Bassav

Physics 1c.Quiz 1.

Problem 1.

In Millikan's oil drop experiment, if the electric field between the plates was of just the right magnitude, it would exactly balance the weight of the drop. Suppose a tiny spherical oil droplet of radius $1.6 \times 10^{-4}$ cm carries a charge equivalent to one electron. What electric field is required to balance the weight? (The density of oil is 0.85 g/cm$^3$, $e = 1.6 \times 10^{-19}$ C.)

a. $1.1 \times 10^5$ N/C
b. $2.2 \times 10^5$ N/C
c. $4.5 \times 10^5$ N/C
d. $8.9 \times 10^5$ N/C
e. $6.2 \times 10^5$ N/C

Problem 2

A flat surface having an area of 4.8 m$^2$ is rotated in a uniform electric field of magnitude E = 6.2 x 10$^5$ N/C. Determine the electric flux through this area (1) when the electric field is perpendicular to the surface and (2) when the electric field is parallel to the surface.

~~A 1→ $\Phi_E$=2.0x10$^6$ Nm$^2$/C; 2→ $\Phi_E$=0~~
B 1→ $\Phi_E$=3.0x10$^6$ Nm$^2$/C; 2→ $\Phi_E$=0
C 1→ $\Phi_E$=0; 2→ $\Phi_E$=3.0x10$^6$ Nm$^2$/C
D 1→ $\Phi_E$=0; 2→ $\Phi_E$=2.0x10$^6$ Nm$^2$/C
~~E 1→ $\Phi_E$=2.0x10$^6$ Nm$^2$/C; 2→ $\Phi_E$=0~~

E A

$\phi = (6.2 \times 10^5)(4.8)$

Problem 3

An uncharged conducting metal spherical shell surrounds a charge +q. Find the electric field at radius $r_a$, $r_b$, and $r_c$

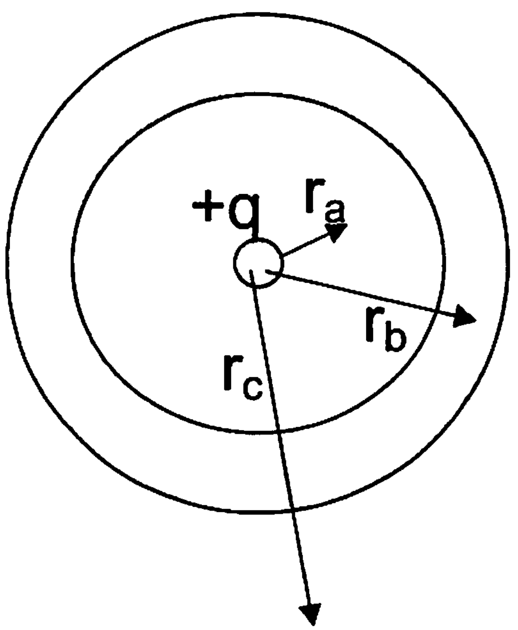
(√)

a) $E_a = \frac{q}{4\pi\varepsilon_0 r_a^2}$ $E_b = 0$ $E_c = \frac{q}{4\pi\varepsilon_0 r_c^2}$

b) $E_a = \frac{q}{4\pi\varepsilon_0 r_a^2}$ $E_b = \frac{q}{4\pi\varepsilon_0 r_b^2}$ $E_c = 0$

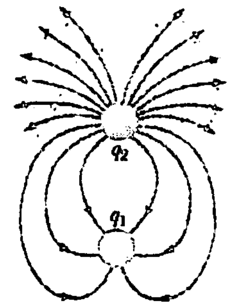
c) $E_a = \frac{q}{4\pi\varepsilon_0 r_a^2}$ $E_b = \frac{q}{4\pi\varepsilon_0 r_b^2}$ $E_c = \frac{q}{4\pi\varepsilon_0 r_c^2}$

d) $E_a = 0$ $E_b = \frac{q}{4\pi\varepsilon_0 r_b^2}$ $E_c = \frac{q}{4\pi\varepsilon_0 r_c^2}$



