California State University, San Marcos FORM UDGE-BB (WHITE)

UPPER DIVISION GENERAL EDUCATION NEW COURSE PROPOSAL FOR AREA BB – MATHEMATICS/QUANTITATIVE REASONING OR PHYSICAL AND LIFE SCIENCES

Please Read Instructions on Next Page of This Form

Course Number PHYS 357 Course Title The Science of Speech and Hearing

- o This is a new course. A FORM C is being filed concurrently.
- ■ This is an existing course not currently satisfying an UDGE requirement, which is not being changed.
- o This is an existing course not currently satisfying an UDGE requirement, which is undergoing change. A FORM C-2 is being filed concurrently.
- o This is an existing course currently satisfying an UDGE requirement which is being submitted for recertification. *A FORM C-2 is required only if the course is being changed.*

1. Please attach a syllabus or draft syllabus of the course.

2. How many units is this course? 3 (Upper-Division General Education courses are limited to 3 units.)

3.a. Does this course have (a) prerequisite (s) other than completion of LDGE requirements?

___yes _X_no

b. Does this course fulfill requirements for a major by the academic unit in which the course is offered? Check the YES box even if the course counts as an elective in the major.

___yes _X_no

c. If you answered "yes" to 3.a. or 3.b., then the course is an exception to the definition printed on the next page of this form, and you must explain why the GE committee should make an exception for this course. Please describe how this course is designed to provide valuable and appropriate learning experiences to both majors and non-majors.

Read Questions 4-7 in the instructions on the next page of this form and submit your answers as attachments. The instructions do not have to be printed or submitted.

Signatures

Originator	Stephen Tsuji	Date 9/30/16
Program Director	J. Burn	Date 9/30/16
General Education Coordinator		Date
General Education Committee Chair		Date

RECEIVED
OCT 05 2015
BY:

8/30/2004

FORM INSTRUCTIONS FOR UDGE-BB (WHITE)
UPPER DIVISION GENERAL EDUCATION NEW COURSE PROPOSAL
FOR AREA BB - MATHEMATICS/QUANTITATIVE REASONING OR PHYSICAL AND LIFE SCIENCES

The Definition of Upper Division GE Courses:

Upper Division General Education provides an opportunity for students to learn about areas of study outside their academic major. Upper Division General Education courses assume satisfaction of Lower Division General Education Requirements and develop upper division skills. Courses should not require discipline-specific prerequisites. Designed for non-majors, these courses make explicit the basic assumptions, principles and methods of the disciplinary or interdisciplinary area of study. This conceptual framework and the applicability of these principles and methods should be emphasized throughout the course.

Upper Division General Education courses should help students see how disciplines, ideas, issues and knowledge are often interrelated, intersecting and interconnected. Upper Division General Education courses should present knowledge which can enhance students' lives outside the classroom or their studies in other subjects. These courses should also provide students with a classroom environment that fosters independent, active, engaged learning and a genuine curiosity about the subject matter.

Upper Division General Education courses shall be three-unit courses so that three such courses will exactly correspond with the 9-unit Upper Division General Education requirement of the CSU.

Attachments and responses for questions 1-4 will help the General Education Committee decide if the course is truly suitable to the General Education student. Please read the definition of Upper Division General Education printed above before answering these questions.

1. Please attach a syllabus or draft syllabus of the course.
   See attached.

2. How many units is this course? Upper-Division General Education Courses are limited to (3) units. **3 units**

3. a. Does this course have (a) prerequisite (s) other than completion of LDGE requirements? **No.**

   b. Does this course fulfill requirements for a major by the academic unit in which the course is offered? Check the YES box even if the course counts as an elective in the major. No.

   c. If you answered "yes" to 3.a. or 3.b., then the course is an exception to the definition printed above, and you must explain why the GE committee should make an exception for this course. Please describe how this course is designed to provide valuable and appropriate learning experiences to both majors and non-majors.

