

## AQA (GCSE Notes)

### Chapter 2: Electricity

#### Q1. What is the role of a potential difference in a closed circuit?

**Answer:** The potential difference provides the energy needed to move charges around the circuit. It acts like a force that pushes the electric charges through the wires and components. Without it, current cannot flow even if the circuit is closed.

#### Q2. Define electric current in terms of charge flow.

**Answer:** Electric current is the rate at which electric charge flows through a point in a circuit. It tells us how much charge passes in one second. The higher the current, the more charge is moving per second.

#### Q3. Describe the conditions needed for an electric current to flow in a circuit.

**Answer:** The circuit must be complete or closed so there's a continuous path for charge to move. It must also contain a power source like a battery to provide potential difference. Without these, the charges have no way to flow.

#### Q4. What happens to the electric current if the circuit is not closed?

**Answer:** If the circuit is not closed, the current cannot flow because there is a break in the path. A complete loop is needed for electrons to move. This is why opening a switch stops the current.

#### Q5. Write the equation that links charge flow, current and time.

**Answer:** The equation is:

**Solution:**

$$Q = I \times t$$

Where Q is charge in coulombs, I is current in amperes, and t is time in seconds. This tells us how much charge flows in a certain time at a given current.

#### Q6. Explain what each symbol represents in the equation $Q = I \times t$ .

**Answer:** In this equation, Q stands for charge measured in coulombs (C), I is current measured in amperes (A), and t is time in seconds (s). This equation shows that charge depends on how strong the current is and how long it flows.

#### Q7. What unit is used to measure charge flow?

**Answer:** Charge flow is measured in coulombs (C). One coulomb is equal to the charge transferred when one ampere of current flows for one second. It's a basic unit of electric charge.

#### Q8. In what unit is current measured, and what is its symbol?

**Answer:** Current is measured in amperes, which is written as A. One ampere means that one coulomb of charge passes a point in the circuit every second. It is often just called "amp".

**Q9. Why must a source of potential difference be included in a circuit?**

**Answer:** A source of potential difference, like a battery, gives the energy needed to push charges around the circuit. It makes the electrons move and creates a current. Without it, the circuit will not work.

**Q10. How does increasing the time affect the total charge transferred in a circuit?**

**Answer:** If the time increases and the current stays the same, more charge will flow through the circuit. This is because charge is the product of current and time. Longer operation means more total charge has passed.

**Q11. What is the current in a wire if 6 C of charge passes in 2 seconds?**

**Answer:** 3 A

**Solution:**

$$Q = I \times t$$

$$6 = I \times 2$$

$$I = 6 \div 2$$

$$I = 3 \text{ A}$$

The current is 3 amperes, meaning 3 coulombs pass each second.

**Q12. A circuit has a current of 3 A for 4 seconds. How much charge flows through it?**

**Answer:** 12 C

**Solution:**

$$Q = I \times t$$

$$Q = 3 \times 4$$

$$Q = 12 \text{ C}$$

So, 12 coulombs of charge pass through the circuit in 4 seconds.

**Q13. Explain why the current is the same at every point in a simple closed loop.**

**Answer:** In a single closed loop with no branches, all parts of the circuit carry the same current. This is because there is only one path for the current to flow. The same amount of charge must pass every point.

**Q14. If a current of 2 A flows for 10 seconds, how much charge has passed?**

**Answer:** 20 C

**Solution:**

$$Q = I \times t$$

$$Q = 2 \times 10$$

$$Q = 20 \text{ C}$$

That means 20 coulombs of charge pass in 10 seconds at a 2 A current.

**Q15. How can you increase the current in a circuit without changing the time?**

**Answer:** You can increase the current by increasing the potential difference (voltage) or decreasing the resistance in the circuit. This makes it easier for charge to flow. The higher the voltage, the stronger the push.

**Q16. What is the relationship between potential difference and current?**

**Answer:** Potential difference and current are directly related. If resistance is fixed, increasing the potential difference increases the current. This is because more energy is pushing the charge.

**Q17. Describe how current behaves in a series circuit.**

**Answer:** In a series circuit, the current is the same at every point. This is because the components are connected one after another with only one path for current to flow. The charge cannot split.

**Q18. Why is a potential difference needed to push charges through a wire?**

**Answer:** Potential difference provides energy to move charges through the wire. It creates an electric field that pushes electrons. Without it, the electrons stay still and no current flows.

**Q19. In a closed loop, what would you expect the current to be at different points in the loop?**

**Answer:** The current will be the same at all points in the loop. This is because the loop is unbroken and the current has only one path. No charge is lost or gained.

**Q20. What does a straight wire symbol represent in a circuit diagram?**

**Answer:** It represents a simple connection between components with no resistance. It shows how electricity can travel through that part of the circuit. It is just a line on the diagram.

**Q21. How would you draw a circuit with a battery, switch, and lamp?**

**Answer:** Use the battery symbol for the power source, a switch symbol, and a lamp symbol. Connect them in a series to show current flowing through the lamp when the switch is closed.

**Q22. How do you show a component is connected in series in a diagram?**

**Answer:** Components in series are drawn along the same path in the circuit. There are no branches between them. This shows that the current flows through each component one after another.

**Q23. How do you show a voltmeter connected correctly in a circuit diagram?**

**Answer:** A voltmeter should be connected in parallel with the component. This allows it to measure the potential difference across the component accurately without changing the current.

**Q24. What does the symbol for a resistor look like?**

**Answer:** It is usually a small rectangle or a zigzag line, depending on the standard. It represents a component that resists the flow of current. It is used to reduce current or divide voltage.

**Q25. What is the purpose of a fuse in a circuit, and how is it represented?**

**Answer:** A fuse protects the circuit from too much current. If the current gets too high, the fuse melts and breaks the circuit. It is drawn as a rectangle with a line through it.

**Q26. Explain how to measure current in a circuit using an ammeter.**

**Answer:** To measure current, place the ammeter in series with the component you want to measure. The current flows through the ammeter, allowing it to record the value. Never connect it in parallel.

**Q27. Why must an ammeter be connected in series?**

**Answer:** An ammeter must be in series so that all the current flows through it. This is the only way to get an accurate measurement. If it's in parallel, it may damage the meter or give wrong readings.

**Q28. How is a battery represented in a circuit diagram?**

**Answer:** A battery is shown as two lines, one long and one short. The long line is the positive terminal and the short one is the negative terminal. A group of these lines represents a full battery.

**Q29. Why do we use standard circuit symbols in diagrams?**

**Answer:** Standard symbols make circuit diagrams easy to understand for everyone. They allow engineers, teachers, and students to read circuits the same way. It avoids confusion.

**Q30. What happens to the current if the potential difference increases and resistance remains the same?**

**Answer:** The current increases. This is because a higher potential difference means more energy is pushing the charge. If resistance doesn't change, more current flows through the circuit.

