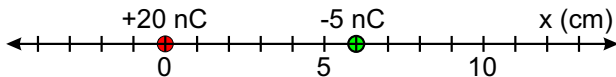
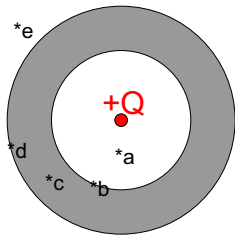


PHY 232C, INTRODUCTORY PHYSICS II
FINAL EXAM, Dec. 8, 2003

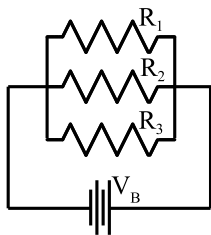
Choose the best answer. For T/F problems, choose only ONE answer.



1. Consider the two charges shown above at $x = 0$ and $x = 6$ cm. For what range of positions x on the axis does the electric field point to the right?
- (a) $x < 0$ and $x > 4.8$ cm
 - (b) $x < -4.8$ and $x > 4.8$ cm
 - (c) $x < 4.8$ and $x > 12$ cm
 - (d) $0 < x < 6$ and $x > 12$ cm
 - (e) $x > 4.8$ cm

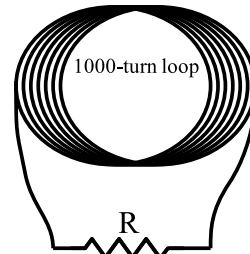


2. Consider a thick spherical conducting shell with NO NET CHARGE. A point charge, $+Q$ is placed at its center. Which single statement is TRUE?
- (a) The electric field at a equals zero.
 - (b) The voltage at c equals zero.
 - (c) The voltage at b equals the voltage at d .
 - (d) The inner surface of the shell carries a charge $+Q$.
 - (e) The electric field at e is zero.

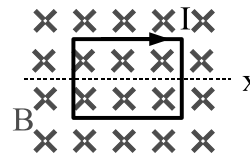


3. In the figure above, how much power is put out by the battery? DATA: $R_1 = R_2 = 20$ ohms, $R_3 = 40$ ohms, $V_B = 12$ V.
- (a) 4.0 W
 - (b) 6.0 W
 - (c) 8.0 W
 - (d) 12.0 W
 - (e) 18.0 W
 - (f) 24.0 W

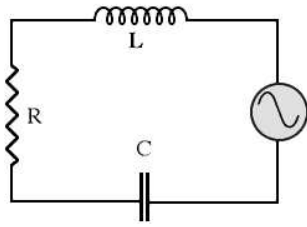
4. The potential difference between two parallel conducting plates is 500 V. An alpha particle with mass 6.50×10^{-27} kg and charge 3.20×10^{-19} C is released from one plate. What is the speed of the alpha particle when it reaches the other plate?
- (a) 6.06×10^4 m/s
 - (b) 1.11×10^5 m/s
 - (c) 2.22×10^5 m/s
 - (d) 4.44×10^5 m/s
 - (e) 8.88×10^5 m/s



5. A 1000-turn loop (radius = 0.05 m) of wire is connected to a 25 ohm resistor as shown in the figure above. A magnetic field which is perpendicular to the plane of the loops rises from 0.0 T to 0.25 T in 0.125 s. Neglect the resistance of the wire. What is the current through the resistor?
- (a) 1.216 A
 - (b) 0.863 A
 - (c) 0.628 A
 - (d) 0.213 A
 - (e) 0.0925 A



6. Consider the square coil immersed in a magnetic field as shown above. Choose the ONE FALSE statement from the list ($a - d$). If none of statements is false, choose e .
- (a) Rotating the loop about the x axis in a steady magnetic field will induce a current.
 - (b) Increasing the rate of rotation of the loop about the x axis will increase the magnitude of the current.
 - (c) A decreasing magnetic field will induce a current.
 - (d) Pulling the loop to the right at constant velocity will induce a current while the loop is half way in the region with field and half way in the region with no field.
 - (e) None of these statements is false.

