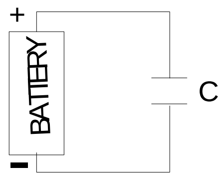
Second Exam

Note: $k=$ = $9x10^9 N.m^2/C^2$; = $8.85x10^{-2} C^2/N.m^2$

The mass of a proton is, $m_p=$ *1.67x10^- 27 kg, le V=1.6x10^-19 J*

1. A capacitor is connected to a battery as shown. When a dielectric is inserted between its plates,

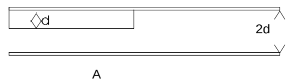


A) only the capacitance changes;
B) only the voltage across the capacitor changes;
C) only the charge on the capacitor changes;
D) both the capacitance and the charge change.
E) both the capacitance and the voltage change;

2. By what percentage dose the resistance of a copper wire (a $=3.9x10^3 1K$) increase when its temperature increases from 40℃ t o 100℃?

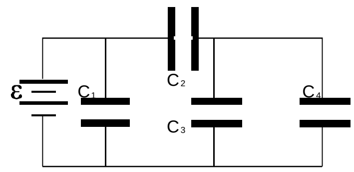
A)11%; B)14%; C)23% D)31%; E)57%.

3. A conducting plate of thickness d is inserted into a large area parallel plate capacitor of area A and separation 2d as shown in figure (consider the field to be uniform all over the area). If the conductor fills half the capacitor, the effective capacitance of the combination is:



A) (5/4)(~0AId) B) (1I4)($\varepsilon_\circ$A/d) C) (112)($\varepsilon_\circ$A/d) D) ($\varepsilon_\circ$A/d)
E) (3/4)($\varepsilon_\circ$A/d)

4. Four parallel plate capacitors are connected to a battery as shown below. The charge on the capacitor C_1 is:



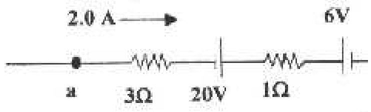
A) Smaller than the charge on C_2
B) Smaller than the charge on C_4
C) Larger than the charge on C_3
D) Equal to the charge on C_2 and C_4
E) Equal to the charge on C_3 and C_4

5. A typical toaster oven can generate 1200 watts in its heating element, when driven by 120 volts. The heating element is a thin Nichrome wire of length 4 meters and cross sectional are~Q.33 mm^2. The resistivity p of the Nichrome wire (in Ohm.m) is:

A) 9.9 x 10^{-4} B)9.9 x 10^{-7} C) 0.99 D) 12 E) 1.46 x 108

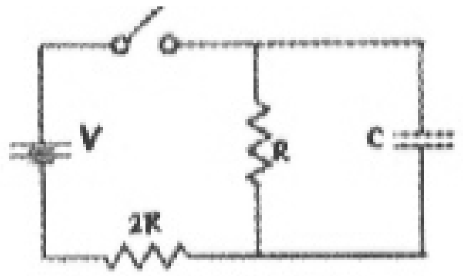
6. If a current of 2.0 A is flowing from point a to point b, the potential difference between Vb — Va (in V) is

A) 6 B) 8 C) -6 D) -8 E) 22



7. In the circuit shown, the switch has been opened for a long time so that the capacitor is uncharged. the charge on the capacitor after the switch has been closed for a long time is

A) VC B) 2CV/3 C) V/3 D) 2CV E) 3CV



8. When two identical resistors are connected in parallel across the terminals of a battery, the power delivered by the battery is 10 watts. If these resistors are instead connected in series across the terminals of the same battery, then the power delivered by the battery (in W) is:

A)40 B) 5 C) 20 D) 10 E) 3 2.5

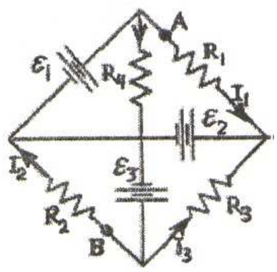
<u>The **following text is for question 9 and 10:**</u> Four wires and three batteries are connected as shown here. **$R_{3\sim}$ 30 11**