**Q31. How is a closed circuit different from an open circuit?**

**Answer:** A closed circuit is one where all components are connected properly, allowing current to flow through the entire loop. In contrast, an open circuit has a break somewhere in the loop, such as an open switch or a disconnected wire. This break stops the flow of electric current completely.

**Q32. Why does current stop flowing when a switch is opened?**

**Answer:** Opening a switch breaks the circuit, meaning there is no longer a continuous path for current to flow. This stops the movement of electric charge. The flow of current can only happen if the circuit is complete or closed.

**Q33. Describe how current flows from the positive terminal to the negative terminal.**

**Answer:** In conventional current flow, the current moves from the positive terminal of the power source, through the circuit components, and returns to the negative terminal. This is how we represent current direction in diagrams, even though electrons actually move the other way.

**Q34. If no potential difference is applied to a circuit, what happens to the current?**

**Answer:** Without a potential difference, there is no energy to push charges through the circuit. As a result, no current flows. The charges remain still because there is no driving force acting on them.

**Q35. What happens to the current when you add more resistors in series?**

**Answer:** Adding more resistors in series increases the total resistance of the circuit. This makes it harder for the current to flow. As a result, the current decreases if the potential difference remains the same.

**Q36. If a charge of 10 C flows in 5 seconds, what is the current?**

**Answer:** 2 A

**Solution:**

$$Q = I \times t$$

$$10 = I \times 5$$

$$I = 10 \div 5$$

$$I = 2 \text{ A}$$

So, the current is 2 amperes.

**Q37. How would you calculate the time if you know the charge flow and current?**

**Answer:**

**Solution:**

Use the formula  $Q = I \times t$

Rearrange to get  $t = Q \div I$

This allows you to calculate how long current flows if you know the total charge and the current.

**Q38. A charge of 24 C passes in 6 seconds. What is the value of the current?**

**Answer:** 4 A

**Solution:**

$$Q = I \times t$$

$$24 = I \times 6$$

$$I = 24 \div 6$$

$$I = 4 \text{ A}$$

So, the current is 4 amperes.

**Q39. What symbol is used to represent time in the charge flow equation?**

**Answer:** The symbol used for time in the charge flow equation is "t". It is measured in seconds and tells us how long the current flows.

**Q40. How would the current be affected if the time doubled but charge stayed the same?**

**Answer:** If time doubles and the total charge stays the same, then the current is halved. This is because current is the amount of charge per unit time. More time means less charge flowing per second.

**Q41. Draw a circuit with a battery, resistor, and an open switch.**

**Answer:** The battery is represented by long and short lines, the resistor by a rectangle, and the switch by a break in a line with a diagonal line showing it's open. These are all connected in series to show a complete layout, but the switch remains open, so no current flows.

**Q42. Which part of the circuit provides the energy needed for charge to move?**

**Answer:** The battery or cell provides the energy needed for charge to move in the circuit. It creates a potential difference that pushes charges around the loop, powering the components.

**Q43. Why does a bulb not light up when a switch is open?**

**Answer:** When the switch is open, the circuit is broken and current cannot flow. Since no current reaches the bulb, it cannot light up. Bulbs need a continuous current to produce light.

**Q44. What do you understand by the term "closed circuit"?**

**Answer:** A closed circuit is a complete electrical loop where all parts are connected, allowing current

to flow. It means there are no breaks or gaps, so electricity can move from the power source through the components and back again.

**Q45. Why is it important to learn standard circuit symbols?**

**Answer:** Standard circuit symbols help everyone understand and read circuit diagrams easily. Whether you're a student, teacher, or engineer, using the same symbols makes communication clear and avoids confusion.

**Q46. What does the unit ampere represent in practical terms?**

**Answer:** One ampere means that one coulomb of charge flows past a point in the circuit every second. It tells us how fast the electric charge is moving. So, a higher ampere value means more charge is flowing per second.

**Q47. What causes electric charge to flow in a circuit?**

**Answer:** A potential difference, usually from a battery or power supply, causes the electric charge to flow. It provides the force or energy needed to move electrons through the circuit, creating an electric current.

**Q48. Can current exist in a circuit without potential difference? Explain.**

**Answer:** No, current cannot exist without a potential difference. Without a voltage, there is no force to move the charge. The electrons stay in place, and the circuit remains inactive.

**Q49. How does the length of time current flows affect the total charge moved?**

**Answer:** The longer the current flows, the more total charge moves through the circuit. Since charge flow equals current times time, increasing the time means more charge is transferred, assuming current stays the same.

**Q50. Explain what is meant by the term 'electric charge'.**

**Answer:** Electric charge is a basic property of matter carried by particles like electrons and protons. It causes the particles to experience a force in an electric field. Charges can be positive or negative and are measured in coulombs.

**Q51. What is the relationship between current, resistance, and potential difference?**

**Answer:** The current in a circuit depends on both the potential difference across the component and its resistance. If potential difference increases, current increases. If resistance increases, current decreases for the same potential difference.

**Q52. Write the equation that links potential difference, current, and resistance.**

**Answer:**

**Solution:**

The equation is:

$$V = I \times R$$

Where V is potential difference in volts, I is current in amperes, and R is resistance in ohms.

**Q53. Define potential difference in terms of current and resistance.**

**Answer:** Potential difference is the energy transferred per coulomb of charge. It can be calculated by multiplying current and resistance. It tells us how much push is given to the charges in the circuit.

**Q54. What unit is used to measure resistance?**

**Answer:** Resistance is measured in ohms. The symbol for ohms is the Greek letter omega ( $\Omega$ ). One ohm means one volt is needed to push one ampere of current.

**Q55. What happens to the current in a circuit if the resistance increases but the potential difference stays the same?**

**Answer:** The current decreases. This is because current is inversely proportional to resistance when voltage is constant. A higher resistance means fewer charges can pass per second.

**Q56. What is the effect of increasing potential difference while keeping resistance the same?**

**Answer:** The current increases. More potential difference means more energy is pushing the charges through the circuit. This results in more charge flowing per second.

**Q57. Describe how to calculate resistance if you know the current and the potential difference.**

**Answer:**

**Solution:**

Use the formula:  $V = I \times R$

Rearrange the formula to:  $R = V \div I$

Then put the values in to find resistance.

**Q58. A component has a current of 2 A and a potential difference of 10 V. What is its resistance?**

**Answer:** 5  $\Omega$

**Solution:**

Use the formula:  $R = V \div I$

$R = 10 \div 2$

$R = 5 \Omega$

The resistance of the component is 5 ohms.

**Q59. How does the current change if resistance is doubled and potential difference stays the same?**

**Answer:** The current is halved. This is because current and resistance are inversely related. If resistance doubles, it becomes harder for charges to flow, so current reduces to half.

**Q60. What is meant by an ohmic conductor?**

**Answer:** An ohmic conductor is a component where the current is directly proportional to the potential difference, as long as the temperature stays constant. This means resistance remains the same.