Problem 4

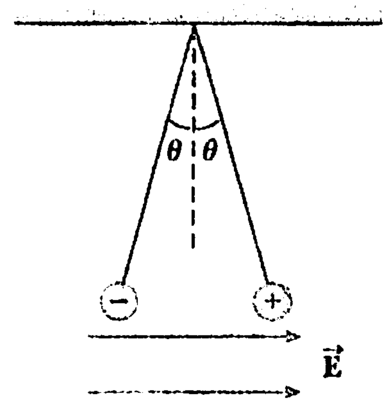
Diagram shows the electric field lines for two point charges separated by a small distance. (1) Determine the ratio $q_1/q_2$. (2) What are the signs of $q_1$ and $q_2$?




A $q_1/q_2=-1/3$; $q_2>0$, $q_1<0$
B $q_1/q_2=1/3$; $q_2>0$, $q_1>0$
C $q_1/q_2=-2/3$; $q_2>0$, $q_1<0$
D $q_1/q_2=2/3$; $q_2>0$, $q_1>0$
E $q_1/q_3=-3$; $q_2>0$, $q_1<0$

Problem 5

Two 2.0-g spheres are suspended by 10,0-cm long light strings (see diagram). A uniform electric field is applied in the x-direction. If the spheres have charges $-5.0\times10^{-8}$ C and $+5.0\times10^{-8}$ C, determine the electric field intensity that enables the spheres to be in equilibrium at $\theta=10^0$.




a) $E=4.4\times10^5$ N/C
b) $E=2.2\times10^5$ N/C
c) $E=8.8\times10^5$ N/C
d) $E=1.1\times10^5$ N/C
e) $E=1.7\times10^6$ N/C

Problem 6

Two identical conducting spheres are placed with their centers 0.30 m apart. One is given a charge of $12 \times 10^{-9}$C, the other a charge of $-18 \times 10^{-9}$C. (1) Find the electrostatic force exerted on one sphere by the other. (2) The spheres are connected by a conducting wire. Find the electrostatic force between the two after equilibrium is reached.

a) 1→ $2.2\times10^{-5}$ N; 2→ $9.0\times10^{-7}$ N
b) 1→ $9.0\times10^{-7}$ N; 2→ $2.2\times10^{-5}$ N
c) 1→ $1.1\times10^{-5}$ N; 2→ $4.5\times10^{-7}$ N
d) 1→ $2.2\times10^{-7}$ N; 2→ $9.0\times10^{-5}$ N
e) 1→ $1.1\times10^{-7}$ N; 2→ $4.5\times10^{-5}$ N

Physics 1B-c Winter 2008 Quiz 2. Chapter 16 **FORM D**

**Problem 1**

There is a hollow, conducting, uncharged sphere with a negative charge inside the sphere. Consider the electrical potential at the inner and outer surfaces of the sphere. Which of the following is true?

a. The potential on the inner surface is greater.
b. The potential on the outer surface is greater.
c. The potentials on both surfaces are zero.
d. The potentials on both surfaces are equal but not zero.

**Problem 2**

Determine the potential energy of the charge distribution shown in the diagram

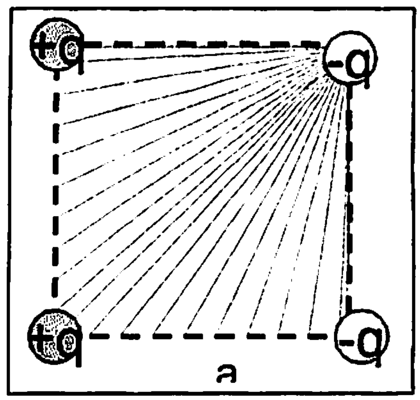
a) $PE = \frac{-2kq^2}{a\sqrt{2}}$

b) $PE = \frac{kq^2}{a\sqrt{2}}$

c) $PE = \frac{-kq^2}{a\sqrt{2}}$

d) $PE = \frac{kq^2}{a}$

e) $PE = 0$

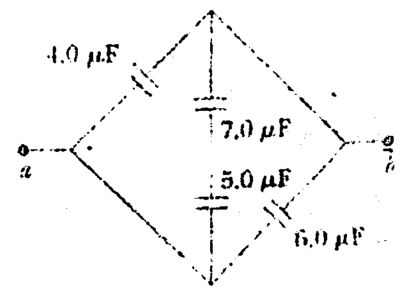



**Problem 3**

A 10.0 μF capacitor is fully charged across a 12V battery. The capacitor is then disconnected from the battery and connected across an initially uncharged capacitor with capacitance C. The resulting voltage across each capacitor is 3.00V. What is the value of C?

