



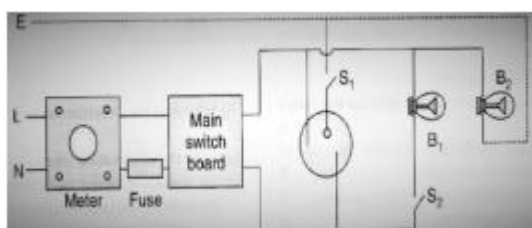
INDIAN SCHOOL AL WADI AL KABIR



CLASS: X	DEPARTMENT OF SCIENCE -2024-25 SUBJECT: PHYSICS	DATE OF COMPLETION:
WORKSHEET NO:4 WITH ANSWERS	TOPIC: ELECTRICITY	A4 FILE FORMAT (PORTFOLIO)
CLASS & SEC:	NAME OF THE STUDENT:	ROLL NO.

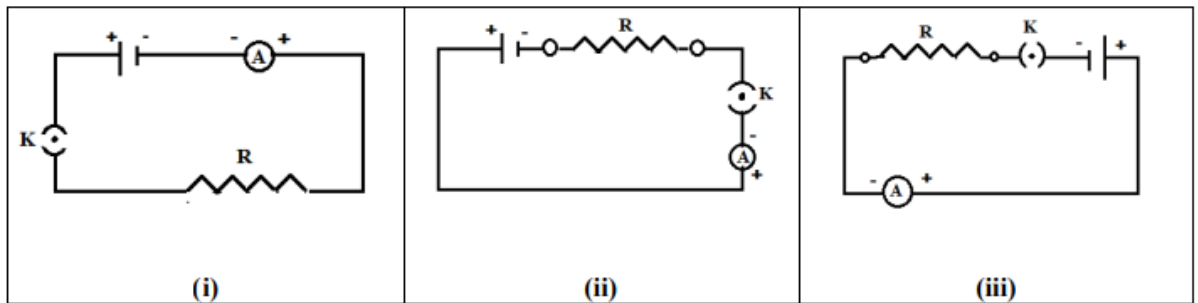
OBJECTIVE TYPE QUESTIONS

- If the length of a conductor and its radius is increased twice, how the resistance will change?
 - Resistance will remain unchanged.
 - Resistance will increase twice.
 - Resistance will become half.
 - Resistance will increase 4 times.
- In a resistive circuit if the current is increased to two times, the percentage change in the amount of heat dissipated in the circuit would be :
 - 400%
 - 300%
 - 200%
 - 100%
- Mention the colour convention for live, neutral and earth wire respectively.

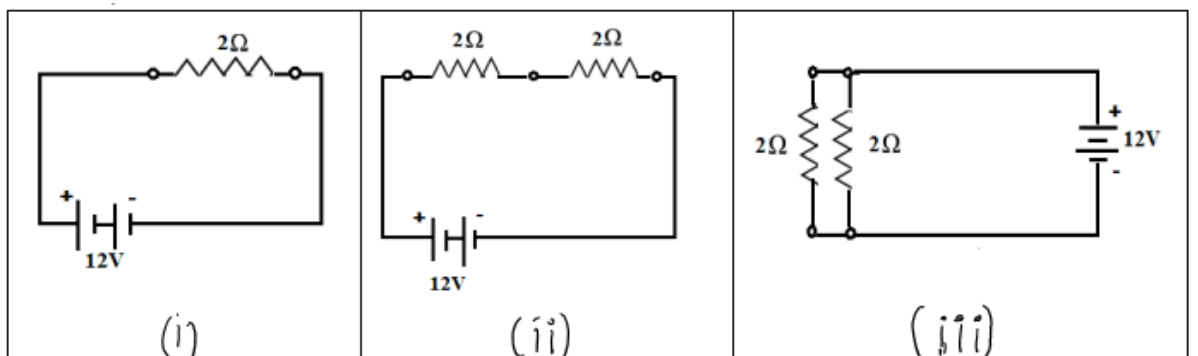


- Red, green, Black
 - Black, green, red
 - Red, black, green
 - Green, black, red
- In domestic electric circuits the wiring with 15 A current rating is for the electric devices which have
 - higher power ratings such as geyser.
 - lower power ratings such as fan.