**Q61. How does the resistance of an ohmic conductor behave at constant temperature?**

**Answer:** The resistance stays the same no matter how much current flows. The graph of current versus potential difference is a straight line through the origin.

**Q62. Give an example of a component that is an ohmic conductor.**

**Answer:** A fixed resistor is an example of an ohmic conductor. Its resistance does not change with current, provided the temperature remains constant.

**Q63. How does the resistance of a filament lamp change as the current increases?**

**Answer:** The resistance increases. As more current flows, the filament gets hotter, which causes its resistance to rise. This makes it a non-ohmic component.

**Q64. What happens to the temperature of a filament lamp when current flows through it?**

**Answer:** The temperature increases. Electrical energy is converted into heat and light, so the filament becomes hot. This heat affects the resistance of the lamp.

**Q65. Describe the current-potential difference graph for an ohmic conductor.**

**Answer:** The graph is a straight line through the origin. This shows that current increases evenly with potential difference, meaning resistance is constant.

**Q66. Describe the current-potential difference graph for a filament lamp.**

**Answer:** The graph curves. At first, current increases with potential difference, but the curve flattens because resistance increases as the filament gets hotter.

**Q67. Why does the resistance of a filament lamp increase as it gets hotter?**

**Answer:** As the filament heats up, the metal ions vibrate more. This makes it harder for electrons to pass through, so the resistance increases with temperature.

**Q68. What is the direction of current flow through a diode?**

**Answer:** Current flows through a diode in one direction only—forward direction. In the reverse direction, the diode has very high resistance and blocks the current.

**Q69. Why does a diode have high resistance in the reverse direction?**

**Answer:** Diodes are designed to allow current to pass in one direction only. In reverse direction, the diode's internal structure blocks charge flow, causing high resistance.

**Q70. Sketch the current-potential difference graph for a diode.**

**Answer:** The graph shows almost no current in the reverse direction. In the forward direction, current stays near zero until a certain voltage is reached, then increases sharply.

**Q71. What is a thermistor?**

**Answer:** A thermistor is a temperature-dependent resistor. Its resistance changes with temperature. In most thermistors, resistance decreases as temperature increases.

**Q72. How does the resistance of a thermistor change with temperature?**

**Answer:** As temperature increases, the resistance of a thermistor decreases. More energy makes it easier for charge to flow through the material.

**Q73. What is a practical application of a thermistor?**

**Answer:** Thermistors are used in thermostats. When the temperature changes, their resistance changes, which can turn a heating system on or off automatically.

**Q74. Describe a circuit where a thermistor is used in a thermostat.**

**Answer:** The thermistor is connected in a potential divider circuit. When the room gets cold, the thermistor's resistance increases, changing the voltage and turning the heater on.

**Q75. What is an LDR?**

**Answer:** An LDR (Light Dependent Resistor) is a resistor whose resistance depends on light intensity. Its resistance decreases when more light is present.

**Q76. How does the resistance of an LDR change with light intensity?**

**Answer:** When light intensity increases, the resistance of the LDR decreases. This allows more current to flow in brighter conditions.

**Q77. Give one example where an LDR is used in real life.**

**Answer:** LDRs are used in street lights. As it gets dark and light intensity drops, resistance increases and switches the lights on.

**Q78. How can an LDR be used to automatically switch on lights in the dark?**

**Answer:** The LDR is placed in a potential divider. As light decreases, resistance increases, changing the voltage in the circuit and triggering a switch to turn the light on.

**Q79. What happens to the resistance of an LDR in bright sunlight?**

**Answer:** The resistance becomes very low. More light means more energy, which allows charge to pass through the LDR easily.

**Q80. Why is it useful that the resistance of a thermistor decreases when it gets hot?**

**Answer:** It allows the thermistor to control current based on temperature. For example, in a cooling fan circuit, the thermistor lets more current flow as temperature increases, turning on the fan.

**Q81. What does a linear component mean in terms of resistance?**

**Answer:** A linear component is one where the current increases in direct proportion to the potential difference. This means its resistance stays constant, and its current-voltage graph is a straight line through the origin.

**Q82. How can you tell from a graph if a component is non-linear?**

**Answer:** If the current-voltage graph curves or does not pass through the origin in a straight line, the component is non-linear. This shows its resistance is changing as the current increases.

**Q83. How would you set up a circuit to measure the resistance of a component?**

**Answer:** You would connect the component in series with an ammeter and connect a voltmeter in parallel across the component. Then apply a power source and use the readings to calculate resistance using  $V = I \times R$ .

**Q84. What instruments do you need to measure resistance in a circuit?**

**Answer:** You need an ammeter to measure current, a voltmeter to measure potential difference, and a power supply. These help you find resistance by using the formula  $R = V \div I$ .

**Q85. Why must you measure both current and potential difference to calculate resistance?**

**Answer:** Resistance depends on how much current flows for a given potential difference. Without knowing both, you cannot use the formula  $R = V \div I$  to find the resistance of a component.

**Q86. Draw a circuit diagram for measuring the resistance of a resistor.**

**Answer:** The circuit includes a power source, a resistor, an ammeter in series, and a voltmeter in parallel across the resistor. This setup lets you find both current and voltage to calculate resistance.

**Q87. In what part of the circuit should you place the ammeter?**

**Answer:** The ammeter should be placed in series with the component. This allows it to measure the current that flows through the resistor accurately.

**Q88. In what part of the circuit should you place the voltmeter?**

**Answer:** The voltmeter should be connected in parallel with the component. This way, it measures the potential difference directly across the resistor.

**Q89. Why must the voltmeter be connected in parallel?**

**Answer:** A voltmeter measures the difference in potential between two points. It must be connected across the component to show how much energy each coulomb of charge loses or gains.

**Q90. Why should the wire be kept at constant temperature in resistance investigations?**

**Answer:** If the temperature changes, the resistance of the wire may also change. This can affect the accuracy of the experiment and give unreliable results, especially for metal wires.

**Q91. How does increasing the length of a wire affect its resistance?**

**Answer:** Resistance increases with the length of the wire. A longer wire means charges must travel through more material, which increases the number of collisions and slows them down.

**Q92. What type of wire would have the lowest resistance?**

**Answer:** A short, thick wire made from a good conductor like copper would have the lowest resistance. These factors reduce the number of collisions that slow down charge flow.

**Q93. Why is it important to use the same wire material when testing wire length and resistance?**

**Answer:** Different materials have different resistivities. Using the same material ensures that changes in resistance are due to length alone, not differences in material properties.

**Q94. How would you investigate the effect of wire length on resistance?**

**Answer:** Set up a circuit with a variable-length wire, a power supply, ammeter, and voltmeter. Measure current and voltage for different lengths and use  $R = V \div I$  to calculate resistance.

**Q95. What safety precautions should you take when investigating wire resistance?**

**Answer:** Use low voltages to avoid overheating. Do not touch the wire during or just after use, as it can get hot. Also, switch off the power supply between readings to prevent burns.