4. Upper division general-education students may have fulfilled their lower division area B requirements in broad, interdisciplinary courses or in a different discipline than the discipline in which this course is offered. Please explain how this course introduces such students to the basic assumptions, principles and methods of the discipline, and how connection is made between these fundamentals and the particular applications emphasized in the course.

   Speech and hearing are omnipresent processes fundamental to most people's daily lives. This course examines the underlying physics behind these processes and how the same physical principles can be applied to the world around us. Students develop models – graphical, mathematical, pictorial -- to describe sound and hearing in terms of energy principles and wave phenomena. The course also covers interdisciplinary aspects between physics and speech language pathology. For example, students also learn about the filtering of sound by the human vocal tract and the diagnosis of speech processes via electronic instrumentation.

Criteria for Upper Division Area BB Courses: Questions 5-7 will help the General Education Committee decide if the course belongs in the Mathematics/Quantitative Reasoning or Physical and Life Sciences category.

Address the criteria implied by the following instructions. (In the following instructions, "scientific" or "science" is meant to pertain to the natural, as opposed to social, sciences). "Mathematical" or "mathematics" is meant to include fundamental studies of quantitative, geometrical, statistical and computational methods, and not merely their application to particular problems. Courses in this area include inquiry into the physical universe and its life forms and into mathematical concepts and quantitative reasoning and their applications.

5. Please specify how the course requires students to use reasoning skills characteristic of common scientific and mathematical practice to do one or more of the following: to solve problems, to interpret observations, to make predictions, to design experiments for the testing of hypotheses, or to prove theorems. Examples given should illustrate how these skills are used throughout the course.
   Students must use high school level mathematics and trigonometry skills to quantitatively characterize wave behavior. Calculations include determining wavelength, frequency, and interference conditions. One relevant assignment is the study of a sound spectrogram that students perform using software such as Praat. Students also perform basic calculations of the wattage, current, and voltage for simple circuits and their home electronics, since it relates to the understanding of speech diagnostic equipment. Students are also asked to make predictions of physical situations, such as how the air speed through the mouth changes as the lips are opened and closed.

6. Please specify how both past successes and current uncertainties in science or mathematics are well represented in the course, in order that the cumulative, historical nature of the development of science and mathematics can be illustrated. Give examples covered in the course of (a) older, well-established laws and theories that are no longer debated in scientific and mathematical circles, and (b) issues where either fundamental questions remain unanswered or where the application of well-established principles to new situations carries some uncertainty or controversy.

The mathematics used in the course are high school level arithmetic, algebra, and trigonometry, which are well established. The physical properties of sound waves have also been long established and have been verified in the properties of light, sound, and other mechanical waves. These properties include reflection, refraction, diffraction, and superposition. The more recent science that is still being researched relates to the human formation of sound. Linear source-filter theory of speech production has been established since the 1940's, but nonlinear source-filter phenomena continue to be investigated. Also, the instrumentation of speech diagnosis continues to be developed as technology advances, e.g., MRI, electropalatography, and X-ray.

Assessment for Upper Division Area BB Courses: Question 7 will help the General Education Committee to evaluate whether you have planned sufficiently for assessing the success of your course.

7. a. Please give examples explaining how the work assigned to students (quizzes, tests, essays, projects, etc.) allows you to measure how successful individual students are in meeting the UDGE learning objectives for this course. Please attach an example of the type of assignment you will use to evaluate how successfully students meet the UDGE learning objectives.

Students are assessed through their performance of simple calculations and essay responses. Example questions include:

- **From graphical representations of a wave function, determine the amplitude, wavelength, period, and frequency of the wave.**
- **Cite three examples of nonlinear source-filter behavior.**
- **From a graphical representation of a spectrograph, determine the formant frequencies as prescribed by linear source-filter theory.**
- **How much do you pay the electric company for running your computer for one hour?**
- **If you extend the length of a vocal tract, how would it change the value of the lowest frequency?**

Example assignment attached.

b. If you use any course assessment activities (e.g., "pre" and "post" testing, class-wide analysis of individual test questions, etc.) that measure whether or not the class as a whole successfully meets the General Education learning objectives for this course, please attach examples of these as well.

