Electric Current and Circuit

1. Define current. Gives it SI unit
2. Calculate the number of electron constituting one column of charge
3. The value of 1 mA and 1 mA are [CBSE 2020]
(a)10^{-6} and 10^{-3} A respectively (b) 10^{-6} and 10^{-9} A respectively (c) 10^{-3} and 10^{-6} A respectively (d) 10^{3} and 10^{6} A
4. State two properties of charge. How many electrons must be removed from a conductor, so that it acquires a charge of 4.8×10^{-6} C?
5. In how much time 9×10^{3} coulomb of charge will flow, if an electric current of 6 A is drawn by an electrical appliance?
6. What is meant by electric current? Name and define its SI unit. In a conductor electrons are flowing from B to A. What is the direction of conventional current? Give justification for your answer .A steady current of 1 ampere flows through a conductor. Calculate the number of electrons that flows through any section of the conductor in 1 second. (Charge on electron $1.6 \times 10{-19}$ coulomb).
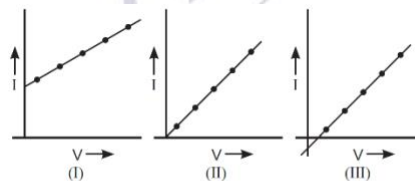
Electric Potential and Potential Difference

1. Write the function of voltmeter metre in an electric circuit.
2. A. What is the least count of voltmeter.
   B. In a voltmeter there are 20 division between the zero mark and 0.5 mark calculate its least count.
3. Name a device that helps to maintain a potential difference across a conductor
4. What is meant by saying that potential difference between 2 point is one volt
   3. (i) Define electric charge and state its unit of measurement.
5.   (ii) Describe how electric charge arises in matter. (Re)
6. Should the resistance of an ammeter be low or high. GIVE REASON

Circuit and Circuit Diagram

Draw a labelled circuit diagram to study the dependence of current on potential difference across a resistor Define an electric circuit. Draw a labelled Schematic diagram of an electric circuit comprising of a cell , resistor , an ammeter, a voltmeter and a closed switch .

Ohm's Law and Factors on which the Resistance of a Conductor Depends

1. In the experiment on studying the dependence of current (I) and potential difference (V), three students plotted the following graph between (V) and (I) as per their respective observations

The observation likely to be correct are those of
(a) Student I only   (b) Student II only
(c) Student III only   (d) All the three students

2. For verifying Ohm's law, we design an electric circuit diagram in which we show the arrangement of different circuit components. We find that with respect to resistor [CBSE 2023]
(a) ammeter is connected in parallel and voltmeter in series. (b) ammeter is connected in series and voltmeter in parallel.

(*c*) ammeter and voltmeter are both connected in series.

(*d*) ammeter and voltmeter are both connected in parallel.

3. When a 4 V battery is connected across an unknown resistor there is a current of 100 mA in the circuit. The value of the resistance of the resistor is [CBSE 2019]
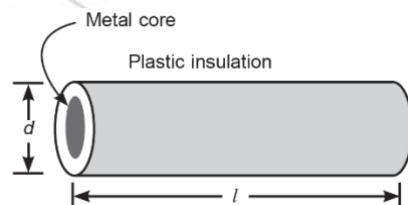
(*a*) 4 Ω (*b*) 40 Ω (*c*) 400 Ω (*d*) 0.4 Ω

4. A cylindrical conductor of length '*l*' and uniform area of cross-section '*A*' has resistance '*R*'. Another conductor of length 2.5*l* and resistance 0.5*R* of the same material has area of cross-section [CBSE 2020]

    (*a*) 5 A (*b*) 2.5 A (*c*) 0.5 A (*d*) 1/5 A

5. Plastic insulation surrounds a wire having diameter *d* and length *l* as shown above. A decrease in the resistance of the wire would be produced by an increase in the [CBSE Sample Paper 2023]
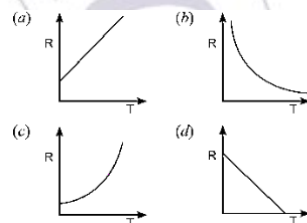
    (*a*) length *l* of the wire (*b*) diameter *d* of the wire (*c*) temperature of the wire (*d*) thickness of the plastic insulation

6. A complete circuit is left on for several minutes, causing the connecting copper wire to become hot. As the temperature of the wire increases, the electrical resistance of the wire [CBSE Sample Paper 2023]

    (*a*) decreases. (*b*) remains the same. (*c*) increases. (*d*) increases for some time and then decreases.