**Q96. How do resistors behave when placed in series in a circuit?**

**Answer:** In series, the resistors share the total potential difference, and the current is the same through each resistor. Their resistances add up to give the total resistance.

**Q97. How does adding more resistors in series affect total resistance?**

**Answer:** The total resistance increases. Each resistor adds its resistance to the total, making it harder for current to flow through the circuit.

**Q98. How does adding more resistors in parallel affect total resistance?**

**Answer:** The total resistance decreases. Adding another path for the current allows more charge to flow, which reduces the overall resistance of the circuit.

**Q99. Explain how current behaves in a parallel circuit with two resistors.**

**Answer:** The total current splits between the two branches. Each branch has its own current depending on its resistance, but the total current is the sum of both.

**Q100. Explain how the total resistance in a series circuit is calculated.**

**Answer:**

**Solution:**

Use the formula:  $R_{\text{total}} = R_1 + R_2 + R_3 \dots$

Add the resistance values of each resistor in the series

For example, if  $R_1 = 2 \Omega$ ,  $R_2 = 3 \Omega$ , and  $R_3 = 5 \Omega$ :

$$R_{\text{total}} = 2 + 3 + 5$$

$$R_{\text{total}} = 10 \Omega$$

So the total resistance is 10 ohms.

**Q101. Explain how the total resistance in a parallel circuit is calculated.**

**Answer:**

**Solution:**

The formula for total resistance in a parallel circuit is:

$$1/R_{\text{total}} = 1/R_1 + 1/R_2 + 1/R_3 \dots$$

After calculating the sum of the reciprocals, take the inverse to get the total resistance.

Example:  $R_1 = 6 \Omega$ ,  $R_2 = 3 \Omega$

$$1/R_{\text{total}} = 1/6 + 1/3 = 1/6 + 2/6 = 3/6$$

$$R_{\text{total}} = 6/3 = 2 \Omega$$

**Q102. How would you use a graph to identify if a component is ohmic or non-ohmic?**

**Answer:** A straight-line graph of current against potential difference shows the component is ohmic. If the graph curves or does not pass through the origin, the component is non-ohmic and its resistance changes.

**Q103. What would a curved line on a current-potential difference graph suggest about the component?**

**Answer:** A curved line means the current is not increasing proportionally with potential difference. This shows the component is non-ohmic and its resistance is changing as the current changes.

**Q104. What does it mean if a component shows a straight line through the origin on a current-potential difference graph?**

**Answer:** It means the component is ohmic. The current is directly proportional to the potential difference, and resistance remains constant at all values of current.

**Q105. What is the resistance if a potential difference of 12 V causes a current of 3 A to flow?**

**Answer:** 4  $\Omega$

**Solution:**

Use the formula:  $R = V \div I$

$$R = 12 \div 3$$

$$R = 4 \Omega$$

**Q106. If a component has a resistance of 4  $\Omega$  and the current is 2 A, what is the potential difference across it?**

**Answer:** 8 V

**Solution:**

Use the formula:  $V = I \times R$

$$V = 2 \times 4$$

$$V = 8 \text{ V}$$

**Q107. What is the current when the potential difference is 15 V and the resistance is 5  $\Omega$ ?**

**Answer:** 3 A

**Solution:**

Use the formula:  $I = V \div R$

$$I = 15 \div 5$$

$$I = 3 \text{ A}$$

**Q108. Why does a diode conduct only in one direction?**

**Answer:** A diode is designed to allow current to flow in only one direction. In the reverse direction, it has a very high resistance that blocks the flow of current.

**Q109. How can you tell from a graph that a diode only allows current in one direction?**

**Answer:** On the graph, in the reverse voltage region, current stays at zero. In the forward direction, current increases sharply after a certain voltage. This shows it only conducts in one direction.

**Q110. How would the resistance of a thermistor behave if placed in a cold environment?**

**Answer:** In a cold environment, the thermistor's resistance would be high. Low temperature makes it harder for current to pass through the thermistor.

**Q111. How does the function of a thermistor help in regulating heating systems?**

**Answer:** As the room gets colder, the thermistor's resistance increases. This change can trigger a circuit to turn the heater on, helping maintain a stable room temperature.

**Q112. What does the symbol for a diode look like and what does the arrow show?**

**Answer:** The diode symbol is a triangle pointing to a line. The triangle shows the direction in which current can flow, and the line blocks reverse current.

**Q113. Why does a light bulb glow brighter as the current increases?**

**Answer:** More current means more energy is transferred to the filament. This increases its temperature, causing it to emit more light and glow brighter.

**Q114. How does increasing the resistance affect the brightness of a bulb?**

**Answer:** If resistance increases and potential difference stays the same, the current decreases. Less current means less energy is transferred, so the bulb becomes dimmer.

**Q115. What happens to total resistance when identical resistors are placed in parallel?**

**Answer:** The total resistance becomes less than the resistance of any one resistor. This is because the current has more than one path to flow through.

**Q116. How would you explain to someone why LDRs are useful in automatic lighting systems?**

**Answer:** LDRs change resistance with light. As it gets dark, resistance increases and can be used to switch lights on automatically. They help save energy and improve convenience.

**Q117. Why is it incorrect to assume resistance is always constant in every component?**

**Answer:** Some components like filament lamps, diodes, and thermistors have resistance that changes with temperature, light, or current. Only ohmic conductors have constant resistance.

**Q118. Why is it necessary to repeat readings and take averages when investigating resistance?**

**Answer:** Repeating readings helps reduce the effect of errors or fluctuations. Taking the average gives a more reliable and accurate value for resistance.

**Q119. What would you expect the graph of resistance vs. temperature for a thermistor to look like?**

**Answer:** The graph would show a downward curve. As temperature increases, the resistance drops, showing an inverse relationship between resistance and temperature.

**Q120. Why do non-ohmic components not obey Ohm's law?**

**Answer:** Non-ohmic components have resistance that changes with current or voltage. Ohm's law only applies when resistance is constant, so it does not hold for these components.

**Q121. What is the difference between a series and a parallel circuit?**

**Answer:** In a series circuit, components are connected one after another in a single path, so the same current flows through each. In a parallel circuit, components are connected across the same two points, so each component has its own branch and gets the full potential difference.

**Q122. In a series circuit, what happens to the current at each component?**

**Answer:** The current is the same at every point in a series circuit. This is because there is only one path for the charges to flow through, so the same amount of current must pass through each component.

**Q123. In a parallel circuit, how does the potential difference across each component behave?**

**Answer:** Each component in a parallel circuit receives the same potential difference as the power supply. This is because each branch is directly connected across the power source.

**Q124. What is the formula to calculate total resistance in a series circuit?**

**Answer:**

**Solution:**

Use the formula:

$$R_{\text{total}} = R_1 + R_2 + R_3 \dots$$

Add the resistance values of each resistor in the series to find the total resistance.