N/A

California State University
SAN MARCOS

Physics 357: The Science of Speech and Hearing
Summer 2016, Section 01
Online Meeting Time Monday 6:00-7:00 pm, Pacific Standard Time

Instructor
Stephen Tsui, PhD
stsui@csusm.edu
760-750-4144
Office: Department of Physics, Science Hall II, Room 217

Welcome!
Physics 357 is a prerequisite for entrance into the MA program in Communicative Sciences and Disorders, or Speech Language Pathology. The course is designed to provide a foundation in the science of sound, including its production and perception, as applied to speech and hearing. This course is taught as part of the CSD Prep Cohort and complements EDSL 320 and 391. It should be noted that this course is first and foremost a physics course, with applications to speech science to be explored after the fundamental physical science is covered.

Required Resources and Class Meetings
All materials will be posted on Cougar Courses cc.csusm.edu; be sure to watch the introductory video! Primary readings will be taken from *Speech Science*, 3rd ed., by Carole T. Ferrand. To participate in the class meetings, you will need to install Zoom (as described in the Cougar Courses page) and have at least a speaker. Zoom comes with online chat, but you may also ask questions via microphone. Attendance in the online meeting via Zoom is mandatory and will be scored as part of your participation grade. The meeting activities will include lectures, class discussions, and answering questions. If you cannot attend a session, you should make every effort to notify the instructor in advance.

Additional Contact
Questions can be addressed using the online Question Café on the Cougar Courses page, or via email. The Café is a great place to start in the chance that you or a peer can respond to your classmates' queries when the instructor is away. If you do email the instructor, please enter "Phys 357-01" in your email header. The instructor is not always at a computer during the day due to research laboratory responsibilities, but he will respond to all emails within 24 hours of receipt.

Grading

All assignments and exams will be handled online. Plan on having something to read or an activity to work on every day! Each assignment will have a total amount of points associated with it, and your final assignments grade will simply be the ratio of the sum of your points to the total maximum number of points. Assignments, which make up 50% of your points, will include online question sets, short essays, article reviews, and activity uploads. Due dates will be posted in the week's module on Cougar Courses, but they will typically be Monday mornings. Late assignments are not accepted unless there is a compelling, catastrophic reason that is up to the instructor's discretion. A term paper will be due at the end of the class, worth 10%, and attendance at the Zoom meetings will account for 5% of your participation grade. Lastly, there will be a midterm worth 15% of your grade and a comprehensive final worth 20%.

50% Assignments
5% Participation and Attendance Grade
15% Weekend Midterm due Monday, July 25, 9 am
20% Final exam due Monday, August 15, 9 am
10% Term paper due Monday, August 15, 5 pm

Unless otherwise announced, grading will be as follows:
A 93-100; A- 90-92; B+ 87-89; B 84-86; B- 80-83; C+ 77-79; C 74-76; C- 70-73; D+ 67-69; D 64-66; D- 60-63; F otherwise

Course Content and Learning Outcomes

Upon completion of this course, you should be able to understand and apply the following to clinical practice:

1. Principles of sound;
2. Physical quantities used to measure and describe sound;
3. Principles of sound production;
4. Physical quantities used to measure and describe speech;
5. Relationship between acoustics and speech production;
6. Instrumentation used in the collection of data in clinical populations.

You will also engage in the practice of developing physical models about natural phenomena and applying those models to make predictions about physical systems.