a) C = 2.5 μF
b) C = 5 μF
c) C = 20 μF
d) C = 30 μF
e) C = 40 μF

**Problem 4**
Find the equivalent capacitance between points a and b in the combination of capacitors in the diagram.




a) C = 12.9 μF
b) C = 7.7 μF
c) C = 10.0 μF
d) C = 2.0 μF
e) C = 22.0 μF

**Problem 5**
A 0.25-μF capacitor is connected to a 400-V battery. What potential energy is stored in the capacitor?

a. $1.2 \times 10^{-12}$ J
b. 0.020 J
c. 0.003 J
d. $1.0 \times 10^{-4}$ J
e. 0.040 J

**Problem 6**
An electron is released from rest at the negative plate of a parallel-plate capacitor. If the distance between the plates is 5.0 mm and the potential difference between the plates is 5.0 V, with what velocity does the electron hit the positive plate?
($m_e = 9.1 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C)

a. $2.6 \times 10^{5}$ m/s
b. $2.6 \times 10^{6}$ m/s
c. $1.0 \times 10^{6}$ m/s
d. $5.3 \times 10^{6}$ m/s
e. $1.3 \times 10^{6}$ m/s

Quiz 3 Chapter 17 **FORM A**

**Problem 1**

Find the drift velocity of electrons in a copper wire with a current I=10 A and a cross-sectional area $A=3x10^{-6}$ $m^2$. Use density of Cu, ρ=8.95 $g/cm^3$ (each atom of Cu contributes 1 carrier electron) MA=63.5g/mole

a) $V_d=2.5x10^2$ m/s
b) $V_d=2.5x10^{-4}$ m/s
c) $V_d=1.0x10^{-4}$ m/s
d) $V_d=1.6x10^{-2}$ m/s
e) $V_d=5.0x10^{-2}$ m/s

**Problem 2**

An 8.00 Ω resistor is dissipating 100 watts. What is the current through the resistor, and the potential difference across it?

a) I=3.53 A, V=28.3 V
b) I=12.5 A, V=100 V
c) I=0.44 A, V=3.53 V
d) I=1.41 A, V=11.3 V
e) I=7.06 A, V=56.6 V

$$V=\sqrt{PR}=\sqrt{(100)(8)}$$
$$I=\sqrt{P/R}=\sqrt{\frac{100}{8}}$$

**Problem 3**

A metal wire has a resistance of 25.00 Ω under room temperature conditions of 20 °C. When the wire is heated to 80 °C the resistance increases by 0.75 Ω. What is the temperature coefficient of resistivity (α) of this metal?

$$R=R_0[1+\alpha(T-T_0)]$$
$$R_0=25\,\Omega$$
$$25.75=25[1+\alpha(80-20)]$$

a) $\alpha = 1.2x10^{-2}\ C^{-1}$
b) $\alpha = 1.6x10^{-2}\ C^{-1}$
c) $\alpha = 3.1x10^{-4}\ C^{-1}$
d) $\alpha = 5.0x10^{-4}\ C^{-1}$
e) $\alpha = 2.2x10^{-4}\ C^{-1}$

**Problem 4**
A copper cable is designed to carry a current of 300 A with a power loss of 2.00 W/m. What is the required radius of this cable? (Resistivity of copper is approximately $\rho = 1.7 \times 10^{-8}\ \Omega \cdot m$)

a) r=0.077 m
b) $r=7.7\times10^{-4}$ m
c) r=0.011 m
d) r=0.016 m
e) $r=1.5\times10^{-4}$ m

