Audiology Workbook

Fourth Edition

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Preface

This fourth edition of *Audiology Workbook* is composed of an abundance of exercises and questions designed for undergraduate and graduate students to reinforce their understanding of the scientific foundations and clinical procedures traditionally covered in introductory hearing science and clinical audiology courses. This workbook is a useful companion to the fourth edition of the textbook *Audiology: Science to Practice* or to any introductory textbook in audiology, supported by additional literature and input from the instructor. The exercises and questions focus on concepts typically difficult for students to understand without practice, including properties of sound, decibels, anatomy, physiology, interpreting and describing audiograms, masking, immittance, evoked physiologic responses, vestibular/balance assessment, and hearing aids. In addition, there are exercises to build upon the student's knowledge of auditory and vestibular disorders, including a chapter devoted to case studies, so the student can begin to develop their skills at integrating basic diagnostic test results and how they relate to hearing and balance disorders. Because many students are unaware that audiology's scope of practice requires knowledge and skills related to the vestibular system, we have included exercises on the auditory and vestibular systems together in the chapters on anatomy, physiology, and disorders.

The exercises and questions are comprehensive and challenging but designed so they may be answered with relatively short answers. As with the previous editions, there is a complete set of answers at the back of the workbook to guide the student in the learning process. This workbook may also be appropriate for group discussions and/or as a study aid for those taking the Praxis exam. We expect that students who use this workbook will apply and think about what they have covered in class or read in their textbook and will end up with a solid foundation and appreciation of audiology.

Features and Additions to This Edition

This edition represents a collaboration with a new coauthor, David K. Brown, whose longtime teaching experience and expertise in audiology and hearing science provided an opportunity to bring his perspectives to the content of the workbook. In addition, users of past editions of the workbook were surveyed and their feedback was helpful as we updated, revised, and expanded this edition. New exercises related to clinical topics have been added, including preparation for patient testing, case history, wideband acoustic immittance, and evoked physiologic responses. Also new to this addition is a chapter on audiology treatment, including hearing aids, hearing assistive technologies, implantable devices, and aural (re)habilitation. New anatomy diagrams have been added. Additional exercises were added to areas from previous editions, and new questions were added on wavelength, resonance, decibels, signal-to-noise ratio, complex vibrations, stages of transduction through the auditory system, psychoacoustics,

anatomy/physiology, audiogram interpretation/description, and masking. The popular case studies chapter has also been expanded. In addition, each chapter now ends with a set of multiple-choice questions. We are excited about all the improvements in this edition that will help students gain a better understanding, through crafted exercises and probing questions, about audiology concepts.

Acknowledgments

We wish to acknowledge and thank
Dr. Larry Small and Dr. Lesli Guthrie
for their contributions to earlier editions of this workbook.

We wish to acknowledge and thank
Maury Aaseng
for the new illustrations in this edition.

To all current and future students who take the challenge to work through this workbook—for you will come to know and appreciate audiology.

To my wife Paula, and to all of my colleagues for their continued support during the revision of this workbook.

—Steven Kramer

To those students who want to challenge themselves, may this workbook assist in determining your level of knowledge about audiology.

To my wife Dianne, and my colleagues, new and old, for their support in this new venture.

—David K. Brown

1 Properties of Sound and Speech Acoustics

1.1 What is the approximate speed of sound in air (at 68°F), in meters/second (m/s), and how does it compare to the speed of light (miles/s)? Is the speed of sound in air faster or slower than the speed of sound in water, and why?

1.2 Given the following frequencies, calculate the period in seconds (s) and in milliseconds (ms).

A. 20 Hz

B. 60 Hz

C. 250 Hz

D. 500 Hz

E. 1000 Hz

F. 2000 Hz

G. 3000 Hz

H. 4000 Hz

I. 6000 Hz

J. 8000 Hz

K. 20,000 Hz

1.3 Given the following periods in seconds (s), calculate the frequency in hertz (Hz) and kilohertz (kHz).

A. 0.0000625 s

B. 0.0001 s

C. 0.000125 s

D. 0.00025 s

E. 0.0005 s

F. 0.001 s

G. 0.002 s

H. 0.004 s

I. 0.008 s

J. 0.016 s

1.4 Given the following periods in milliseconds (ms), convert the period to seconds (s) and calculate the frequency in hertz (Hz) and kilohertz (kHz).