7. The temperature of a conductor is increased. The graph best showing the variation of its resistance is

8. Two wires of equal lengths, one of copper and the other of manganin (an alloy) have the same thickness. Which one can be used for (*i*) electrical transmission lines, and (*ii*) electrical heating devices? Why?

9. (*a*) In a given ammeter, a student saw that needle indicates 12th division in ammeter while performing an experiment to verify Ohm's law. If ammeter has 10 divisions between 0 to 0.5 A, then what is the ammeter reading corresponding to 12th division?

    (*b*) How do you connect an ammeter and a voltmeter in an electric circuit? [CBSE 2019]

10. (*a*) Write the relationship between electrical resistance and electrical resistivity for a metallic conductor of cylindrical shape. Hence derive the SI unit of electrical resistivity.
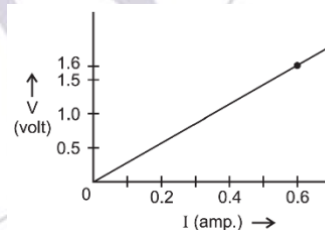
(*b*) Find the resistivity of the material of a metallic conductor of length 2 m and area of crosssection, 1.4×10^{-6} m². The resistance of the conductor is 0.04 ohm. [CBSE 2022]

11. A V-I graph for a nichrome wire is given below. What do you infer from this graph? Draw a labelled circuit diagram to obtained such a graph. [CBSE 2020]

12. Draw a closed circuit diagram consisting of a 0.5 m long nichrome wire XY, an ammeter, a voltmeter, four cells of 1.5 V each and a plug key.

(*b*) Following graph was plotted between V and I values :

What would be the values of V /I ratios when the potential difference is 0.8 V, 1.2 V and 1.6 V respectively? What conclusion do you draw from these values? [CBSE 2015]

13. Plot a graph between Current (*I*) and potential difference (*V*) and determine the resistance (*R*) of the resistor. [CBSE 2018]

14. (*a*) List the factors on which the resistance of a conductor in the shape of a wire depends.

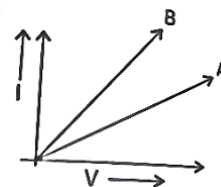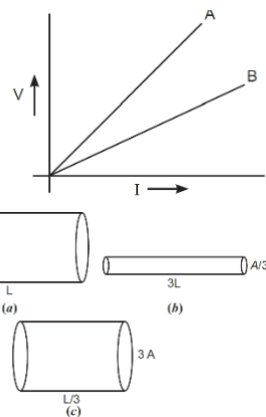(*b*) Why are metals good conductors of electricity whereas glass is a bad conductor of electricity? Give reason.

(*c*) Why are alloys commonly used in electrical heating devices? Give reason. [CBSE 2018]

V (volts)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
I (amperes)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8

15. V-I graph for two conducting wires A and B are shown. If both wires are of the same length and same thickness, which of the two is made of a material of high resistivity? Give justification for your answer. [CBSE 2023]

16. The figure below shows three cylindrical copper conductors along with their face areas and lengths. Discuss in which geometrical shape the resistance will be highest. [CBSE Sample Paper 2018]

17. (*a*) List the factors on which the resistance of a uniform cylindrical conductor of a given material depends.
(*b*) The resistance of wire of 0.01 cm radius is 10 Ω. If the resistivity of the wire is 50×10^{-8} Ω m, find the length of this wire. [CBSE 2022]

18. (*a*) Draw a labelled circuit diagram of the circuit used to show the variation of potential difference across the ends of a resistor with current flowing through it. If you use this circuit, what relation would you find between
the voltmeter reading, V and the ammeter reading, I ?
   (*c*) A wire of given material having length *l* and area of cross-section 'A' has a resistance of 4 Ω. Find the resistance of another wire of themsame material having length *l*/2 and area of cross-section 2A.

