PHYSICS

BOOKS - NAVNEET SCIENCE (HINGLISH)

EFFECTS OF ELECTRIC CURRENT

Can You Recall

1. How do we decide that a given material is a good conductor of electricity or is an insulator

?

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2. Iron is a conductor of electricity , but when we pick up a piece of iron resting on the group , why don't we get electric shock ?

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Think About It

1. How can we write mechanical power in a manner similar to the electrical power?

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Observe And Discuss

1. What do you observe in the following pictures ?

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2. Which effects of electric current do you find ?

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Try This

1. Material : Connecting wires , electric cells, electrical resistance, voltmeter , ammeter , plug key.

Procedure : Connect the circuit as shown in

the accompanying figure after taking the components with proper values. Measure the current (I). Also measure the potential difference $(V)_{AB}$ between the two ends (A and B) of the resistance .

The potential at A is higher than the potential at B as the point A is connected to the positive electrode of the cell and the point B to the negative electrode of the cell.

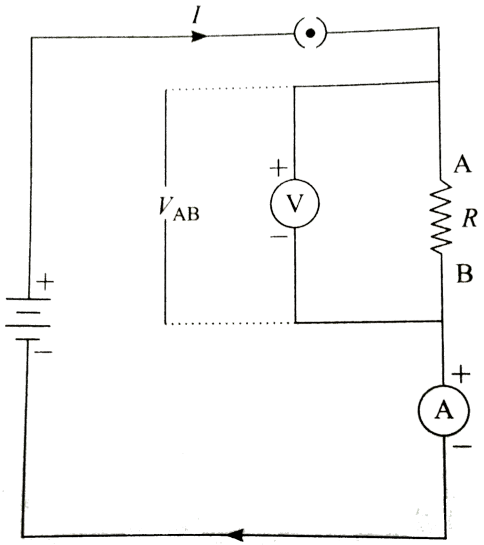

Fig. 4.9 : Electric circuit

If a charge Q flows from A to B, work V_{AB} Q, has been done on Q while going from A to B . From where does the energy come to do this work.

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2. Material : Connecting wires , electric cells, electrical resistance, voltmeter , ammeter , plug key.

Procedure : Connect the circuit as shown in the accompanying figure after taking the components with proper values. Measure the current (I). Also measure the potential difference $(V)_{AB}$ between the two ends (A and B) of the resistance .

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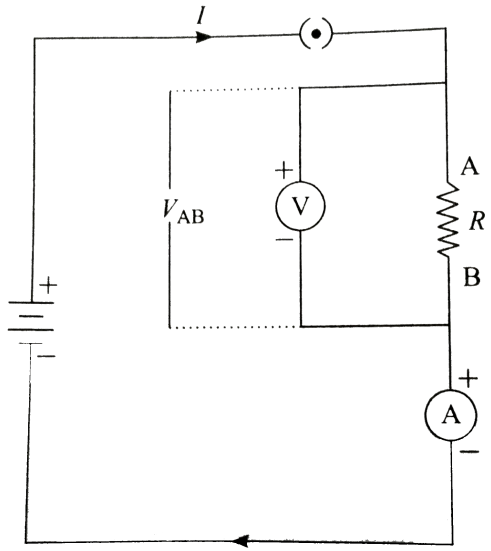

Fig. 4.9 : Electric circuit

What happens to this energy?

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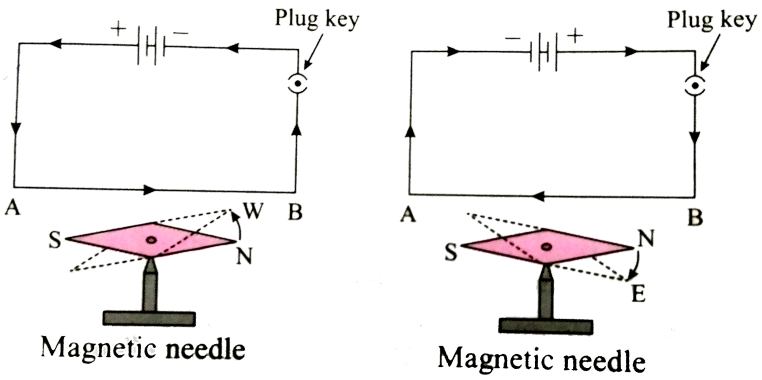
3. Connect the circuit as shown in figure

Connect a copper wire, thicker and straight as

compared to the connecting wires, between A and B. Keep a magnetic needle adjacent to the wire. Keep the plug key open in the circuit and observe the direction of the needle. Close the plug key and observe the direction of the needle. What do you notice? Now interchange the connecting wires connected to the cell and observe the direction of the magnetic needle. Do you notice any relation between the direction of current and position of the needle?



