

Name:

Physics 2140: Example Exam Chapters 21, 26-28.8

Real Exam Date 7 April 2004

20 multiple choice questions worth 5 points each.

1. The frequency in an AC series circuit is doubled. By what factor does this change the capacitive reactance?
 - a. $1/2$
 - b. $1/4$
 - c. 2
 - d. 4
2. What is the impedance of an AC series circuit that is constructed of a $10.0\ \Omega$ resistor along with $12.0\ \Omega$ inductive reactance and $7.0\ \Omega$ capacitive reactance?
 - a. $37.0\ \Omega$
 - b. $27.7\ \Omega$
 - c. $27.1\ \Omega$
 - d. $11.2\ \Omega$
3. The primary winding of an electric train transformer has 400 turns and the secondary has 50. If the input voltage is 120 V, what is the output voltage?
 - a. 480 V
 - b. 60 V
 - c. 15 V
 - d. 10 V
4. Resonance occurs in an AC series circuit when which of the following conditions is met?
 - a. resistance equals capacitive reactance
 - b. resistance equals inductive reactance
 - c. capacitive reactance equals inductive reactance
 - d. capacitive reactance equals zero

5. What is the wavelength of 100 MHz television EM waves?
- a. 0.3 cm
 - b. 3 m
 - c. 9 km
 - d. 10 m
6. An object moves by an observer at $0.500c$ ($1/2$ the speed of light). The total energy of the object will be what factor times that of the rest energy?
- a. 0.600
 - b. 0.970
 - c. 1.15
 - d. 1.67
7. Which characterizes the main result of the Michelson-Morley experiment?
- a. verified the existence of ether
 - b. involved measuring the speed of sound from a moving source
 - c. detected no difference in the speed of light regardless of speed of the source relative to observer
 - d. was designed purposely to verify Einstein's theory of relativity
8. When a one-megaton nuclear bomb is exploded, approximately 4.5×10^{15} J of energy is released. How much mass would this represent in a mass-to-energy conversion? ($c = 3.00 \times 10^8$ m/s)
- a. 1.5×10^{-6} kg
 - b. 0.050 kg
 - c. 5.3×10^3 kg
 - d. 1.7×10^5 kg

9. If astronauts could travel at $v = 0.95 c$, we on Earth would say it takes $(4.2/0.95) = 4.4$ years to reach Alpha Centauri, 4.2 lightyears away. The astronauts disagree. How much time passes on the astronaut's clocks?
- a. 1.4 years
 - b. 1.9 years
 - c. 2.4 years
 - d. 3.0 years
10. From a stationary position, I observe a moving boxcar which has a mirror along the front wall but it is open at the back of the boxcar. I send a flash of light from my flashlight and time the flash of light as it goes to the front of the boxcar and returns to the back of the boxcar. A passenger in the boxcar also times the round trip of the flash of light. Compare the times recorded on our watches.
- a. The time recorded on his watch is longer.
 - b. The time recorded on the two watches is the same.
 - c. The time recorded on his watch is shorter.
 - d. The answer depends on the reference system you are in.
11. What is the frequency of monochromatic light where the photon energy is 5.5×10^{-19} J? ($h = 6.63 \times 10^{-34}$ J-s)
- a. 2.2×10^{14} Hz
 - b. 4.4×10^{14} Hz
 - c. 8.3×10^{14} Hz
 - d. 9.8×10^{14} Hz
12. A helium-neon laser emits red light having a wavelength of 632.8 nm and a power of 0.50 mW. How many photons are emitted each second? ($h = 6.63 \times 10^{-34}$ J-s, $c = 3.00 \times 10^8$ m/s and $1 \text{ nm} = 10^{-9} \text{ m}$)
- a. 1.6×10^{15}
 - b. 3.3×10^{16}
 - c. 4.8×10^{17}
 - d. 2.6×10^{18}

- 13.** What is the de Broglie wavelength for a proton ($m = 1.67 \times 10^{-27}$ kg) moving at a speed of 6.0×10^6 m/s? ($h = 6.63 \times 10^{-34}$ J-s)
- a.** 2.0×10^{-13} m
 - b.** 0.33×10^{-13} m
 - c.** 1.3×10^{-13} m
 - d.** 0.66×10^{-13} m
- 14.** If the measured momentum of an electron is 3.20×10^{-27} kg-m/s with an uncertainty of 1.6×10^{-29} kg-m/s, what is the minimum uncertainty in the position? ($h = 6.63 \times 10^{-34}$ J-s)
- a.** 2.6×10^{-8} m
 - b.** 3.3×10^{-6} m
 - c.** 0.63×10^{-4} m
 - d.** 1.1×10^{-3} m
- 15.** Blue light will not eject electrons from a certain metal; however, which one of the following may possibly eject electrons from that metal?
- a.** infrared
 - b.** ultraviolet
 - c.** red
 - d.** green
- 16.** The quantum mechanical model of the hydrogen atom requires that if the orbital quantum number of the hydrogen atom is 4, there will be how many permitted orbital magnetic quantum numbers?
- a.** three
 - b.** four
 - c.** seven
 - d.** nine

17. The quantum mechanical model of the hydrogen atom requires that if the orbital magnetic quantum number is 3, there will be how many permitted spin magnetic quantum numbers?
- a. two
 - b. three
 - c. four
 - d. seven
18. The quantum mechanical model of the hydrogen atom suggests a visual picture of the electron as which of the following?
- a. raisin in pudding
 - b. probability cloud
 - c. planetary orbiting body
 - d. light quantum
19. The ground state electronic configuration for aluminum is $1s^2 2s^2 2p^6 3s^2 3p^1$. What is the orbital quantum number of the last ($3p^1$) electron?
- a. 0
 - b. 1
 - c. 2
 - d. 3
20. A hydrogen atom in the ground state absorbs a 12.75 eV photon. To what level is the electron promoted? (The ionization energy of hydrogen is 13.6 eV.)
- a. $n = 2$
 - b. $n = 3$
 - c. $n = 4$
 - d. $n = 5$