- (c) metallic bodies and low power ratings.
 (d) non-metallic bodies and low power ratings.
5. 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
- (a) decreases. (b) remains the same.
 (c) increases. (d) increases for some time and then decreases.
6. A component used to regulate current without changing the voltage source is called as
- (a) Resistance
 (b) Electric current
 (c) Potential difference
 (d) Variable resistance
7. A cell, a resistor, a key and an ammeter are arranged as shown in the circuit diagrams. The current recorded in the ammeter will be:

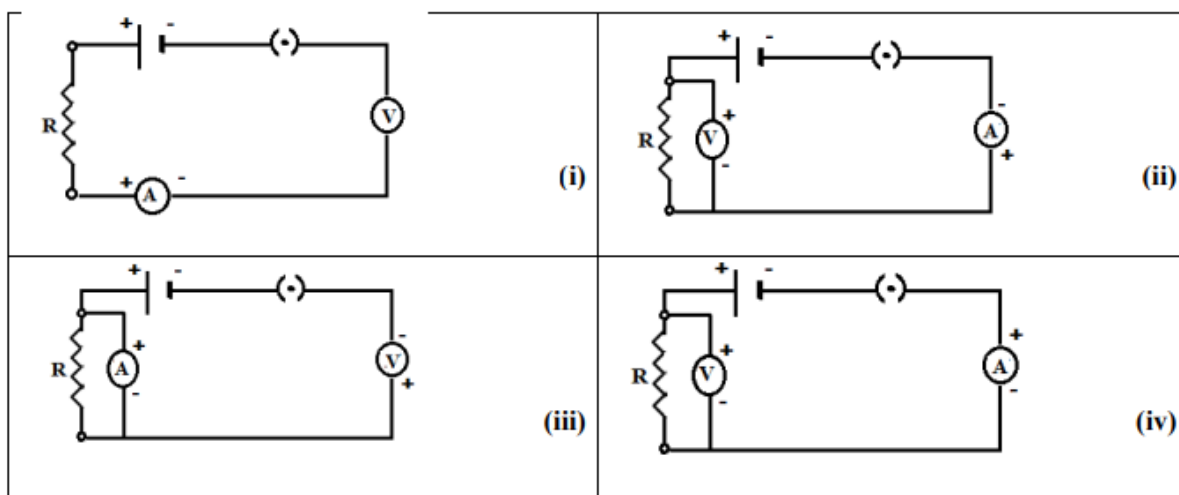


- (a) maximum in (i)
 (b) maximum in (ii)
 (c) maximum in (iii)
 (d) the same in all the cases
8. In the following circuits, heat produced in the resistor or combination of resistors connected to a 12 V battery will be:



- (a) same in all cases
 (b) minimum in case (i)
 (c) maximum in case (ii)
 (d) maximum in case (iii)

9. Identify the circuit, the diagrams given below, in which the electrical components have been properly connected



- (a) (i) (b) (ii) (c) (iii) (d) (iv)

10. What is the maximum resistance which can be made using five resistors each of $(1/5) \Omega$?
- (a) $(1/5) \Omega$ (b) 10Ω (c) 5Ω (d) 1Ω

ASSERTION AND REASONING

DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
 (c) Assertion (A) is true but reason (R) is false.
 (d) Assertion (A) is false but reason (R) is true.
 (e) Both Assertion and Reason are false.

11. **Assertion:** Electrons move from lower potential to higher potential in a conductor.

Reason : A dry cell maintains electric potential difference across the ends of a conductor.

12. **Assertion:** The connecting wires are made of copper.

Reason: Copper has very high electrical conductivity.

13. **Assertion:** The resistance of a given mass of copper wire is inversely proportional to the square of length.

Reason: When a copper wire of given mass is stretched to increase its length, its cross-sectional area also decreases.

14. **Assertion:** Electric current flow from a body at 15 V to 10 V.

Reason: Electric current flow from a body at higher potential to lower potential.

15. **Assertion:** A fuse used in electric circuit has high resistance and low melting point.

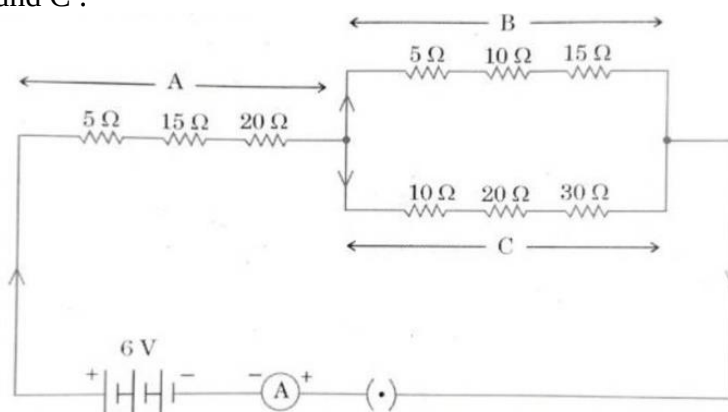
Reason: During the flow of any unduly high electric current the fuse wire melts and protects the circuits and appliances

16. **Assertion:** The commercial unit of electrical energy is kilowatt hour.