What do you learn from this experiment?

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4. Connect the circuit as shown in Fig, When a large current (approximately 1 A or more) flows through the thick copper wire passing through the cardboard, the magnetic needle kept at different points on the cardboard

around the wire stands in different directions.

Mark these directions with a pencil. The direction of the current shown in the circuit is its convential direction. What changes are caused by increasing or decreasing current? What do you see when the magnetic needle is kept a little away from the wire? Now, instead of the magnetic needle, spread iron filings on the cardboard and observe. The iron filings arrange themselves in a circular manner around the wire. Why does this happen?

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5. Material : Flexible copper wire, stand, electric cell, a horseshoe magnet with a strong magnetic field. Procedure : Using the stand, fix the copper wire so that it passes through the poles of the horse-shoe magnet as shown in the figure 4.17. Connect the circuit as well. What do you observe? Whenever a current is not flowing through the wire, it remains straight (position A). When the current flows from top to bottom, the wire bends and comes into position C.If the current direction

is reversed, i.e. it flows from the bottom to the top end, the wire bends but comes in the position B. This means the direction of the force on the wire is perpendicular to both the magnetic field and the direction of the current.

Here, the direction of magnetic field is from N to S, (H). In this experiment it is noted that whenever a current flows through a conductor in the presence of magnetic field, a force is exerted on the conductor. If the direction of the current is réversed, the direction of the force also gets reversed. If the magnet is kept

reversed, i.e. its South pole is brought at the position of its North pole and its North pole brought to the position of its South pole, what will happen?

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6. The given experiment clearly shows that a force is exerted on the current-carrying conductor. The direction of this force depends on both the direction of the current and the direction of the magnetic field. Experimentally,

it is possible to show that this force is maximum when the direction of the current is perpendicular to the direction of the magnetic field. How will you do this?

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7. Complete the circuit as shown in figure (a). Discuss about and select the components as required. In this experiment, if we open the plug key and make the current zero in the coil,

the pointer of the galvanometer deflects to a side and quickly comes back to zero. If the current in the coil is started again, the pointer again deflects to the other side and then returns quickly to zero. Now when the electrical current is flowing through the solenoid coil and the solenoid coil is displaced with respect to the coil, the current is still produced in the coil.

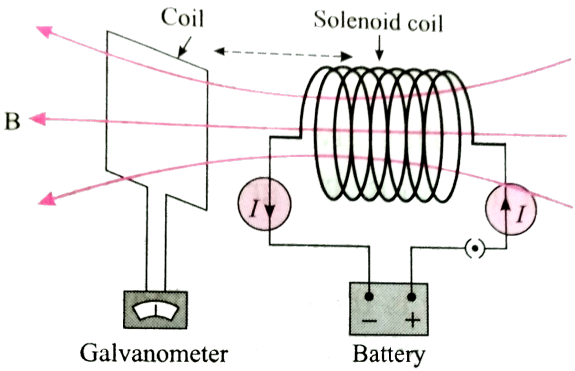

Fig. 4.22 (c) : When a current is passing through the solenoid coil and the solenoid coil is displaced longitudinally with respect to the coil

What can be inferred from these two experiments ?

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Find Out

1. What is The right hand thumb rule (also called Maxwell's cork-screw rule)?

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Use Your Brain Power

1. If in the circuit, the resistor is replaced by a motor, in which form will the energy given by the cell get transformed into?

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2. Draw the diagram of a DC generator Then explain as to how the DC current j obtained.

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Fill In The Blanks

1. Electric power $= \frac{V^2}{\ldots\ldots}$

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2. ..... =1 joule/ 1 second.

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3. 1 kW · h= ..... J

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4. According to Joule's law , quantity of heat (H) produced by an electric current = ...

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5. The magnetic effect of electric current was discovered by

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6. ..... Is expressed in oersted.

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7. Electromagnetic induction was discovered by ..... .

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8. A galvanometer is used for ..... .

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9. In India, the frequency of alternating current is ..... .

