Which of these particles has an electrical charge?

A. Proton.
B. Electron.
C. Ion.
D. All of the above.
Which of these particles has an electrical charge?

A. Proton.
B. Electron.
C. Ion.
D. All of the above.

*Explanation:*
An ion, by definition, is a charged atom—one with an extra electron(s) or deficient in one or more electrons.
Which is the predominant carrier of charge in copper wire?

A. Proton.
B. Electron.
C. Ion.
D. All of the above.
Which is the predominant carrier of charge in copper wire?

A. Proton.
B. Electron.
C. Ion.
D. All of the above.
If a neutral atom has 22 protons in its nucleus, the number of surrounding electrons is

A. less than 22.
B. 22.
C. more than 22.
D. sometimes all of the above in a neutral atom.
If a neutral atom has 22 protons in its nucleus, the number of surrounding electrons is

A. less than 22.
B. 22.
C. more than 22.
D. sometimes all of the above in a neutral atom.
When we say charge is conserved, we mean that charge can

A. be saved, like money in a bank.
B. only be transferred from one place to another.
C. take equivalent forms.
D. be created or destroyed, as in nuclear reactions.
When we say charge is conserved, we mean that charge can

A. be saved, like money in a bank.
B. **only be transferred from one place to another.**
C. take equivalent forms.
D. be created or destroyed, as in nuclear reactions.

*Explanation:*
Electric charge cannot be created or destroyed. It can only be transferred.
Which of these rules is basic to all of physics?

A. The conservation of energy.
B. The conservation of momentum.
C. The conservation of charge.
D. All of the above.
Which of these rules is basic to all of physics?

A. The conservation of energy.
B. The conservation of momentum.
C. The conservation of charge.
D. All of the above.
According to Coulomb’s law, doubling both charges of a pair of particles will result in a force between them that is

A. twice as strong.
B. four times as strong.
C. half as strong.
D. one-quarter as strong.
According to Coulomb’s law, doubling both charges of a pair of particles will result in a force between them that is

A. twice as strong.
B. four times as strong.
C. half as strong.
D. one-quarter as strong.
According to Coulomb’s law, a pair of particles that are placed twice as close to each other will experience forces that are

A. twice as strong.
B. four times as strong.
C. half as strong.
D. one-quarter as strong.
According to Coulomb’s law, a pair of particles that are placed twice as close to each other will experience forces that are

A. twice as strong.
B. **four times as strong.**
C. half as strong.
D. one-quarter as strong.

*Explanation:*
Coulomb’s law is an inverse-square law—for closeness as well as increased distance.
When a negatively charged balloon is placed against a non-conducting wall, negative charges in the wall are

A. attracted to the balloon.
B. repelled from the balloon.
C. too bound to positive charges in the wall to have any effect.
D. neutralized.
When a negatively charged balloon is placed against a non-conducting wall, negative charges in the wall are

A. attracted to the balloon.
B. repelled from the balloon.
C. too bound to positive charges in the wall to have any effect.
D. neutralized.

**Explanation:**
The negative balloon repels negative charge in the wall and attracts positive charge. Charges of atoms and molecules are therefore nudged apart. This condition of charge separation is called *polarization.*
When you brush your hair and scrape electrons from your hair, the charge of your hair is

A. positive.
B. negative.
C. Both of these.
D. Neither of these.
When you brush your hair and scrape electrons from your hair, the charge of your hair is

A. **positive.**
B. **negative.**
C. **Both of these.**
D. **Neither of these.**

**Comment:**
And if electrons were scraped off the brush onto your hair, your hair would have a negative charge.
The strength of an electric field is measured by the force

A. exerted on a charged particle in the field.
B. between electric field lines.
C. between oppositely charged parallel plates.
D. All of the above.
The strength of an electric field is measured by the force

A. exerted on a charged particle in the field.
B. between electric field lines.
C. between oppositely charged parallel plates.
D. All of the above.
The direction of an electric field, by convention, is the direction of force that the field would exert on

A. an electron.
B. a proton.
C. an atom.
D. All of the above.
The direction of an electric field, by convention, is the direction of force that the field would exert on

A. an electron.  
B. a proton.  
C. an atom.  
D. All of the above.
When you do work on an electrically charged particle, you change the particle's

A. charge.
B. potential energy.
C. capacitance.
D. power.
When you do work on an electrically charged particle, you change the particle’s

A. charge.
B. potential energy.
C. capacitance.
D. power.

Comment:
Recall the work–energy theorem in Chapter 3.
When you increase the potential energy of a charged particle, you increase its ability to

A. do work.
B. charge other particles.
C. conduct.
D. transform to heat.
When you increase the potential energy of a charged particle, you increase its ability to

A. do work.
B. charge other particles.
C. conduct.
D. transform to heat.

Comment:
Recall from Chapter 3 that the potential energy acquired by something equals the work done on it.
Electric potential, measured in volts, is a ratio of

A. charge to the square of the separation distance.
B. current to resistance.
C. energy to charge.
D. power to current.
Electric potential, measured in volts, is a ratio of

A. charge to the square of the separation distance.
B. current to resistance.
C. energy to charge.
D. power to current.
A party balloon may be charged to thousands of volts. The charged balloon isn’t dangerous because it carries relatively little

A. current.  
B. energy.  
C. capacitance.  
D. resistance.
A party balloon may be charged to thousands of volts. The charged balloon isn’t dangerous because it carries relatively little

A. current.
B. energy.
C. capacitance.
D. resistance.
A coulomb of charge that passes through a 12-volt battery is given

A. 12 joules.
B. 12 amperes.
C. 12 ohms.
D. 12 watts.
A coulomb of charge that passes through a 12-volt battery is given

A. 12 joules.
B. 12 amperes.
C. 12 ohms.
D. 12 watts.

Explanation:
Voltage = energy/charge; \(12 \text{ V})/(1 \text{ C}) = 12 \text{ J/C}.\)
Which statement is correct?