Reason: The SI unit of power is volt.

CASE STUDY BASED QUESTION

17. Study the following electric circuit in which the resistors are arranged in three arms A, B and C :



- (a) Find the equivalent resistance of arm A.
(b) Calculate the equivalent resistance of the parallel combination of the arms B and C.
(c) (i) Determine the current that flows through the ammeter.

OR

- (ii) Determine the current that flows in the ammeter when the arm B is withdrawn from the circuit

18. Go through the table and answer the following.

Conductor Material	Resistivity (Ohm meters @ 20 °C)
Silver	1.64×10^{-8}
Copper	1.72×10^{-8}
Aluminum	2.83×10^{-8}
Tungsten	5.50×10^{-8}
Nickel	7.80×10^{-8}
Iron	12.0×10^{-8}
Constantan	49.0×10^{-8}
Nichrome II	110×10^{-8}

We come across large number of electrical devices in our daily life. Each one has different properties and uses. Different appliances make use of different materials given in the table above.

i. Which substance is used in electrical transmission lines and why?

- (a) Nickel due to its high resistivity.
(b) Nichrome due to its high resistivity.
(c) Silver due to its low cost.
(d) Copper due to its high conductivity.

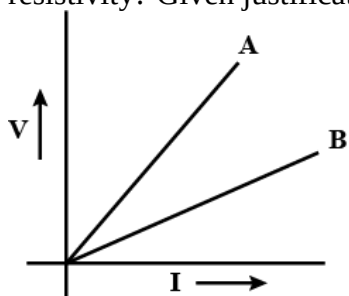
ii. What is the resistance of a tungsten wire of length 2m and area of cross section 1cm^2 ?

- (a) $22 \times 10^{-2} \Omega$
(b) $22 \times 10^{-4} \Omega$
(c) $11 \times 10^{-4} \Omega$
(d) $11 \times 10^4 \Omega$

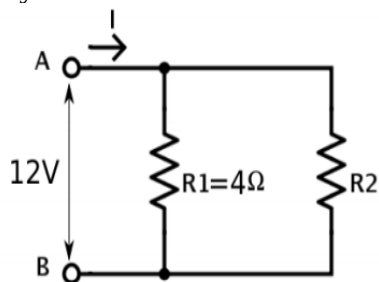
- iii. Which of these substances is used as electrical heating device and why?
- Nichrome due to its high resistivity.
 - Copper due to its high conductivity.
 - Nickel due to its high resistivity.
 - Tungsten due to its high conductivity.
- iv. A constantan wire of length 'l' and area of cross section A is drawn to double its length, what will be the value of new resistivity of the wire?
- Resistivity gets doubled.
 - Resistivity remains the same.
 - Resistivity gets halved.
 - Resistivity becomes four times.
- v. What are the factors on which resistivity of a wire depends on?
- Length and area of cross section.
 - Length and nature of the material.
 - Area of cross section and temperature.
 - Nature of the material and temperature.

TWO MARKS TYPE QUESTIONS

19. An electric source can supply a charge of 750 coulomb. If the current drawn by a device is 15 mA, find the time in which the electric source will be discharged completely.
20. An electric source can supply a charge of 500 coulomb. If the current drawn by a device is 25 mA, find the time in which the electric source will be discharged completely.
21. **V-I** graph for two wires **A** and **B** are shown in the figure. If the both wires are of same length and same thickness, which of the two is made of a material of high resistivity? Given justification for your answer.

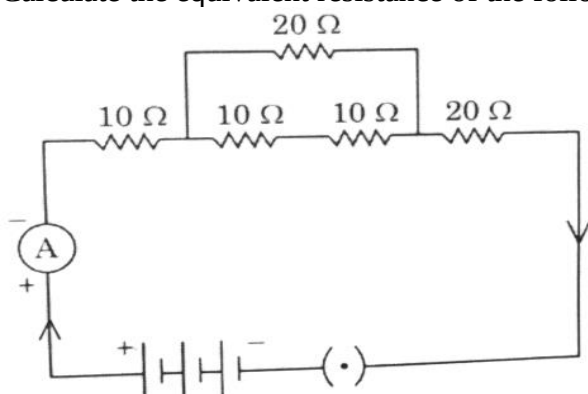


22. A student has two resistors- $2\ \Omega$ and $3\ \Omega$. She has to put one of them in place of R_2 as shown in the circuit. The current that she needs in the entire circuit is exactly 9A. Show by calculation which of the two resistors she should choose.