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10. Electric motor converts electric energy into ..... Energy.

Watch Video Solution

11. Electric generator converts ..... Energy into electric energy.

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Selecting The Correct Options

1. The device used for producing a current is called .....

A. a voltmeter

B. an ammeter

C. a galvanometer

D. a generator

Answer:

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2. At the time of short circuit , the current in the circuit .....

A. increases

B. decreases

C. remains the same

D. increases in steps

Answer:

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3. The direction of the magnetic field around a straight conductor carrying current is given by ..... .

A. the right hand thumb rule

B. Fleming's left hand rule

C. fleming's right hand rule

D. none of these

Answer:

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4. The resistance of a wire is 100Ω. If it carries a current of 1 A for 10 seconds , the heat produced will be ..... .

A. 1000 J

B. 10 J

C. 0.1 J

D. 10000 J

Answer:

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5. If 220 V potential difference is applied across an electric bulb, a current of 0.45 A flows in the bulb . What must be the power of the bulb ?

A. 99 W

B. 70 W

C. 45 W

D. 22 W

Answer:

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6. Which of the following best explains electromagnetic induction ?

A. charing of an electric conductor

B. production of magnetic field due to a current flowing through a coil

C. generation of a current in a coil due to relative motion between the coil and the magnet.

D. motion of the coil around the axle in an electric motor.

Answer:

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7. Write the correct option by observing the figures.

A. Magnetic field in A is stronger

B. Magnetic field in B is stronger

C. Magnetic fields in A and B are same .

D. Magnetic fields in A and B are weaker .

Answer: A::B::C::D

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8. Observe the following diagram and choose the correct alternative.

A. The intensity of magnetic field in A is larger than in B.

B. The intensity of magnetic field in B is less than in A.

C. The intensity of magnetic field in A and B is same .

D. The intensity of magnetic field in A is less than in B.

Answer:

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9. Which of the statement given below correctly describes the magnetic field near a long , straight current -carrying conductor ?

A. The magnetic lines of force are in a plane, perpendicular to the conductor in the form of straight lines.

B. The magnetic lines of force are parallel to the conductor on all the sides of conductor .

C. The magnetic lines of force are perpendicular to the conductor going radially outward.

D. The magnetic lines of force are in concetric circles with the wire as the centre, in a plane perpendicular to the conductor .

Answer:

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10. Which device is used to produce electricity ? Describe with a neat diagram.

A. Electric motor

B. Galvanometer

C. Electric generator (DC)

D. Voltmeter

Answer:

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True And False

1. Electric power $= I^2R$

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2. Magnetic poles exist in pairs. State true / false. Explain using the example of a bar magnet.

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3. Electromagnetism was discovered by Oersted.

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4. Magnetic field decreases we go away from a magnet.

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5. Magnetic lines of force cross each other .State true/false. Give reasons for your answer

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6. Electric generator is used to generate current. Which principle is used in it?

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7. State whether the following statement is true or false :

An electric motor converts mechanical energy into electrical energy.

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8. In India, the frequency of AC is 50 Hz.

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9. The electricity meter in the domestic electric circuit measures electrical energy consumption in kilowatt hours. Is it true? Also express 1 kilowatt hour in joules.

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10. Electric generator converts electric energy into mechanical energy. State true/ false

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11. Split rings are used in a DC generator an in an electric motor.

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12. Electromagnetic induction was discovered by Coulomb .

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13. Faraday found that electricity could produce rotational motion.

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Tell The Odd One Out Give Proper Explanation

1. Fuse wire, Bad conductor, Rubber gloves, Generator.

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2. Voltmeter , Ammeter, Galvanometer, Thermometer.

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3. Lound speaker, Microphone, Electric motor , Magnet.

Find the Odd one out.

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Find The Odd One Out And Justify It

1. Fuse wire , M.C.B. Rubber gloves, Generator.

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Match The Column

1. 

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Name The Following

1. The negatively charged particle considered as a free particle moving in a metallic conductor.

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2. The quantity expressed in ampere.

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3. The quantity expressed in ohm.

Watch Video Solution

4. The quantity expressed in volt.

Watch Video Solution

5. The quantity expressed in joule.

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6. The quantity expressed in watt.

Watch Video Solution

7. The quantity expressed in kilowatt hour.

Watch Video Solution

8. The component used to control the current.

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9. An instrument used to measure electric current.

