

ELECTRICITY: MAGNETIC & HEATING EFFECTS
Class 08 - Science (Curiosity)

Time Allowed: 1 hour and 28 minutes

Maximum Marks: 131

1. What happens when electric current passes through a nichrome wire? [1]
 - a) It gets warm
 - b) It remains cool
 - c) It glows brightly
 - d) It turns into copper wire
2. Which component in a Dry cell serves as the positive terminal? [1]
 - a) Aluminium cap
 - b) Paste-like electrolyte
 - c) Zinc container
 - d) Carbon rod
3. What is the main reason countries are focusing on battery recycling and development? [1]
 - a) To prevent chemical leaks from used batteries.
 - b) To reduce battery sizes.
 - c) To boost the sales of electric vehicles.
 - d) To ensure sustainable use of limited resources (like lithium and cobalt).
4. Which household device does NOT work on the heating effect of electric current? [1]
 - a) Electric stove
 - b) Electric room heater
 - c) Electric fan
 - d) Hair dryer
5. What is the role of the electrolyte in a battery? [1]
 - a) To act as the battery's positive terminal
 - b) To trigger chemical reactions for electricity generation
 - c) To neutralize the battery's metal plates
 - d) To support the battery's physical framework
6. Heat produced in a heating element on passing current through it depends on: [1]
 - i. Nature of the material of the heating element
 - ii. Thickness of the wires of the element
 - iii. Colour of the element
 - iv. Length of the wire of the element
 - a) (i) and (ii) only
 - b) (i), (ii), and (iv) only
 - c) (i), (ii), (iii) and (iv)
 - d) (ii) and (iii) only
7. What change will a compass needle show if an electromagnet is turned on and off repeatedly? [1]
 - a) Moving random directions
 - b) Continuous spin
 - c) Deflects and returns to original position
 - d) Stops working eventually

8. What happens to the compass needle when current flows through a nearby wire? [1]
a) It deflects b) It points to South
c) It points to North d) It stays still
9. How does increasing the number of coil turns affect an electromagnet? [1]
a) Decreases its strength b) Increases its strength
c) Reduces the flow of electricity d) Makes it no longer function
10. What causes a wire to get heated when current passes through it? [1]
a) Hot temperature in the room b) Shiny surface of the wire
c) The flow of cool breeze d) Resistance of the wire
11. The magnetic effect of an electric current generates a magnetic field around the current-carrying coil of a metallic wire [1]
a) When the electric current is flowing through the coil
b) When the coil becomes hot due to the heating effect of the electric current
c) When the electric current stops flowing through the coil
d) When the coil is brought near another magnet
12. In a dry cell, the positive terminal is the metallic tip on top of the carbon rod. Which then is the negative terminal of the cell? [1]
a) Bottom of the zinc container b) Carbon rod just below the metallic tip
c) The paste of chemicals inside the cell d) Bottom of the carbon rod
13. What is the difference between Voltaic cells and Dry cells? [1]
a) Both use liquid electrolytes b) They are identical in structure and function
c) Voltaic cells use a solid electrolyte; Dry cells use a liquid one d) Voltaic cells use a liquid electrolyte; Dry cells use a paste
14. Who discovered the link between electricity and magnetism? [1]
a) Albert Einstein b) Hans Christian Oersted
c) Isaac Newton d) Thomas Edison
15. Why does a wire carrying electric current act like a magnet? [1]
a) It changes its shape into a magnet b) It conducts electricity efficiently
c) It creates a magnetic field like a magnet does d) It heats up and attracts metals
16. What is a common use of rechargeable batteries? [1]
a) Used in non-electronic products b) Used multiple times after charging
c) Used only in medical equipment d) Used once and then disposed of
17. What type of compass needle movement is observed when electric current is stopped? [1]
a) It starts vibrating b) It returns to its original direction

