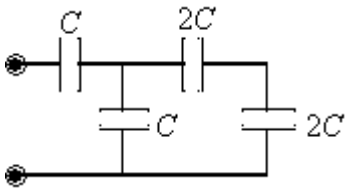
Name: _____ **Class:** _____ **Date:** _____ **ID: A**

w9final

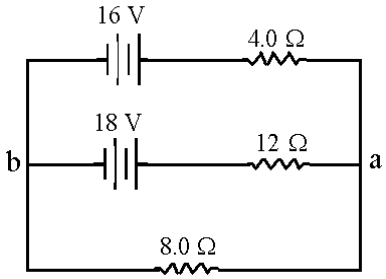
Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 1. If $C = 36\ \mu$F, determine the equivalent capacitance for the combination shown.



a. 24 μF
b. 28 μF
c. 36 μF
d. 32 μF
e. 20 μF

____ 2. What is the potential difference between points a and b?



a. 24 V
b. 27 V
c. 6 V
d. 8 V
e. 12 V

____ 3. Consider two charged spheres, one with charge +2 C and the other with −2 C. A proton (a positively charged particle) is at the point halfway between the spheres. What is not zero?
a. the dipole moment of the proton
b. the work to move the proton from infinity to that point
c. all of the four above are zero
d. the force on the proton
e. the potential energy of the proton

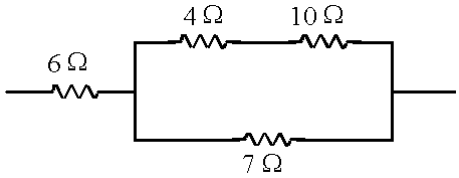
____ 4. A solid conducting sphere of 10 cm radius has a net charge of 20 nC. If the potential at infinity is taken as zero, what is the potential at the center of the sphere?
   a. 36 μV
   b. 360 μV
   c. 1.8×10^3 V
   d. $=1.8 \times 10^4$ V
   e. $>1.8 \times 10^4$ V

____ 5. An initially uncharged hollow metallic sphere with radius of 5 cm has a small object with a charge of +10 μC carefully placed at the center of the sphere through a hole in the latter's surface. With the charge in place, what charge is now present on the outside surface of the sphere?
   a. +10 μC
   b. +4 000 μC
   c. zero
   d. −10 μC
   e. −4000 μC

____ 6. A proton moving at 3.0×10^4 m/s is projected at an angle of 30° above a horizontal plane. If an electric field of 400 N/C is acting down, how long does it take the proton to return to the horizontal plane? (Hint: Ignore gravity. $m_{\text{proton}} = 1.67 \times 10^{-27}$ kg, $q_{\text{proton}} = 1.6 \times 10^{-19}$ C)
   a. 1.7×10^{-6} s
   b. 7.8×10^{-7} s
   c. 1.0×10^{-5} s
   d. 3.9×10^{-6} s
   e. 7.8×10^{-6} s

____ 7. A circular loop carrying a current of 1.0 A is oriented in a magnetic field of 0.35 T. The loop has an area of 0.24 m^2 and is mounted on an axis, perpendicular to the magnetic field, which allows the loop to rotate. If the plane of the loop is oriented parallel to the field, what torque is created by the interaction of the loop current and the field?
   a. 0.0093 N·m
   b. 5.8 N·m
   c. 0.017 N·m
   d. 0.68 N·m
   e. 0.084 N·m

____ 8. Resistors of values 6.0Ω, 4.0Ω, 10.0Ω and 7.0Ω are combined as shown. What is the equivalent resistance for this combination?



   a. 3.0 Ω
   b. 30 Ω
   c. 2.3 Ω
   d. 10.7 Ω
   e. 27 Ω

____ 9. By what factor is the self-inductance of an air solenoid changed if only its number of coil turns, N, is tripled?
a. 1/3
b. 6
c. 9
d. 3
e. 1/9

____ 10. A 500-turn circular coil with an area of 0.050 0 m^2 is mounted on a rotating frame, which turns at a rate of 20.0 rad/s in the presence of a 0.050 0-T uniform magnetic field that is perpendicular to the axis of rotation. What is the instantaneous emf in the coil at the moment that the normal to its plane is at a 90.0° angle to the field?
a. 37.5 V
b. zero
c. 21.6 V
d. 12.5 V
e. 25.0 V

____ 11. A high-voltage power line 20 m above the ground carries a current of 2 000 A. What is the magnetic field due to the current directly underneath the power line? ($\mu_0 = 4\pi \times 10^{-7}$ T·m/A)
a. 0.20 T
b. 35 μT
c. 20 μT
d. 14 mT
e. 0.30 T

____ 12. Two identical iron spheres have equal positive charges and the force between them when they are 1 m apart is 1 N. What percentage of the electrons has been removed from each sphere if each sphere has 1 mole (6×10^{23}) of iron atoms? ($k_e = 8.99 \times 10^9$ N·m²/C², the atomic number of iron is 26, and the electron charge is -1.6×10^{-19} C)
a. 1×10^{-8} %
b. 2×10^{-12} %
c. 0.001%
d. 4×10^{-10} %
e. 0.000 002%