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10. An instrument used to measure electric potential difference,

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11. The ratio of the work done to the quantity of charge transferred .

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12. An alloy of Ni, Cr, Mn, and Fe.

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13. The SI unit of resistance .

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14. A metal used to make the filament of an electric bulb.

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15. An alloy used to prepare a coil of high resitance for use in electric appliances such as an electric heater.

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16. Constituents of the alloy to make a fuse wire.

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17. The unit same as the watt second.

Watch Video Solution

18. A unit for intensity of magnetic field.

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19. The scientist in whose honour the SI unit of power is named,

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20. A device that converts electric energy into mechanical energy.

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21. A device that converts mechanical energy into electric energy.

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Answer The Following Questions In One Sentence Each

1. What is the production of magnetism by an electric current called?

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2. Is magnetic field a scalar or a vector?

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3. In India, what is the time interval in which AC changes direction?

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4. What is the periodic time of AC in India?

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Answer The Following Questions

1. Define electric power.

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2. State the formula for electric power. Hence, obtain its SI unit.

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3. What is the commercial unit of electric energy? Obtain the relation between this unit

and the SI unit of energy.

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4. What is one kilowatt hour?

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5. What is heating effect of electric current? What is its origin?

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6. Statement 1: Electric current (flow of electrons) creates heat in a resistor. Statement 2 : Heat in the resistor is created according to the law of energy conservation.

Explain Statement 1 with the help of Statement 2.

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7. State Joule's law about heating effect of electric current.

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8. Obtain the mathematical expression for the heat generated in a metallic condactor by electric current (Joule's law).

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9. Two dissimilar bulbs are connected in series. Which bulb will be brighter?

(Hint: Consider the resistance of each bulb.)

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10. Name any six domestic appliances whose working is bases on the heating effect of electric current.

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11. State applications of heating effect of electric current.

Watch Video Solution

12. Explain the application of heating effect of electric current in an electric bulb.

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13. Tungsten is used to make a solenoid type coil in an electric bulb.

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14. Explain the application of heating effect of electric current in the electric iron.

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15. Take any electricity bill of your home. In the bill there is one table which shows the units consumed by you for the last eleven months. Find the average consumption of electricity in your home for each season (i.e., summer,

winter and rainy season). Are they the same? Why?

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16. Name the types of wires or cables used the electric power supply provided by the tate Electricity Board for houses and factories.

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17. In a domestie electrie supply in India, what is the potential difference between the live wire and the neutral wire?

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18. Name the type of wire to which the main fuse is connected.

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19. What does the electricity meter measure?

Watch Video Solution

20. Is the electric potential difference across each appliance (in a domestic electric circuit) the same?

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21. Name the types of wire across which an electric appliance is connected.

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22. Electircal appliances are connected in parallel. What are the advantages of this arrangement ?

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23. In a domestic electric supply, if two bulbs are connected in series instead of parallel, what will happen if the filament of one of the bulbs breaks?

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24. Explain the term short circuiting. What does a short circuit lead to?

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25. How does the short circuit form? What is its effect?

26. What is overloading? When does it occur? What does it cause? How can overloading be avoided?

27. Explain the application of heating effect of electric current in a fuse.

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28. State the conclusions that can be drawn from Oersted's experiment.

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29. What is the effect on the magnetic needle in Oersted's experiment, when a current is passed through the wire

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30. What is the effect on the magnetic needle in Oersted's experiment, when the current through the wire is increased.

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31. What is the effect on the magnetic needle in Oersted's experiment, when The current through the wire is stopped .

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32. What is the effect on the magnetic needle in Oersted's experiment, when the current through the wire is reversed .

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33. What is the effect on the magnetic needle in Oersted's experiment, when the distance between the magnetic needle and the wire is increased.

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34. State the factors on which the magnitude of the magnetic field due to a current-carrying conductor depends and how it depends.

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35. State the right hand thumb rule.

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36. With a neat labelled diagram, describe the pattern of magnetic lines of force due to a current through a circular loop. Also explain how the magnetic field depends on the number of turns (n) in the loop.

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37. What is a solenoid ? Compare the magnetic field produced by a solenoid with the magnetic field of a bar magnet. Draw neat figures and name various eomponents.

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38. Write Fleming's left hand rule.

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39. What is electric motor? Explain its working.

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40. State the principle on which the working of an electric motor is based.