- c) It spins continuously d) It keeps deflecting
18. In which part of the cell does the chemical reaction occur to produce electricity? [1]
 a) Within the LED terminal b) Between the electrodes only
 c) Inside the metal plates d) In the electrolyte
19. What is produced around a current-carrying conductor? [1]
 a) Electric field b) Magnetic field
 c) No field is produced d) Gravitational field
20. Wires made of which of the following materials is more suitable for showing the heating effects of electric current? [1]
 a) Copper wire b) Aluminium
 c) Nichrome d) Silver
21. **Assertion (A):** The connection of multiple cells results in a stronger magnetic field around a coil. [1]
Reason (R): More cells generate a greater current, which enhances the electromagnet's strength.
 a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
 c) A is true but R is false. d) A is false but R is true.
22. **Assertion (A):** Dry cells are more convenient than Voltaic cells for portable use. [1]
Reason (R): Dry cells use a thick moist paste, avoiding spillage issues associated with liquid electrolytes.
 a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
 c) A is true but R is false. d) A is false but R is true.
23. **Assertion (A):** A current-carrying wire creates a magnetic effect similar to a typical permanent magnet. [1]
Reason (R): The magnetic effect is a result of the flow of electricity through the wire.
 a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
 c) A is true but R is false. d) A is false but R is true.
24. **Assertion (A):** Electromagnets do not have poles like the North pole and South pole of a bar magnet. [1]
Reason (R): When we interchange the terminals of the battery in a circuit, the poles of the electromagnet also change positions.
 a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
 c) A is true but R is false. d) A is false but R is true.
25. List two metals commonly used as electrodes in a Voltaic cell. [1]
26. Explain why solid-state batteries are a significant development in battery technology. [1]

27. Identify the scientist who discovered the link between electricity and magnetism in 1820. [1]
28. What happens to the electric current in a conductor when resistance is present? [1]
29. Explain the conversion process that occurs when electric current flows through a nichrome wire. [1]
30. What is the observed effect when a nichrome wire is connected to a current source? [1]
31. Describe how the strength of an electromagnet can be increased. [1]
32. Illustrate how different metal pairings affect the efficiency of a Voltaic cell. [1]
33. Describe the role of the nichrome wire's properties in the heating effect of electric current. [1]
34. What happens to the magnetic field when an electric current stops flowing through a conductor? [1]
35. Match the items in Column A with those in Column B. [2]

Column A	Column B
(i) Voltaic cell	(a) Best suited for electric heater
(ii) Electric iron	(b) Works on magnetic effect of electric current
(iii) Nichrome wire	(c) Works on heating effect of electric current
(iv) Electromagnet	(d) Generates electricity by chemical reactions

36. Explain why a Voltaic cell eventually becomes 'dead' and stops supplying electricity. [2]
37. What is meant by the 'magnetic effect of electric current'? [2]
38. What creative solution is suggested for preventing energy loss and overheating in electrical circuits? [2]
39. List the changes you would observe in the behavior of a compass needle when varying the current through a wire. [2]
40. How does the model of an electromagnet illustrate the concept of the magnetic effect of electric current? [2]
41. Describe the principle that causes household appliances to generate heat when powered by electric current. [2]
42. Who discovered the relationship between electricity and magnetism, and when? [2]
43. In a simple lemon battery setup, what happens if the LED remains unlit, and what should be done to resolve this? [2]
44. Describe an application of electromagnets and how they benefit from the magnetic effect of electric current. [2]
45. Explain how a magnetic compass helps to demonstrate the magnetic effect of electric current. [2]
46. **State whether the given statement is True or False:** [3]
 - (a) The strength of an electromagnet depends on the resistance offered to the electric current by the coil material. [1]
 - (b) A hair dryer is an example of the magnetic effects of electric current. [1]
 - (c) Safety devices are necessary in household circuits to prevent energy transmission losses due to overheating. [1]
47. How does the heating effect of electric current vary when a nichrome wire is connected to one cell compared to two cells? Analyze the implications of this variation using the concept of electric current magnitude. [3]
48. What is the main difference between Voltaic cells and dry cells? [3]
49. Identify two practical applications of electromagnets in everyday life. [3]

50. Describe an electromagnet and explain how its magnetic strength can be altered through various factors. [3]
51. Evaluate the implications of electromagnets compared to permanent magnets in industrial applications, focusing on their advantages. [3]
52. Design a unique experiment to test alternate methods of generating electricity using everyday materials. [3]
53. How would you demonstrate the functionality of a battery using lemons and an LED in the classroom? [3]
54. Explain how a Voltaic cell generates electricity. [3]
55. Explain the reasons nichrome wire is used as a heating element in various electrical appliances based on its physical and electrical characteristics. [3]
56. Discuss the importance of selecting appropriate materials for household wiring to minimize unnecessary heating and energy loss. [3]
57. **Read the following text carefully and answer the questions that follow:** [4]