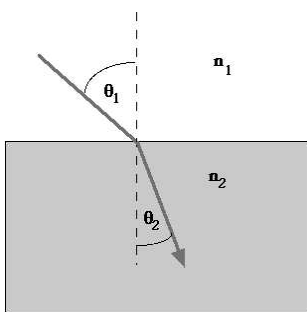


7. Consider a power supply running at 110 V rms and 60 Hz in series with an inductor, resistor and capacitor as shown above. If $R = 100$ ohms, $L = 1.0$ H and $C = 6\mu\text{F}$, what is the rms current in the circuit?

- (a) 0.449 Amps
- (b) 0.921 Amps
- (c) 2.32 Amps
- (d) 12.0 Amps
- (e) 37.3 Amps

8. Which ONE of the following statements is TRUE? If none are true choose (e).

- (a) When a long wire carries a DC current, there will be electromagnetic radiation from the wire.
- (b) The speed of electromagnetic waves in the vacuum depends on their frequency.
- (c) The speed of electromagnetic waves in the vacuum depends on their wavelength.
- (d) Two polaroids are each lined up perpendicular to incoming light with their transmission axes arranged 90° to one another. If the intensity after traversing polaroid #1 is I , the amplitude after traversing the polaroid #2 is $I/2$.
- (e) None of these statements is true.

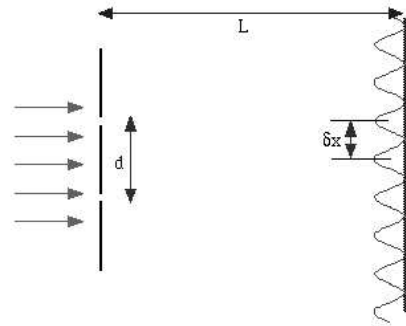


9. Light enters a slab of plastic from the air above as shown above. If $\theta_1 = 60^\circ$ and $\theta_2 = 45^\circ$, what is the index of refraction of the plastic.

- (a) 0.851
- (b) 1.0
- (c) 1.22
- (d) 1.37
- (e) 1.50

10. A farsighted professor has a prescription of 2.5 diopters. What is the closest distance at which the professor can focus?

- (a) 33.3 cm
- (b) 50.0 cm
- (c) 66.7 cm
- (d) 1.00 m
- (e) 2.50 m



11. Light traveling through a pair of slits separated by $d = 0.8$ mm produces an interference pattern on a screen 2.3 m away. If the separation of the interference maxima, $\delta x = 2.0$ mm, what is the wavelength of the light?

- (a) 696 nm
- (b) 584 nm
- (c) 535 nm
- (d) 499 nm
- (e) 401 nm

12. Select the single TRUE statement.

- (a) Black body radiation of stars like our sun occurs predominantly in the x-ray region of the spectrum.
- (b) A single photon has an energy proportional to its frequency.
- (c) If two sources emit the same number of photons per second, one near the red end of the spectrum will emit more energy than one near the blue end.
- (d) If a photon and an electron have the same wavelength, then they have the same energy.
- (e) If a proton and an electron have the same wavelength, then they have the same velocity.

13. The nucleus of a neutral atom is labeled by the symbol ${}^1_7\text{N}$. Which single statement is FALSE? If none are false (e).

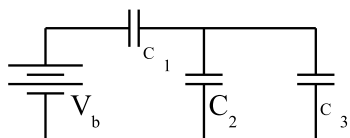
- (a) There are 7 protons in the nucleus.
- (b) There are 8 neutrons in the nucleus
- (c) The ground state electronic configuration is $1s^2 2s^2 2p^6 3s^2 2p^3$.
- (d) The atomic weight of the nucleus is 15.
- (e) None of these statements is false.

14. When observing 10^{12} atoms of ${}^{56}\text{Ni}$ one counts 104,053 decays in the first second. What is the half life of ${}^{56}\text{Ni}$?