23. An electric heater rated 1100W operates at 220V. Calculate
- its resistance, and
 - the current drawn by it

24. Calculate the equivalent resistance of the following electric circuit



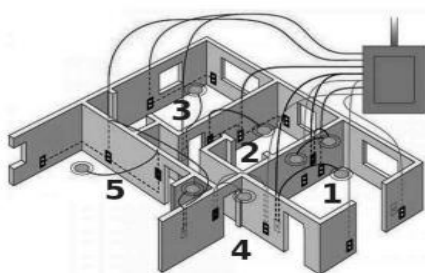
THREE MARKS TYPE QUESTIONS

25. Explain the meaning of overloading of an electrical circuit. List two possible causes due to which overloading may occur in household circuits. Write one preventive measure that should be taken to avoid overloading of domestic electric circuits
26. i) What is the function of earth wire in electrical instruments?
 ii) Explain what is short circuiting an electric supply.
 iii) What is the usual current rating of the fuse wire in the line to feed
 (a) Lights and fans? (b) Appliances of 2kW or more power?
27. Draw a circuit diagram of an electric circuit containing a cell, a key, an ammeter, a resistor of 4Ω in series with a combination of two resistors (8Ω each) in parallel and a voltmeter across parallel combination. Each of them dissipate maximum energy and can withstand a maximum power of 16W without melting. Find the maximum current that can flow through the three resistors.

FIVE MARKS TYPE QUESTIONS

28. (i) The potential difference across the two ends of a circuit component is decreased to one-third of its initial value, while its resistance remains constant. What change will be observed in the current flowing through it? Name and state the law which helps us to answer this question.
 (ii) Draw a schematic diagram of a circuit consisting of a battery of four 1.5 V cells, a 5 resistor, a 10 resistor and a 15 resistor and a plug key, all connected in series. Now find (I) the electric current passing through the circuit, and (II) potential difference across the 10 resistor when the plug key is closed.
29. i. When is the potential difference between two points said to be 1 volt?
 ii. A copper wire has a diameter of 0.2 mm and resistivity of 1.6 m . What will be the length of this wire to make its resistance 14? How much does the resistance change, if the diameter of the wire is doubled?

30.



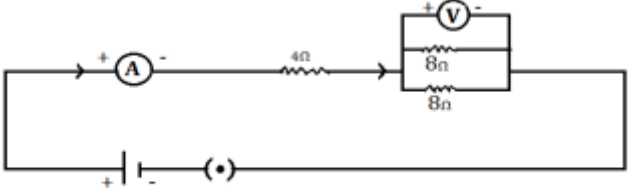
The diagram above is a schematic diagram of a household circuit. The house shown in the above diagram has 5 usable spaces where electrical connections are made. For this house, the mains have a voltage of 220 V and the net current coming from the mains is 22A.

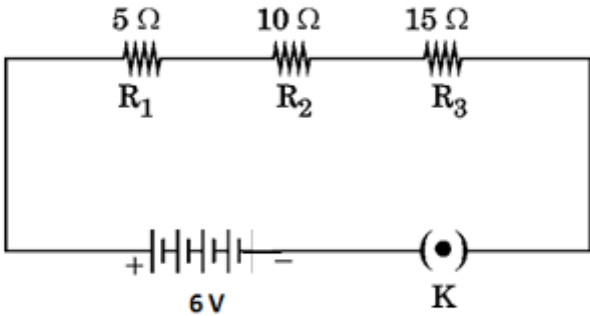
- (a) What is the mode of connection to all the spaces in the house from the mains?
- (b) The spaces 5 and 4 have the same resistance and spaces 3 and 2 have respective resistances of 20Ω and 30Ω . Space 1 has a resistance double that of space 5. What is the net resistance for space 5.
- (c) What is the current in space 3?
- (d) What should be placed between the main connection and the rest of the house's electrical appliances to save them from accidental high electric current?
31. a) Derive an expression for equivalent resistance of three resistors in parallel with the help of a circuit diagram.
 b) How can three resistors each of resistance 6Ω be connected to give a total resistance of
 (i) 2Ω
 (ii) 9Ω ?
32. a) State Joules law of heating and derive an expression for it.
 b) Two lamps, one rated 60W at 220 V and the other 40 W at 220V, are connected in parallel to the electric supply at 220 V.
 (i) Draw a circuit diagram to draw the connections.
 (ii) Calculate the total current drawn from the electric supply.