A battery generates electricity through chemical reactions between electrodes and electrolytes. The earliest type, the Voltaic cell, used two different metals and a liquid electrolyte. Later, dry cells became popular, using a zinc container and carbon rod with a paste-like electrolyte. Modern rechargeable batteries, like lithium-ion, can be reused many times and power devices from phones to electric vehicles. Future solid-state batteries may be safer, charge faster, and last longer.

Questions:

- Which part of a dry cell acts as the positive terminal? (1)
- What is the main difference between a dry cell and a Voltaic cell? (1)
- Why are rechargeable batteries preferred over dry cells? (2)

OR

Explain why lithium-ion batteries are important for the future. (2)

58. **Read the following text carefully and answer the questions that follow:** [4]

When an electric current passes through a straight conductor, it produces a magnetic field around it. The direction of this magnetic field can be found using the Right-Hand Thumb Rule. According to this rule, if you hold the current-carrying conductor in your right hand with the thumb pointing in the direction of the current, then the curl of the fingers gives the direction of the magnetic field around the conductor.

Questions:

- How do you find the direction of the magnetic field around a current-carrying straight conductor? (1)
- What does the Right-Hand Thumb Rule state? (1)
- How can you demonstrate the direction of the magnetic field around a conductor using the Right-Hand Thumb Rule? (2)

OR

Why is the Right-Hand Thumb Rule important in understanding electromagnetism? (2)

59. **Read the following text carefully and answer the questions that follow:** [4]

An electromagnet is formed when a coil of wire is wound around a material like soft iron, and

current is passed through it. The coil produces a magnetic field, and the soft iron core becomes strongly magnetized. The magnetism remains as long as the current flows but disappears once the current is switched off. Electromagnets are widely used in devices such as electric bells, cranes for lifting heavy scrap iron, and electric motors.

Questions:

- a. What happens to the magnetism of an electromagnet when the electric current is switched off? **(1)**
- b. Why does soft iron make a good core for an electromagnet? **(1)**
- c. How does an electromagnet in a crane help in lifting heavy scrap iron? **(2)**

OR

Differentiate between a permanent magnet and an electromagnet. **(2)**

60. Discuss how the principle of the heating effect of electric current is used in everyday household appliances, citing specific examples. **[5]**
61. Evaluate how the development of lithium-ion batteries has influenced the modern electronics industry and what challenges remain for future advancements. **[5]**
62. What is the magnetic effect of an electric current, and how does it relate to electromagnets? **[5]**
63. Describe the process of heating in a nichrome wire when an electric current passes through it, and explain why different conductors vary in their resistance to electric current. **[5]**
64. **Fill in the blanks:** **[10]**
 - (a) The amount of heat produced by the electric current flowing through the conductors also depends on the _____ of the electric current. **[1]**
 - (b) The electrolyte in a dry cell is in the form of a _____. **[1]**
 - (c) Hans Christian Oersted discovered the link between electricity and _____. **[1]**
 - (d) The common rechargeable battery found in many devices today is the _____. **[1]**
 - (e) Heavy iron scrap is fed into _____ at very high temperatures to melt it and make iron ingots and iron rods. **[1]**
 - (f) Solid-state batteries replace liquid electrolytes with _____. **[1]**
 - (g) The metal plates in a Voltaic cell are dipped in a liquid called an _____. **[1]**
 - (h) When we increase the current flowing through the coil (use battery of two or more cells in place of one cell), the magnet becomes _____. **[1]**
 - (i) The heat generated in a wire depends on the material, thickness, and _____ of the wire. **[1]**
 - (j) If the direction of the flow of _____ is reversed, the poles of electromagnet interchange their positions. **[1]**

