

Physics 241E - Final Exam - Saturday, 12/19/98 - 9:00am

1. A wave is described by the equation $y=(0.15 \text{ m})\sin^2(1.8x-40t)$, where x and y are in m and t is in s. Determine the speed (v) of the wave, and the wavelength (λ) of the wave.

- a) $v=62.5 \text{ m/s}$, $\lambda=7.85 \text{ m}$
- b) $v=22.2 \text{ m/s}$, $\lambda=3.5 \text{ m}$
- c) $v=2 \text{ m/s}$, $\lambda=1.26 \text{ m}$
- d) $v=5 \text{ m/s}$, $\lambda=10.26 \text{ m}$
- e) $v=80.5 \text{ m/s}$, $\lambda=5.26 \text{ m}$

2. A charged cork ball of mass 2 g is suspended on a light string in the presence of a uniform electric field. When $E=1 \times 10^5 \mathbf{i}$, the ball is in equilibrium, and its supporting string makes an angle of 37° with respect to the vertical. The force on the ball due to gravity is $-mg\mathbf{j}$, and the tension in the string is T . What is the charge on the ball?

- a) 147 nC
- b) 73 nC
- c) 221 nC
- d) 8 nC
- e) 56 nC

3. A solid copper sphere 15 cm in radius has a total charge of 50 nC. The electric field values at 17 cms and 12 cms from the center of the sphere are:

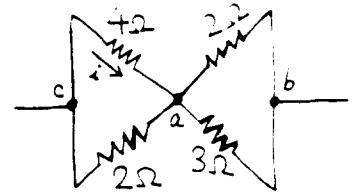
- a) $E=0$ at 12 cm, $E=1.25 \times 10^4 \text{ N/C}$ at 17 cm
- b) $E=2.5 \times 10^4 \text{ N/C}$ at 12 cm, $E=1.25 \times 10^4 \text{ N/C}$ at 17 cm
- c) $E=0$ at 12 cm, $E=2.61 \times 10^3 \text{ N/C}$ at 17 cm
- d) $E=0$ at 12 cm, $E=1.56 \times 10^4 \text{ N/C}$ at 17 cm
- e) $E=0$ at 12 cm, $E=3114 \text{ N/C}$ at 17 cm

4. At a certain point P in space, which is some distance from a point charge, q , the electric field intensity is 100 V/m, and the potential is -3000 V. The distance of the point P from the charge and the magnitude of the charge are:

- a) 30 m and $-10 \mu\text{C}$,
- b) 3m and $-1 \mu\text{C}$
- c) 6m and $-2 \mu\text{C}$
- d) 6m and $2 \mu\text{C}$
- c) 3m and $1 \mu\text{C}$

9. Part of a circuit is shown in the figure. The potential difference between points a and b is 3 V. Find current i in the $4\text{-}\Omega$ resistor.

- a) 0.33 A
- b) 1.1 A
- c) 0.55 A
- d) 0.75 A
- e) 0.83 A

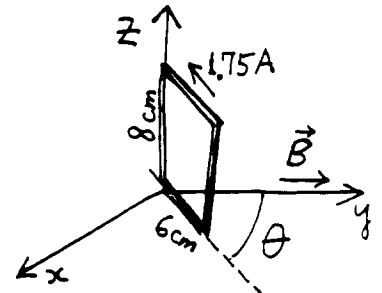


10. A solenoid of length 10 cm, area 5 cm^2 , and 150 turns has a resistance of 8Ω . The solenoid is connected across the terminals of a 12-V battery. Find the energy stored in the solenoid when the final current is attained.

- a) $7.1 \times 10^{-5}\text{ J}$
- b) $3.4 \times 10^{-4}\text{ J}$
- c) $2.8 \times 10^{-4}\text{ J}$
- d) $1.6 \times 10^{-4}\text{ J}$
- e) $3.5 \times 10^{-5}\text{ J}$

11. A rectangular, 50-turn coil carries a current of 1.75A is as shown. It is pivoted about the z axis and its plane makes an angle of 30 degrees with the yz plane. Find the torque on the coil when there is a uniform magnetic field $B=1.5\text{T j}$.

- a) 0.546 N.m k
- b) 0.592 N.m k
- c) 0.483 N.m k
- d) 0.315 N.m k
- e) 0.405 N.m k



12. A series LCR circuit is driven by an ac generator with a rms emf of 110V and at a frequency of 60 Hz. The inductance L has a reactance of 100Ω . What are R and C if the maximum average power supplied to R is 300W?

- a) 50Ω , $4.2\mu\text{F}$
- b) 30Ω , $1.8\mu\text{F}$
- c) 40Ω , $2.7\mu\text{F}$
- d) 73Ω , $7.0\mu\text{F}$
- e) 61Ω , $5.3\mu\text{F}$