**Q125. Why does adding more resistors in series increase total resistance?**

**Answer:** When resistors are added in series, the current must pass through each one. This increases the opposition to current flow, which adds up and increases the total resistance.

**Q126. Why does adding resistors in parallel reduce the total resistance?**

**Answer:** Adding resistors in parallel provides more paths for the current to flow. This reduces the overall opposition to current flow, lowering the total resistance.

**Q127. What happens to the total current in a parallel circuit when more branches are added?**

**Answer:** The total current increases when more branches are added, because each new branch allows additional current to flow through the circuit.

**Q128. In a series circuit, how is the total potential difference of the power supply divided?**

**Answer:** The total potential difference is shared between all components in a series circuit. The more resistance a component has, the greater its share of the potential difference.

**Q129. In a parallel circuit, what remains constant across all components?**

**Answer:** The potential difference across each branch remains the same. Each component in parallel is directly connected to the power supply.

**Q130. What does the term “equivalent resistance” mean in a circuit?**

**Answer:** Equivalent resistance means the total resistance of a group of resistors combined into one. It is the resistance that could replace the group without changing the current or potential difference in the circuit.

**Q131. If one bulb breaks in a series circuit, what happens to the rest of the circuit?**

**Answer:** If one bulb breaks in a series circuit, the entire circuit stops working. This is because the path for current is broken, and current cannot flow through the rest of the components.

**Q132. If one bulb breaks in a parallel circuit, what happens to the rest of the circuit?**

**Answer:** The other branches continue to work as normal. In a parallel circuit, each component has its own path, so one broken branch doesn't affect the others.

**Q133. How do you calculate current in different branches of a parallel circuit?**

**Answer:** Measure or calculate the current in each branch based on its resistance and the shared potential difference. Then add all the branch currents to get the total current in the circuit.

**Q134. Why is it easier to add more components in a parallel circuit than in series?**

**Answer:** In a parallel circuit, adding components does not increase total resistance much. Each component gets full voltage and works independently, making the system more efficient.

**Q135. What type of circuit is commonly used in domestic lighting and why?**

**Answer:** Parallel circuits are used in domestic lighting. This allows each light to work independently and receive the full voltage, so switching one off does not affect the others.

**Q136. Describe how energy is shared between components in a series circuit.**

**Answer:** In a series circuit, the energy from the power supply is divided among the components. Components with higher resistance use more energy, and each component gets a portion of the total voltage.

**Q137. What happens to the brightness of bulbs in a series circuit if more bulbs are added?**

**Answer:** The brightness of each bulb decreases. Adding more bulbs increases total resistance, which reduces the current and the energy transferred to each bulb.

**Q138. Why do components in a parallel circuit get full potential difference?**

**Answer:** Each branch in a parallel circuit is connected directly across the power supply. This means the potential difference across each component is the same as the supply voltage.

**Q139. How does current behave at junctions in a parallel circuit?**

**Answer:** The current splits at a junction. The total current entering the junction equals the total current leaving it, shared between the branches depending on their resistances.

**Q140. What is a common use of series circuits in everyday devices?**

**Answer:** Series circuits are often used in simple devices like fairy lights or old-style Christmas lights. These circuits are easy to set up and control with a single switch.

**Q141. Why is the total resistance in a parallel circuit always lower than the smallest resistor?**

**Answer:** In a parallel circuit, current has multiple paths to flow. This reduces the overall opposition to current, so the total resistance is always less than the smallest individual resistor.

**Q142. In a series circuit with 2 resistors, how is the current affected if one resistor is doubled?**

**Answer:** Doubling one resistor increases total resistance. Since current = potential difference ÷ total resistance, the current in the circuit will decrease.

**Q143. Describe a method to test if two resistors are connected in series or parallel.**

**Answer:** Use a multimeter to measure total resistance. If the total resistance is the sum of both resistors, they are in series. If it is less than the smallest resistor, they are in parallel.

**Q144. How does current behave in a complete series loop?**

**Answer:** The current is the same at all points in a series loop. This is because there is only one path for the current to flow.

**Q145. What must remain equal in all components of a series circuit?**

**Answer:** The current must remain equal in all components. It does not split, as there is only one route through the components.

**Q146. In parallel, how is total current related to branch currents?**

**Answer:** The total current is the sum of the currents in each branch. Current splits at junctions and adds up again as it rejoins.

**Q147. What is the main difference in energy distribution between series and parallel circuits?**

**Answer:** In a series circuit, the energy is shared between components. In a parallel circuit, each branch receives full energy from the supply.

**Q148. What happens to the total resistance if you connect identical resistors in series?**

**Answer:**

**Solution:**

$$R_{\text{total}} = R + R$$

If two identical resistors of 4 Ω are connected in series:

$$R_{\text{total}} = 4 + 4 = 8 \Omega$$

So, total resistance doubles.

**Q149. Explain the design of a basic dc series circuit used for testing components.**

**Answer:** A simple DC series circuit includes a battery, a switch, an ammeter in series, and the component being tested. This setup allows current to flow through the component for observation and measurement.

**Q150. How would you construct a circuit to measure total resistance in a series circuit?**

**Answer:** Connect the resistors in series, place a voltmeter across both and an ammeter in series. Use the formula  $R = V \div I$  after measuring voltage and current.

**Q151. Why can series circuits be useful for safety alarms?**

**Answer:** In a series circuit, if one component fails or a wire is broken, the whole circuit stops working. This is useful for alarms so that a break triggers the system to alert users.

**Q152. What makes a parallel circuit more suitable for household wiring?**

**Answer:** In a parallel circuit, each appliance operates independently. If one is turned off or fails, the others continue to work, which is ideal for homes.

**Q153. Why is it important to understand equivalent resistance in circuits?**

**Answer:** Knowing equivalent resistance helps predict how a circuit behaves. It allows you to calculate current, design efficient circuits, and ensure safe operation.

**Q154. What does a frequency of 50 Hz mean in terms of alternating current?**

**Answer:** It means the current changes direction 50 times per second. This is standard for mains electricity in the UK.

**Q155. What is the potential difference of mains electricity in the UK?**

**Answer:** The mains electricity in the UK has a potential difference of about 230 V. This is the voltage supplied to homes.

**Q156. What is the role of the live wire in a three-pin plug?**

**Answer:** The live wire carries the alternating potential difference from the mains supply to the appliance. It is brown in colour.

**Q157. What does the neutral wire do in a mains circuit?**

**Answer:** The neutral wire completes the circuit by carrying current back to the supply. It is at or near earth potential and is blue in colour.

**Q158. What is the purpose of the earth wire in electrical safety?**

**Answer:** The earth wire provides a path for current to flow to the ground if the live wire touches the metal casing. This prevents electric shock.

**Q159. What are the colour codes for the three wires in a three-core cable?**

**Answer:** The live wire is brown, the neutral wire is blue, and the earth wire has green and yellow stripes. These colours help identify the wires easily.