**Problem 5**
A microbiologist measures the total current due to potassium ions (K+) moving through a cell membrane of a rock crab neuron cell to be 30 nA. How many ions pass through the membrane each second?

a) 2.50 nmole
b) 0.050 pmole
c) 1.88 nmole
d) 1.88 pmole
e) 0.311 pmole

**Problem 6**
The resistivity of copper as a function of temperature is given approximately by $\rho = \rho_o[1 + \alpha(T-T_o)]$ where $\rho = 1.7\times10^{-8}\ \Omega\cdot m$ at T=20 °C and $\alpha = 4.3\times10^{-3}\ C^{-1}$. Find the temperature at which the copper's resistivity is twice its room-temperature value.

a) 253 C
b) 150 C
c) 40 C
d) 486 C
e) 298 C

$$\rho = \rho_o [1 + \alpha (T - T_o)]$$

$$1.7\times10^{-8} = \rho_o [1 + 4.3\times10^{-3} (?$$

$$T = \frac{\rho - \rho_o}{\alpha \rho_o} + T_o$$

$$\frac{1.7\times10^{-8} - 3.9\times10^{-3}}{4.3\times10^{-3}(3.9\times10^{-3})} + 20$$

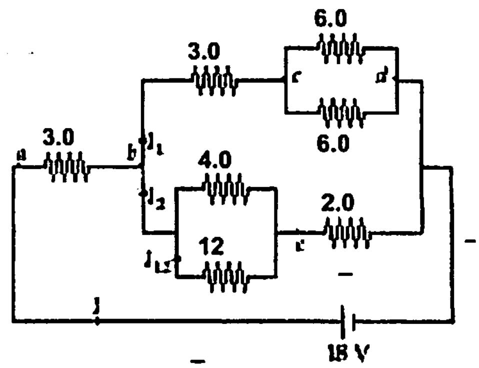
Quiz 4: Ch 18-19

**FORM C**

**Problem 1**

Find the current through the 12 Ω resistor.

a) $I_{12} = 1.23$ A
b) $I_{12} = 0.41$ A
c) $I_{12} = 3.14$ A
d) $I_{12} = 1.65$ A
e) $I_{12} = 1.50$ A

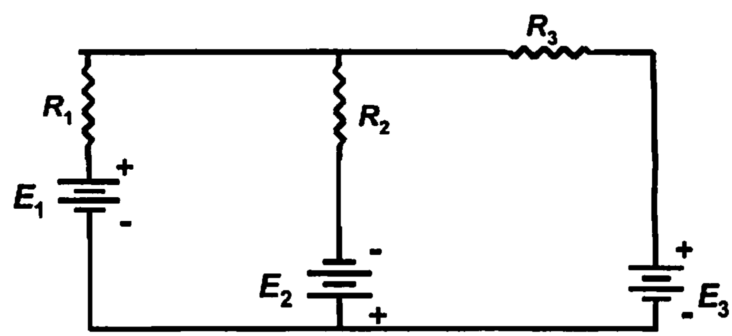



**Problem 2**

Find the current through $R3$.

($E1 = 12$ V, $E2 = 3$ V, $E3 = 3$ V, $R1 = 1$ Ω, $R2 = 5$ Ω, $R3 = 5$ Ω)

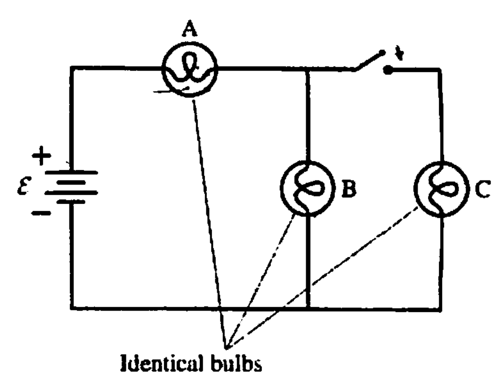
a) I3 = 1.11 A
b) I3 = 1.33 A
c) I3 = 0.60 A
d) I3 = 0.30 A
e) I3 = 0.79 A




**Problem 3**

Lightbulb puzzle: Initially the switch is open. The current is the same through lightbulbs A and B whereas bulb C is obviously not glowing. What happens to the brightness of A and B when the switch is closed.

