1. Conventional current points in the direction that:

   ☐ no charge flows

   ☐ positive charge would flow

   ☐ electrons actually flow

   ☐ the wire is thickest

2. Potential difference is the energy transferred per unit:

   ☐ length

   ☐ current

   ☐ charge

   ☐ time

3. A component has 12 V across it and 3.0 A through it. What is its resistance?

   _____ Ω

4. The smallest free unit of charge is the _____ charge, $e = 1.6 \times 10^{-19}$ C.

   _____

5. One volt equals one joule per _____.

   _____

6. An ohmic conductor at constant temperature has:

   ☐ current proportional to resistance

   ☐ a constant current whatever the p.d.

   ☐ current proportional to p.d.

   ☐ zero resistance

7. A current of 2.0 A flows for 5.0 s. How much charge passes?

   _____ C

8. Both e.m.f. and potential difference are measured in volts.

   ☐ True ☐ False

9. A filament lamp's resistance rises at higher voltage because:

   ☐ it obeys Ohm's law

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   ☐ the voltage falls

   ☐ the electrons run out

10. The charge that has flowed equals the area under an I–t graph.

    ☐ True ☐ False

1. **positive charge would flow**

   Conventional current is the flow of positive charge – opposite to the electron drift in a metal wire.

2. **charge**

   $V = \dfrac{W}{Q}$ – energy per unit charge, in joules per coulomb (volts).

3. **4 Ω**

   $R = \dfrac{V}{I} = \dfrac{12}{3.0} = 4.0\ \Omega$.

4. **elementary**

   All free charges are whole-number multiples of the elementary charge e.

5. **coulomb**

   $1\ \text{V} = 1\ \dfrac{\text{J}}{\text{C}}$ – one joule of energy moved per coulomb of charge.

6. **current proportional to p.d.**

   Ohm's law: $I \propto V$, so $R = \dfrac{V}{I}$ is constant and the I–V graph is a straight line through the origin.

7. **10 C**

   $Q = It = 2.0 \times 5.0 = 10\ \text{C}$.

8. **True**

   Yes – both are energy per unit charge (J/C). The difference is whether energy is given to, or taken from, the charge.

9. **the filament heats up**

   More current heats the filament; in a metal, more lattice vibration scatters electrons, so R increases.

10. **True**

    Yes – current is the rate of flow of charge, so the area (current × time) gives the total charge.

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