**Q160. Why is the earth wire connected to the metal casing of some appliances?**

**Answer:** If the live wire touches the metal case, the earth wire directs the current safely to the ground. This stops the case from becoming live and dangerous.

**Q161. What danger exists even when a switch is off in a mains circuit?**

**Answer:** The live wire still carries voltage even when the switch is off. If someone touches the live wire, they can get an electric shock because it remains connected to the mains supply.

**Q162. Why is the live wire the most dangerous part of the mains supply?**

**Answer:** The live wire carries high voltage (about 230 V in the UK) and can cause a severe electric shock if touched. It stays connected to the power supply even if the appliance is switched off.

**Q163. What could happen if the live wire touches a metal case without an earth connection?**

**Answer:** The metal case could become live, and anyone touching it may receive an electric shock. Without the earth wire, there's no safe path for the current to flow to the ground.

**Q164. Why is there no current in the earth wire during normal operation?**

**Answer:** In normal conditions, the live wire never touches the metal casing. So, the earth wire has no current because it only carries current during a fault to keep the user safe.

**Q165. What does it mean for the neutral wire to be at "earth potential"?**

**Answer:** It means the neutral wire is at or very close to 0 volts and is safely connected to the earth at the power station. It completes the circuit without posing a shock risk.

**Q166. How does the earth wire prevent electric shocks?**

**Answer:** If a fault makes the metal casing live, the earth wire carries the current safely to the ground. This causes a large current that blows the fuse, cutting off the supply.

**Q167. What would happen if the live and earth wires were connected directly?**

**Answer:** A large current would flow directly to the earth. This could cause a spark, blow the fuse, or even start a fire. It is highly dangerous and must be avoided.

**Q168. Why is touching a live wire dangerous even if the appliance is off?**

**Answer:** The live wire remains connected to the mains voltage. Touching it can complete the circuit through your body to the ground, causing a serious electric shock.

**Q169. Why must appliances have a properly wired plug?**

**Answer:** A properly wired plug ensures that the live, neutral, and earth wires are connected safely and correctly. This protects users from shocks and ensures the appliance works safely.

**Q170. What safety features are included in UK plug design?**

**Answer:** UK plugs have insulated pins, a fuse, an earth wire, and colour-coded wires. These features reduce the risk of electric shock and protect the user and appliance.

**Q171. What role does fuse or circuit breaker play in protecting the mains circuit?**

**Answer:**

**Solution:**

Fuse or circuit breaker cuts off the current when it becomes too high.

This prevents overheating or damage to the appliance and reduces fire risk.

It is a key safety feature in the circuit.

**Q172. What happens if you touch the live wire while standing on the ground?**

**Answer:** You could get a dangerous electric shock. The current flows from the live wire through your body to the ground because your body completes the circuit.

**Q173. How does mains electricity differ from battery electricity?**

**Answer:** Mains electricity is alternating current (ac), which changes direction. Battery electricity is direct current (dc), which flows in only one direction.

**Q174. Why is ac used for mains instead of dc?**

**Answer:** Alternating current is easier to transmit over long distances. It can be stepped up or down in voltage using transformers, which makes it more efficient for power distribution.

**Q175. What should you check before wiring a plug?**

**Answer:** Check the wire colours, the fuse rating, and that each wire is securely connected to the correct terminal. Also ensure no bare wires are exposed.

**Q176. What might happen if the earth wire is disconnected?**

**Answer:** If a fault occurs, the metal casing could become live. Without the earth wire, there is no safe path to ground, so touching the case could cause a shock.

**Q177. Why must electrical appliances be earthed if they have a metal case?**

**Answer:** To prevent the metal case from becoming live. If a fault connects the live wire to the case, the earth wire provides a safe route to ground and triggers the fuse.

**Q178. How does the live wire cause electric shock?**

**Answer:** The live wire carries high voltage. If touched, the current can flow through the person's body to the earth, causing a harmful or fatal shock.

**Q179. How do fuses protect the circuit from too much current?**

**Answer:** A fuse contains a thin wire that melts if the current is too high. This breaks the circuit and stops the flow of current, preventing damage or fire.

**Q180. Why do we use insulation on each wire in a three-core cable?**

**Answer:** Insulation prevents wires from touching each other or metal parts. It reduces the risk of short circuits, electric shock, and fire, making the cable safe to use.

**Q181. What is the equation that links power, potential difference, and current?**

**Answer:** Power = Potential Difference × Current

**Solution:**

$$P = V \times I$$

**Q182. Write the equation that links power, current, and resistance.**

**Answer:** Power = Current<sup>2</sup> × Resistance

**Solution:**

$$P = I^2 \times R$$

**Q183. Define power in terms of electrical circuits.**

**Answer:** Power is the rate at which electrical energy is transferred or used in a circuit.

**Q184. How does increasing the potential difference affect power if current stays the same?**

**Answer:** Power increases.

**Solution:**

$$P = V \times I$$

If  $I$  stays the same and  $V$  increases,  $P$  increases.

**Q185. How does power change if the current is doubled and resistance stays the same?**

**Answer:** Power becomes four times greater.

**Solution:**

$$P = I^2 \times R$$

New current =  $2I$

$$P = (2I)^2 \times R = 4I^2 \times R$$

**Q186. What unit is used to measure electrical power?**

**Answer:** Watt (W)

**Solution:**

1 Watt = 1 Joule per second

**Q187. If a device has a high current and low resistance, what can you say about its power?**

**Answer:** Its power is high.

**Solution:**

$$P = I^2 \times R$$

High  $I^2$  even with low  $R$  means high power.

**Q188. Describe how to calculate power using current and resistance.**

**Answer:** Use the formula  $P = I^2 \times R$

**Solution:**

Square the current, then multiply by resistance.

**Q189. What happens to the power if the current increases and resistance remains constant?**

**Answer:** Power increases.

**Solution:**

$$P = I^2 \times R$$

If  $I$  increases,  $I^2$  increases, so  $P$  increases.

**Q190. Why do we use two different equations to calculate power?**

**Answer:** Because it depends on what quantities are known ( $V$  and  $I$  or  $I$  and  $R$ ).

**Solution:**

Use  $P = V \times I$  if  $V$  and  $I$  are known. Use  $P = I^2 \times R$  if  $I$  and  $R$  are known.

**Q191. What is meant by energy transferred in an electric circuit?**

**Answer:** It is the amount of energy moved from the power source to the components.

**Q192. How is energy transferred related to power and time?**

**Answer:** Energy transferred = Power  $\times$  Time

**Solution:**

$$E = P \times t$$

**Q193. Write the equation that links energy transferred, charge flow, and potential difference.**

**Answer:** Energy transferred = Charge Flow  $\times$  Potential Difference

**Solution:**

$$E = Q \times V$$

**Q194. If a device is switched on for a longer time, how does this affect the energy transferred?**

**Answer:** Energy transferred increases.

**Solution:**

$$E = P \times t$$

If  $t$  increases,  $E$  increases.