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41. Explain the construction and working of an electric motor. Draw a neat diagram and label it.

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42. Explain with a labelled diagram, the principle, construction and working of an electric generator.

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43. State the uses/applications of an electric motor.

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44. (i) Which principle is explained in this figure?

(ii) Which rule is used to find out the direction of force in this principle?

(iii) In which machine is this principle used? Draw a diagram showing the working of that machine.

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45. Observe the following diagram and answer the question.

Construction of which equipment does the following diagram show?

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46. Observe the following diagram and answer the question.

On which principle does this equipment work ?

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47. Observe the following diagram and answer the question.

According to which law does the coil ABCD rotate?

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48. Observe the following diagram and answer the question.

Write the law in your own words .

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49. Observe the following diagram and answer the question.

Where is this equipment used ?

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50. Study the following principle and answer the question.

A force is excreted on a current-carrying conductor placed in a magnetic field. The direction of this force depends on both the direction of the current and the direction of the magnetic field. This force is maximum when the direction of the current is perpendicular to the direction of the getic field.

By which law can we determine the direction

of the force excreted on the current-carrying conductor?

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51. Study the following principle and answer the question.

A force is excreted on a current-carrying conductor placed in a magnetic field. The direction of this force depends on both the direction of the current and the direction of the magnetic field. This force is maximum

when the direction of the current is perpendicular to the direction of the getic field.

In which electrical equipment is this principle used?

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52. Study the following principle and answer the question.

A force is excreted on a current-carrying conductor placed in a magnetic field. The

direction of this force depends on both the direction of the current and the direction of the magnetic field. This force is maximum when the direction of the current is perpendicular to the direction of the getic field.

Draw a diagram representing the construction of this equipment.

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53. What is galvanometer used for? Explain in brief the working of a galvanometer.

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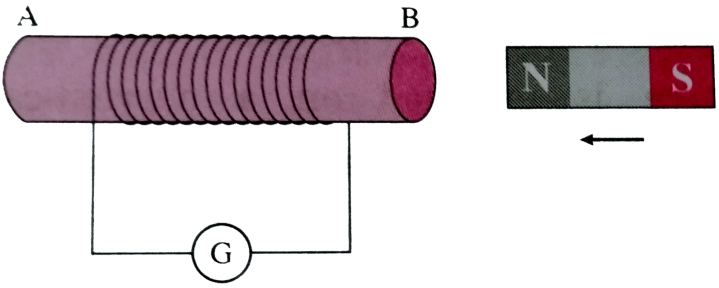
54. Take a coil AB having 10-15 turns. Connect the two ends of the coil to the galvanometer as shown in Fig. Take a strong bar magnet. (1) Move the north pole of the magnet towards the end B of the coil Observe the deflection of the pointer in the galvanometer. Note the

direction of the deflection (i.e. right or left). (2) Now repeat this with the south pole of the magnet towards the end B of the coil. Again observe the deflection. Note its direction. (3) What will happen if instead of the magnet, the coil is moved? (4) If both the coil and the magnet are kept stationary, do you observe any deflection? (5) Compare the direction of the deflection when the north pole of the magnet is moved towards the end B of the coil with that when the end B of the coil is moved away from the north pole of the magnet. (6) What conclusions do you draw from the

observations?



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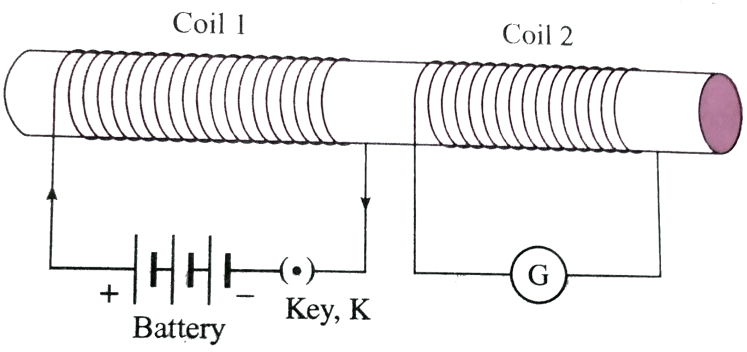
55. Take two coils of about 50 turns. Insert them over a nonconducting cylindrical roll as shown in Fig. 4.23. (A thick paper roll can be used.) Connect coil 1 to a battery with a plug key K. Connect coil 2 to a galvanometer G. (1)

Plug the key and observe the deflection in the galvanometer. (2) Unplug the key and again observe the deflection. Note your observations. What conclusions do you draw from these observations?



