Final Exam (T-002)

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Q1 Q0 The linear density of a vibrating string is 1 g/m.
002Q0 A transverse wave is propagating on the string and
17 Q0 is given by the equation:
   Q0           y(x,t) = 2.0*sin(x - 40*t),
   Q0 where x and y are in meters and t is in seconds. What
   Q0 is the tension in the string?
   Q0
   A1   1.6 N.
   A2   1.9 N.
   A3   0.9 N.
   A4   2.1 N.
   A5   5.2 N.
   Q0
Q2 Q0 A stationary source emits a sound wave of frequency f.
002Q0 If a man travels toward this stationary source with a
18 Q0 speed twice the speed of sound, he will observe the
   Q0 emitted sound to have a frequency of:
   Q0
   A1   3*f.
   A2   f/2.
   A3   2*f.
   A4   f.
   A5   indefinite frequency.
   Q0
Q3 Q0 Which of the following statements are CORRECT:
002Q0
   Q0 1. Waves carry energy and momentum.
   Q0 2. Mechanical waves need a medium to propagate.
   Q0 3. Sound waves are transverse waves.
   Q0 4. A Wave on a stretched string is a longitudinal wave.
   Q0 5. For a tube closed at one end, only odd harmonics are present.
   Q0
   A1  1, 2, and 5.
   A2  2 and 4.
   A3  1, 2 and 3.
   A4  1 and 4.
   A5  3 and 5.
   Q0
Q4 Q0 3.00-kg of water at 100 degrees Celsius is converted to steam
002Q0 at 100 degrees Celsius by boiling at one atmospheric pressure.
20 Q0 For one kg of water, the volume changes from an initial value
   Q0 of 1.0*10**(-3) m**3 as a liquid to 1.671 m**3 as steam.
   Q0 The work done by the water in this process is:
   Q0
   A1    5.07*10**5 J.
   A2    1.23*10**5 J.
   A3    2.45*10**5 J.
   A4    3.01*10**5 J.
   A5    1.69*10**5 J.
   Q0
Q5 Q0 The mass of a hydrogen molecule is 3.3*10**(-27) kg. If
002Q0 1.0*10**23 hydrogen molecules per second strike 2.0 cm**2
21 Q0 of wall at an angle of 55 degrees with the normal when
   Q0 moving with a speed of 1.0*10**3 m/s, what pressure do
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   Q0 they exert on the wall?
   Q0
   A1   1.9*10**3 Pa.
   A2   2.8*10**3 Pa.
   A3   5.7*10**3 Pa.
   A4   8.6*10**3 Pa.
   A5   0.9*10**3 Pa.
   Q0
Q6 Q0 Which of the following statements are CORRECT:
002Q0
   Q0 1. Two objects are in thermal equilibrium if they have the same
   Q0     temperature.
   Q0 2. In an isothermal process, the work done by an ideal gas is
   Q0    equal to the heat energy
   Q0 3. In an adiabatic process, no heat enters or leaves the system.
   Q0 4. The thermal efficiency of an ideal engine can be = 1.0.
   Q0 5. For any process the change in entropy of a closed system < 0.
   Q0
   A1  1, 2, and 3.
   A2  4 and 5.
   A3  1, 2 and 5.
   A4  1 and 4.
   A5  3 and 5.
   Q0
Q7 Q0 Two positive charges, q1 and q2, lie on the x-axis. The first
002Q0 charge, q1 = 12.0*10**(-6) C, is at the origin, and the second
22 Q0 charge, q2 = 3.0*10**(-6) C, is at 3.0 m. Where must a
   Q0 negative charge, q3, be placed on the x-axis such that