19. (a) State the relation correlating the electric current flowing in a conductor and the voltage applied across it. Also draw a graph to show this relationship.
   (*b*) Find the resistance of a conductor if the electric current flowing through it is 0.35 A when the potential difference across it is 1.4 V.

20. What would you suggest to a student if while performing an experiment he finds that the pointer/needle of the ammeter and voltmeter do not coincide with the zero marks on the scales when circuit is open? No extra ammeter/voltmeter is available in the laboratory. [2019 JMS/1

21. Three resistors of 5 Ω, 10 2 and 15 Ω are connected in series and the combination is connected to battery of 30 V. Ammeter and Voltmeter are connected in the circuit. Draw a circuit diagram to connect all the devices in proper correct order. What is the current flowing and potential difference across 10 Ω resistance?

22. An electric lamp and a conductor of resistance 4 Ω are connected in series to a 6 V battery. The current drawn by the lamp is 0.25A. Find the resistance of the electric lamp.

23. Let the resistance of an electrical device remain constant, while the potential difference across its two ends decreases to one fourth of its initial value. What change will occur in the current through it? State the law which helps us in solving the above stated question.

24. Three resistors of 6 Ω, 4 2 and 4 2 are connected together so that the total resistance is 8 Ω. Draw a diagram to show this arrangement and give reason to justify your answer

25. How is electric current related to the potential difference across the terminals of a conductor? Draw a labelled circuit diagram to verify this relationship.

(ii) Why should an ammeter have low resistance? (iii) Two V-I graphs A and B for series and parallel combinations of two resistors are as shown. Giving reason Or, A V-I graph for a nichrome wire is given below. What do you infer from this graph? Draw a labelled circuit diagram to obtain such a graph.

26. State Ohm's law. Draw a labelled circuit diagram to verify this law in the laboratory. If you draw a graph between the potential difference and current flowing through a metallic conductor, what kind of curve will you get? Explain how would you use this graph to determine the resistance of the conductor. [2015
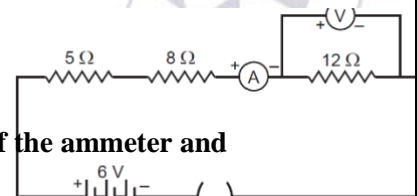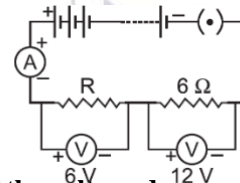Or,
A V-I graph for a nichrome wire is given below. What do you infer from this graph? Draw a labelled circuit diagram to obtain such a graph
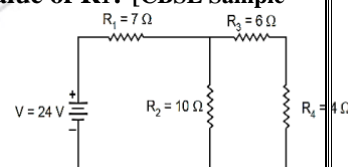
27. a) Nichrome wire of length '' and radius' has resistance of 10 Ω How would the resistance of the wire change when (i) Only length of the wire is doubled? (ii) Only diameter of the wire is doubled? Justify your answer.
(c) Why element of electrical heating devices are made up of alloys?

28. Give reason for the following:
(a) Define electric resistance of a conductor. Name and define its Sl unit.
(b) List two factors on which resistance of a conductor depends.
(c) Resistance of a metal wire of length 1 m is 104 Ω at 20° C. If the diameter of the wire is 0.15 mm, find the resistivity of the metal at that temperature.

29. The resistance of a wire of 0.01 cm radius is 10 Ω. If resistivity of the material of the wire is 50×10^{-8} ohm meter, find the length of the wire .

Resistance of a System of Resistors

1. Two bulbs of 100 W and 40 W are connected in series. The current through the 100 W bulb is 1 A. The current through the 40 W bulb will be:, [CBSE 2020]
2. A circuit is shown in the diagram given below.
(*a*) Find the value of R. (*b*) Find the reading of the ammeter.
 (*c*) Find the potential difference across the terminals of the battery.

4. Two resistors 3 Ω and unknown resistor are connected in a series across a 12 V battery. If the voltage drop across the unknown resistor is 6 V, find
 (*a*) potential across 3 Ω resistance (*b*) the current through unknown resistor 'R'
(*c*) equivalent resistance of the circuit.