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56. What is electromagnetic induction? Who discovered it?

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57. State Faraday's law of induction.

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58. State and explain Fleming's right hand rule.

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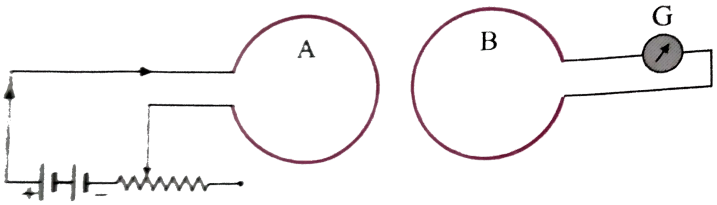
59. Observe the following figure. If the current in the coil A is changed, will some current be induced in the coil B? Explain.



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60. What is a direct current (DC)?

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61. What is an alternating current (AC)?

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62. What is the value of frequency of AC in India?

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63. What is the periodic time of AC in India?

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64. State one advantage of AC over DC.

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65. Name two appliances/devices in which a direct current is used.

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66. Name two appliances/devices in which an alternating current is used.

Watch Video Solution

67. State any two used of an AC generator.

Watch Video Solution

68. What is an electric generator .

Watch Video Solution

69. What is an AC generator

Watch Video Solution

70. What is an DC generator ?

Watch Video Solution

71. State the principle on which the working of an electric generator is based.

Watch Video Solution

72. Explain the construction and working of an electric motor. Draw a neat diagram and label it.

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73. Show graphically variation of AC with time. Explain the nature of the graph.

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74. Identify the figures and explain their use.

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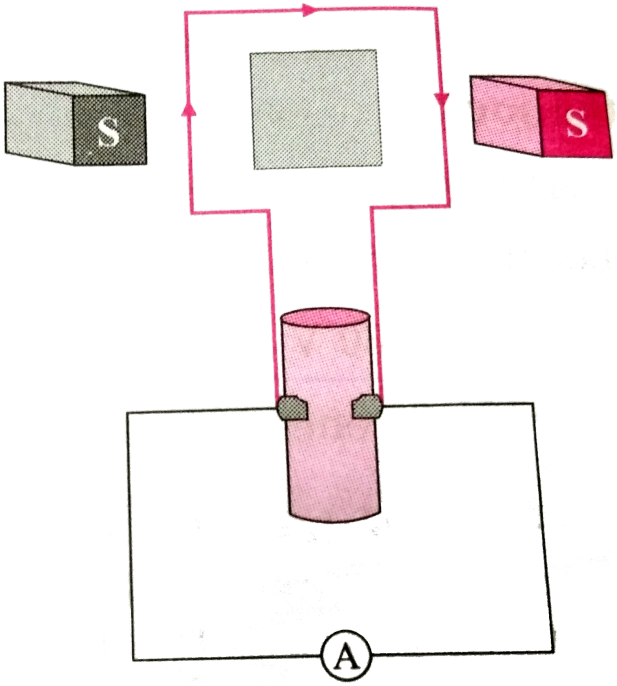
75. Observe the figure and answer the following question.



Identify the machine shown in the figure.

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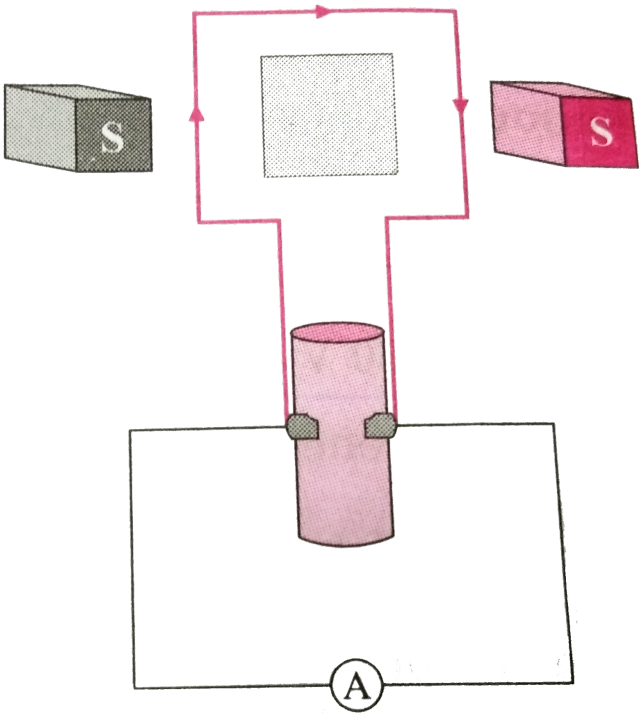
76. Observe the figure and answer the following question.