   Q0 the resultant force on it is zero?
   Q0
   A1   2.0  m.
   A2 - 1.5  m.
   A3   3.0  m.
   A4   1.0  m.
   A5 - 1.0  m.
   Q0
Q8 Q0 An electric dipole, of electric charge 9.3*10**(-12) C and
002Q0 distance 1.0*10**(-3) m, is in an electric field of strength
23 Q0 1100 N/C. What is the difference in potential energy
   Q0 corresponding to dipole orientations parallel and
   Q0 anti-parallel to the field?
   Q0
   A1   2.05*10**(-11) J.
   A2   1.03*10**(-11) J.
   A3   6.15*10**(-15) J.
   A4   4.08*10**(-13) J.
   A5   3.87*10**(-11) J.
   Q0
   Q0
Q9 Q0 A ball of charge -50 e lies at the center of a hollow spherical
002Q0 metal shell that has a net charge of -100 e. What is the charge
24 Q0 on the outer surface of the shell?
   Q0
   A1   -150 e.
   A2   -100 e.
   A3   - 50 e.
   A4    100 e.
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   A5    150 e.
   Q0
Q10Q0 In figure (8), a hollow sphere, of radius r that carries a
25 Q0 negative charge -q, is put inside another hollow sphere, of
002Q0 radius R that carries a positive charge Q. At a distance x from
   Q0 the common center, such that r < x < R, the potential is:
   Q0
   A1  k*[(Q/R)-(q/x)].
   A2  k*[(Q/R)-(q/r)].
   A3  k*[(Q/R)+(q/x)].
   A4  k*[(Q/R)+(q/r)].
   A5  k*[(Q/x)-(q/R)].
   Q0
   Q0
Q11Q0  The electric potential in a certain region is given by:
25 Q0           V(x,y,z) = -4*x*z - 5*y + 3*(z**2)  Volts,
002Q0 where x, y and z are in meters. What is the magnitude of
   Q0 the electric field at the point (+2,-1,-3)?
   Q0
   A1  29  V/m.
   A2  25  V/m.
   A3  35  V/m.
   A4  125 V/m.
   A5  10  V/m.
   Q0
Q12Q0 A parallel combination of two capacitors, C1 and C2
002Q0 where C2=2*C1, is connected to a battery. If the charge
26 Q0 accumulated on C1 is 2.0*10**(-6) C and the total
   Q0 energy stored in the combination is 12.0*10**(-9) Joule,
   Q0 then the capacitance of C2 is:
   Q0
   A1  1.0*10**(-3) F.
   A2  2.5*10**(-6) F.
   A3  1.5*10**(-6) F.
   A4  1.5*10**(-3) F.
   A5  3.0*10**(-6) F.
   Q0
Q13Q0 An electric device, which heats water by immersing a
27 Q0 resistance wire in the water, generates 153 J of heat per
992Q0 second when an electric potential difference of 12 V is
   Q0 placed across its ends. What is the resistance of the
   Q0 heater wire?
   Q0
   A1 0.94 Ohms
   A2 0.81 Ohms
   A3 0.58 Ohms
   A4 0.48 Ohms
   A5 2.10 Ohms
   Q0
Q14Q0 The capacitor in figure (1) is initially charged to 50 V and
28 Q0 then the switch is closed. What charge flows out of the
002Q0 capacitor during the first minute after the switch was closed?
   Q0
   A1  4.8 mC.
   A2  0.3 mC.
   A3  3.6 mC.
   A4  1.4 mC.
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   A5  1.7 mC.
Q15Q0
002Q0 In figure (2), if Vc-Vd=6.0 Volts, what is the emf of the
28 Q0 battery?
   Q0
   A1   10.8   Volts.
   A2    9.61  Volts.
   A3   13.9   Volts.
   A4   18.2   Volts.
   A5   11.7   Volts.
   Q0