- (a) 41 seconds
- (b) 52 minutes
- (c) 77 days
- (d) 23 months
- (e) 1089 years

15. Which single statement is FALSE?

- (a) Gamma rays are energetic photons.
- (b) Neutrinos are one of the most lethal particles emitted in beta decays.
- (c) Nuclei can have more neutrons than protons.
- (d) Beta rays are energetic electrons or positrons(anti-electrons).
- (e) Alpha particles are ${}^4\text{He}$ nuclei.

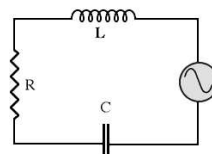


16. What is the charge on C_1 ? DATA: $V_b = 12\text{ V}$, $C_1 = 30\ \mu\text{F}$, $C_2 = C_3 = 15\ \mu\text{F}$.

- (a) $72\ \mu\text{C}$
- (b) $90\ \mu\text{C}$
- (c) $124\ \mu\text{C}$
- (d) $144\ \mu\text{C}$
- (e) $180\ \mu\text{C}$

17. Consider a proton moving with a velocity $v = 2.4 \times 10^6\text{ m/s}$ perpendicular to a uniform magnetic field $B = 1.25\text{ T}$. What is the radius of the protons circular orbit? DATA: $m_p = 1.67 \times 10^{-27}\text{ kg}$.

- (a) 2.00 cm
- (b) 37.1 cm
- (c) 1.23 m
- (d) 4.50 m
- (e) 15.42 m

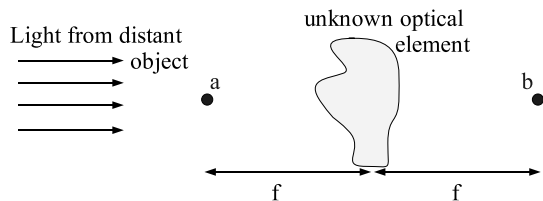


18. Regarding the diagram above, which single statement is FALSE? If none of the statements are false choose (e).

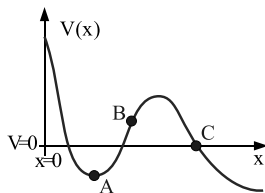
- (a) Energy is stored and released, but not dissipated, in both the capacitor and inductor.
- (b) The frequency of the voltage across the inductor equals the frequency of the voltage across the resistor.
- (c) The current through the inductor equals the current through the resistor at any instant.
- (d) Changing the frequency of the power supply while keeping the magnitude of power supply voltage fixed will result in a different magnitude for the current.
- (e) None of these statements are false.

19. A powerful laser can emit 775 J in one pulse of light. The wavelength of the light is 675 nm. How many photons are in one pulse?

- (a) 2.63×10^{11}
- (b) 2.63×10^{21}
- (c) 2.63×10^{31}
- (d) 2.63×10^{41}
- (e) 2.63×10^{51}



20. Referring to the diagram above choose the single TRUE statement. If all of the statements (a-c) are true choose (d). If none are true choose (e).
- (a) If there is a virtual image at “a”, the element is a diverging lens.
 - (b) If there is a real image at “a”, the element is a concave mirror.
 - (c) If there is a virtual image at “b” the image is a convex mirror.
 - (d) All of these statements are true.
 - (e) None of these statements are true.



21. Referring to the plot of voltage vs. position above, which single statement is FALSE. If none are false, choose (e).
- (a) The electric field at “A” is zero.
 - (b) An electron at “B” feels a force to the right.
 - (c) An electron at “C” feels no force.
 - (d) A proton at “B” feels a force to the left.
 - (e) None of these statements are false.
22. Consider two parallel segments of wire of length L separated by a distance R . They carry currents in the same direction of magnitude $I_1 = I_2$. Select the single TRUE statement. If none of the statements are true choose (e).
- (a) If the separation R is doubled the force between the wires falls by a factor of $1/4$.
 - (b) If I_1 and I_2 are both doubled the force between the wires increases by a factor of 4.
 - (c) If the current in one of the wires is set to zero while the other is unchanged, the force between the wires will fall by a factor of one half.
 - (d) If the directions of both currents are reversed the direction of the force between them will reverse.
 - (e) None of the statements are true.