**Q195. What is the unit for energy transferred?**

**Answer:** Joule (J)

**Solution:**

$$1 \text{ Joule} = 1 \text{ Watt} \times 1 \text{ second}$$

**Q196. If an appliance uses more power, what happens to the energy it transfers in a given time?**

**Answer:** It transfers more energy.

**Solution:**

$$E = P \times t$$

More power means more energy transferred per second.

**Q197. How do you calculate the energy used by a 100 W appliance in 1 hour?**

**Answer:** Energy = 360000 J

**Solution:**

$$P = 100 \text{ W}$$

$$t = 1 \text{ hour} = 3600 \text{ s}$$

$$E = P \times t = 100 \times 3600 = 360000 \text{ J}$$

**Q198. Why is it useful to know the power rating of a domestic appliance?**

**Answer:** To know how much energy it uses and how much it costs to run.

**Q199. What does a 2 kW power rating mean for an appliance?**

**Answer:** It uses 2000 watts of energy per second.

**Solution:**

$$2 \text{ kW} = 2000 \text{ W}$$

**Q200. What is the relationship between charge flow and energy transferred?**

**Answer:** Energy transferred = Charge flow  $\times$  Potential difference

**Solution:**

$$E = Q \times V$$

**Q201. How does a fan transfer energy when it is switched on?**

**Answer:** It converts electrical energy to kinetic energy and heat.

**Q202. Give an example of a device that transfers electrical energy to heat.**

**Answer:** Electric heater

**Q203. Why do some appliances need a higher power rating than others?**

**Answer:** Because they do more work or operate faster.

**Q204. What does the power rating of an appliance tell you about its energy use?**

**Answer:** It tells how much energy it uses per second.

**Q205. How can two appliances use the same amount of energy but have different power ratings?**

**Answer:** One uses more power for less time, the other uses less power for more time.

**Solution:**

$$E = P \times t$$

**Q206. Why is it important to switch off appliances when not in use?**

**Answer:** To save energy and reduce electricity bills.

**Q207. What happens to energy when electrical work is done in a circuit?**

**Answer:** It is transferred into other forms like heat, light, or movement.

**Q208. How does energy transfer differ in a battery-powered device compared to a mains-powered one?**

**Answer:** A battery-powered device uses stored chemical energy, while a mains-powered device uses energy from the grid.

**Q209. Describe how a toaster transfers energy during use.**

**Answer:** It converts electrical energy into heat to toast bread.

**Q210. Explain how electrical energy is transferred to kinetic energy in a washing machine.**

**Answer:** Electrical energy powers a motor, which moves the drum and converts it to kinetic energy.

**Q221. What happens when two insulating materials are rubbed together?**

**Answer:** One material becomes negatively charged and the other becomes positively charged.

**Solution:**

When insulating materials are rubbed, electrons move from one material to the other.

The material that loses electrons becomes positively charged.

The material that gains electrons becomes negatively charged.

**Q222. What kind of particles are transferred during rubbing of insulating materials?**

**Answer:** Only negatively charged electrons are transferred.

**Solution:**

During rubbing, electrons are removed from one object and move to another. Protons do not move because they are fixed in the nucleus. This transfer creates positive and negative charges.

**Q223. What charge does a material have if it gains electrons?**

**Answer:** The material becomes negatively charged.

**Solution:**

Electrons carry a negative charge. When a material gains electrons, it increases its negative charge. So, it becomes negatively charged overall.

**Q224. What charge does a material have if it loses electrons?**

**Answer:** The material becomes positively charged.

**Solution:**

Losing electrons means fewer negative charges remain. This makes the material have more positive than negative charges. Therefore, it becomes positively charged.

**Q225. Why does rubbing a balloon on your hair cause it to stick to a wall?**

**Answer:** The balloon becomes charged and attracts to the wall by static force.

**Solution:**

Rubbing the balloon transfers electrons to it, making it negatively charged. The wall has neutral charges, but nearby positive charges are attracted to the balloon. This creates an attractive force between the balloon and the wall.

**Q226. What is the name of the force between two charged objects that are not touching?**

**Answer:** It is called a non-contact force.

**Solution:**

Charged objects can attract or repel each other without touching. This force acts across space and does not need physical contact. Electric fields cause these non-contact forces.

**Q227. What happens when two objects with the same charge are brought close together?**

**Answer:** They repel each other.

**Solution:**

Like charges always push away from each other. This is due to the interaction of their electric fields. So, two positive or two negative objects repel.

**Q228. What happens when two objects with opposite charges are near each other?**

**Answer:** They attract each other.

**Solution:**

Opposite charges have electric fields that pull them together.

A positive and a negative charge attract.  
This attraction is a non-contact force.

**Q229. What is meant by a non-contact force?**

**Answer:** It is a force that acts without the objects touching.

**Solution:**

Electric and magnetic forces can act over a distance.  
For example, a charged rod can attract bits of paper without touching them.  
This type of force is called a non-contact force.

**Q230. How can you show that charged objects attract or repel without touching?**

**Answer:** You can observe movement of objects when they are near a charged object.

**Solution:**

Bring a charged rod close to small paper pieces; they move toward it.  
Or bring two charged balloons close and watch them move apart.  
These movements show attraction or repulsion without contact.

**Q231. What causes sparking between two charged objects?**

**Answer:** A high enough electric field causes electrons to jump through the air.

**Solution:**

When the electric field between objects is strong, it ionises air particles.  
Electrons can jump across the air gap, causing a spark.  
This is a quick discharge of static electricity.

**Q232. Why can static electricity be dangerous in certain places?**

**Answer:** Sparks can ignite flammable substances or cause shocks.

**Solution:**

In petrol stations or aircraft, static build-up can cause sparks.  
These sparks may ignite fuels or vapours.  
That's why grounding and anti-static methods are used.

**Q233. How can static electricity be reduced in aircraft fuel lines?**

**Answer:** By using grounding wires and adding anti-static additives.

**Solution:**

Grounding wires safely carry charge away to prevent build-up.  
Additives reduce friction and limit charge separation in the fuel.  
These methods prevent dangerous sparks.

**Q234. What everyday situations can cause a build-up of static charge?**

**Answer:** Walking on carpets or removing synthetic clothes can cause static.

**Solution:**

Friction between shoes and carpet transfers electrons.  
Synthetic clothes rubbing can do the same.  
This causes charge to build up on your body or clothes.

**Q235. Why is a person more likely to get a static shock in dry weather?**

**Answer:** Dry air is a poor conductor so charge builds up easily.

**Solution:**

In dry weather, moisture in the air is low.

Low humidity means charge doesn't leak away quickly.

This leads to more static build-up and shocks.

**Q236. What is the difference between static electricity and current electricity?**

**Answer:** Static electricity is the build-up of charges on a surface, while current electricity is the flow of charges through a conductor.