Solution
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1. **(a)** It gets warm
Explanation:
The nichrome wire heats up due to the resistance to electric current.
2. **(d)** Carbon rod
Explanation:
Carbon rod
3. **(d)** To ensure sustainable use of limited resources (like lithium and cobalt).
Explanation:
There's a strategic racing focus on sustainable resource management and technological advancement.
4. **(c)** Electric fan
Explanation:
Electric fans mainly use electric motors to function, not heating elements.
5. **(b)** To trigger chemical reactions for electricity generation
Explanation:
The electrolyte facilitates the flow of ions which is essential for chemical reactions.
6. **(b)** (i), (ii), and (iv) only
Explanation:
Heat produced in a heating element depends on factors that affect resistance and current flow. These include:
 - i. Nature of material - different materials have different resistances.
 - ii. Thickness of wire - thinner wires have higher resistance and produce more heat.
 - iii. Length of wire - longer wires have more resistance, producing more heat.Colour of the element does not affect heat production.
7. **(c)** Deflects and returns to original position
Explanation:
The needle will deflect when the electromagnet is active and return when it's off.
8. **(a)** It deflects
Explanation:
When current flows, the compass needle deflects, showing the magnetic effect.
9. **(b)** Increases its strength
Explanation:
More turns result in a stronger magnetic field and enhance the electromagnet.

10. **(d)** Resistance of the wire
Explanation:
Resistance in the wire converts electrical energy into heat.
11. **(a)** When the electric current is flowing through the coil
Explanation:
A magnetic field is produced around a current-carrying coil only when electric current is flowing through it. This is due to the magnetic effect of electric current. When the current stops, the magnetic field disappears.
12. **(a)** Bottom of the zinc container
Explanation:
In a dry cell, the zinc container acts as the negative terminal. The carbon rod with a metallic cap acts as the positive terminal. Therefore, the bottom of the zinc container serves as the negative terminal of the cell.
13. **(d)** Voltaic cells use a liquid electrolyte; Dry cells use a paste
Explanation:
Voltaic cells use a liquid electrolyte; Dry cells use a paste
14. **(b)** Hans Christian Oersted
Explanation:
Hans Christian Oersted discovered the link between electricity and magnetism in 1820.
15. **(c)** It creates a magnetic field like a magnet does
Explanation:
A current-carrying wire generates a magnetic field, similar to a magnet.
16. **(b)** Used multiple times after charging
Explanation:
Used multiple times after charging
17. **(b)** It returns to its original direction
Explanation:
Without current, the magnetic effect disappears, and the compass needle returns to its original direction.
18. **(d)** In the electrolyte
Explanation:
In the electrolyte
19. **(b)** Magnetic field
Explanation:
A current-carrying conductor produces a magnetic field around it.

20. **(c) Nichrome**
Explanation:
 Wires used for showing the heating effect of electric current should have high resistance so that they produce more heat when current flows through them. Nichrome has high resistance and high melting point, so it is most suitable for heating elements.
21. **(a) Both A and R are true and R is the correct explanation of A.**
Explanation:
 Increasing the cells raises the current and strengthens the magnetic field.
22. **(a) Both A and R are true and R is the correct explanation of A.**
Explanation:
 Dry cells are sealed and portable, unlike liquid-based cells.
23. **(a) Both A and R are true and R is the correct explanation of A.**
Explanation:
 The flow of electricity generates a magnetic field around the wire.
24. **(d) A is false but R is true.**
Explanation:
 (A) is false because an electromagnet does have North and South poles like a bar magnet whenever current flows through it.
 (R) is true because reversing the battery terminals reverses the direction of current, which also reverses the magnetic poles of the electromagnet.
25. Common metals used in Voltaic cells include copper and zinc. These metals are chosen based on their ability to generate electric current with an electrolyte.
26. Solid-state batteries replace liquid/paste electrolytes with solid materials, offering increased safety, faster charging, and longer lifespan, advancing eco-friendly power solutions.
27. The scientist was Hans Christian Oersted.
28. The presence of resistance converts some of the electrical energy into heat energy in the conductor.
29. Electric current flowing through a nichrome wire faces resistance, converting electrical energy into heat, causing the wire to warm up.
30. The nichrome wire feels warm when connected to a current source due to the heating effect caused by electrical resistance.
31. The strength of an electromagnet can be increased by increasing the electric current or by increasing the number of coil turns.
32. Different metals like copper/zinc or aluminum/silver create varied voltage outputs. Testing different pairings under the same setup helps determine which metal combination is most efficient.
33. Nichrome wire has high electrical resistance, contributing to the conversion of electric current into heat, making it suitable for heating applications.
34. The magnetic field disappears when the current stops flowing through the conductor.
35.