Q16Q0 The sum of the currents entering a junction equals the sum
28 Q0 of the currents leaving that junction is a consequence of:
991Q0
002A1 conservation of charge
   A2 conservation of energy
   A3 Coulomb's law
   A4 Ampere's law
   A5 Newton's second law
   Q0
Q17Q0 Find the values of the currents in figure (3).
28 Q0
200Q0
   A1 I1 =  2 A, I2 =  2 A, I3 = -4 A.
   A2 I1 =  2 A, I2 =  2 A, I3 =  4 A.
   A3 I1 = -2 A, I2 = -2 A, I3 = -4 A.
   A4 I1 = -2 A, I2 =  2 A, I3 =  zero.
   A5 I1 =  2 A, I2 = -2 A, I3 =  zero.
   Q0
   Q0
Q18Q0 Which of the following statements are WRONG:
002Q0
   Q0 1. In order to achieve the lowest resistance from several
   Q0    resistors, they should be connected in parallel.
   Q0 2. In order to achieve the lowest capacitance from several
   Q0    capacitors, they should be connected in parallel.
   Q0 3. The resistance of a conductor does not depend on temperature.
   Q0 4. A dielectric increases the capacitance of a capacitor.
   Q0 5. The electric flux through a closed surface is always zero.
   Q0
   A1  2, 3 and 5.
   A2  2 and 4.
   A3  1, 2 and 3.
   A4  1 and 4.
   A5  1 and 3.
   Q0
Q19Q0 An electron is projected into a uniform magnetic field
29 Q0 B = (0.8 k) T. Find the magnitude of the magnetic force,
002Q0 on the electron when the velocity is:
   Q0           v = (5.0*10**5 i + 3.0*10**5 j) m/sec.
   Q0 (i, j and k are the unit vectors in the x, y and z directions,
   Q0 respectively).
   Q0
   A1 7.5*10**(-14) N.
   A2 5.2*10**(-15) N.
   A3 7.8*10**(-18) N.
   A4 1.2*10**(-13) N.
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   A5 ZERO.
   Q0
Q20Q0 In figure (4), a loop of wire carrying a current, I, of 2.0 A
29 Q0 is in the shape of a right triangle with two equal sides, each
002Q0 15 cm long. A 0.7 T uniform magnetic field is in the plane
   Q0 of the triangle and is perpendicular to the hypotenuse.
   Q0 The resultant magnetic force on the two equal sides is:
   Q0
   A1  0.30 N, into the page.
   A2  0.30 N, out of the page.
   A3  0.41 N, into the page.
   A4  0.41 N, out of the page.
   A5  Zero.
   Q0
Q21Q0 A magnetic field CANNOT:
29 Q0
002A1 change the kinetic energy of a charge.
   A2 exert a force on a charge.
   A3 accelerate a charge.
   A5 exert a torque on a charged particle.
   A4 change the momentum of a charge.
   Q0
Q22Q0 Electrons are accelerated from rest through a potential
29 Q0 difference of 500 V. They are then deflected by a magnetic
993Q0 field of 0.2 T that is perpendicular to their velocity. The
   Q0 radius of the electrons trajectory is:
   Q0
   A1 0.38 milli-m.
   A2 0.15 milli-m.
   A3 1.6  milli-m.
   A4 2.4  milli-m.
   A5 0.54 milli-m.
   Q0
Q23Q0 The current loop in figure (5) consists of one loop with two
   Q0 semicircles of different radii. If the current in the circuit
29 Q0 is 19 A, a = 3.0 cm and b = 5.0 cm, then the magnetic dipole
   Q0 moment of the current loop is:
   Q0