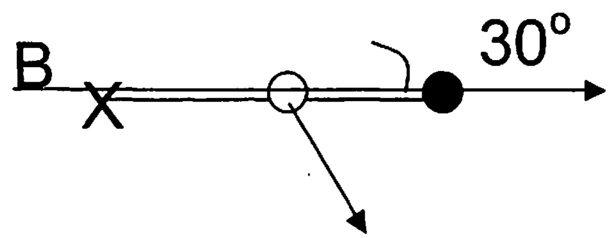
a) Brightness of A stays the same; B decreases
b) Brightness of A increases; B stays the same
c) Brightness of A increases; B decreases
d) Brightness of A decreases; B decreases
e) Brightness of A decreases, B increases



**Problem 4**

A 3A current wire-loop (with 100 turns) and an area of $0.2\ m^2$ makes an angle of 30° with a magnetic field of 0.3T. (1) Find the torque exerted on the coil. (2) What is the direction of rotation?

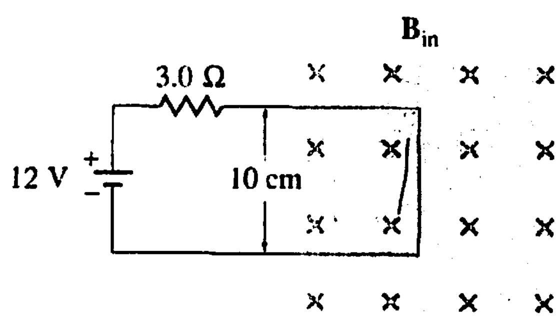
a) $\tau$=16 Nm, counterclockwise
b) $\tau$=9.0 Nm, counterclockwise
c) $\tau$=9.0 Nm, clockwise
d) $\tau$=16 Nm, clockwise
e) $\tau$=3.0 Nm, clockwise




**Problems 5**

A wire of negligible resistance is bent into a rectangle as shown in the diagram and a battery and resistor are connected as shown. The right-hand side of the circuit extends into a region containing a uniform magnetic field of 38 mT pointing into the page. Find the magnitude and direction of the net force on the circuit.

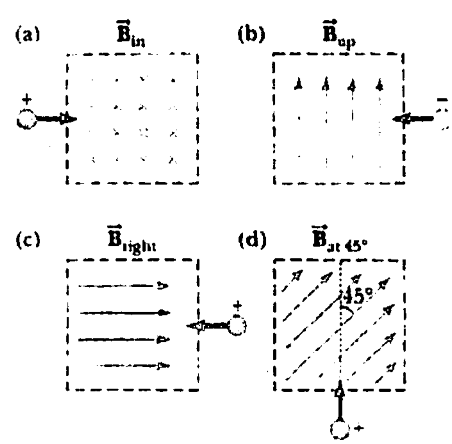
a) F=0.015 N, to the right
b) F=0.030 N, up
c) F=0.015 N, to the left
d) F=0.011 N, to the right
e) F=0.030 N, down




**Problem 6**

Find the direction of the force acting on charged particles moving the various situations shown in the diagram.

a) (a) In, (b) Up, (c) Right, (d) Up and Right
b) (a) Down, (b) In, (c) No force, (d) Out
c) (a) Up, (b) Out, (c) No force, (d) In
d) (a) Up, (b) Out, (c) Down, (d) Left
e) (a) Down, (b) Out, (c) No force, (d) In and Left



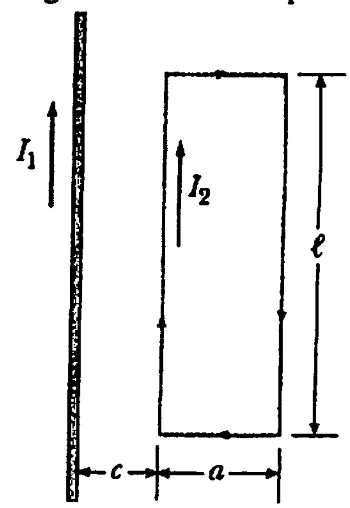
Quiz 5: Ch 19-20

# FORM C

**Problem 1**

In the diagram the current in the long, straight wire is $I_1$=5.00 A and the wire lies in the plane of the rectangular loop which carries a current of 10.0 A. The dimensions shown are c=0.100 m, a=0.150m and l=0.450 m. Find the magnitude and direction of the net force exerted by the magnetic field due to the straight wire on the loop.

