

Enzyme Action: Testing Catalase Activity (O₂)

Many organisms can decompose hydrogen peroxide (H₂O₂) enzymatically. Enzymes are globular proteins, responsible for most of the chemical activities of living organisms. They act as *catalysts*, substances that speed up chemical reactions without being destroyed or altered during the process. Enzymes are extremely efficient and may be used over and over again. One enzyme may catalyze thousands of reactions every second. Both the temperature and the pH at which enzymes function are extremely important. Most organisms have a preferred temperature range in which they survive, and their enzymes most likely function best within that temperature range. If the environment of the enzyme is too acidic or too basic, the enzyme may irreversibly *denature*, or unravel, until it no longer has the shape necessary for proper functioning.

H₂O₂ is toxic to most living organisms. Many organisms are capable of enzymatically destroying the H₂O₂ before it can do much damage. H₂O₂ can be converted to oxygen and water, as follows:



Although this reaction occurs spontaneously, enzymes increase the rate considerably. At least two different enzymes are known to catalyze this reaction: *catalase*, found in animals and protists, and *peroxidase*, found in plants. A great deal can be learned about enzymes by studying the rates of enzyme-catalyzed reactions.

In this experiment, you will measure the rate of enzyme activity under various conditions, such as different enzyme concentrations, pH values, and temperatures. It is possible to measure the concentration of oxygen gas formed as H₂O₂ is destroyed using an O₂ Gas Sensor. If a plot is made, it may appear similar to the graph shown.

At the start of the reaction, there is no product, and the concentration is the same as the atmosphere. After a short time, oxygen accumulates at a rather constant rate. The slope of the curve at this initial time is constant and is called the *initial rate*. As the peroxide is destroyed, less of it is available to react and the O₂ is produced at lower rates. When no more peroxide is left, O₂ is no longer produced.



Figure 1

MATERIALS

Power Macintosh or Windows PC
Vernier computer interface
LoggerPro
Vernier O₂ Gas Sensor
400-mL beaker
10-mL graduated cylinder
250-mL Nalgene bottle
1.5% H₂O₂
3.0% H₂O₂

enzyme suspension
three 18 x 150 mm test tubes
ice
pH buffers
test tube rack
thermometer
three dropper pipettes
Graphical Analysis (optional)

Enzyme Action Testing Catalase Activity Lab Answers

**United States. Public Health Service.
Office of the Surgeon General**



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Agricultural Science with Vernier Robyn L. Johnson,2010-07

Biocatalysis and Agricultural Biotechnology Ching T. Hou, Jie-Fu Shaw,2009-04-27 Worldwide energy and food crises are spotlighting the importance of bio based products an area many are calling on for solutions to these shortages Biocatalysis and Agricultural Biotechnology encapsulates the cutting edge advances in the field with contributions from more than 50 international experts comprising sectors of academia industry an

Biology for AP ® Courses Julianne Zedalis, John Eggebrecht,2017-10-16 Biology for AP courses covers the scope and sequence requirements of a typical two semester Advanced Placement biology course The text provides comprehensive coverage of foundational research and core biology concepts through an evolutionary lens Biology for AP Courses was designed to meet and exceed the requirements of the College Board s AP Biology framework while allowing significant flexibility for instructors Each section of the book includes an introduction based on the AP curriculum and includes rich features that engage students in scientific practice and AP test preparation it also highlights careers and research opportunities in biological sciences

Oxidative Damage to Plants Parvaiz Ahmad,2014-01-29 With contributions that review research on this topic throughout the world Oxidative Damage to Plants covers key areas of discovery from the generation of reactive oxygen species ROSs their mechanisms quenching of these ROSs through enzymatic and non enzymatic antioxidants and detailed aspects of such antioxidants as SOD and CAT Environmental stress is responsible for the generation of oxidative stress which causes oxidative damage to biomolecules and hence reduces crop yield To cope up with these problems scientists have to fully understand the generation of reactive oxygen species its impact on plants and how plants will be able to withstand these stresses Provides invaluable information about the role of antioxidants in alleviating oxidative stress Examines both the negative effects senescence impaired photosynthesis and necrosis and positive effects crucial role that superoxide plays against invading microbes of ROS on plants Features contributors from a variety of regions globally

Microbiology Laboratory Guidebook United States. Food Safety and Inspection Service. Microbiology Division,1998

