can be stored and carried on a single device, such as a tablet or smartphone, saving valuable space and weight. This convenience makes it possible for readers to have their entire library at their fingertips, whether they are commuting, traveling, or simply enjoying a lazy afternoon at home. Additionally, digital files are easily searchable, enabling readers to locate specific information within seconds. With a few keystrokes, users can search for keywords, topics, or phrases, making research and finding relevant information a breeze. This efficiency saves time and effort, streamlining the learning process and allowing individuals to focus on extracting the information they need. Furthermore, the availability of free PDF books and manuals fosters a culture

of continuous learning. By removing financial barriers, more people can access educational resources and pursue lifelong learning, contributing to personal growth and professional development. This democratization of knowledge promotes intellectual curiosity and empowers individuals to become lifelong learners, promoting progress and innovation in various fields. It is worth noting that while accessing free Method Estimation Caffeine In Drinks Manual PDF books and manuals is convenient and cost-effective, it is vital to respect copyright laws and intellectual property rights. Platforms offering free downloads often operate within legal boundaries, ensuring that the materials they provide are either in the public domain or authorized for distribution. By adhering to copyright laws, users can enjoy the benefits of free access to knowledge while supporting the authors and publishers who make these resources available. In conclusion, the availability of Method Estimation Caffeine In Drinks Manual free PDF books and manuals for download has revolutionized the way we access and consume knowledge. With just a few clicks, individuals can explore a vast collection of resources across different disciplines, all free of charge. This accessibility empowers individuals to become lifelong learners, contributing to personal growth, professional development, and the advancement of society as a whole. So why not unlock a world of knowledge today? Start exploring the vast sea of free PDF books and manuals waiting to be discovered right at your fingertips.

FAQs About Method Estimation Caffeine In Drinks Manual Books

How do I know which eBook platform is the best for me? 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. 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. 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. 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. 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. Method Estimation Caffeine In Drinks Manual is one of the best book in our library for free trial. We provide copy of Method Estimation Caffeine In Drinks Manual in digital format, so the resources that you find are reliable. There are also many Ebooks of related with Method Estimation Caffeine In Drinks Manual. Where to download Method Estimation Caffeine In Drinks Manual online for free? Are you looking for Method Estimation Caffeine In Drinks Manual PDF? This is definitely going to save you time and cash in something you should think about.

Find Method Estimation Caffeine In Drinks Manual :

[graphic compo creation through shapes and patterns](#)

great buffalo hunt

[gre practicing to take the general test](#)

[great adventures of sherlock holmes](#)

[great american monuments war memorials vhs tape 1995 great american](#)

graphing equations/algebra/teachers guide

grandpa and i

[great canadian scientists](#)

[grave catastrophe](#)

[grasshopper and the unwise owl](#)

granny goes to bethlehem

grandma goes to law school

[granny maes christmas play](#)

[gray pancakes and gold horses](#)

granny guru

Method Estimation Caffeine In Drinks Manual :

A Student's Guide to American Political Thought ... Carey in A Student's Guide to American Political Thought. Carey's primer instructs students on the fundamental matters of American political theory while ... A Student's Guide to American Political Thought A Student's Guide to American Political Thought by George W. Carey - Who are the most influential thinkers, and which are the most important concepts, ... A Student's Guide to American Political Thought Learn America's political heritage in one sitting. Download George W. Carey's primer to understand the basics of American political theory - completely ... A Student's Guide to Political Philosophy Harvard University's Harvey C. Mansfield, one of America's preeminent political theorists, here provides a compelling account of the philosophers who have ... A Student's Guide To American Political Thought He taught political theory in that department from 1961 to 2013. A Georgetown University tribute described him as "an expert on American political thought, ... A Student's Guide to American Political Thought ... A Student's Guide to American Political Thought (Guides to Major Disciplines) by Carey, George W. - ISBN 10: 1932236422 - ISBN 13: 9781932236422 - ISI Books ... A Student's Guide to American Political Thought A Student's Guide to American Political

