104ex2s

Physics 104 Exam 2

Name DEL ID #_____

Section #_____ TA Name_____

Fill in your name, student ID # (not your social security #), and section # on the scantron sheet. Fill in the letters given for the first 5 questions on the scantron sheet. These letters determine which version of the test you took and are IMPORTANT to get right.

1. A

2. B

3. E

4. C

5. D

6. A 2.0 m wire segment carrying a current of 0.60 A oriented parallel to a uniform magnetic field of 0.50 T experiences a force of what magnitude?

a. zero
b. 0.60 N
c. 0.30 N
d. 6.7 N
e. 0.15 N

7. A 100 m long wire carrying a current of 4.0 A will be accompanied by a magnetic field of what strength at a distance of 0.05 m from the wire? (magnetic permeability of empty space $\mu_0 = 4\pi \times 10^{-7}$ T-m/A)

$B = \frac{\mu_0 I}{2\pi r} = \frac{4\pi \times 10^{-7} \times 4.0}{2\pi \times .05} =$

a. 40×10^{-6} T
b. 20×10^{-6} T
c. 16×10^{-6} T
d. zero
e. 32×10^{-6} T

8. Geophysicists today generally attribute the existence of the earth's magnetic field to which of the following?

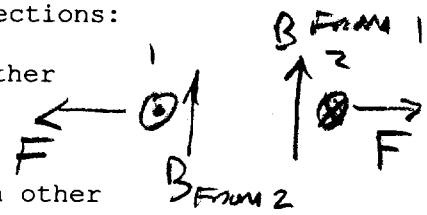
a. solar flares
b. lightning strikes
c. iron ore deposits in the crust
d. convection currents within the liquid interior
e. nickel-iron deposits in the crust

9. When a magnetic field causes a charged particle to move in a circular path, the only quantity listed below which the magnetic force changes significantly as the particle goes around in a circle is the particle's:

a. time to go around the circle once — CONSTANT
b. electric charge CONSTANT
c. momentum ← $F = \frac{\Delta P}{\Delta t} = \frac{\Delta (mv)}{\Delta t}$ CONSTANT MAGNITUDE CHANGING DIRECTION
d. energy X NO CHANGE
e. radius for the circle — CONSTANT

10. Consider two long, straight parallel wires, each carrying a current I. If the currents are flowing in opposite directions:

a. neither wire will exert a force on the other
b. the force on the wires will be zero
c. the two wires will repel each other
d. the two wires will attract each other
e. the two wires will exert a torque on each other



11. The operation of a tape player to play music depends on which of the following?

a. induced current from the motion of a magnet past a wire
b. the Oersted effect
c. the photoelectric effect
d. the Doppler effect
e. the force acting on a current-carrying wire in a magnetic field

↓ THE TAPE ↓ THE TAPE HEAD

12. The wiring in a motor has resistance of 3.0 Ohm and produces back emf of 1.0 V when connected to a 9 V battery of negligible resistance. Find current flow through the motor.

a. 2.67 A
b. 3.33 A
c. 0.44 A
d. 0.19 A
e. 1.50 A

$I = \frac{\mathcal{E} - \mathcal{E}_{BACK}}{R} = \frac{8}{3}$

13. A uniform 1.5 T magnetic field passes perpendicular through the plane of a wire loop 0.3 m^2 in area. What flux passes through the loop?

a. 0.135 Wb
b. 0.2 Wb
c. 0.45 Wb
d. 5 Wb
e. 0.25 Wb

$\Phi = B_{\perp} A = 1.5 \times 0.3 = 0.45$

B (POINTS NORTH)

WEST ⊗ + EAST → F ON + CHARGE

− ↓ ROD FALLS ↓

14. A metal rod is falling toward the surface of the earth near the equator. As it falls, one end of the rod becomes positively charged due to the motional emf of the rod through the earth's magnetic field. The rod is oriented so that:

a. the rod is horizontal with the positive end toward the west.
b. the rod is vertical with the positive end lower.
c. the rod is horizontal with the positive end toward the north.
d. the rod is vertical with the positive end higher.
e. the rod is horizontal with the positive end toward the east.

15. Electricity may be generated by rotating a loop of wire between the poles of a magnet. The induced current is greatest when:

a. the plane of the loop makes an angle of 45° with the magnetic field
b. the magnetic flux through the loop is not changing
c. the plane of the loop is perpendicular to the magnetic field
d. the plane of the loop is parallel to the magnetic field
e. the magnetic flux through the loop is a maximum

WHEN Φ IS CHANGING FASTEST

16. What is the effective (rms) current value for an ac current with a peak amplitude of 10 A?

a. 14.1 A
b. 0.5 A
c. 3.1 A
d. 28.2 A
e. 7.1 A

$\frac{10}{\sqrt{2}} = 7.07$

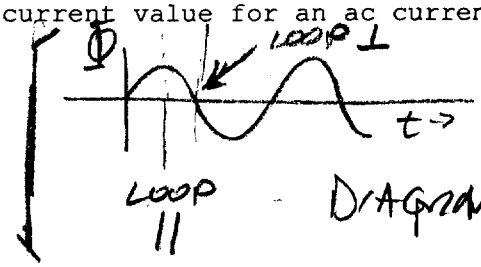


DIAGRAM FOR #15

17. A transformer consists of a 500 turn primary coil and a 2000 secondary coil. If the current in the secondary is 3.0 amps, what is the primary current?