Nanozymes: Next Wave of Artificial Enzymes Xiaoyu Wang, Wenjing Guo, Yihui Hu, Jiangjiexing Wu, Hui Wei,2016-07-27 This book describes the fundamental concepts the latest developments and the outlook of the field of nanozymes i e the catalytic nanomaterials with enzymatic characteristics As one of today s most exciting fields nanozyme research lies at the interface of chemistry biology materials science and nanotechnology Each of the book s six chapters explores advances in nanozymes Following an introduction to the rise of nanozymes research in the course of research on natural enzymes and artificial enzymes in Chapter 1 Chapters 2 through 5 discuss different nanomaterials used to mimic various natural enzymes from carbon based and metal based nanomaterials to metal oxide based nanomaterials and other nanomaterials In each of these chapters the nanomaterials enzyme mimetic activities catalytic mechanisms and key applications are covered In closing Chapter 6 addresses the current challenges and outlines further directions for nanozymes Presenting extensive information on nanozymes and supplemented with a wealth of color illustrations and tables the book offers an ideal guide for readers from disparate areas including analytical chemistry materials science nanoscience and nanotechnology biomedical and clinical engineering environmental science and engineering green chemistry and novel catalysis

Principles of Modern Microbiology Mark Wheelis,2008 This text balances brevity and clarity in a condensed introduction to microbiology It contains a manageable amount of detail and yet covers the full range and diversity of the microbial world

Enzymology of Disturbed Soils S. Kiss,D. Pasca,M. Dragan-Bularda,1998-10-21 The disturbance of soils like other phenomena of environmental pollution encountered in so many areas all over the world has become a subject of extensive concern and has led to a vast amount of literature in the field of enzymology too The book is the first comprehensive and updated review of the enzymological literature on three great categories of disturbed soils including their remediation The volume consists of three sections I Enzymology of oil contaminated soils II Enzymology of soils affected by industrial emissions and III enzymology of technogenic soils Within each section the reviewed studies are grouped by country The volume will be of great value to soil scientists environmental scientists conservationists and many other scientists in these and related fields

Biology with Vernier Kelly Redding,David Masterman,2007-01-01

How Tobacco Smoke Causes Disease United States. Public Health Service. Office of the Surgeon General,2010 This report considers the biological and behavioral mechanisms that may underlie the pathogenicity of tobacco smoke Many Surgeon General s reports have considered research findings on mechanisms in assessing the biological plausibility of associations observed in epidemiologic studies Mechanisms of disease are important because they may provide plausibility which is one of the guideline criteria for assessing evidence on causation This report specifically reviews the evidence on the potential mechanisms by which smoking causes diseases and considers whether a mechanism is likely to be operative in the production of human disease by tobacco smoke This evidence is relevant to understanding how smoking causes disease to identifying those who may be particularly susceptible and to assessing the potential risks of tobacco products

Molecular Biology of The Cell Bruce Alberts,2002

Nutrient Requirements of Laboratory Animals, National Research Council,Board on Agriculture,Committee on Animal Nutrition,Subcommittee on Laboratory Animal Nutrition,1995-02-01 In the years since the third edition of this indispensable reference was published a great deal has been learned about the nutritional requirements of common laboratory species rat mouse guinea pig hamster gerbil and vole The Fourth Revised Edition presents the current expert understanding of the lipid carbohydrate protein mineral vitamin and other nutritional needs of these animals The extensive use of tables provides easy access to a wealth of comprehensive data and resource information The volume also provides an expanded background discussion of general dietary considerations In addition to a more user friendly organization new features in this edition include A significantly expanded section on dietary requirements for rats reporting substantial new findings A new section on nutrients that are not required but that may produce beneficial results New information on growth and reproductive performance among the most commonly used strains of rats and mice and on several hamster species An expanded discussion of diet formulation and preparation including sample diets of both purified and natural ingredients New information on mineral deficiency and toxicity including warning signs This authoritative resource will be important to researchers laboratory technicians and manufacturers of laboratory animal feed

Cumulated Index Medicus ,1987

Toxicological Profile for Lead ,2007

Laboratory Methods in Anaerobic Bacteriology V. R. Dowell, Center for Disease Control, 1974

Fundamentals of Enzyme Engineering Young Je Yoo, Yan Feng, Yong-Hwan Kim, Camila Flor J. Yagonia, 2017-01-12 This book provides a comprehensive introduction to all aspects of enzyme engineering from fundamental principles through to the state of the art in research and industrial applications It begins with a brief history describing the milestones of advancement in enzyme science and technology before going on to cover the fundamentals of enzyme chemistry the biosynthesis of enzymes and their production Enzyme stability and the reaction kinetics during enzymatic reactions are presented to show how enzymes function during catalysis and the factors that affect their activity Methods to improve enzyme performance are also presented such as cofactor regeneration and enzyme immobilization The book emphasizes and elaborates on the performance and characteristics of enzymes at the molecular level Finally the book presents recent advances in enzyme engineering and some key industrial application of enzymes addressing the present needs of society This book presents essential information not only for undergraduate and graduate students but also for researchers in academia and industry providing a valuable reference for the development of commercial applications of enzyme technology

