Physics II
Exam 2 Review

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Outline

Must Knows!!

Constants:

$$k = \frac{1}{4\pi\varepsilon_0} = 8.99 \times 10^9 Nm^2/C^2$$

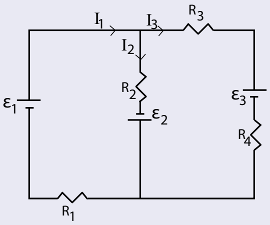
$$\varepsilon_0 = 8.85 \times 10^{-12} C^2/Nm^2$$

$$e = 1.602 \times 10^{-19} C$$

Problems

Problem 1

Consider the following resistor circuit:



A Find I_1, I_2, and I_3 and state if the assumed directions are correct.

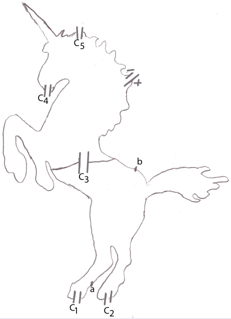
B Find the power dissipated in each resistor.

C Find the power delivered to or by each battery.

D Find the magnitude of potential difference between the two nodes in the circuit.

Problem 2

Consider the following capacitor circuit:



A Calculate the equivalent capacitance.

B Find the charge and potential difference across each capacitor.

C Find the potential difference between points *a* and *b*.

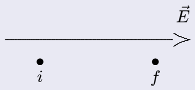
D What is the total energy of this system? If the separation in $C_5 = 10x10^{-6}$m what is its electric field?

Multiple Choice

Chapter 24: Electric Potential

Question 1

An electron moves from point i to point f, in the direction of a uniform electric field. During this displacement:



A the work done by the field is positive and the potential energy of the electron-field system increases

B the work done by the field is negative and the potential energy of the electron-field system increases

C the work done by the field is positive and the potential energy of the electron-field system decreases

D the work done by the field is negative and the potential energy of the electron-field system decreases

E the work done by the field is positive and the potential energy of the electron-field system does not change

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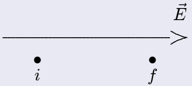

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C the work done by the field is positive and the potential energy of the electron-field system decreases

D the work done by the field is negative and the potential energy of the electron-field system decreases

E the work done by the field is positive and the potential energy of the electron-field system does not change

Answer: B

Question 2

Choose the correct statement:

A A proton tends to go from a region of low potential to a region of high potential

B The potential of a negatively charged conductor must be negative

C If $\vec{E} = 0$ at a point P then V must be zero at P

D If $V = 0$ at a point P then $\vec{E}$ must be zero at P

E None of the above are correct

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Choose the correct statement:

A A proton tends to go from a region of low potential to a region of high potential

B The potential of a negatively charged conductor must be negative

C If $\vec{E} = 0$ at a point P then V must be zero at P

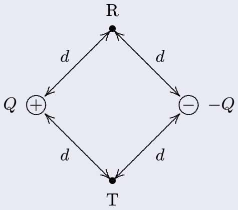
D If V $= 0$ at a point P then $\vec{E}$ must be zero at P

E None of the above are correct

Answer: E

Question 3

Points R and T are each a distance d from each of two particles with charges of equal magnitudes and opposite signs as shown. If $k = \frac{1}{4\pi\varepsilon_0}$, the work required to move a particle with a negative charge q from R to T is:



A 0

B $\frac{kqQ}{d^2}$

C $\frac{kqQ}{d}$

D $\frac{kqQ}{\sqrt{2}d}$

E $\frac{kqQ}{2d}$

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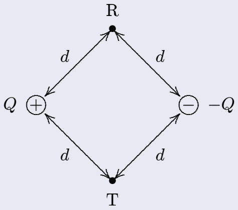

A 0

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Answer: A

Question 4

An electron volt is:

A the force acting on an electron in a field of $1\frac{N}{C}$

B the force required to move an electron 1 meter

C the energy gained by an electron in moving through a potential difference of 1 volt