   A1 0.10 A*m**2, into the page.
   A2 0.10 A*m**2, out of the page.
   A3 0.02 A*m**2, out of the page.
   A4 0.02 A*m**2, into the page.
   A5 1.15 A*m**2, into the page.
   Q0
Q24Q0 A conductor consists of a circular loop of radius R = 0.10 m
30 Q0 and two straight, long sections, as in Figure (6). The wire
001Q0 lies in the plane of the paper (xy-plane) and carries a current
   Q0 of I = 5.3 A. Determine the magnetic field, in Tesla, at the
   Q0 center of the loop. (k is a unit vector in +z-direction)
   Q0
   A1 -4.4*10**(-5) k.
   A2  5.8*10**(-5) k.
   A3 -5.8*10**(-5) k.
   A4  4.4*10**(-5) k.
   A5  1.8*10**(-5) k.
   Q0
Q25Q0 A long solid cylindrical conductor of radius R= 4.0 mm carries
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30 Q0 a current I parallel to its axis. The current density in the
993Q0 wire is 2*10**4 A/m**2. Determine the magnitude of the magnetic
   Q0 field at a point that is 5.0 mm from the axis of the conductor.
   Q0
   A1 40  micro-T.
   A2 17  micro-T.
   A3 12  micro-T.
   A4 30  micro-T.
   A5 55  micro-T.
   Q0
Q26Q0 A solenoid is 3.0 m long and has a circumference of
30 Q0 9.4*10**(-2) m. It carries a current of 12.0 A. The magnetic
   Q0 field inside the solenoid is 25.0*10**(-3) T. The length
   Q0 of the wire forming the solenoid is:
   Q0
   A1  467 m.
   A2  245 m.
   A3  233 m.
   A4  410 m.
   A5  900 m.
   Q0
   Q0
Q27Q0 Suppose that the identical currents I in figure (7) are all
30 Q0 out of the page. The magnitude of the force per unit length
002Q0 on the wire at the origin is:
   Q0 [take I = 10.0 A, and a = 1.0*10**(-4) m.]
   Q0
   A1 0.28  N/m.
   A2 0.17  N/m.
   A3 0.18  N/m.
   A4 0.30  N/m.
   A5 0.55  N/m.
   Q0
Q28Q0 Faraday's law states that an induced emf is proportional to:
31 Q0
002Q0
   Q0
   A1   the rate of change of magnetic flux.
   A2   the rate of change of magnetic field.
   A3   the rate of change of electric flux.
   A4   the rate of change of electric field.
   A5   the rate of change of gravitational field.
   Q0
Q29Q0 A magnet is taken towards a metallic ring in such a way that
31 Q0 a constant current of 10**(-2) A is induced in it. The total
002Q0 resistance of the ring is 0.25 Ohm. In 10 seconds, the flux
   Q0 of the magnetic field through the ring changes by:
   Q0
   A1   2.5*10**(-2) Wb.
   A2   2.5*10**(-3) Wb.
   A3   2.5*10**(-6) Wb.
   A4   2.5*10**(-1) Wb.
   A5   2.5*10**(-9) Wb.
   Q0
Q30Q0 Consider a circular loop of wire within which the magnetic flux,
31 Q0 Phi, is given as a function of time, t, as
002Q0             Phi =  a*t**2 + b,
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Q0 where a and b are constants. If the induced emf is measured as
Q0 48 V at t=3 s, what is the value of a?
Q0
A1   - 8.0 V/s.
A2   - 3.2 V/s.
A3   - 6.0 V/s.
A4   - 4.0 V/s.
A5   - 2.1 V/s.
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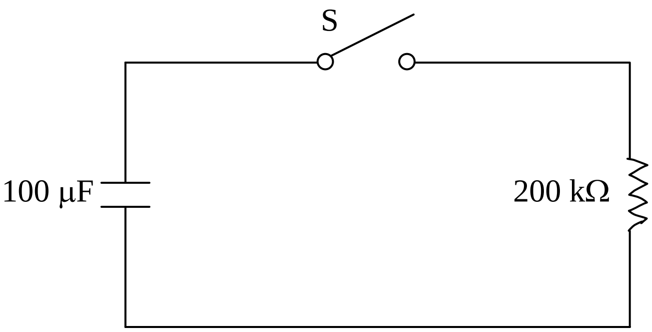