5. Consider the following circuit: [CBSE 2018(C)] What would be the readings of the ammeter and the voltmeter when key is closed? Give reason to justify your answer.

6.You have three resistors of resistance R Ω each and a battery of 'E' volts. How would you connect these resistors with a battery to obtain maximum current? Draw circuit diagram to illustrate your answer and also calculate the current drawn from the battery. [CBSE 2016]

7. In the above circuit, if the current reading in the ammeter A is 2A, what would be the value of R_1? [CBSE Sample Paper 2022]
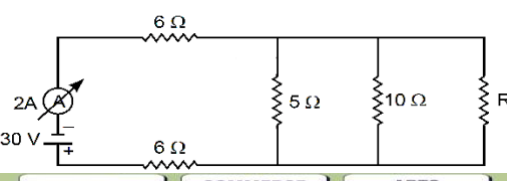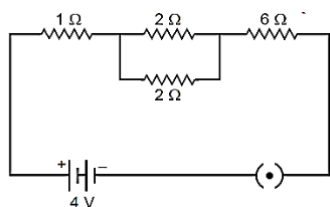
8. Calculate the total resistance of the circuit and find the total current in the circuit.

Question 9

9. Find the current following through the following electric circuit. [CBSE 2022C]

Question 8

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SCIENCE
Physics
Chemistry
Mathematics

COMMERCE
Accountancy
Mathematics
Economics
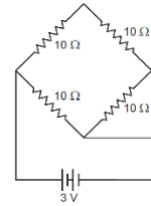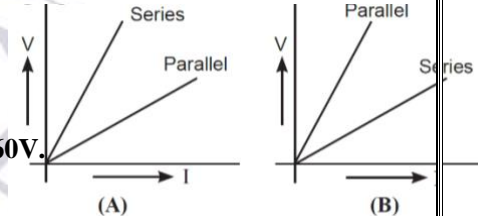Business Std.*

ARTS
Pol. Science
Geography
History
English

10. List three advantage of connecting electrical appliances in parallel with the mains instead of connecting them in series. [CBSE 2022(C)

11. Find the current drawn from the battery by the network of four resistors shown in the figure
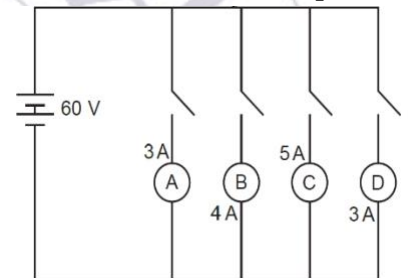
12. Two students perform the experiments on series and parallel combinations of two given resistors R_1 and R_2 and plot the following V-I graphs. Which of the two diagrams correctly represents the labels 'series and parallel' on the plotted curves? Justify your answer.
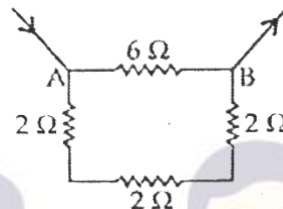
13. In the given circuit, A, B, C and D are four lamps connected with a battery of 60V. Analyse the circuit to answer the following questions. [CBSE Sample Paper 2021]
(*i*) What kind of combination are the lamps arranged in (series or parallel)?
(*ii*) Explain with reference to your above answer, what are the advantages (any two) of this combination of lamps?
(*iii*) Explain with proper calculations which lamp glows the brightest?
(*iv*) Find out the total resistance of the circuit.

14. Find the resistance between points A and B in the circuit diagram given below

15. Show four different ways in which four resistors of r ohm each may be connected in a circuit. In which case is the equivalent resistance of the combination i. maximum   ii. Minimum

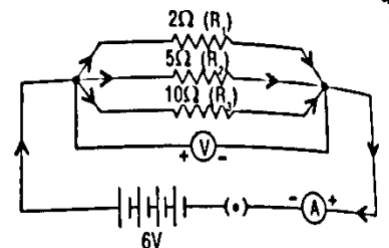16. Two identical resistors each of resistance 10 ohm are connected: (2013
    (i)   in series
    (ii)   in parallel, in turn to a battery of 6V. Calculate the ratio of power consumed in the combination of resistors in the two cases.