a) $F_{net}=5.40\times10^{-5}$ N to the right
b) $F_{net}=1.35\times10^{-5}$ N to the left
c) $F_{net}=2.70\times10^{-5}$ N to the left
d) $F_{net}=1.35\times10^{-5}$ N to the right
e) $F_{net}=0$ N




**Problem 2**

What current is required in the windings of a long solenoid that has 1000 turns uniformly distributed over a length of 0.400 m in order to produce a magnetic field of magnitude $1.00\times10^{-4}$ T at the center of the solenoid?

a) I = 79.6 mA
b) I = 31.8 mA
c) I = 56.5 mA
d) I = 1.40 A
e) I = 0.20 A

**Problem 3**

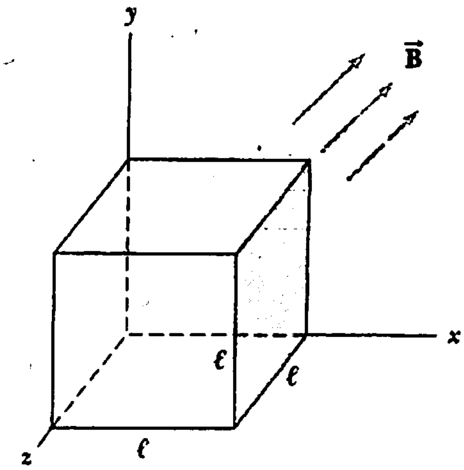
A wire loop of radius 0.30 m lies so that an external magnetic field of magnitude 0.30 T is perpendicular to the loop. The field reverses its direction and its magnitude changes to 0.20 T in 1.5 s. Find the magnitude of the average induced emf in the loop during this time.

a) $\varepsilon$ = 19 mV
b) $\varepsilon$ = 38 mV
c) $\varepsilon$ = 57 mV
d) $\varepsilon$ = 94 mV
e) $\varepsilon$ = 64 mV

**Problem 4**

A cube of edge length l=2.5 cm is position as shown in the diagram. There is a uniform magnetic field throughout the region with components $B_x$=+5.0 T, $B_y$=+4.0 T, $B_z$=+3.0 T. Calculate the flux through the shaded face of the cube.

a) $\Phi_B$=4.3x$10^{-3}$ T·m$^2$
b) $\Phi_B$=2.5x$10^{-3}$ T·m$^2$
c) $\Phi_B$=1.9x$10^{-3}$ T·m$^2$
d) $\Phi_B$=1.0x$10^{-3}$ T·m$^2$
e) $\Phi_B$=3.1x$10^{-3}$ T·m$^2$




**Problem 5**

A 300-turn solenoid with a length of 20 cm and a radius 1.5 cm initially carries a current of 2.0 A. A second coil of 4 turns is wrapped tightly about this solenoid so that it can be considered to have the same radius as the solenoid. Find the magnitude of the average induced emf in the coil when the current in the solenoid increases to 5.0 A in a period of 0.90 s.

a) $\varepsilon = 10\ \mu V$
b) $\varepsilon = 30\ \mu V$
c) $\varepsilon = 3.6\ \mu V$
d) $\varepsilon = 54\ \mu V$
e) $\varepsilon = 18\ \mu V$

**Problem 6**

A Boeing 747 jet with a wingspan of 60.0 m is flying horizontally at a speed of 300 m/s at a location where the Earth's magnetic field is 50.0 μT directed 58° below the horizontal. What voltage is generated between the wingtips?

a) $\varepsilon = 0.763$ V
b) $\varepsilon = 0.477$ V
c) $\varepsilon = 1.51$ V
d) $\varepsilon = 0.050$ V
e) $\varepsilon = 9.12$ V