9. The potential difference between the points marked A and B, V_{AB}= *$V_B - V_A$ (in V) is:*

A) 20 B)-20 C)10 D)-10 E)can not be found

10. The current passing through R_2 (in A) is:

A) 0.25 B) 0.5 C) 0.75 D)1.5 E) 1.25



Use k = 9*~ **N m^2/C^2** 1 p.F10^6 F; **I** nC i0^9 **C**

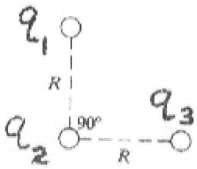
1- Two spherical conductors of radii r_1 = 0.30 m and r_2 =0.60 rn are very far apart. initially sphere is uncharged and the electric field at the surface of smaller sphere is I 8x 1 0^3 N/C. If the spheres are then connected by a very long thin conducting wire, the final charge (in larger sphere is:

a) 54 b) 12 c) 6.0 d) 36 e) 15

2- The electric field in a region of space is given by *E (V /* **m)** = _6.0*10^2. x *(m). I.* If points A and B have locations r_A*(rn) = 2.Oi* and r_B *(in)* = 3.0 i + 2.0.j, the potential difference V_B –V_A, (in V) is:

a) 6.0x10^2 V b) 6.3x10^3 c) zero d) 1.5x 10^3 e) 3.Ox 10^3

3- If q_1 = q_2 Q and q3 = - *Q* in the charge configuration shown in the figure, the electrostatic potential energy of this system is:



a) - (k Q^2)/ $\sqrt{2}R$ **b)** - (4k Q^2)/ $\sqrt{2}R$ **R**

c)(k Q2/R) (2-1/$\sqrt{2}$) d) zero

e)(k Q^2/R) (2+1/$\sqrt{2}$)

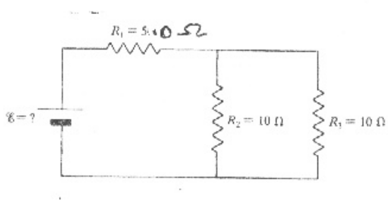
4- The capacitance of a parallel—plate capacitor is 24 μF with the space between its plates is filled with a material of dielectric constant *K* = 2.0, If this dielectric material is being replaced by air and then the separation between the plates is tripled, the final capacitance (in μ **F) is:**

a)15 b)5.0 c)4.0 d) 12 e) 16

5- When a I 5-μF capacitor is combined with a capacitor of unknown capacitance C, the equivalent capacitance of the combination is 5.0 *j.t* F. The value of C (in μF) is:

a)2.5 b)5.0 c)8.6
d)30 e)7.5

6- If the 5.0- Ω resistor in the circuit shown in the figure shown is dissipating energy at a rate of 20 **W,** the e.m.f



ε (in V) of the battery is:

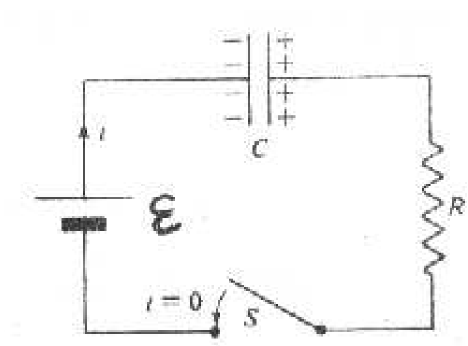
a) 20 b) 10 c) 30
c) 40 e) 50

7- A resistor R, a battery of e.m ε, charged capacitor are connected in series so that the polarity capacitor is as shown in the figure. If the magnitude of the potential different across C is 2g immediately after the switch S is closed, the current i **(t** _ 0) is given by:

a) $(4\varepsilon/R)\, e^{-t/RC}$ b) $(\varepsilon/R)\, e^{-t/RC}$

c) $\varepsilon\, e^{-t/RC}$ d) Zero

e) $(3\varepsilon/R)\, e^{-t/RC}$



8- Two capacitors having capacitances in air $\mathbf{C_1}$ (20p.F) and C_2 (40~.tF) are connected in series The space region between the plates of C_2 is then filled with a dielectric material (K =1 *.5)* while the potential difference across the combination is held constant held constant at 80 V. The final energy (in mJ) stored in C_2 is:

a) 48 b) 10 c)12

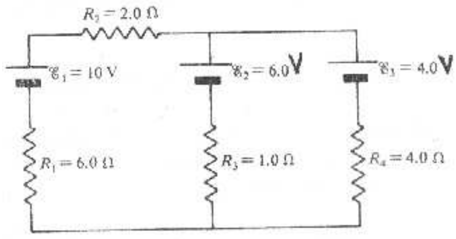
D 51 e) 36

9-In the circuit shown in the figure, the current (in A) through the resistor R_3 is:

a) 0.50 b) 1.5 c) 0.13

c) 0.13 d) zero

e) 1.2



10.The capacitors in the circuit shown are initially uncharged. if $\varepsilon = 30$ V, the final charge (in μ C) on each capacitor after the switch *S* is closed is:

a) 530 b) 150 c) 880

d)250 e)360