17. Two resistors, with resistance 10 Ω and 15 Ω, are to be connected to a battery of e.m.f. 12V so as to obtain:
(i)   minimum current (ii) maximum current

18. (a) Describe the mode of connecting the resistances in each case.
    (*b*) Calculate the strength of the total current in the circuit in each case.
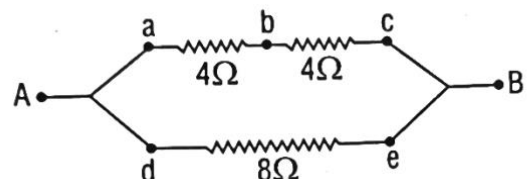
19. In the circuit diagram given here, calculate:
(a) the current through each resistor.
(b) the total current in the circuit.
(c) the total effective resistance of the circuit.

20. Resistors given as R1, R2, and R3 are connected in series to a battery V. Draw the circuit diagram showing the arrangement. Derive an expression for the equivalent resistance of the combination.

(b) If R1= 10 Ω ,R2 = 20 Ω and R3= 30 Ω calculate the effective resistance when they are connected in series to a battery of 6 V. Also find the current flowing in the circuit
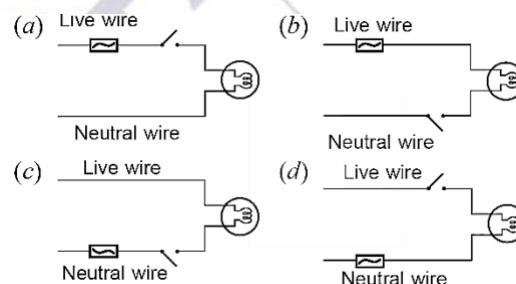
21. (i) Establish a relationship to determine the equivalent resistance R of a combination of three resistors having resistances R1, R2 and R3 connected in parallel.
(ii)   Three resistors are connected in an electrical circuit as shown. Calculate the resistance between A and B.

22. The resistance of resistor is reduced to half of its initial value. If other parameters of the circuit remain unchanged, the amount of heat produced in the resistor will become [CBSE 2023, 20]
    (a) four times *(b)* two times *(c)* half *(d)* one fourth

Heating Effect of Electric Current

1. The resistance of resistor is reduced to half of its initial value. If other parameters of the circuit remain unchanged, the amount of heat produced in the resistor will become [CBSE 2023, 20]

(a) four times *(b)* two times *(c)* half *(d)* one fourth

2. Which circuit shows the correct and safe position for the fuse and switch?

3. A fuse wire melts at 5 A. If it is desired that the fuse wire of the same material melt at 10 A, thenshould the new fuse wire be of smaller or larger radius than the earlier one? Give reason for your answer.

4. Which of the following does not represent electric power? [CBSE 2020] *(a)* I^2R *(b)* IR^2 *(c)* VI *(d)* V^2/R

5. Give reason for the following:
(i) Electric bulbs are usually filled with chemically inactive gases like nitrogen and argon.
(ii) Copper and aluminium wires are usually employed for electricity transmission.
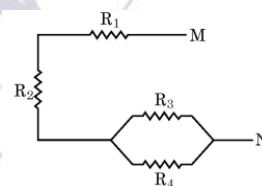(iii) Fuse wire is placed in series with the device.

6. Write the mathematical expression for Joule's law of heating. [2018, 2020/88/1]
    (c) Two lamps, one rated 100 W; 220 V, and the other 60 W; 220 V, are connected in parallel to electric mains supply. Find the current drawn by two bulbs from the line, if the supply voltage is 220 V.

7. Compute the heat generated while transferring 96,000 coulomb of charge in two hours through a potential difference of 40 V.

8. For the combination of resistors shown in the given figure, find the equivalent resistance between M & N.
     (b) Why we need a 5 A fuse for an electric iron which consumes 1 kW power at 220 V?
      (c) Why is it impracticable to connect an electric bulb and an electric heater in series?

