(Targeting Trouble Spots)
Exam Announcements

The Final Exam will be on Friday December 20th from 8:00 - 11:00 am. in the LSH Auditorium

There will be 30 questions in total:
15 questions on material in the final third of the course (since the last exam)
15 questions on material from the entire course

You may bring three sheets of handwritten notes on letter-size paper (8.5 x 11 inches) to the exam.

Help Sessions Serin 232 (lab room)
Thursday Dec. 12 11:30 - 5:30
Thursday Dec. 19 11:00 - 2:30
(see course website for more details)
Electrocautereries are often used in surgery to cut tissue and stop bleeding. An electrocauterery can be modeled as a simple circuit with a resistor and a power source. An engineer designing the electrocauterery would like to increase the total current flowing through the system without changing the total voltage. This can be done by:

- **A.** adding a resistor in parallel.
- **B.** adding a resistor in series.
- **C.** adding a capacitor in parallel.
- **D.** adding a capacitor in series.
Question 753

Three capacitors each with a capacitance of 30 $\mu$F are arrayed in series and used to generate a current in a pacemaker. What is the overall capacitance of pacemaker?

- A. 10 $\mu$F
- B. 30 $\mu$F
- C. 90 $\mu$F
- D. 27 mF
9. A drum reaches a sound intensity level of 95 decibel if you are 4.0 meters away from it. What is the intensity level of two of the same drums together as heard by a listener at 8.0 meter?

   a) 92 dB
   b) 95 dB
   c) 101 dB
   d) 98 dB
   e) 89 dB

(Practice Exam 2)
11. An unstable nucleus follows a decay scheme where the final stable nucleus is a different isotope of the original nucleus. For which decay scheme is this the case?

a) gamma decay
b) alpha decay followed by two beta (electron) decays
c) a beta (electron) decay followed by an alpha decay
d) a beta (electron) decay followed by neutron decay
e) a beta (electron) decay
Question (Today’s Material = Review for the Final)

6. A pure sample of $^{226}$Ra contains $3.0 \times 10^{13}$ atoms of the isotope. If the half-life of $^{226}$Ra is 1600 years, what is the activity of this sample?

a) $1.3 \times 10^{10}$ decays/year
b) $1.9 \times 10^{10}$ decays/year
c) $4.1 \times 10^{2}$ decays/year
d) $4.8 \times 10^{16}$ decays/year
e) $8.1 \times 10^{6}$ decays/year
15. The lowest frequency a person can hear is about 20 Hz. How long should an organ pipe, open at both ends, be so that it produces a 20 Hz sound as its fundamental frequency? Use $v = 344 \text{ m/s}$.

- a) 34.4 m
- b) 17.2 m
- c) 8.6 m
- d) 4.3 m
- e) 2.15 m
28. An isotope of krypton has a half-life of 3 minutes. A sample of this isotope produces 1200 counts per second in a Geiger counter. Determine the number of counts per second after 15 minutes.

a) 19
b) 37
c) 75
d) 600
e) 1200

(Practice Final)
Question 752

An MRI technician would like to check the voltage drop of a resistor within an MRI machine. Which of the following describes the instrument the technician must use?

I. A voltmeter must be used.
II. The instrument must be added in parallel.
III. The instrument must be extremely low in its resistance.

○ A. I only
○ B. I and II only
○ C. II and III only
○ D. I, II, and III
Question

You are jogging on the sidewalk at a rate of 3 m/s. A police car behind you is patrolling at a rate of 4 m/s when it turns on its siren. If the siren has a frequency of 10,000 Hz, is the frequency you perceive higher or lower than the frequency emitted?

a) Lower because you are running slower than the police car is moving
b) Higher because the siren is traveling in the same direction as you are going
c) Same because the Doppler effect only affects lower frequencies
d) Lower because the overall distance between you and the siren is increasing
e) Higher because the overall distance between you and the siren is decreasing
Question 638

A capacitor within an ultrasound machine generates an electric field of $4 \times 10^4 \text{ V/m}$. Its parallel plates are separated by a distance of 3 mm. How much work is done to move an electron across the capacitor? An electron has a charge of $Q = -1.6 \times 10^{-19} \text{ C}$.

- A. $4.80 \times 10^{-22} \text{ J}$
- B. $1.92 \times 10^{-17} \text{ J}$
- C. $6.40 \times 10^{-15} \text{ J}$
- D. $1.92 \times 10^{-14} \text{ J}$
The Na\(^+\)/K\(^+\) pump pumps three positively charged ions out of a neuron, while pumping 2 equally positively charged ions into the neuron. If this action establishes the an electric potential across the membrane, the direction of the electric field lines point:

○ A. from the inside of the neuron toward the outside.
○ B. from the outside of the neuron toward the inside.
○ C. along the axon toward the axon terminals.
○ D. along the axon away from the axon terminals.
Many medical devices, including the electrocardiogram machine, contain resistors. From the diagram below, what is the resistance if the power produced by the resistor is 0.172 mW and each battery’s voltage is 1.5 V?

- A. 13 Ω
- B. 118 Ω
- C. 13 kΩ
- D. 118 kΩ
Scoliosis surgery is the surgical implantation of steel objects into the spine in order to correct for abnormal curvature. Prior to implantation, a surgeon notes that the 50 cm steel rod has an electrical resistance of $7.41 \times 10^{-8} \Omega$. What is the diameter of the steel rod? ($\rho_{\text{steel}} = 1.48 \times 10^{-7} \Omega m$)

- A. 0.31 m
- B. 0.57 m
- C. 1.1 m
- D. 2.3 m
13. A parallel-plate capacitor of capacitance, $C$ is attached to a battery of voltage, $V$. The energy stored on the capacitor is 4 J. We then carry out the following steps. While the capacitor is still connected to the battery, the separation of the two plates is doubled. The battery is then disconnected and while the capacitor remains disconnected from the battery, the two plates are brought back to their original separation. After this last step, what is then the energy stored on the capacitor?

a) 4 J  
b) 8 J  
c) 1 J  
d) 2 J  
e) 16 J
25. Consider a gas in a container having a moveable piston. The gas expands isothermally, pushing the piston and doing 214 J of work. Which of the following is true?

a) The change in the internal energy of the gas cannot be determined, since we need the initial and final volumes to determine $Q$.

b) The internal energy decreases by 214 J.

c) The internal energy is unchanged.

d) The added heat $Q$ is zero.

e) The internal energy of the gas increases by 214 J.

(Practice Final)
18. The deepest point in the Pacific Ocean is 11,033 m, in the Mariana Trench. What is the water pressure at that depth? The density of sea water is \(1025\ \text{kg/m}^3\).

a) \(5.55 \times 10^7\ \text{N/m}^2\)
b) \(8.88 \times 10^7\ \text{N/m}^2\)
c) \(1.11 \times 10^8\ \text{N/m}^2\)
d) \(2.22 \times 10^8\ \text{N/m}^2\)
e) \(5.55 \times 10^8\ \text{N/m}^2\)

(Practice Final)
Good Luck in your Exams

Happy Holidays!