Fundamentals of Enzyme Kinetics Athel Cornish-Bowden, 2014-05-20 Fundamentals of Enzyme Kinetics details the rate of reactions catalyzed by different enzymes and the effects of varying the conditions on them The book includes the basic principles of chemical kinetics especially the order of a reaction and its rate constraints The text also gives an introduction to enzyme kinetics the idea of an enzyme substrate complex the Michaelis Menten equation the steady state treatment and the validity of its assumption Practical considerations the derivation of steady state rate equations inhibitors and activators and two substrate reactions are also explained Problems after the end of each chapter have also been added as well as their solutions at the end of the book to test the readers learning The text is highly recommended for undergraduate students in biochemistry who wish to study about enzymes or focus completely on enzymology as most of the mathematics used in this book which have been explained in detail to remove most barriers of understanding is elementary

Principles of Enzyme Kinetics Athel Cornish-Bowden, 2014-05-20 Principles of Enzyme Kinetics discusses the principles of enzyme kinetics at an intermediate level It is primarily written for first year research students in enzyme kinetics The book is composed of 10 chapters Chapter 1 provides the basic principles of enzyme kinetics with a brief discussion of dimensional analysis Subsequent chapters cover topics on the essential characteristics of steady state kinetics temperature dependence methods for deriving steady state rate equations and control of enzyme activity Integrated rate equations and introductions to the study of fast reactions and the statistical aspects of enzyme kinetics are provided as well Chemists and biochemists will find the book invaluable

Biochemical Ecotoxicology Francois Gagne, 2014-07-07 Biochemical Ecotoxicology Principles and Methods presents practical approaches to biochemical ecotoxicology experiments for environmental protection and conservation With its methodical stepped approach this essential reference introduces readers to current techniques for toxicity endpoint testing suitable for laboratories of any size and budget Each chapter presents a state of the art principle a quick and inexpensive procedure including appropriate reagents case studies and demonstrations on how to analyze your results Generic techniques are covered suitable for a variety of organisms as well as high throughput techniques like quantitative polymerase chain reactions and enzyme linked immunoassays Cutting edge approaches including gPCR arrays and lipidomic techniques are also included making this is an essential reference for anyone who needs to assess environmental toxicity Practical cost effective approaches to assess environmental toxicity endpoints for all types of organism Presents theory methods case studies and information on how to analyze results State of the art techniques such as omics approaches to toxicology

Clinical Microbiology Procedures Handbook , 2020-08-06 In response to the ever changing needs and responsibilities of the clinical microbiology field Clinical Microbiology Procedures Handbook Fourth Edition has been extensively reviewed and updated to present the most prominent procedures in use today The Clinical Microbiology Procedures Handbook provides step by step protocols and descriptions that allow clinical microbiologists and laboratory staff personnel to confidently and accurately perform all analyses including appropriate quality control recommendations from the receipt of the specimen through processing testing interpretation presentation of the final report and subsequent consultation

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Table of Contents Enzyme Action Testing Catalase Activity Lab Answers

1. Understanding the eBook Enzyme Action Testing Catalase Activity Lab Answers
 - The Rise of Digital Reading Enzyme Action Testing Catalase Activity Lab Answers
 - Advantages of eBooks Over Traditional Books
2. Identifying Enzyme Action Testing Catalase Activity Lab Answers
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Enzyme Action Testing Catalase Activity Lab Answers
 - User-Friendly Interface
4. Exploring eBook Recommendations from Enzyme Action Testing Catalase Activity Lab Answers
 - Personalized Recommendations
 - Enzyme Action Testing Catalase Activity Lab Answers User Reviews and Ratings
 - Enzyme Action Testing Catalase Activity Lab Answers and Bestseller Lists

5. Accessing Enzyme Action Testing Catalase Activity Lab Answers Free and Paid eBooks
 - Enzyme Action Testing Catalase Activity Lab Answers Public Domain eBooks
 - Enzyme Action Testing Catalase Activity Lab Answers eBook Subscription Services
 - Enzyme Action Testing Catalase Activity Lab Answers Budget-Friendly Options
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 - ePub, PDF, MOBI, and More
 - Enzyme Action Testing Catalase Activity Lab Answers Compatibility with Devices
 - Enzyme Action Testing Catalase Activity Lab Answers Enhanced eBook Features
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 - Adjustable Fonts and Text Sizes of Enzyme Action Testing Catalase Activity Lab Answers
 - Highlighting and Note-Taking Enzyme Action Testing Catalase Activity Lab Answers
 - Interactive Elements Enzyme Action Testing Catalase Activity Lab Answers
8. Staying Engaged with Enzyme Action Testing Catalase Activity Lab Answers
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Enzyme Action Testing Catalase Activity Lab Answers
9. Balancing eBooks and Physical Books Enzyme Action Testing Catalase Activity Lab Answers
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Enzyme Action Testing Catalase Activity Lab Answers
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Enzyme Action Testing Catalase Activity Lab Answers
 - Setting Reading Goals Enzyme Action Testing Catalase Activity Lab Answers
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Enzyme Action Testing Catalase Activity Lab Answers
 - Fact-Checking eBook Content of Enzyme Action Testing Catalase Activity Lab Answers
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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