9. (a) Why are metals good conductors of electricity whereas glass is a bad conductor of electricity? Give reason.
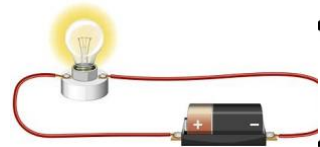   (b) Why are alloys commonly used in electrical heating devices? Give reason

10. Name an instrument that measures potential difference between two points in a circuit. Define the unit of potential difference in terms of Sl unit of charge and work. Draw the circuit symbols for a
    (i) variable resistor, (ii) a plug key which is closed one.
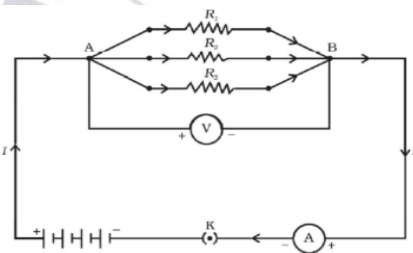   Two electric circuits I and II are shown below.

i)   Which of the two circuits has more resistance?
ii)   Through which circuit more current passes?
iii)   In which circuit, the potential difference across each resistor is equal?
iv)   If R1 > R2 > R3 in which circuit more heat will be produced in R1 as compared to other two resistors?

11. When an electric current flows through a conductor it becomes hot. Why? List the factor on which the heat produced in a conductor depends. State Joule's law of heating. How will the heat produced in an electric circuit be affected, if the resistance in the circuit is doubled for the same current?
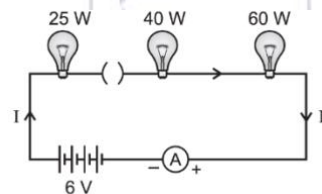

Electric Power and Energy

1.   An electric iron of 1500 W, 200 V and a flash light of 500 W, 200 V are used in homes. The rating of fuse to be used should be [CBSE 2023] (1 Mark)
(*a*) 5 A (*b*) 10 A (*c*) 15 A (*d*) 20 A

2.   The wattage of a bulb is 24 W when it is connected to a 12 V battery. Calculate its effective wattage if it operates on a 6 V battery (Neglect the change in resistance due to unequal heating of the filament in the two cases)

3.   In the circuit given below:
(*a*) Would any bulb glow when plug key is in open position?
(*b*) Write the order of brightness of the bulb when key is closed. Give reason.

4.   (*a*) It would cost a man Rs. 3.50 to buy 1.0 kWh of electrical energy from the Main Electricity Board. His generator has a maximum power of 2.0 kW. The generator produces energy at this maximum power for 3 hours. Calculate how much it would cost to buy the same amount of energy from the Main Electricity Board.
A student boils water in an electric kettle for 20 minutes. Using the same mains supply he wants to reduce the boiling time of water. To do so should he increase or decrease the length of the heating element? Justify your answer. [CBSE Sample Paper 2022]

5. An electric motor rated 1100 W is connected to 220 V mains. Find:
(*i*) The current drawn from the mains.
(*ii*) Electric energy consumed if the motor is used for 5 hours daily for 6 days.
(iii)   Total cost of energy consumed if the rate of one unit is ` 5.

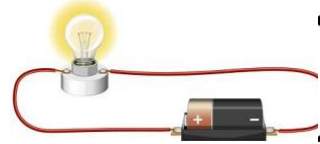6. (*a*) Write two point of difference between electric energy and electric power.
(*b*) Out of 60 W and 40 W lamps, which one has higher electrical resistance when in use.
(*c*) What is the commercial unit of electric energy? Convert it into joules.

7. (*a*) Define electric power. Express it in terms of potential difference V and resistance R.
(*b*) An electrical fuse is rated at 2A. What is meant by this statement?

(*c*) An electric iron of 1 kW is operated at 220 V. Find which of the following fuses that respectively rated at 1 A, 3 A and 5 A can be used in it. [CBSE 2014]

8. An electric kettle of 2 kW is used for 2 h. Calculate the energy consumed in (*i*) Kilowatt hour (*ii*) Joules.

9. A bulb is rated 40 W; 220 V. Find the current drawn by it when it is connected to a 220 V supply. Also find its resistance. If the given bulb is replaced by a bulb of rating 25 W; 220 V, will there be any change in the value of current and resistance? Justify your answer and determine the change.