Column A	Column B
(i) Voltaic cell	(d) Generates electricity by chemical reactions
(ii) Electric iron	(c) Works on heating effect of electric current
(iii) Nichrome wire	(a) Best suited for electric heater
(iv) Electromagnet	(b) Works on magnetic effect of electric current
36. A Voltaic cell stops working, or becomes 'dead', when the chemicals in the electrolyte and electrodes are used up. Once the chemical reaction ceases, it can no longer generate electricity, preventing any current from flowing.

37. The magnetic effect of electric current refers to the phenomenon where an electric current flowing through a conductor produces a magnetic field around it. This field can cause deflection in a magnetic compass or attract magnetic materials like iron.
38. To prevent energy loss and overheating, the use of appropriately rated wires, plugs, and sockets in household circuits is emphasized. This solution involves selecting components capable of handling the specific current without excessive resistance or heat buildup.
39. If the current in the wire increases, the deflection of the compass needle will be greater due to a stronger magnetic field. Conversely, if the current decreases, the deflection will reduce. Switching the current on and off causes the needle to deflect and return to its original position alternately.
40. In the model of an electromagnet, an iron nail is wrapped with a wire connected to a battery. When current flows through the wire, the nail behaves like a magnet (attracting iron clips). This illustrates that electric current can create a magnetic field around the wire, demonstrating the magnetic effect of electric current.
41. Household appliances generate heat because the current flowing through a heating element, such as a coil or rod, faces resistance. This resistance converts electrical energy to heat, warming the element to the point where it can perform tasks like heating, cooking, or drying.
42. The relationship between electricity and magnetism was discovered by Hans Christian Oersted in the year 1820. He found that a current carrying wire can influence the direction of a compass needle due to the magnetic field created.
43. If the LED doesn't light up, the likely cause is incorrect polarity connections. Reversing the LED connections, ensuring the longer wire of the LED connects to the copper (positive terminal) and the shorter wire to the iron (negative terminal), should resolve this.
44. Lifting electromagnets are used in scrapyards and factories to lift heavy metal objects. When current is passed through the electromagnet, it creates a strong magnetic field, allowing metal items to be lifted. The magnetic effect of electric current is crucial for this application, as it allows for easy control of lifting through switching the current on and off.
45. A magnetic compass, when placed near a current-carrying conductor, gets deflected from its original direction. This deflection demonstrates that a magnetic field is produced around the conductor due to the flow of current, thus illustrating the magnetic effect of electric current.
46. State whether the given statement is True or False:
- (a) **(b) False**
Explanation:
The strength of an electromagnet mainly depends on the number of turns in the coil, the amount of current flowing through it, and the presence of a soft iron core. It does not directly depend on the resistance of the coil material.
- (b) **(b) False**
Explanation:
A hair dryer mainly works using the heating effect of electric current. The current heats a coil, and a fan blows air over it to produce hot air. Therefore, it is not primarily an example of the magnetic effect of electric current.
- (c) **(b) False**
Explanation:
Safety devices prevent overheating and potential damage, not specifically energy transmission losses.
47. When a nichrome wire is connected to two cells instead of one, the heating effect of electric current increases. This is because the magnitude of the current flowing through the wire is greater with two cells, increasing the energy conversion from electricity to heat. According to Joule's Law, the heat produced is proportional to the square of the current; therefore, doubling the current significantly increases the heat generated. This principle underlies many practical applications, including robust household and industrial appliances that require enhanced heat.
48. The main difference between Voltaic cells and dry cells is the form of the electrolyte used. In Voltaic cells, the electrolyte is in a liquid state, often a weak acid or salt solution. In contrast, dry cells utilize a thick