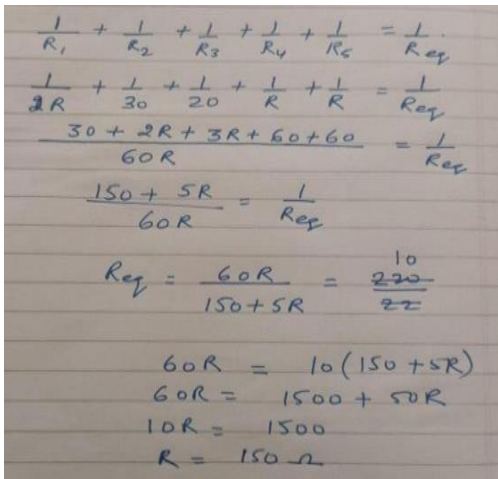
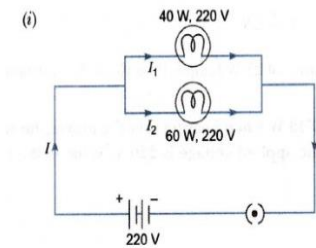
ANSWERS

QN NO	ANSWER	MARKS
1.	(c) Resistance will become half.	1
2.	(b)300% Heat dissipated is given by $H = I^2 R t$ If the current is increased to times the original value, then new current is given by $H' = I'^2 R t = 4I^2 R t = 4H$ The percentage increase in heat dissipation is given by $\Delta H \% = \frac{4H - H}{H} \times 100 = 300\%$	1
3.	(c) Red, black, green	1
4.	(a) higher power ratings such as geyser.	1
5.	(c) increases.	1
6.	(d) Variable resistance	1
7.	(d) the same in all the cases	1
8.	(d)maximum in case (iii)	1
9.	(b) (ii)	1
10.	(d) 1Ω	1
11.	(a) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A).	
12.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1
13.	(d) Assertion (A) is false but reason (R) is true.	1
14.	(a) Both assertion (A) and reason (R) are true and reason (R) is the	1

	correct explanation of assertion (A).	
15.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1
16.	(c) Assertion (A) is true but reason (R) is false.	1
17.	(a) The equivalent resistance in the arm A = $5\Omega + 15\Omega + 20\Omega = 40\Omega$ (b) The equivalent resistance of the parallel combination of the arms B and C = $((1/10\Omega + 20\Omega + 30\Omega) + (1/5\Omega + 10\Omega + 15\Omega))^{-1} = 20\Omega$ (c)i) Current flow flowing through the ammeter = $6/60 = 0.1\text{ A}$ OR ii) Current that flows in the ammeter when the arm B is withdrawn from the circuit = $6/100 = 0.06\text{ A}$	1
18.	(i) d (ii) c (iii) a (iv) b (v) d	1
19.	Time (t) = Charge (Q) / Current (I) Substitute the values: $t = 750\text{ C} / 0.015\text{ A}$ $t = 50000\text{ seconds}$	
20.	$Q = I \times t$ $\therefore t = \frac{500\text{ C}}{25 / 1000\text{ A}}$ $= 20000\text{ s}$	2
21.	From the graph, slope of wire A is greater. Hence wire A has greater resistance. The heat produced by resistor is given by $H = I^2 R T$. It is directly proportional to square of current passing through it, resistance and time for which the current passes through the conductor. Hence A wire is made of a material of high resistivity.	2
22.	The overall current needed = 9A. The voltage is 12V Hence by Ohm's Law $V = IR$, The resistance for the entire circuit = $12/9 = 4/3\Omega = R$ R1 and R2 are in parallel. Hence, $R = (R_1 R_2) / (R_1 + R_2) = 4R_2 / (4 + R_2) = 4/3$ $R_2 = 2\Omega$.	2
23.	$P = 1100\text{ W}$ $V = 220\text{ V}$ i) $P = V^2 / R$ $1100 = 220 \times 220 / R$ $R = 44\Omega$ ii) $I = V / R = 220 / 44 = 5\text{ A}$	2