Figure 1

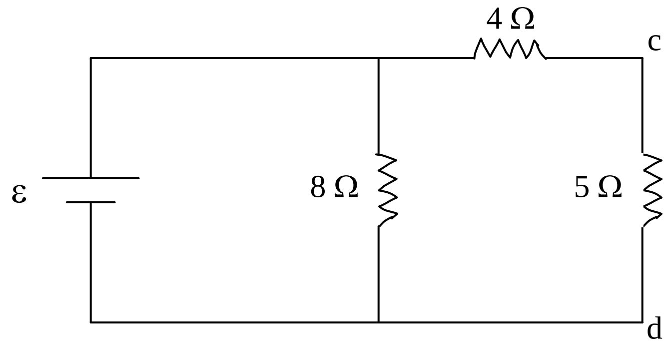


Figure 2

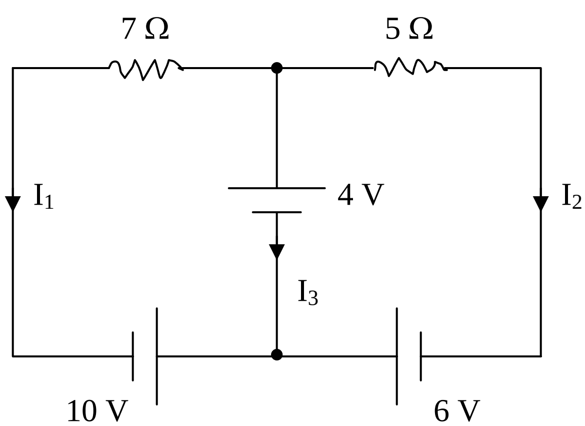
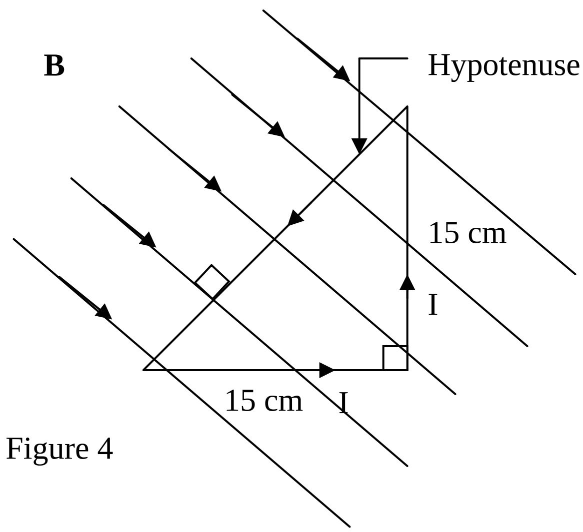


Figure 3



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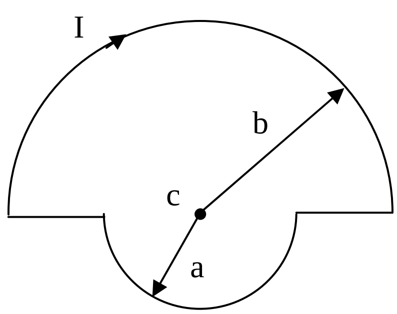
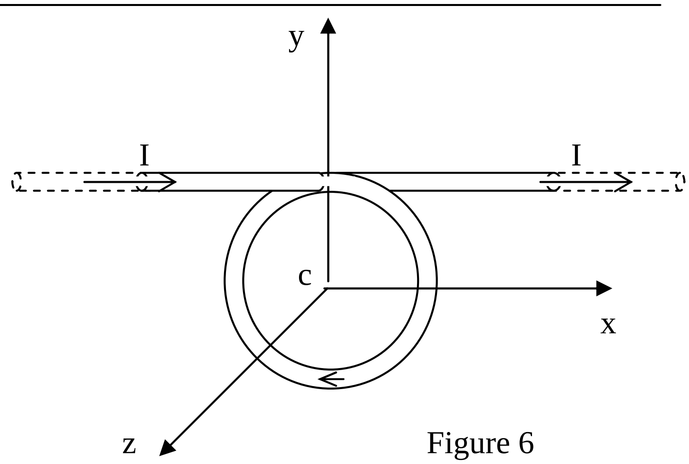


Figure 5



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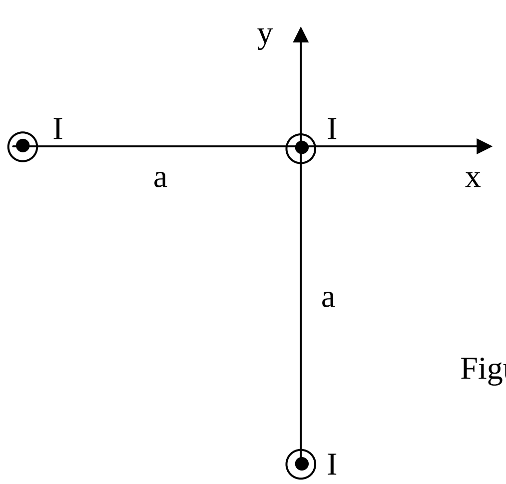

Figure 7

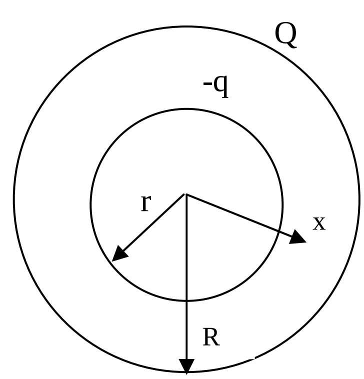

Figure 8