The tentative outline will be:

Week 1	Force, Energy, Spectrograms, Fluids, Pressure
Week 2	Oscillations, Wave Properties, Superposition Phenomena, Resonance
Week 3	Source-Filter Theory, Mid-Term
Week 4	Charge, Electronics, Diagnostic Instrumentation
Week 5	Survey of Modern SLP Science Topics, Final Exam, Paper

CSUSM Academic Honesty Policy

"Students will be expected to adhere to standards of academic honesty and integrity, as outlined in the Student Academic Honesty Policy. All assignments must be original work, clear and error-free. All ideas/material that are borrowed from other sources must have appropriate references to the original sources. Any quoted material should give credit to the source and be punctuated accordingly.

Academic Honesty and Integrity: Students are responsible for honest completion and representation of their work. Your course catalog details the ethical standards and penalties for infractions. There will be zero tolerance for infractions. If you believe there has been an infraction by someone in the class, please bring it to the instructor's attention. The instructor reserves the right to discipline any student for academic dishonesty, in accordance with the general rules and regulations of the university. Disciplinary action may include the lowering of grades and/or the assignment of a failing grade for an exam, assignment, or the class as a whole."

http://www.csusm.edu/policies/active/documents/academic_honesty.html

Plagiarism

It is expected that each student will do his/her own work, and contribute equally to group projects and processes. Plagiarism or cheating is unacceptable under any circumstances. If you are in doubt about whether your work is paraphrased or plagiarized, see the Plagiarism Prevention for Students website http://library.csusm.edu/plagiarism/index.html. If there are questions about academic honesty, please consult the University catalog.

Students with Disabilities Requiring Reasonable Accommodations

Every student has the right to equitable educational consideration and appropriate accommodation. Students having differing ability (mobility, sight, hearing, documented learning challenges, first language/English as a second language) are requested to contact the professor at the earliest opportunity. Every effort will be made to accommodate special need. Students are reminded of the availability of Disabled Student Services, the Writing Center, technology assistance in the computer labs, and other student support services available as part of reasonable accommodation for special needs students.

Students are approved for services through the Disabled Student Services Office (DSS). This office is located in Craven Hall 5205, and can be contacted by phone at (760) 750-4905, or TTY (760) 750-4909. Students authorized by DSS to receive reasonable accommodations should contact the instructor.

Term Paper due Monday, August 15, 5 pm

This is an opportunity for you to spend the time to really explore an aspect of speech-language pathology research. The topic can be about anything that you want in the discipline, so long as it is related either to the science behind speech production or hearing, or based on a survey or experiment performed in the field. The work can even be controversial. This is your chance to play and learn!

Requirements:

- 5-7 pages, 1.15 single line spacing, not including references list
- At least 3 references with proper citations in the text
- References must be scholarly: from a printed text or peer reviewed journals

Articles may be found on Google Scholar and then looked up via the CSUSM Library website. There is a "Looking for specific article" link that allows you to paste DOI identifiers directly to get journal access. If CSUSM does not have access to the article, you can request it via Interlibrary Loan, which should process in two to three days.

Identifying a topic and finding articles will be part of our course activities.

Structure and Scoring:

• Introductory thesis statement	10%
• Background information	20%
• Explanation of phenomenon or experimental methods	20%
• Results of research	20%
• Concluding remarks, including interpretation	20%
• Citations	5%
• Grammar	5%

Note that this is a literature review paper and not an opinion paper. You of course will interpret the results and draw conclusions, but all interpretations and conclusions must be supported by evidence.

357 Final Review Worksheet

Formulas

The period of an oscillation is the inverse of the frequency.

$$T = \frac{1}{f}$$

For any wave, the wave speed is the product of the wavelength and frequency.

$$v = \lambda f$$

For harmonics, any nth harmonic frequency is just a multiple of the first harmonic frequency.

$$f_n = nf_1$$

For strings (half wave resonators), the length of the resonator can be divided up into half wavelengths of those particular harmonics.

$$L = \frac{n}{2}\lambda_n$$

For closed-open air tubes (quarter wave resonators), the length of the resonator can be divided up into quarter wavelengths of those particular harmonics.