Write a use of this machine .

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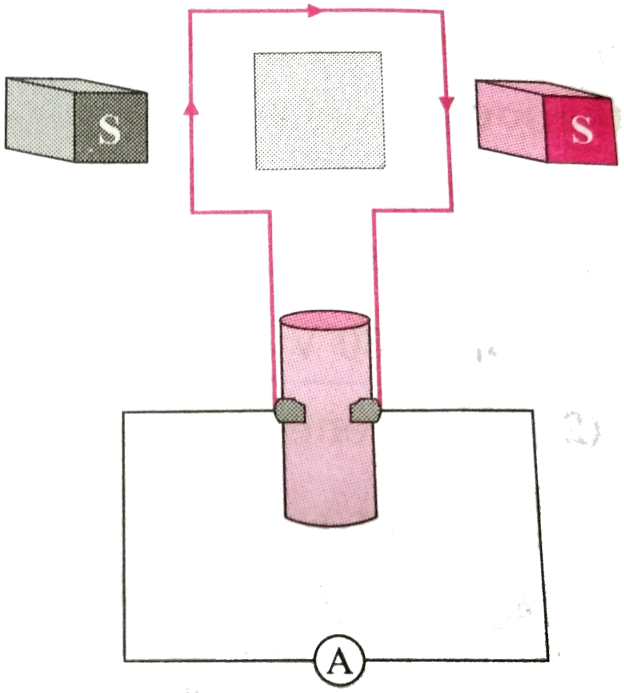
77. Observe the figure and answer the following question.

Identify the machine shown in the figure.



How transformation of energy takes place in this machine.

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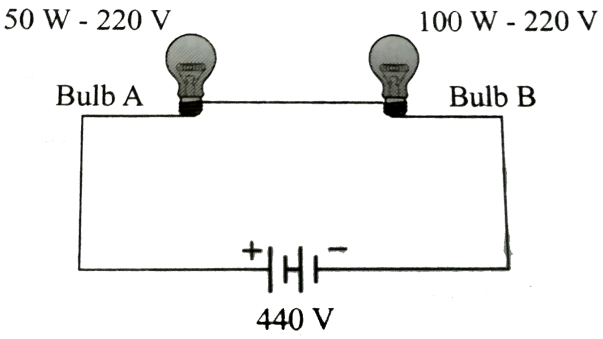
78. Observe the following figure. Which bulb will fuse ?



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Give Scientific Reasons

1. For electric power transmission, copper or aluminium wire is used.

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2. In practice the unit kW.h rather than the joule, is used for the measurement of electric energy.

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3. Tungsten is used to make a solenoid type coil in an electric bulb.

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4. The filament of an electric bulb is made of tungsten.

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5. The melting point of the filament of a bulb is very high.

6. The filament of a bulb should have a high melting point.Why?

7. In the electric equipment producing heat e.g. iron, electric heater, boiler, toaster, etc. an alloy such as Nichrome is used, not pure metals.

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8. The coils in heating devices such as a toaster and electric iron are made of an alloy such as Nichrome, rather than a pure metal. Give reason

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9. In an electric iron, the coil of high resistance is kept between mica sheets.

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10. The material used for fuse has low melting point.

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11. A fuse should be made of a material of low melting point. Give reason

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Distinguish Between The Following

1. Distinguish between Direct current and Alternating current.

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2. Distinguish between Electric motor and Electric generator

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3. What is the basic difference in the design of an a.c. generator and d.c. generator ?

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Numerical Problems

1. An electric is connected to a source of 250 volts. The current passing through it is 0.27 A. what is the power of a the bulb ?

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2. If a bulb of 60 W is connected across a source of 220 V, find the current drawn by it.

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3. A bulb of 40 W is connected across a source of 220 V . Find the resistance of the bulb.