a. 48.0 A
b. 3.0 A
c. 1.33 A
d. 0.75 A
e. 12.0 A

$\frac{I_p}{I_s} = \frac{N_s}{N_p}$ $\frac{I_p}{3.0} = \frac{2000}{500}$

BECAUSE $P_s = P_p \Rightarrow I_s V_s = I_p V_p$ AND $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

18. An ac series circuit contains a resistor of 20 ohms, an inductor of 30 mH and a variable capacitor. If the frequency of the applied voltage is 500 Hz, to what setting should the capacitor be set if resonance is achieved?

a. 3.4 μF
b. 3.0 μF
c. 1.6 μF
d. 0.8 μF
e. 2.4 μF

$f = \frac{1}{2\pi\sqrt{LC}}$

$f^2 = \frac{1}{4\pi^2 LC}$

$C = \frac{1}{4\pi^2 f^2 L} = \frac{1}{4\pi^2 500^2 30\times10^{-3}}$

19. An ultraviolet light has a wavelength of 300 nm and speed of 2.1×10^8 m/s through a transparent medium. What is the frequency of this wave in the medium? (1 nm = 10^{-9} m and $c = 3 \times 10^8$ m/s)

a. 10×10^{14} Hz
b. 14×10^{14} Hz
c. 9×10^{2} Hz
d. 6.3×10^{2} Hz
(e.) 7×10^{14} Hz

$f\lambda = v \quad f = v/\lambda = \frac{2.1\times10^8}{300\times10^{-9}} =$

$f = 7\times10^{14}$ Hz

20. What value of inductance should be used in a series circuit with a capacitor of 1.8×10^{-3} microFarads when designed to radiate a wavelength of 35 m? ($c = 3 \times 10^8$ m/s)

a. 3.8 mH
b. 2.6×10^{-2} mH
c. 3.8×10^{-3} mH
(d.) 1.9×10^{-4} mH
e. 7.6×10^{-3} mH

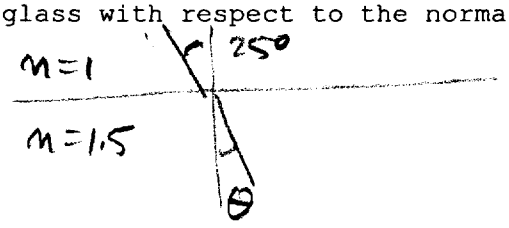
$f\lambda = C \quad f = C/\lambda = \frac{3\times10^8}{35} = 8.57\times10^6$

$f = \frac{1}{2\pi\sqrt{LC}} \quad L = \frac{1}{4\pi^2 f^2 C} = \frac{1}{4\pi^2(8.57\times10^6)^2 \times 1.8\times10^{-3}\times10^{-6}}$

$L = 1.9\times10^{-7}$ H

21. A ray of light traveling in air strikes a thick sheet of glass (n = 1.5) at an angle of 25° with the normal. Find the angle of the refracted ray within the glass with respect to the normal.

(a.) 16°
b. 33°
c. 46°
d. 56°
e. 25°



$1 \sin 25° = 1.5 \sin\theta$

$\sin\theta = \frac{\sin 25°}{1.5}$

$\theta = 16.4°$

22. A monochromatic beam of light in air has a wavelength of 589 nm in air. It passes through glass (n = 1.52) and then through carbon disulfide (n = 1.63). What is its wavelength in the carbon disulfide?

a. 960 nm
b. 589 nm
c. 387.5 nm
(d.) 361 nm
e. 895 nm

$f\lambda_{CS_2} = v = C/n_{CS_2}$ IN CARBON DISULFIDE (CS_2)

$f\lambda = C$ IN AIR SO $\frac{\lambda_{CS_2}}{\lambda} = \frac{C/n_{CS_2}}{C} = \frac{1}{n_{CS_2}} = \frac{1}{1.63}$

$\lambda_{CS_2} = 589/1.63$

23. According to Planck's formula, tripling the frequency of the radiation from a monochromatic source will change the energy content of the individually radiated photons by what factor?

(a.) 3.0
b. 9.0
c. 1.0
d. 0.33
e. 1.73

$E = hf \quad f \times 3 \rightarrow E \times 3$

24. One phenomenon that demonstrates the wave nature of light is:

a. interference effects. — INTERFERENCE ONLY HAPPENS WITH WAVES
b. finite speed of light.
c. quantization effects.
d. photoelectric effects.
e. absorption of light by an electron.

25. When light from air hits a smooth piece of glass (n = 1.5) with the ray perpendicular to the glass surface, which of the following will occur?

a. a refraction at an angle of 41.8°
b. reflection and transmission at an angle of 0°
c. a change in frequency of the light
d. dispersion
e. all of the above will occur