**Solution:** In static electricity, charges stay in one place until discharged. In current electricity, electrons flow in a circuit, driven by a potential difference. Static charges build from friction, while current needs a power supply.

**Q237. Why does a plastic ruler attract small pieces of paper after being rubbed?**

**Answer:** Rubbing the ruler transfers electrons, giving it a charge that attracts neutral objects.

**Solution:** When rubbed, the plastic ruler becomes negatively charged by gaining electrons. The electric field around it polarises the paper, attracting the positive side. This causes the small paper pieces to move toward the ruler.

**Q238. What is the result of unequal distribution of electrons between two materials?**

**Answer:** One material becomes positively charged and the other becomes negatively charged.

**Solution:** If one material loses electrons, it becomes positively charged. The other gains those electrons and becomes negatively charged. This charge imbalance creates static electricity and electric forces.

**Q239. What safety precautions can be taken to avoid static sparks in petrol stations?**

**Answer:** Use grounding, anti-static materials, and proper signage to reduce risk.

**Solution:** Grounding removes built-up charge safely into the earth. Anti-static clothing and hoses prevent friction and charge build-up. Signs warn users to avoid actions that can cause sparks during fueling.

**Q240. What happens to electrons in static charge build-up?**

**Answer:** Electrons accumulate on one object, causing it to become negatively charged.

**Solution:** Friction transfers electrons from one surface to another. The object gaining electrons holds a negative static charge. This imbalance can result in discharge through sparking.

**Q241. What is an electric field?**

**Answer:** An electric field is the region around a charged object where it can exert a force.

**Solution:** The electric field is invisible but can cause attraction or repulsion of other charges. It is strongest near the charge and gets weaker with distance. The field affects any other charges placed in it.

**Q242. How does the strength of an electric field change with distance from a charged object?**

**Answer:** The strength decreases as the distance increases.

**Solution:** Electric field strength is inversely related to distance from the charge. Close to the object, field lines are close together, showing a strong field. Farther away, the lines spread out, and the field becomes weaker.

**Q243. What direction do electric field lines point for a positively charged object?**

**Answer:** Electric field lines point away from a positively charged object.

**Solution:** Field lines represent the direction a positive test charge would move. Since like charges repel, the test charge is pushed away. This makes field lines move outward from a positive charge.

**Q244. What direction do electric field lines point for a negatively charged object?**

**Answer:** Electric field lines point toward a negatively charged object.

**Solution:** A positive test charge would be pulled toward a negative charge. This shows attraction, so field lines point inward. The lines start from positive and end at negative charges.

**Q245. What shape is the electric field around a single charged sphere?**

**Answer:** It is radial, with field lines pointing directly in or out from the centre.

**Solution:** A sphere creates a symmetrical electric field. Lines radiate equally in all directions. They show attraction if the sphere is negative and repulsion if it is positive.

**Q246. How do electric fields explain the attraction between charged objects?**

**Answer:** A charged object's electric field exerts a force on another nearby charge.

**Solution:** A positive charge creates a field that pulls in negative charges. A negative charge does the opposite. These fields cause the two objects to move toward each other without touching.

**Q247. How do electric fields explain repulsion between objects with like charges?**

**Answer:** Their fields push each other apart as the same charges repel.

**Solution:** When two like charges are near, their electric fields interact. Both try to push a positive test charge away, creating repulsion. This causes the objects to move apart.

**Q248. How can we draw an electric field to show its strength?**

**Answer:** Use field lines spaced closely for strong fields and far apart for weak fields.

**Solution:** Draw arrows showing the field direction. The closer the lines, the stronger the field. Fewer, widely spaced lines mean a weaker electric field in that area.

**Q249. Why is the electric field stronger closer to the charged object?**

**Answer:** The field lines are denser near the charge, showing more force per area.

**Solution:** Field strength depends on how concentrated the lines are. Near the charge, they are packed together. This means any nearby charge feels a stronger force.

**Q250. What is the link between electric fields and the force on a nearby charged object?**

**Answer:** The electric field applies a force on the object depending on its charge and distance.

**Solution:** The force is stronger if the electric field is stronger. Positive charges move in the field direction, and negatives move opposite. Closer objects feel more force due to field strength.

**Q251. How can electric fields cause sparking between objects?**

**Answer:** A strong field causes electrons to jump across the air gap.

**Solution:** When two objects have large opposite charges, their field becomes strong. If the field is strong enough, it ionises air molecules. Electrons then flow through the air, causing a spark.

**Q252. Why does a charged object influence another object without touching it?**

**Answer:** Its electric field applies a force on other charges nearby.

**Solution:** Every charged object has a field that reaches into space. Another object in this field experiences a force. This happens even if the two objects are not in contact.

**Q253. What would happen to the electric field if the charge of the object increases?**

**Answer:** The electric field would become stronger.

**Solution:** Electric field strength is directly related to the amount of charge. More charge means more force on nearby charges. This makes the field lines denser and the field stronger.

**Q254. How can field lines show the difference between strong and weak electric fields?**

**Answer:** Strong fields have closely spaced lines, weak fields have lines far apart.

**Solution:** Field lines represent force strength. If they are close together, the force is strong. If they are far apart, the field is weak and the force is lower.

**Q255. What is the shape of the electric field between two oppositely charged plates?**

**Answer:** It is uniform, with straight lines from positive to negative.

**Solution:** The field between parallel plates is even in strength and direction. Lines run parallel and equally spaced. This shows a constant force throughout the region.

**Q256. Why are electric field lines never crossed or broken?**

**Answer:** Because each point in space has only one field direction.

**Solution:** Crossing lines would mean two directions of force at one point, which is not possible. So, field lines are always smooth and continuous without overlaps.

**Q257. What does the spacing between electric field lines tell us?**

**Answer:** It shows the strength of the electric field.

**Solution:** Closely packed lines indicate a strong field. Widely spaced lines show a weaker field. Field strength is based on line density in a diagram.

**Q258. How can the idea of electric fields help to understand lightning?**

**Answer:** Lightning occurs when the electric field between clouds and Earth becomes strong enough to spark.

**Solution:** Storm clouds build up negative charge, creating a field with the ground. When the field is strong, air ionises and electrons jump. This discharge is seen as lightning.

**Q259. What causes the force between a charged balloon and a neutral wall?**

**Answer:** The balloon's field polarises the wall's surface, causing attraction.

**Solution:** The negative charge on the balloon repels electrons in the wall. This leaves a positive area near the surface. Opposites attract, so the balloon sticks.

**Q260. How does a charged rod cause small bits of paper to jump toward it?**

**Answer:** It polarises the paper and pulls it using its electric field.

**Solution:** The rod's electric field affects the electrons in the paper. This creates an imbalance, with the closer side becoming oppositely charged. Attraction pulls the paper pieces toward the rod.

GRADEUP