$$L = \frac{n}{4}\lambda_n$$

The ratio of change in the intensity level of a sound leads to a loudness change of

$$dB\ IL = 10 \times \log(change\ ratio)$$

The ratio of change in the pressure level, or amplitude, of a sound leads to a loudness change of

$$dB\ SPL = 20 \times \log(change\ ratio)$$

The formant spacing for a mammal is correlated to the vocal tract length.

$$VTL = \frac{v}{2(\Delta f)}$$

Pressure can be defined both as an energy per unit volume and as a force applied over an area.

$$P = \frac{F}{A}$$

The equation of continuity dictates the behavior of continuous flow as a balance between the cross sectional areas of the flow channels and the fluid speed.

$$A_1 v_1 = A_2 v_2$$

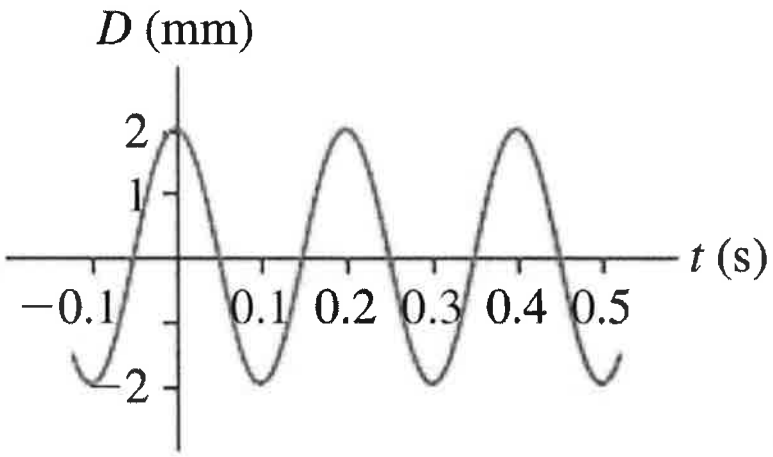
For a circuit, Ohm's law states that voltage is the produce of current and resistance

$$V = IR$$

Electrical power is defined by

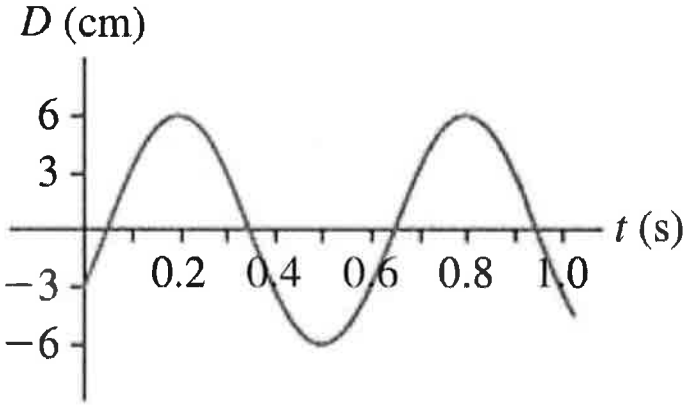
$$P = IV$$

Wave Questions



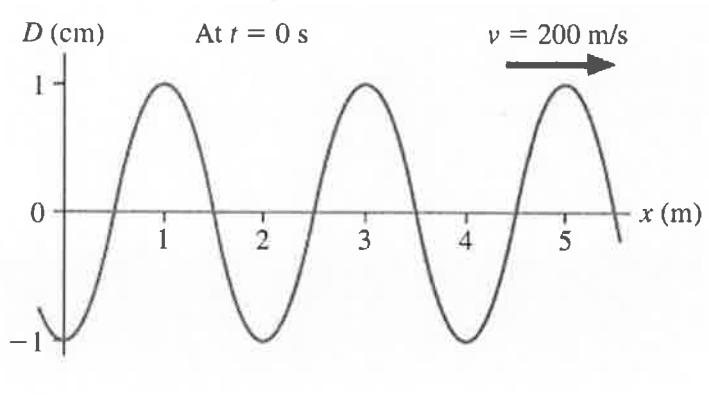
Looking at the above oscillation:

1. What is the amplitude?
2. What is the period?
3. What is the frequency?



Looking at the above oscillation:

4. What is the amplitude?
5. What is the period?
6. What is the frequency?



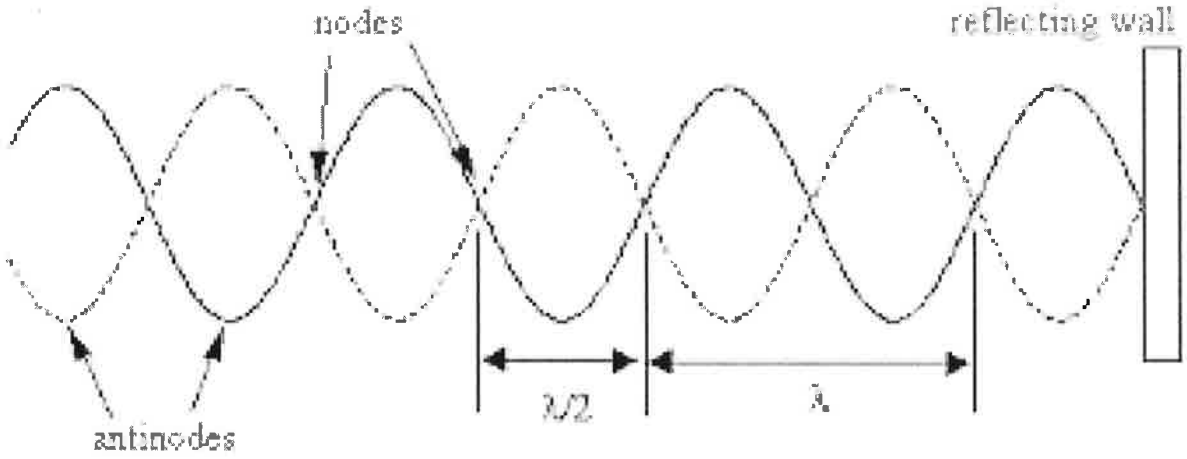
Looking at the above wave,

7. What is the amplitude?
8. What is the wavelength?
9. What is its frequency?
10. What is the period of the oscillators that make it up?

Your friend taps the surface of a pool of water every 3 seconds. The tap causes a depression in the surface of the water of 2 cm, and ripples ensue. The ripples travel at 1.5 m/s.

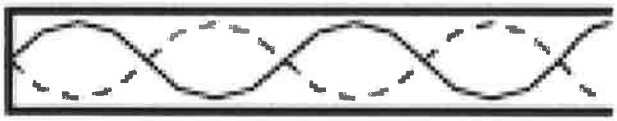
11. What is the amplitude of the ripples?
12. What is the period of the ripples?
13. What is the frequency of the ripples?
14. What is the wavelength of the ripples?

Superposition and Interference Questions



The picture above shows a standing wave on a string. It has a wave speed of 10 m/s and oscillates at 40 Hz.

15. Which harmonic is this?
16. What is the wavelength of this harmonic?
17. What is the length of the string?
18. What is the frequency of the first harmonic?



The picture above shows a standing wave in a closed-open air tube (or vocal tract). It has a wave speed of 340 m/s and oscillates at 900 Hz Hz.

19. Which harmonic is this?
20. What is the wavelength of this harmonic?
21. What is the length of the resonator?
22. What is the frequency of the first harmonic?

A vocal tract produces a fundamental resonance frequency of 600 Hz. The speed of sound in air is 340 m/s.

23. What is the wavelength of its first harmonic?
24. How long is this vocal tract?
25. What is its third harmonic frequency?
26. What is the wavelength of its third harmonic?