24.	First, calculate the resistance of 2 series resistors inside the loop, i.e., $= R_1 + R_2$ $= 10\Omega + 10\Omega$ $= 20\Omega$ To calculate the equivalent resistance in the given electric circuit, let us find the parallel resistance. For that we use $= \frac{R_1 \times R_2}{R_1 + R_2}$ $= \frac{20\Omega \times 20\Omega}{20\Omega + 20\Omega}$ $= \frac{400\Omega}{40\Omega}$ $= 10\Omega$ Now, again applying the series formula to add the resistors together $= 10\Omega + 10\Omega + 20\Omega = 40\Omega$ So the total resistance of the given 40Ω	2
25.	Ans:-Overloading of an electrical circuit happens when an excessive amount of electric current passes through the wire and excessive heating takes place. Two possible causes of overloading: (a) Live and neutral wires come in contact with each other. (b) Connecting too many appliances in parallel to a single socket. Preventive measures: (a) Proper insulation (b) Not connecting too many appliances in a single socket.	2
26	Earth wire in electrical instruments saves us from all possible electric shocks. ii) Accidentally, when live and neutral wires of an electric circuit comes into direct contact, it is called short circuiting. iii) (a) 5A (b) 15A	2
27.	 Maximum current through 4Ω resistor $= \sqrt{\frac{P}{R}}$ $= \sqrt{\frac{16}{4}} = 2A$ $\therefore$ Maximum current through each 8Ω resistor $= \frac{1}{2} \times 2 = 1A$	3

28	(a) (i) • Current becomes one-third of its initial value. • Ohm's Law The potential difference across the ends of a conductor is directly proportional to the current flowing through it, provided its temperature remains the same. (ii)  $5\ \Omega$ $10\ \Omega$ $15\ \Omega$ R_1 R_2 R_3 $+$  $-$ $(\bullet)$ 6 V K Total Voltage = $V = 4 \times 1.5\text{ V} = 6\text{ V}$ Total resistance, $R(s) = R_1 + R_2 + R_3$ $= 5\ \Omega + 10\ \Omega + 15\ \Omega = 30\ \Omega$ (I) Current, $I = \frac{V}{R} = \frac{6\text{ V}}{30\ \Omega} = 0.2\text{ A}$ (II) $V = IR = 0.2\text{ A} \times 10\ \Omega = 2\text{ V}$	
29	(i) When 1 joule of work is done to move a charge of 1 coulomb from one point to the other. (ii) $d = 0.2\text{ mm} = 2 \times 10^{-4}\text{ m}$; $R = 14\ \Omega$ $\rho = 1.6 \times 10^{-8}\ \Omega\text{ m}$; $A = \frac{\pi d^2}{4}$ $R = \frac{\rho l}{A} = \frac{4\rho l}{\pi d^2} \text{ or } l = \frac{\pi d^2 R}{4\rho}$ $l = \frac{22}{7} \times \frac{(2 \times 10^{-4})^2}{4 \times 1.6 \times 10^{-8}} \times 14$ $= 27.5\text{ m}$ When the diameter is doubled, $d' = 2d$ $A' = 4A$ $\frac{R'}{R} = \frac{A}{A'} \text{ or } R' = \frac{RA}{A'} = \frac{RA}{4A}$ $\frac{R'}{14} = \frac{A}{4A}$ $R' = 3.5\ \Omega$ Change $(14.0 - 3.5) = 10.5\ \Omega$	

30.	(a) All spaces are connected in parallel. (1mark) (b) Let Resistance of Space 5 and 4 be R ohms respectively (2marks) Resistance of Space 1 = 2 R ohms Resistance of Space 2 = 30 ohms Resistance of Space 3 = 20 ohms Current = 22 A V= 220 V Total Resistance= V/I 	3
31	a) Circuit diagram for parallel combination. Derivation- Steps b) (i) 2 Ω - all three 6 Ω resistors in parallel (either numerically or by using diagram) (ii) 6 Ω - two 6 Ω resistors in parallel with the third 6 Ω resistor	5
32	(a) Statement of Joules law of heating Derivation -steps (b) (i)  (ii) Current drawn by 40 W bulb, $I_1 = \frac{P}{V} = \frac{40}{220} \text{ A} = \frac{2}{11} \text{ A} = 0.18 \text{ A}$ Current drawn by 60 W bulb, $I_2 = \frac{P}{V} = \frac{60}{220} \text{ A} = \frac{3}{11} \text{ A} = 0.27 \text{ A}$ Total current drawn from circuit, $I = I_1 + I_2 = 0.18 \text{ A} + 0.27 \text{ A} = \mathbf{0.45 \text{ A}}$	5

Prepared by
Ms. Vipina Gangadharan

Checked by
HoD Science