D the energy needed to move an electron through 1 meter in any electric field

E the work done when 1 coulomb of charge is moved through a potential difference of 1 volt

Question 4

An electron volt is:

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C the energy gained by an electron in moving through a potential difference of 1 volt

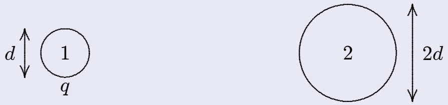
D the energy needed to move an electron through 1 meter in any electric field

E the work done when 1 coulomb of charge is moved through a potential difference of 1 volt

Answer: C

Question 5

Two conducting spheres, one having twice the diameter of the other, are separated by a distance large compared to their diameters. The smaller sphere (1) has charge q and the larger sphere (2) is uncharged. If the spheres are then connected by a long thin wire:



A 1 and 2 have the same potential

B 2 has twice the potential of 1

C 2 has half the potential of 1

D 1 and 2 have the same charge

E all of the charge is dissipated

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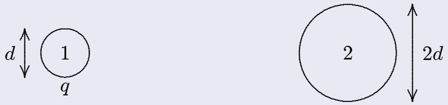

A 1 and 2 have the same potential

B 2 has twice the potential of 1

C 2 has half the potential of 1

D 1 and 2 have the same charge

E all of the charge is dissipated

Answer: A

Question 6

A hollow metal sphere is charged to a potential V. The potential at its center is:

A V

B 0

C $-V$

D $2V$

E πV

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Answer: A

Question 7

In a certain region of space the electric potential increases uniformly from east to west and does not vary in any other direction. The electric field:

A points east and varies with position

B points east and does not vary with position

C points west and varies with position

D points west and does not vary with position

E points north and does not vary with position

Question 7

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C points west and varies with position

D points west and does not vary with position

E points north and does not vary with position

Answer: B

Chapter 25: Capacitance

Question 1

A capacitor C has a charge Q. The actual charges on its plates are:

A Q, Q

B $\frac{Q}{2}, \frac{Q}{2}$

C $Q, -Q$

D $\frac{Q}{2}, -\frac{Q}{2}$

E $Q, 0$

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Answer: C

Question 2

The capacitance of a parallel-plate capacitor is:

A proportional to the plate area

B proportional to the charge stored

C independent of any material inserted between the plates

D proportional to the potential difference of the plates

E proportional to the plate separation

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Answer: A

Question 3

The capacitance of a parallel-plate capacitor can be increased by:

A increasing the charge

B decreasing the charge

C increasing the plate separation

D decreasing the plate separation

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The capacitance of a parallel-plate capacitor can be increased by:

A increasing the charge

B decreasing the charge

C increasing the plate separation

D decreasing the plate separation

E decreasing the plate area

Answer: D

Question 4

The capacitance of a cylindrical capacitor can be increased by:

A decreasing both the radius of the inner cylinder and the length

B increasing both the radius of the inner cylinder and the length

C increasing the radius of the outer cylindrical shell and decreasing the length

D decreasing the radius of the inner cylinder and increasing the radius of the outer cylindrical shell

E only by decreasing the length

Question 4

The capacitance of a cylindrical capacitor can be increased by:

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B increasing both the radius of the inner cylinder and the length

C increasing the radius of the outer cylindrical shell and decreasing the length

D decreasing the radius of the inner cylinder and increasing the radius of the outer cylindrical shell

E only by decreasing the length

Answer: B

Question 5

Let Q denote charge, V denote potential difference, and U denote stored energy. Of these quantities, capacitors in series must have the same:

A Q only

B V only

C U only

D Q and U only

E V and U only

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A Q only

B V only

C U only

D Q and U only

E V and U only

Answer: A

Question 6

Capacitors C_1 and C_2 are connected in series. The equivalent capacitance is given by:

A $\frac{C_1 C_2}{C_1+C_2}$

B $\frac{C_1+C_2}{C_1 C_2}$

C $\frac{1}{C_1+C_2}$

D $\frac{C_1}{C_2}$

E $C_1 + C_2$

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D $\frac{C_1}{C_2}$

E $C_1 + C_2$

Answer: A

Question 7

Two identical capacitors, each with capacitance C, are connected in parallel and the combination is connected in series to a third identical capacitor. The equivalent capacitance of this arrangement is:

A $\frac{2C}{3}$

B C

C $\frac{3C}{2}$

D $2C$

E $3C$

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B C

C $\frac{3C}{2}$

D $2C$

E $3C$

Answer: A

Chapter 26: Current and Resistance

Question 1

A car battery is rated at 80 $A \cdot h$. An ampere-hour is a unit of:

A power

B energy

C current

D charge

E force

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A car battery is rated at 80 $A \cdot h$. An ampere-hour is a unit of:

A power

B energy

C current

D charge

E force

Answer: D

Question 2

Current is a measure of:

A force that moves a charge past a point

B resistance to the movement of a charge past a point

C energy used to move a charge past a point

D amount of charge that moves past a point per unit time

E speed with which a charge moves past a point

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D amount of charge that moves past a point per unit time

E speed with which a charge moves past a point

Answer: D

Question 3

Two wires made of different materials have the same uniform current density. They carry the same current only if:

A their lengths are the same

B their cross-sectional areas are the same

C both their lengths and cross-sectional areas are the same

D the potential differences across them are the same

E the electric fields in them are the same

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Two wires made of different materials have the same uniform current density. They carry the same current only if:

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B their cross-sectional areas are the same

C both their lengths and cross-sectional areas are the same

D the potential differences across them are the same

E the electric fields in them are the same

Answer: B

Question 4

If the potential difference across a resistor is doubled:

A only the current is doubled

B only the current is halved

C only the resistance is doubled

D only the resistance is halved

E both the current and resistance are doubled

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D only the resistance is halved

E both the current and resistance are doubled

Answer: A

Question 5

Of the following, the copper conductor that has the least resistance is:

A thin, long and hot

B thick, short and cool

C thick, long and hot

D thin, short and cool

E thin, short and hot

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D thin, short and cool

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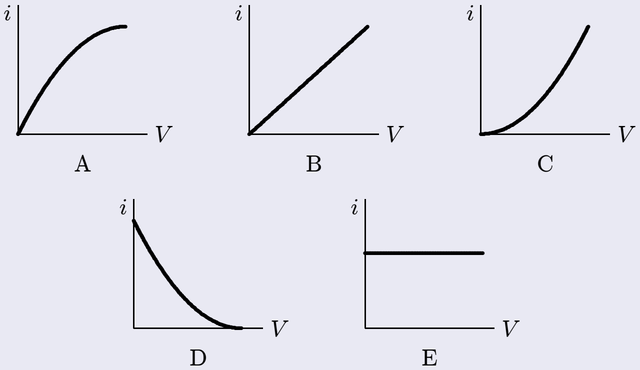
Answer: B

Question 6

Which of the following graphs best represents the current-voltage relationship for a device that obeys Ohms law?



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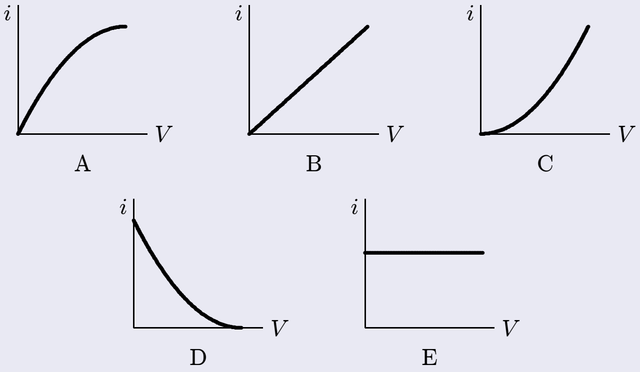

Answer: B

Question 7

For a cylindrical resistor made of ohmic material, the resistance does NOT depend on:

A the current

B the length

C the cross-sectional area

D the resistivity

E the electron drift velocity

Question 7

For a cylindrical resistor made of ohmic material, the resistance does NOT depend on:

A the current

B the length

C the cross-sectional area

D the resistivity

E the electron drift velocity

Answer: A

Question 8

You wish to triple the rate of energy dissipation in a heating device. To do this you could triple:

A the potential difference keeping the resistance the same

B the current keeping the resistance the same

C the resistance keeping the potential difference the same

D the resistance keeping the current the same

E both the potential difference and current

Question 8

You wish to triple the rate of energy dissipation in a heating device. To do this you could triple:

A the potential difference keeping the resistance the same

B the current keeping the resistance the same

C the resistance keeping the potential difference the same

D the resistance keeping the current the same

E both the potential difference and current

Answer: D

Chapter 27: Circuits

Question 1

Four wires meet at a junction. The first carries 4 A into the junction, the second carries 5 A out of the junction, and the third carries 2 A out of the junction. The fourth carries:

A 7 A out of the junction

B 7 A into the junction

C 3 A out of the junction

D 3 A into the junction

E 1 A into the junction

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A 7 A out of the junction

B 7 A into the junction

C 3 A out of the junction

D 3 A into the junction

E 1 A into the junction

Answer: D

Question 2

In the context of the loop and junctions rules for electrical circuits a junction is:

A where a wire is connected to a resistor

B where a wire is connected to a battery

C where only two wires are joined

D where three or more wires are joined

E where a wire is bent

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Answer: D

Question 3

By using only two resistors, R_1 and R_2, a student is able to obtain resistances of 3 Ω, 4 Ω, 12 Ω, and 16 Ω. The values of R_1 and R_2 (in ohms) are:

A 3, 4

B 2, 12

C 3, 16

D 4, 12

E 4, 16

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A 3, 4

B 2, 12

C 3, 16

D 4, 12

E 4, 16

Answer: D

Question 4

Two wires made of the same material have the same lengths but different diameters. They are connected in parallel to a battery. The quantity that is NOT the same for the wires is:

A the end-to-end potential difference

B the current

C the current density

D the electric field

E the electron drift velocity

Question 4

Two wires made of the same material have the same lengths but different diameters. They are connected in parallel to a battery. The quantity that is NOT the same for the wires is:

A the end-to-end potential difference

B the current

C the current density

D the electric field

E the electron drift velocity

Answer: B

Question 5

Resistor 1 has twice the resistance of resistor 2. They are connected in parallel to a battery. The ratio of the thermal energy generation rate in resistor 1 to that in resistor 2 is:

A 1 : 4

B 1 : 2

C 1 : 1

D 2 : 1

E 4 : 1

Question 5

Resistor 1 has twice the resistance of resistor 2. They are connected in parallel to a battery. The ratio of the thermal energy generation rate in resistor 1 to that in resistor 2 is:

A $1:4$

B $1:2$

C $1:1$

D $2:1$

E $4:1$

Answer: B

Question 6

A series circuit consists of a battery with internal resistance r and an external resistor R. If these two resistances are equal ($r = R$) then the thermal energy generated per unit time by the internal resistance r is:

A the same as by R

B half that by R

C twice that by R

D one-third that by R

E unknown unless the emf is given

Question 6

A series circuit consists of a battery with internal resistance r and an external resistor R. If these two resistances are equal ($r = R$) then the thermal energy generated per unit time by the internal resistance r is:

A the same as by R

B half that by R

C twice that by R

D one-third that by R

E unknown unless the emf is given

Answer: A

Question 7

In the capacitor discharge formula $q = q_0 e^{-\frac{t}{RC}}$ the symbol t represents:

A the time constant

B the time it takes for C to lose the fraction $\frac{1}{e}$ of its initial charge

C the time it takes for C to lose the fraction $(1 - \frac{1}{e})$ of its initial charge

D the time it takes for C to lose essentially all of its initial charge

E none of the above

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D the time it takes for C to lose essentially all of its initial charge

E none of the above

Answer: E