A. 0.125 ms

B. 0.250 ms

C. 0.400 ms

D. 0.500 ms

E. 1.000 ms

F. 2.000 ms

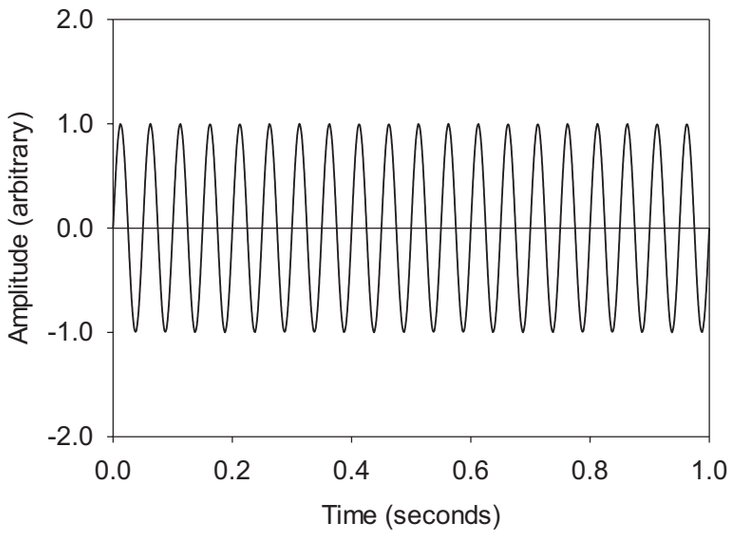
G. 4.000 ms

H. 25.000 ms

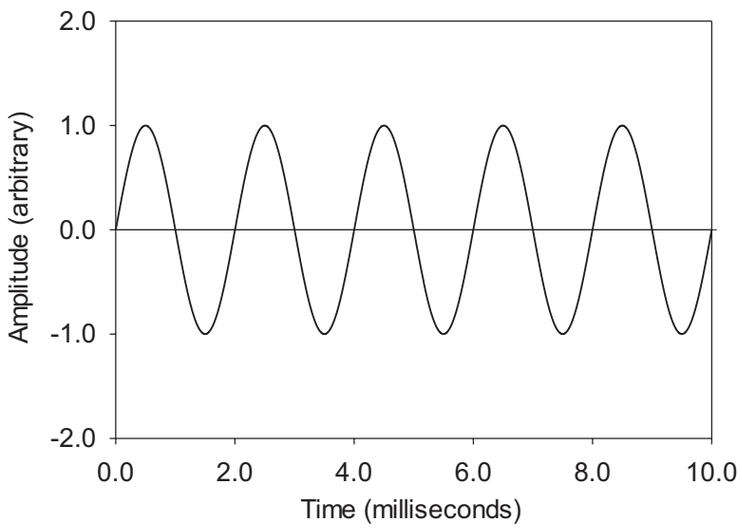
I. 500.000 ms

J. 1000.000 ms

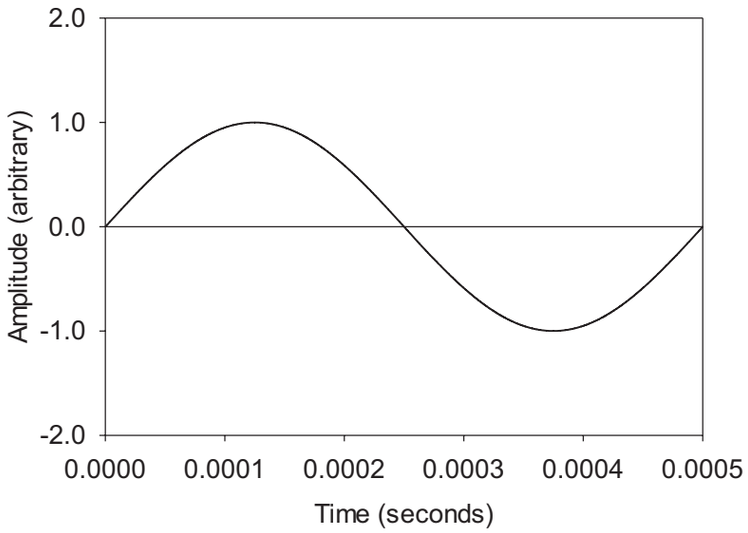
1.5 Calculate the frequency in hertz (Hz) and kilohertz (kHz) for each of the given time-domain waveforms.



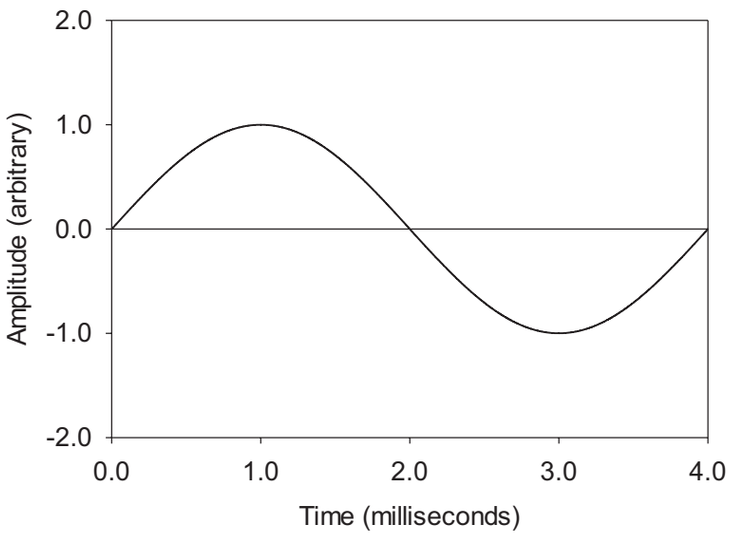
A. _____ Hz _____ kHz



B. _____ Hz _____ kHz



C. _____ Hz _____ kHz



D. _____ Hz _____ kHz

1.6 Define wavelength. What is the general formula/equation for wavelength?

1.7 What is the general relation between wavelength and frequency, and why?

1.8 Given the following frequencies, calculate wavelength in meters (assume speed of sound in air = 343 m/s).

A. 20 Hz

B. 60 Hz

C. 440 Hz

D. 1 kHz

E. 8000 Hz

F. 12.5 kHz

1.9 Given the following wavelengths (in meters), calculate the frequency in Hz (assume speed of sound = 343 m/s).

A. 0.01715 m