- moist paste as the electrolyte, making them more suitable for everyday use as they are less prone to leakage. Additionally, dry cells are typically single-use and disposable, unlike rechargeable types.
49. 1. Electric Bells: An electromagnet triggers the hammer that strikes the bell, producing sound.
2. Cranes in Scrap Yards: Used for lifting heavy metal objects, electromagnets can be turned on and off as needed to secure or release scrap material.
This is efficient for transport and management of large quantities of metal. These applications showcase the functional versatility of electromagnets in modern technology.
 50. An electromagnet is a device where an electric current flows through a coiled wire, creating a magnetic field. Its magnetic strength can be adjusted by:
 1. Varying the electric current: Increasing the current enhances the magnetic power, while reducing it weakens it.
 2. Changing the number of wire turns: More turns result in a stronger field.
 3. Inserting an iron core: Placing an iron core within the coil boosts the electromagnet's strength significantly.
 51. Electromagnets offer distinct advantages over permanent magnets in industrial settings. Their magnetic strength can be easily adjusted by varying current or coil turns, offering flexibility and control. They can also be turned on or off, allowing precise handling of materials, unlike permanent magnets that cannot be deactivated. Electromagnets are employed in cranes for lifting heavy metals, providing operational efficiency. Their adaptability and controllability make them a preferred choice over permanent magnets in various industrial applications, enhancing process safety and productivity.
 52. For a unique experiment using everyday materials, create a simple fruit battery using potatoes or other acidic fruits. Gather several potatoes, copper pennies, galvanized nails, and connecting wires. Insert a penny and a nail into different parts of each potato, ensuring they don't touch. Connect these 'cells' in series by linking the penny from one potato to the nail of another. Connect a small digital clock or LED between the open ends and observe if it powers up. This experiment demonstrates alternative methods to generate electricity through multiple potato cells, providing insights into electrochemical reactions and renewable energy.
 53. To demonstrate the functionality of a battery using lemons and an LED in the classroom, begin by collecting five to six lemons, copper wires, iron nails, an LED, and connecting wires. Insert one copper wire and one iron nail into each lemon, creating individual cells. Connect these cells in series, attaching a copper wire from one lemon to the nail of the next. Attach an LED between the copper wire of the first lemon and the iron nail of the last lemon. If the LED does not initially glow, reverse its connections. The glowing LED confirms the formation of a complete circuit, illustrating the principles of battery operation.
 54. A Voltaic cell generates electricity through a chemical reaction between two metal plates called electrodes and an electrolyte. The electrodes, made from different materials, are partly submerged in the electrolyte, which may be a weak acid or a salt solution. When the circuit is closed, a chemical reaction occurs between the electrodes and the electrolyte, producing an electric current. The current flows from the positive terminal to the negative terminal, enabling the flow of electricity. Over time, the chemicals in the cell are consumed, leading to a 'dead' cell that can no longer generate electricity.
 55. Nichrome wire is frequently used as a heating element across various electrical devices due to its physical and electrical properties. Its high electrical resistance allows it to effectively convert electrical energy into heat, making it an efficient heater. Additionally, nichrome can withstand high temperatures without oxidizing or degrading, ensuring durability and safety in appliances like toasters and irons. Its ability to handle substantial thermal stress without melting or malfunctioning makes it ideal for use in household and industrial heating applications.
 56. Selecting the right materials for household wiring is essential to minimizing unnecessary heating and energy loss. Electrical wires should be made from conductors with low resistance, such as copper, which efficiently transmit electricity with minimal heat generation. Properly gauged wires suited to the current load prevent excessive heating, reducing energy waste and avoiding potential fire hazards. Utilizing insulation materials that withstand heat ensures safety and efficiency in electrical distribution while complying with regional electrical codes further enhances household electrical system safety.
 57. a. The carbon rod acts as the positive terminal of a dry cell.

- b. A Voltaic cell uses liquid electrolytes, while a dry cell uses a paste-like electrolyte, making it more practical and portable. Unlike Voltaic cells, dry cells are widely used in everyday devices like torches and clocks.
- c. Rechargeable batteries can be reused many times, reducing waste and saving money in the long run. They are commonly used in phones, laptops, and electric vehicles. Although they eventually wear out, their repeated usability makes them more eco-friendly and economical compared to single-use dry cells.