Thought is written by George W. Carey and published by Intercollegiate Studies Institute. The Digital and eTextbook ... A Student's Guide to American Political Thought A Student's Guide to American Political Thought — Carey, George W. — Who are the most influential thinkers, and which are the most important concepts, ... A Student's Guide to American Political Thought Jul 25, 2016 — Among these questions are: On what principles is the government based? How is authority allocated within it? What are its primary purposes? Are ... A Student's Guide to American Political Thought (Guides to Major ... A Student's Guide to American Political Thought (Guides to Major Disciplines... Be the first to write a review. murfbooks 98.6% Positive feedback. Solution Manual for Federal Tax Research 10th Edition ... May 30, 2018 — Solution Manual for Federal Tax Research 10th Edition Sawyers, Raabe, Whittenburg, Gill · 1. Are expenses associated with emotional illnesses ... Federal Tax Research 10th Edition Sawyers - Scribd Federal Tax Research 10th Edition Sawyers Solutions Manual - Free download as PDF File (.pdf), Text File (.txt) or read online for free. Solutions Manual. Federal Tax Research 10th Edition Textbook Solutions Access Federal Tax Research 10th Edition solutions now. Our solutions are written by Chegg experts so you can be assured of the highest quality! Federal Tax Research 10th Edition Solutions Manual Test ... Federal Tax Research 10th Edition Solutions Manual Test Bank By Sawyers Raabe Whittenburg Gill Page 1-1 Federal Tax Research 10th Edition Solutions Manual ... Federal Tax Research 10th Edition Sawyers Federal Tax Research 10th Edition Sawyers Solutions Manual - Free download as PDF File (.pdf), Text File (.txt) or read online for free. Solutions Manual. Solution Manual for Federal Tax Research 10th Edition ... View Solution Manual for Federal Tax Research 10th Edition Sawyers, Raabe, Whittenburg, Gill from ECE 644 at New Jersey Institute Of Technology. Chapter 12 Problem 5DQ Solution | Federal Tax Research ... Access Federal Tax Research 10th Edition Chapter 12 Problem 5DQ solution now. Our solutions are written by Chegg experts so you can be assured of the ... Federal Tax Research - 10th Edition Solution Manual Includes ; 10 Questions from expert ; 200,000+ Expert answers ; 24/7 Tutor Help ; Federal Tax Research. FULL List Test Bank And Solution Manual 2022 2023 ... Instructor Solution Manual Federal Tax Research 12th Edition by Roby B. ... Solution Manual Federal Tax Research, 10th Edition Roby B. Sawyers, William A. Raabe ... Federal Tax Research: Sawyers, Roby, Raabe, William A. ... This market-leading tax research text takes a practical, hands-on approach that goes beyond a random sampling of tax research sources. Workshop manual for Vauxhall Holden Viva HB series ... You are purchasing a Workshop manual for Vauxhall Holden Viva HB series 1967-1969. Used service manual as shown in the photos. Holden Viva Factory Workshop Manual 2002-2008 ... Holden Viva was sold in Australia as a rebadged Daewoo Lacetti, this manual covers the Daewoo Lacetti. ENGINES - Petrol/Gasoline. 1.4L DOHC F14D Vauxhall Viva HB and Holden Torana HB Workshop ... Vauxhall Viva HB and Holden Torana HB Workshop Manual, 1967-69 ; Publisher. Inter-Europe ; Publication date. October 1, 1970 ; ISBN-10. 0901610178 ; ISBN-13. 978- ... HOLDEN Workshop Repair Manuals Holden Workshop Repair Manuals and Wiring Diagrams. The same workshop repair and service manuals used by Holden garages worldwide. Download Now! Holden Viva Repair &

Service Manuals (2 PDF's 2 Holden Viva Workshop, Owners, Service and Repair Manuals. Updated - September 23. We have 2 Holden Viva manuals covering a total of 3 years of production ... Vauxhall Viva HB and Holden Torana HB Workshop ... Vauxhall Viva HB and Holden Torana HB Workshop Manual, 1967-69 by Russek, Peter - ISBN 10: 0901610178 - ISBN 13: 9780901610171 - Inter-Europe - 1970 ... Holden Viva owner's manual Holden Viva owner's manuals. Below you can find links to download for free the owner's manual of your Holden Viva. Manuals from 2005 to 2009. New & Used in holden viva workshop manual in Australia holden viva workshop manual | Find new and used Cars, Vans & Utes for Sale in Australia. Buy and sell almost anything on Gumtree classifieds. I have a Holden Viva JF 2007 so far diagnosed with error Feb 23, 2021 — Hi I have a Holden Viva JF 2007 so far diagnosed with error message: P0700 (TCM) Transmission Control Module. I am looking for a repair manual ...