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4. Heat energy is being produced in a resitance in a circuit at the rate of 100 W . The current of 3 A is flowing in the circuit. What must be the value of the resistance ?

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5. If the current passing through a bulb is 0.2 A and the power of the bulb is 20 W , find the voltage applied across the bulb.

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6. Two tungsten bulbs of wattage 100 W and 60 W power work on 220 V potential difference. If they ar connected in parallel, how much current will flow in the main conductor ?

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7. Two tungsten bulbs of power 50 W and 60 W work on 220 V potential difference . If they are connected in parallel, how much current will flow in the main conductor ?

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8. An electric iron rated 750 W is operated for 2 hours/day. How much energy is consumed by the electric iron for 30 days ?

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9. Who Will spend more electrical energy ? 500 W TV set in 30 mins, or 600 W heater in 20 mins ?

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10. If a TV of rating 100 W operates for 6 hours per day, find the number of units consumed in a leap year.

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11. An electric appliance of rating 300 W is used 5 hours per day in the month of March. Find the number of units consumed.

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12. A washing machine rated 300 W operates one hour/day. If the cost of a unit is Rs. 3.00 , find the cost of the energy of operate the washing machine for the month of March.

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13. An electric iron of 1100 W is operated for 2 hours daily. What will be the electrical consumption expenses for that in the month of April ? (The electric company charges Rs. 5 per unit of energy.)

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14. Find the heat produced in joule if a current of 0.1 A is passed through a coil of resistance 50 Ω for two minutes. Keeping other

conditions the same if the length of the wire is reduced to $\frac{1}{4}$ th the original length (by cutting the wire), what will be the heat produced ?

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15. Calculate the heat produced in calorie when a current of 0.1 A is passed through a wire of resistance 41.8Ω for 10 minutes.

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16. A potential differnce of 250 volts is applied across a resistance of 1000 Ω in an electric iron. Find (1) the current (2) the heat produced in joule in 12 seconds.

keeping other conditions the same , if the length of the wire in the iron is reduced to half the original length (by cutting the wire), what will be the current and heat produced ?

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17. A potential differnce of 100 V is applied across a resistor of resistance 50Ω for 6 minutes and 58 seconds . Find the heat produced in Joule

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18. A potential differnce of 100 V is applied across a resistor of resistance 50Ω for 6 minutes and 58 seconds . Find the heat produced in calorie .

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Numerical Problems For Practice

1. When the voltage applied across a bulb is 200 V, the current passing through the bulb is 0.1 A. Find the power of the bulb .

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2. A bulb of 100 W is connected across a source of 200 V . Find the current drawn by it .

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3. A bulb of 60 W is connected across a source of 240 V. Find the resistance of the bulb.

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4. If the current passing through a bulb is 0.15 A and the power of the bulb is 30 W, find the voltage applied across the bulb.

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5. An electric appliance of rating 800 W is used 4 hours per day in the month of December . Find the number of units consumed.

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6. An electric appliance rated 400 W is used 5 hours per day in the month o June. If the cost of a unit is ₹3.00 , find the energy bill for June.

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7. An electric bulb rated 60 W and 40 W respectively are used 5 hours per day for 20 days . If the cost of a unit is Rs. 4.00, find the cost of the energy used.

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8. Two electric bulbs rated 50 W and 40 W respectively are used 5 hours per day for 20 days . If the cost of a unit is Rs . 4.00, find the cost of the energy used.

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9. Find the heat produced in joule if a current of 0.1 A is passed through a coil of resistance 25 Ω for one minute.

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10. Calculate the heat produced in calorie when a current of 0.1 A is passed through a wire of resistance `41.8 Omega for 100 minutes.

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11. Calculate the heat produced in calorie when a current of 0.2 A is passed through a wire of resistance 14.8 Ω for 10 minutes.

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12. Find the heat produced in calorie when a current of 0.2 A is passed through a wire of resistance 41.8 Ω for 10 minutes.

Watch Video Solution

13. A potential difference of 100 V is applied across a wire of resistance 50 Ω for one minute. Find the heat produced in joule.

Watch Video Solution

14. A potential difference of 100 V is applied across a wire for two minutes. If the current through the wire is 0.1 A , find the heat produced in houle .

Watch Video Solution

15. A potential difference of 100 V is applied across a wire for 6 minutes and 58 seconds. If the current through the wire is 0.1 A, find the heat produced in calorie.

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