OR

Lithium-ion batteries are lightweight, efficient, and rechargeable, powering most modern devices like mobiles, laptops, and electric cars. As the world shifts to clean energy, Li-ion batteries play a crucial role. Scientists are now developing solid-state versions, which promise to be safer, faster-charging, and longer-lasting, making them essential for sustainable energy solutions. Here's the structured content based on your instructions:

58. a. Use the Right-Hand Thumb Rule. Point your right thumb in the direction of the current, and your curled fingers show the direction of the magnetic field.
- b. The Right-Hand Thumb Rule states that if you hold a straight current-carrying conductor with your right hand and thumb pointing in the direction of current, then the curled fingers show the direction of magnetic field.
- c. To demonstrate, hold the conductor in your right hand with the thumb pointing in the direction of current flow. The curling of the fingers around the conductor shows the direction of the magnetic field lines. This helps in visualizing how current produces circular magnetic fields around the wire.

OR

The Right-Hand Thumb Rule is important because it helps to easily predict the orientation of magnetic fields produced by current-carrying conductors. This understanding is crucial in designing devices like motors, generators, and electromagnets, where the interaction of electric current and magnetic fields is used to produce motion or energy.

59. a. When the current is switched off, the magnetism of the electromagnet disappears. This is because an electromagnet works only when electric current flows through it.
- b. Soft iron is an excellent core because it becomes magnetized quickly when current flows through the coil and loses magnetism as soon as the current is switched off, making it useful for temporary magnets.
- c. In cranes, a large coil with a soft iron core becomes a powerful electromagnet when current flows through it. This strong magnet can easily attract and lift heavy scrap iron. When the current is switched off, the scrap iron is released immediately, making the process efficient.

OR

A permanent magnet retains its magnetism and cannot be switched on or off. In contrast, an electromagnet works only when electric current flows through the coil. Its strength can be varied by changing the current, making it more versatile than a permanent magnet.

60. The principle of the heating effect of electric current is utilized in various household appliances, such as electric room heaters, stoves, irons, kettles, and hair dryers. Each of these devices contains a heating element, typically a coil or rod made from a material like nichrome, that converts electrical energy into heat when connected to a power source. For instance, in an iron, the heating element gets warm and transfers heat to the baseplate, which is then used to smooth out fabric wrinkles. Similarly, in electric kettles, the element heats water to boiling point efficiently. The heating effect is therefore essential in providing warmth, cooking, and enabling other daily functions.
61. Lithium-ion batteries have revolutionized modern electronics by providing lightweight, rechargeable, and efficient power sources for a wide range of devices, including smartphones, laptops, and electric vehicles. Their high energy density and recharge efficiency have driven technological developments enabling more compact yet powerful devices. However, challenges persist, such as limited resource availability due to precious metals like lithium and cobalt, safety concerns due to overheating risks, and the need for efficient recycling processes. Future advancements aim at solid-state batteries, which could offer enhanced safety, longevity, and performance, sustaining electronics innovation while mitigating environmental concerns.

62. The magnetic effect of electric current occurs when current flows through a conductor, creating a magnetic field around it. This effect is utilized in electromagnets, which consist of coiled wire around an iron core. When electric current passes through the coil, it magnetizes the iron core, turning it into a temporary magnet. The strength of the electromagnet depends on the amount of current and the number of coil turns. Unlike permanent magnets, electromagnets can be turned on and off with the current flow, making them versatile for various applications, such as lifting heavy metal objects in scrap yards and factories.
63. When an electric current passes through a nichrome wire, the wire gets heated because of its resistance to the flow of current. Resistance is a property of conductors that causes them to oppose the flow of electric charge. In the case of a nichrome wire, it offers high resistance compared to conductors like copper when they are of the same size and length. This high resistance causes some of the electrical energy in the current to be converted into heat energy. Different conductors vary in their resistance due to differences in their material properties. The material structure, atomic arrangement, and electron mobility contribute to the resistance, making nichrome an excellent choice for heating elements due to its optimal resistance and heat tolerance.
64. Fill in the blanks:
- (a) Magnitude
 - (b) paste
 - (c) magnetism
 - (d) lithium-ion battery
 - (e) Furnaces
 - (f) solid
 - (g) electrolyte
 - (h) Stronger
 - (i) length
 - (j) Current

USP