

Vocabulary: Doppler shift, frequency, pitch, sonic boom, sound waves, wavelength

Highlight your answers in either **GREEN** / **BLUE** / OR **YELLOW**

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

Have you ever heard a siren on a moving ambulance, fire truck, or police car? If so, what happens to the sound as the vehicle passes by?

Sometimes when cars are passing I usually hear the car running and sometimes I hear the horn of the car.

The change in the sound that you hear is called the **Doppler shift**.

Gizmo Warm-up

The Doppler Shift Gizmo illustrates why the Doppler shift occurs. The Gizmo shows a vehicle that emits **sound waves** and an observer who will hear the sounds.

- Click the **PLAY SAMPLE** button (). (Check that the Gizmo's sound and your computer's speakers are on.)

What do you hear?

I hear I police siren

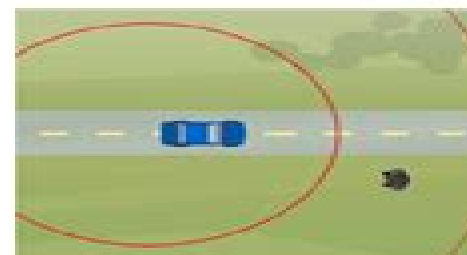
- Click **Play** () and observe the sound waves emitted from the moving car. Click **Pause** () and compare the sound waves in front of and behind the car. **What do you notice?**

Something that I notice is the length between them is about 900cm

- Use the **Ruler** to measure the **wavelength**, or the distance between the lines, of the waves in front of and behind the car. (Note: The red circles represent every thousandth wave.)

Wavelength in front of car: 600 cm

Wavelength behind car: 900 cm



Why do you think the waves in front of the car have a shorter wavelength than the waves behind the car? *I think that the reason that the front is shorter than the back is because the car is chasing the waves and the waves in the back are running away from the car.*

Activity A: The Doppler shift	<u>Get the Gizmo ready:</u> - Click Reset (). - Check that f_{source} is set to 500 Hz and v_{sound} is set to 340 m/s, close to the actual speed of sound. - Set v_{source} to 0 m/s.	f_{source} (Hz) v_{source} (m/s) v_{sound} (m/s)
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Answer Sheet To Exploring Learning Doppler Shift

**National Research Council, Division on
Engineering and Physical
Sciences, Space Studies
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Lunar Exploration**

Answer Sheet To Exploring Learning Doppler Shift:

Paradigm Shifts in Communication, Embedded Systems, Machine Learning, and Signal Processing Deep Gupta, Vipin Kamble, Vishal Satpute, Ashwin Kothari, 2025-08-25 This two volume set CCIS 2490 2491 constitutes the refereed proceedings of the Third International Conference on Paradigm Shifts in Communication Embedded Systems Machine Learning and Signal Processing PCEMS 2024 held in Nagpur India during November 11 12 2024 The 73 full papers and 17 short papers presented in this volume were carefully reviewed and selected from 330 submissions The papers present recent research in the areas of communication antenna computer vision medical image analysis deep learning AI based systems and applications classification problem embedded system and IoT etc *Modules*, 2005 *Innovative Technology-based Solutions for Primary, Secondary and Tertiary STEM Education* Cristina Hava Muntean, Diana Bogusevschi, Gabriel-Miro Muntean, 2019-09-23 This book presents innovative technology enhanced learning solutions for STEM education proposed by the EU Horizon 2020 funded NEWTON project by first highlighting the benefits and limitations of existing research work e learning systems and case studies that embedded technology in the teaching and learning process NEWTON's proposed innovative technologies and pedagogies include adaptive multimedia and multiple sensorial media virtual reality fabrication and virtual labs gamification personalisation game based learning and self directed learning pedagogies The main objectives are to encourage STEM education among younger generations and to attract students to STEM subjects making these subjects more appealing and interesting Real life deployment of NEWTON technologies and developed educational materials in over 20 European educational institutions at primary secondary and tertiary levels demonstrated statistical significant increases in terms of learner satisfaction learner motivation and knowledge acquisition Smart Assisted Living Feng Chen, Rebeca I. García-Betances, Liming Chen, María Fernanda Cabrera-Umpiérrez, Chris Nugent, 2019-08-20 Smart Homes SH offer a promising approach to assisted living for the ageing population Yet the main obstacle to the rapid development and deployment of Smart Home SH solutions essentially arises from the nature of the SH field which is multidisciplinary and involves diverse applications and various stakeholders Accordingly an alternative to a one size fits all approach is needed in order to advance the state of the art towards an open SH infrastructure This book makes a valuable and critical contribution to smart assisted living research through the development of new effective integrated and interoperable SH solutions It focuses on four underlying aspects 1 Sensing and Monitoring Technologies 2 Context Interference and Behaviour Analysis 3 Personalisation and Adaptive Interaction and 4 Open Smart Home and Service Infrastructures demonstrating how fundamental theories models and algorithms can be exploited to solve real world problems This comprehensive and timely book offers a unique and essential reference guide for policymakers funding bodies researchers technology developers and managers end users carers clinicians healthcare service providers educators and students helping them adopt and implement smart assisted living systems NASA Technical Memorandum, 1994 Strategy for the Detection and Study of Other

Planetary Systems and Extrasolar Planetary Materials National Research Council, Division on Engineering and Physical Sciences, Space Studies Board, Committee on Planetary and Lunar Exploration, 1990-02-01 This volume addresses a new opportunity in the planetary sciences to extend our exploration outward to discover and study planetary systems that may have formed or are forming around other stars It concludes that a coordinated program of astronomical observation laboratory research theoretical development and understanding of the dynamics and origins of whatever may be found would be a technologically feasible and potentially richly rewarding extension of the study of bodies within the solar system IoT Based Control Networks and Intelligent Systems P. P. Joby, Marcelo S. Alencar, Przemyslaw Falkowski-Gilski, 2023-11-27 This book gathers selected papers presented at International Conference on IoT Based Control Networks and Intelligent Systems ICICNIS 2023 organized by School of Computer Science and Engineering REVA University Bengaluru India during June 21 22 2023 The book covers state of the art research insights on Internet of things IoT paradigm to access manage and control the objects things people working under various information systems and deployed under wide range of applications like smart cities healthcare industries and smart homes **Prentice Hall Physical Science Concepts in Action Program Planner National Chemistry Physics Earth Science** ,2003-11 Prentice Hall Physical Science Concepts in Action helps students make the important connection between the science they read and what they experience every day Relevant content lively explorations and a wealth of hands on activities take students understanding of science beyond the page and into the world around them Now includes even more technology tools and activities to support differentiated instruction Topics in Modal Analysis II, Volume 8 Randall Allemang, 2025-08-07 This eighth volume of eight from the IMAC XXXII Conference brings together contributions to this important area of research and engineering The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics including papers on Linear Systems Substructure Modelling Adaptive Structures Experimental Techniques Analytical Methods Damage Detection Damping of Materials Members Modal Parameter Identification Modal Testing Methods System Identification Active Control Modal Parameter Estimation Processing Modal Data **Applied Mechanics Reviews** ,1975

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