27. What is the lowest value of F_1 for a male with a vocal tract that is 18 cm long?
Since the vocal tract is a quarter wavelength resonator

28. Who has a greater formant dispersion, a person with a 16.6 cm vocal tract or a person with a 14.8 cm vocal tract?

Sound and Loudness Questions

29. If you increase the intensity of a sound wave by a factor of 5, by how much do you increase the loudness in dB IL?

30. If you decrease the intensity of a sound wave to a fifth, by how much do you decrease the loudness in dB IL?

31. If you decrease the amplitude of a sound wave to $\frac{1}{7}$ of the original amplitude, by how much do you decrease the loudness in dB SPL?

32. If you increase the amplitude of a sound wave by a factor of 7, by how much do you increase the loudness in dB SPL?

33. Can a 21,000 Hz sound at 98 dB be heard?

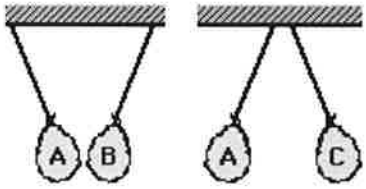
Pressure and Bernoulli's Principle

34. An elephant with a mass of 10,000 lbs. has feet that each have a surface area of approximately 279 square inches. What is the combined pressure that the elephant puts on all four of its feet in psi?

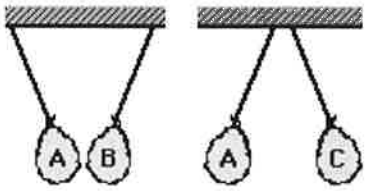
35. Water is flowing in a stream that narrows from 10 m^2 to a 7 m^2. If the speed of the water out the narrow side is 3 m/s, what is the speed of the water at the wider side?

36. Is the water pressure higher or lower on the wider side of the stream from Problem 35?

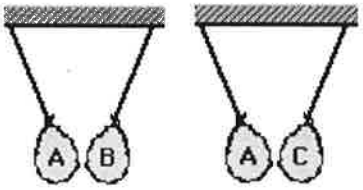
Charge and Circuit Questions



37. If Balloon C is positively charged, then Balloon B is:
a) Positively charged
b) Negatively charged
c) Neutral
d) Positively charged or neutral
e) Negatively charged or neutral



38. If Balloon A is positively charged, then Balloon C is:
a) Positively charged
b) Negatively charged
c) Neutral
d) Positively charged or neutral
e) Negatively charged or neutral



39. If Balloon B is positively charged, then Balloon C is:
a) Positively charged
b) Negatively charged
c) Neutral
d) Positively charged or neutral
e) Negatively charged or neutral

40. A 300 Ω LED is being powered by a 5 V battery. How much current is running through the LED?

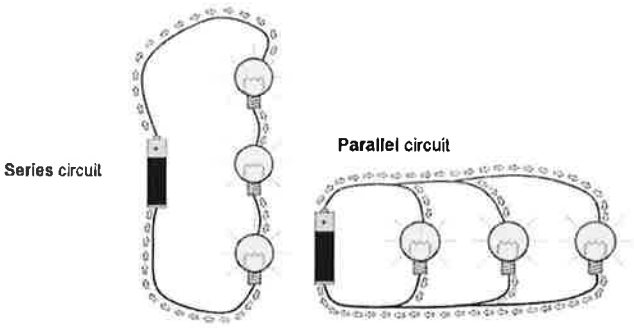
41. A 100 Ω LED is draws 1 mA of current. How much voltage is running through the LED?

42. An electronics system requires 1.5 Amps to run at 120 V. What is the power of this device?

43. A 15 W instrument draws 0.25 A of current. What voltage is being applied across it?

44. A light bulb possesses a resistance of 150 Ω and is connected to a battery rated at 12 V. What is the current going through the bulb?

45. A 9 V battery is hooked up to a copper wire. Another 9 V battery is hooked up to a piece of plastic. Which draws more current?



45. The picture above shows identical light bulbs connected to the same battery in series or parallel. In which configuration are the light bulbs brighter?