10. Calculate the total cost of running the following electrical devices in the month of September, if the rate of 1 unit of electricity is ` 6.00.
(*i*) Electric heater of 1000 W for 5 hours daily.
(*ii*) Electric refrigerator of 400 W for 10 hours daily. [CBSE 2018(C)]

11. (*a*) An electric iron consumes energy at a rate of 880 W when heating is at the maximum rate and 330 W when the heating is at the minimum. If the source voltage is 220 V, calculate the current and resistance in each case.
(*b*) What is heating effect of electric current?
(*c*) Find an expression for the amount of heat produced when a current passes through a resistor for some time.

12. Two lamps, one rated 100 W at 220 V and the other 60 W at 220 V, are connected in parallel to electric mains supply of 220 V. Draw a circuit diagram to show this arrangement and calculate the current drawn by the two lamps from the mains. [CBSE 2021(C)]

13. Write the relation between electric power (P) of a device with potential difference (Volt) across it and current (amp) flowing through it

14. An electric heater rated 800 W operates 6hr./ day. Find the cost of energy to operate it for 30 days at 3.00 per unit

15. Calculate the current through a lamp of 25 W operating at 250 V

16. A bullb is rated at 200 V, 100 W. Calculate its resistance. Five such bull burn for 4 Hours daily. Calculate the units of electrical energy consumed per day. What would be the cast of using these bulbs per day at the rate of 74.00 per unit?

17. Two electric bulbs rated 100 W; 220 V and 60 W; 220 V are connected in parallel to an electric mains of 220 V. Find the current drawn by the bulbs from the mains.

18. A circuit has a line of 5 A. How many lamps of rating 40W; 220V can simultaneously run on this line safely?

19. Two electric bulbs rated 100 W; 220 V and 60 W; 220 V are connected in parallel to an electric mains of 220 V. Find the current drawn by the bulbs from the mains.

20. Amit lives in Delhi and is much concerned about the increasing electricity bill of his house. He took some steps to save electricity and succeeded in doing so. 2014
    (1) Amit fulfilled his duty towards the environment by saving electricity. How?
    (ii) Which alternative source of energy would you suggest Amit to use?

21. An electric iron draws 2.2 amperes of current from a 220 V source. Find its (i) resistance and
    (ii) wattage (Power)

22. Two lamps, one rated 40W at 220V and the other 100 W at 220V, are connected in parallel to the electric supply at 220V.
    (a) Draw a circuit diagram to show the connections.
    (b) Calculate the current drawn from the electric supply.
    (c) Calculate the total energy consumed by the two lamps together when they operate for one hour.

23. An electric iron consumes energy at a rate of 840 W when heating is at the maximum and 360 W when the heating is at the minimum The voltage at which it is running is 220V What are the current and resistance in each case?

24. (a) An electric bulb is rated at 200 V; 100 W. What is its resistance? (b) Calculate the amount of work done in shifting a charge of 2 coulombs from a point A to B having potentials +10V and -5V respectively.
    (c) Calculate the potential difference between the two terminals of a battery if 12 joules of work is done in transferring 2 coulombs of charge.

25. a) What does an electric circuit mean? Name a device that helps to maintain a potential difference across a conductor in a circuit. When do we say that the potential difference across a conductor is 1 volt?
    (b) Calculate the energy consumed by 3 such bulbs if they glow continuously for 10 hours for the complete month of November.
    (c) Calculate the total cost if the rate is ₹6.50 per unit

26. In an electric circuit three bulbs of 100 w each are connected in series to a source. In another circuit set of three bulbs of the same wattage are connected in parallel to the same source.
    (i) Will the bulb in the two circuits glow with the same brightness? Justify your answer.
    (ii) Now, let one bulb in both the circuits get fused. Will the rest of the bulbs continue to glow in each circuit? Give reason for your answer.

27. Define Power and state its Sl unit.
    (b) A torch bulb is rated 5 V and 500 mA. Calculate its [2020 JBB/3
    (i) Power (ii) Resistance (iii) Energy consumed when it is lighted for 2.5 hours