A. Voltage flows in a circuit.
B. Charge flows in a circuit.
C. Current causes voltage.
D. All the above are correct.
Which statement is correct?

A. Voltage flows in a circuit.
B. **Charge flows in a circuit.**
C. Current causes voltage.
D. All of the above are correct.

**Explanation:**
Voltage is established across a circuit, not through it. Also, voltage causes current, and not the other way around.
The rate at which electrons flow in a wire is measured by

A. current.
B. voltage.
C. resistance.
D. energy flow.
The rate at which electrons flow in a wire is measured by

A. **current**.
B. **voltage**.
C. **resistance**.
D. **energy flow**.
A 10-ohm resistor carries 10 amperes. The voltage across the resistor is

A. zero.
B. more than zero but less than 10 V.
C. 10 V.
D. more than 10 V.
A 10-ohm resistor carries 10 amperes. The voltage across the resistor is

A. zero.
B. more than zero but less than 10 V.
C. 10 V.
D. more than 10 V.

*Explanation:*
The voltage, in accord with Ohm’s law, is 100 V, much greater than 10 V.
A 100.14 resistor is connected to a 120-volt power supply. The current in the resistor is

A. 1 A.
B. 10 A.
C. 12 A.
D. 120 A.
A 10-ohm resistor is connected to a 120-volt power supply. The current in the resistor is

A. 1 A.
B. 10 A.
C. 12 A.
D. 120 A.

*Explanation:*
By Ohm’s law, current = voltage/resistance = 120 V/10 ohm = 12 A.
Electric shock can be so damaging to the human body mainly due to excess

A. voltage.
B. current.
C. resistance.
D. None of the above
Electric shock can be so damaging to the human body mainly due to excess

A. voltage.  
**B. current.**  
C. resistance.  
D. None of the above.
When two identical lamps in a circuit are connected in parallel, the total resistance is

A. less than the resistance of either lamp.
B. the same as the resistance of each lamp.
C. less than the resistance of each lamp.
D. None of the above.
When two identical lamps in a circuit are connected in parallel, the total resistance is

A. less than the resistance of either lamp.
B. the same as the resistance of each lamp.
C. less than the resistance of each lamp.
D. None of the above.

Explanation:
Resistors in parallel are like extra lines at a checkout counter. More lines means less resistance, allowing for more flow.
The equivalent resistance of a pair of identical resistors connected in parallel is

A. half the value of either resistor.
B. the same value of either resistor.
C. twice the value of either resistor.
D. Not enough information for an answer.
The equivalent resistance of a pair of identical resistors connected in parallel is

A. half the value of either resistor.
B. the same value of either resistor.
C. twice the value of either resistor.
D. Not enough information for an answer.

*Explanation:*

By the product-over-sum rule, \( \frac{RR}{R + R} = \frac{RR}{2R} = \frac{R}{2} \).
The purpose of a safety fuse is to

A. provide an additional voltage source.
B. measure the electric power through a circuit.
C. prevent overloading in a circuit.
D. reduce the amount of current in the circuit.
The purpose of a safety fuse is to

A. provide an additional voltage source.
B. measure the electric power through a circuit.
C. prevent overloading in a circuit.
D. reduce the amount of current in the circuit.
A major difference between DC and AC in circuits is the

A. voltage associated with each.
B. timing associated with each.
C. way charges flow.
D. way circuits are wired.
A major difference between DC and AC in circuits is the

A. voltage associated with each.
B. timing associated with each.
C. **way charges flow.**
D. way circuits are wired.

*Explanation:*

In a DC circuit, charge flows in one direction; in AC, charge flows to and fro, alternating direction.
What is the rate at which electric energy is converted to another form or transferred to another device?

A. Electric power.
B. Electric resistance.
C. AC current.
D. Ohm’s law.
What is the rate at which electric energy is converted to another form or transferred to another device?

A. Electric power.
B. Electric resistance.
C. AC current.
D. Ohm’s law.
How much current is in a 120-volt line at 1200 watts?

A. 6 amperes.
B. 10 amperes.
C. 120 amperes.
D. 240 amperes.
How much current is in a 120-volt line at 1200 watts?

A. 6 amperes.
B. **10 amperes.**
C. 120 amperes.
D. 240 amperes.

*Explanation:*
From power = voltage × current,
current = power/voltage = 1200 W/120 V = 10 A.
A 120-volt line carries 20 amperes. The power expended is

A. 6 watts.
B. 20 watts.
C. 120 watts.
D. 2400 watts.
A 120-volt line carries 20 amperes. The power expended is

A. 6 watts.
B. 20 watts.
C. 120 watts.
D. 2400 watts.

*Explanation:*

Power = voltage × current.
How much current is in a 1200-watt device operating on 20 volts?

A. 6 amperes.
B. 10 amperes.
C. 120 amperes.
D. 240 amperes.
How much current is in a 1200-watt device operating on 20 volts?

A. 6 amperes.
B. 10 amperes.
C. 120 amperes.
D. 240 amperes.

Explanation:
From power = voltage × current,

\[ \text{current} = \frac{\text{power}}{\text{voltage}} = \frac{1200 \text{ W}}{120 \text{ V}} = 10 \text{ A}. \]
What is the power rating of a lamp connected to a 12-V source when it carries 1.5 A?

A. 8 W.
B. 12 W.
C. 18 W.
D. None of the above.
What is the power rating of a lamp connected to a 12-V source when it carries 1.5 A?

A. 8 W.
B. 12 W.
C. **18 W.**
D. None of the above.

Explanation:
Power = voltage × current = 12 V × 1.5 A = 18 W.