Answer on Question 51719, Physics, Electromagnetism

2. What are the dimensions of electrical resistance?

a) $MLT^{-2}A^{-2}$

b) $M^2L^2TAL^{-2}$

c) $ML^2T^{-3}A^{-2}$

d) None of the above

Solution:

By the definition, electrical resistance of an object is defined as the ratio of voltage across it to current through it:

$$R = \frac{V}{I}.$$

Voltage is measured in volts and is derived unit in SI system. Current is measured in amperes and is based unit in SI system. So, let's get the ratio:

$$R = \frac{\frac{ML^2}{AT^3}}{A} = \frac{ML^2}{A^2T^3} = ML^2T^{-3}A^{-2}.$$

Answer: c) $ML^2T^{-3}A^{-2}$.

3. Select the correct option from the following?

a) Electric field is a scalar quantity.

b) Electromotive force is a vector quantity.

c) Electric current is a scalar quantity.

d) Electric potential is a vector quantity.

Answer:

A scalar is a quantity that is completely specified by its magnitude and has no direction, while a vector is a quantity that specifies both the magnitude and a

direction. The examples of vectors are force and electric field. So, the correct answer is b) Electromotive force is a vector quantity.

4. Calculate the currents in $3ohms$ resistor:

a) $1.94A$

b) $1.36A$

c) $3.23A$

d) $5.45A$

Solution:

Unfortunately, there is no scheme added to calculate the currents in $3ohms$ resistor.

5. A current flows in a wire of a circular cross-section with the free electrons travelling with a mean drift velicity v. If an equal current flows in a wire of the same material but of twice the radius, what is the new mean drift velocity?

a) $v/2$

b) $v/4$

c) $2v$

d) $4v$

Solution:

By the definition the formula for mean drift velocity looks like:

$$v = \frac{I}{nAq},$$

where, v is the mean drift velocity, I is the current flowing through the wire, n is the charge-carrier density, A is the the area of cross-sectionof the wire, q is the charge on the charge-carrier.

Because current, charge-carrier density and the charge on the charge-carrier in the wire with radius $2r$ are the same as in the wire with radius r and are constant (from

the condition of question we know that current and material are the same) we can write:

$$v_r = \frac{1}{A} = \frac{1}{\pi(r)^2} = \frac{1}{\pi r^2}\,(for\ radius\ r)$$

$$v_{2r} = \frac{1}{A} = \frac{1}{\pi(2r)^2} = \frac{1}{4\pi r^2}\,(for\ twice\ radius)$$

So, we can see that the mean drift velocity will be $v/4$

Answer: b) $v/4$

6. Which of the following is not correct:

a) A changing electric field can produce a changing magnetic field.

b) A steady magnetic field produces a steady current.

c) A changing magnetic field can produce a changing current.

d) A changing magnetic field can produce a steady electric field.

Answer:

A static magnetic field relative to a wire induces a zero current.

The false statement is b) A steady magnetic field produces a steady current.