____ 13. A parallel-plate capacitor has a capacitance of 20 μF. What potential difference across the plates is required to store 7.2×10^{-4} C on this capacitor?
a. 18 V
b. 36 V
c. 68 V
d. 1.4×10^{-8} V
e. 2.2×10^{-2} V

____ 14. Charges of 4.0 μC and −6.0 μC are placed at two corners of an equilateral triangle with sides of 0.10 m. At the third corner, what is the electric field magnitude created by these two charges? ($k_e = 8.99 \times 10^9$ N·m²/C²)
a. 3.1×10^6 N/C
b. 4.8×10^6 N/C
c. 1.6×10^6 N/C
d. 4.5×10^6 N/C
e. 7.5×10^6 N/C

____ 15. An electric car is designed to run off a bank of 12-V batteries with total energy storage of 3.0×10^7 J. If the electric motor draws 6 000 W in moving the car at a steady speed of 10 m/s, how far will the car go before it is "out of juice?"
a. 25 km
b. 150 km
c. 100 km
d. 50 km
e. 250 km

____ 16. Wire A and Wire B are each carrying the same current. If the diameter of Wire A is twice that of Wire B, how does the drift velocity v_{dA} in Wire A compare to that in Wire B?
a. $v_{dA} = 4\, v_{dB}$
b. $v_{dA} = v_{dB}/4$
c. $v_{dA} = 2\, v_{dB}$
d. $v_{dA} = v_{dB}$
e. $v_{dA} = v_{dB}/2$

____ 17. A superconducting solenoid is to be designed to generate a magnetic field of 5.00 T. If the solenoid winding has 1 000 turns/m, what is the required current? ($\mu_0 = 4\pi \times 10^{-7}$ T·m/A)
a. 1 990 A
b. 7 820 A
c. 1 000 A
d. 3 980 A
e. 5 000 A

____ 18. A deuteron, with the same charge but twice the mass of a proton, moves with a speed of 3.0×10^5 m/s perpendicular to a uniform magnetic field of 0.20 T. Which of the paths described below would it follow? ($q_p = 1.6 \times 10^{-19}$ C and $m_d = 3.34 \times 10^{-27}$ kg)
a. a circular path of 1.6 cm radius
b. a circular path of 0.39 cm radius
c. a circular path of 0.78 cm radius
d. a straight line path
e. a circular path of 3.1 cm radius

____ 19. A bar magnet is falling through a loop of wire with constant velocity. The south pole enters first. As the magnet leaves the wire, the induced current (as viewed from above):
a. is counterclockwise.
b. is along the length of the magnet.
c. is zero.
d. More information is needed.
e. is clockwise.

____ 20. A nichrome wire has a radius of 0.50 mm and a resistivity of 1.5×10^{-6} Ω·m. What is the resistance per unit length of this wire?
a. 0.95 Ω/m
b. 1.6 Ω/m
c. 0.001 5 Ω/m
d. 1.9 Ω/m
e. 7.4 Ω/m

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Answer Section

MULTIPLE CHOICE

1. ANS: A DIF: 2
   TOP: 16.7 The Parallel-Plate Capacitor, 16.8 Combinations of Capacitors
2. ANS: E DIF: 3
   TOP: 18.4 Kirchhoff's Rules and Complex DC Circuits
3. ANS: D DIF: 1
   TOP: 16.2 Electric Potential and Potential Energy Due to Point Charges, 16.3 Potentials and Charged Conductors, 16.4 Equipotential Surfaces
4. ANS: C DIF: 3
   TOP: 16.2 Electric Potential and Potential Energy Due to Point Charges, 16.3 Potentials and Charged Conductors, 16.4 Equipotential Surfaces
5. ANS: A DIF: 2 TOP: 15.6 Conductors in Electrostatic Equilibrium
6. ANS: B DIF: 3 TOP: 15.4 The Electric Field
7. ANS: E DIF: 2
   TOP: 19.5 Torque on a Current Loop and Electric motors
8. ANS: D DIF: 2
   TOP: 18.1 Sources of emf, 18.2 Resistors in Series, 18.3 Resistors in Parallel
9. ANS: C DIF: 2 TOP: 20.6 Self-Inductance
10. ANS: E DIF: 3 TOP: 20.5 Generators
11. ANS: C DIF: 2
    TOP: 19.7 Magnetic Field of a Long, Straight Wire and Ampere's Law
12. ANS: D DIF: 3 TOP: 15.6 Conductors in Electrostatic Equilibrium
13. ANS: B DIF: 2 TOP: 16.6 Capacitance
14. ANS: B DIF: 3 TOP: 15.4 The Electric Field
15. ANS: D DIF: 2 TOP: 17.8 Electrical Energy and Power
16. ANS: B DIF: 2
    TOP: 17.2 A Microscopic View: Current and Drift Speed
17. ANS: D DIF: 2
    TOP: 19.9 Magnetic fields of Current Loops and Solenoids
18. ANS: E DIF: 2
    TOP: 19.6 Motion of a Charge Particle in a Magnetic field
19. ANS: A DIF: 2 TOP: 20.2 Faraday's Law of Induction
20. ANS: D DIF: 2 TOP: 17.5 Resistivity