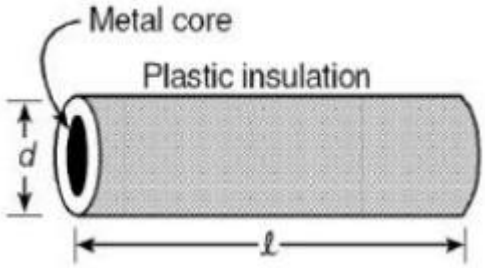
INDIAN SCHOOL AL WADI AL KABIR		
Class: X	DEPARTMENT OF SCIENCE -2023-24 SUBJECT: PHYSICS	DATE: 17/10/2023
WORKSHEET NO:4 WITH ANSWERS	TOPIC: ELECTRICITY	A4 FILE FORMAT (PORTFOLIO)
CLASS & SEC:	NAME OF THE STUDENT:	ROLL NO.

OBJECTIVE TYPE QUESTIONS

1. 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 the resistor, the :
   (a) ammeter is connected in parallel and the voltmeter in series.
   (b) ammeter is connected in series and the voltmeter in parallel.
   (c) ammeter and voltmeter are both connected in series.
   (d) ammeter and voltmeter are both connected in parallel.
2. 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 :
   (a) 400%
   (b) 300%
   (c) 200%
   (d) 100%
3. If four identical resistors of resistance 8 ohm are first connected in series so as to give an effective resistance Rs and the. connected in parallel so as to give an effective resistance Rp then the ratio Rs/Rp is
   (a) 32 (b)2 (c) 0.5 (d) 16
4. In domestic electric circuits the wiring with 15 A current rating is for the electric devices which have
   (a) higher power ratings such as geyser.
   (b) 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.



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

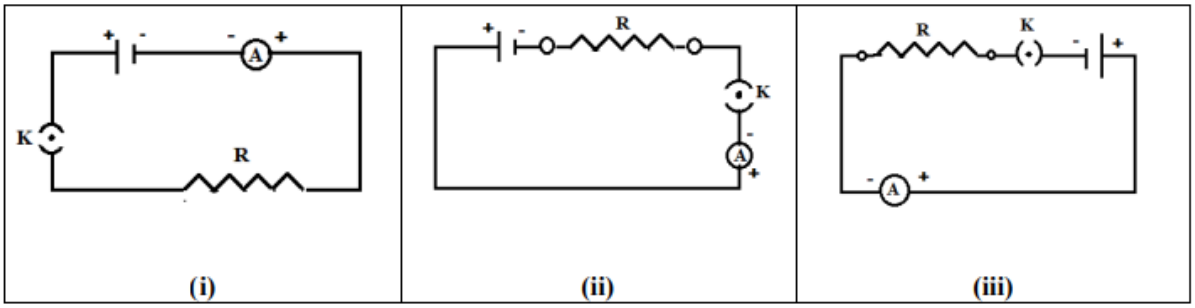
(a) length l of the wire

(b) diameter d of the wire

(c) temperature of the wire

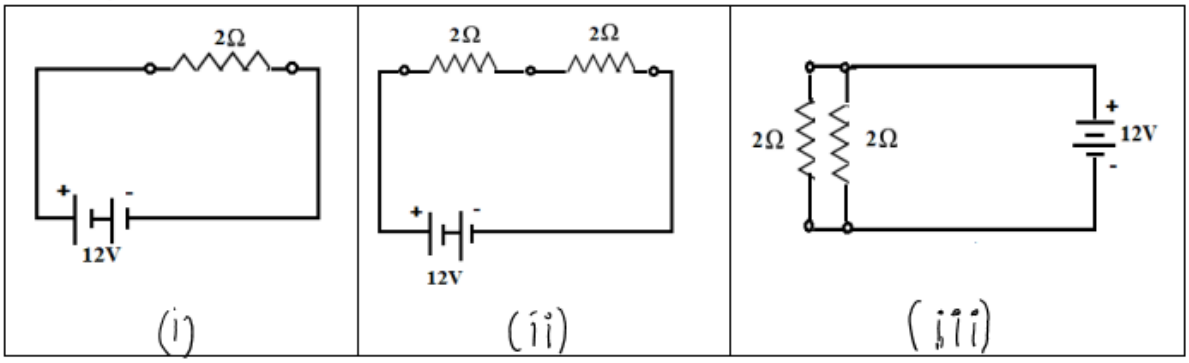
(d) thickness of the plastic insulation

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:



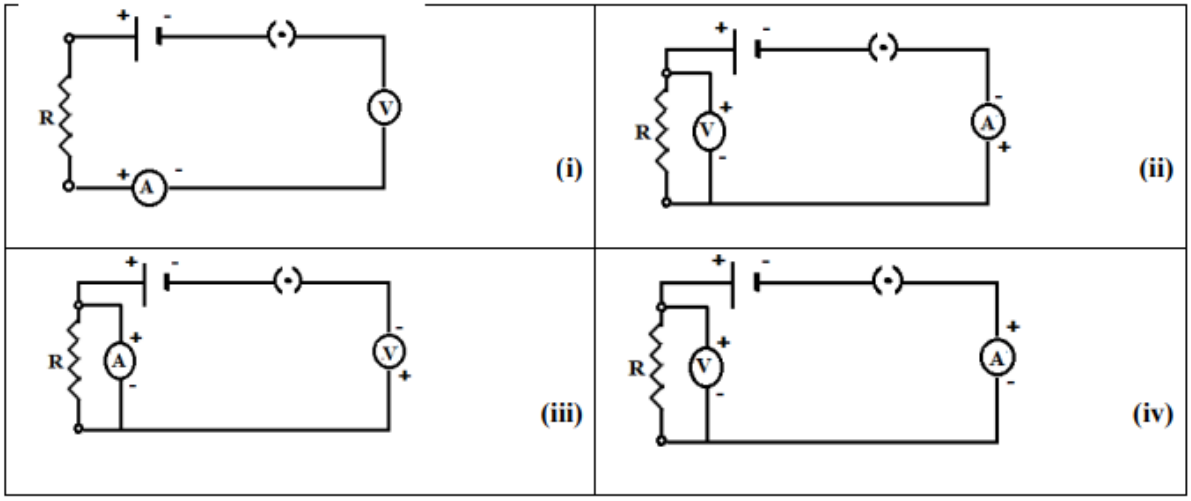
(a) maximum in (i) (b) maximum in (ii) (c) maximum in (iii) (d) the same in all the cases

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) Ω?
    (a) (1/5) Ω (b) 10 Ω (c) 5 Ω (d) 1 Ω

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.

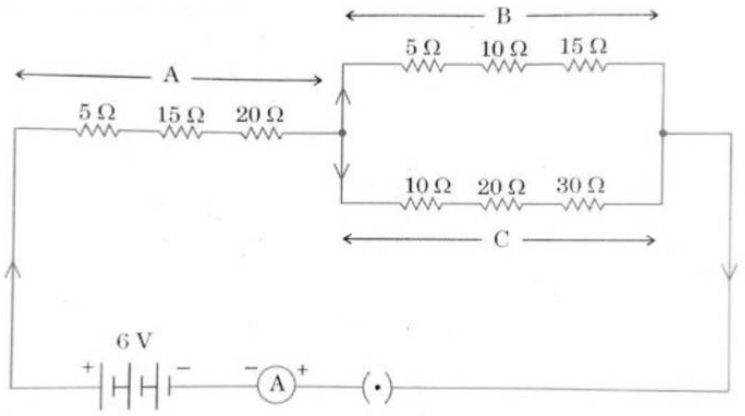
(d) Assertion (A) is false but reason (R) is true.

(e) Both Assertion and Reason are false.

11. Assertion: The connecting wires are made of copper.
    Reason: Copper has very high electrical conductivity.
12. 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.
13. 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.
14. 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
15. Assertion: The commercial unit of electrical energy is kilowatt hour.
    Reason: The SI unit of power is volt.

CASE STUDY BASED QUESTION

16. 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

17. 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?

(a)Nichrome due to its high resistivity.

(b)Copper due to its high conductivity.

(c)Nickel due to its high resistivity.

(d)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?

(a)Resistivity gets doubled.

(b)Resistivity remains the same.

(c)Resistivity gets halved.

(d)Resistivity becomes four times.

v. What are the factors on which resistivity of a wire depends on?

(a)Length and area of cross section.

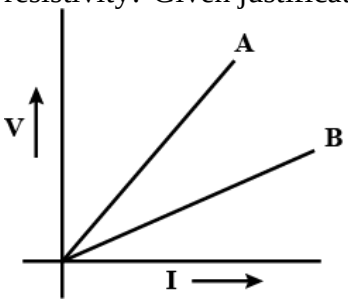
(b)Length and nature of the material.

(c)Area of cross section and temperature.

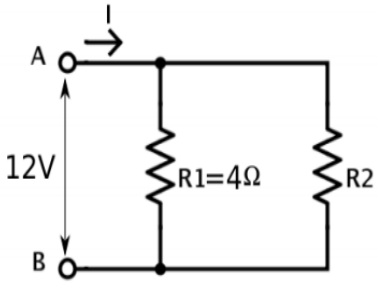
(d)Nature of the material and temperature.

TWO MARKS TYPE QUESTIONS

18. **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.



19. A student has two resistors- 2 Ω and 3 Ω. She has to put one of them in place of R2 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.

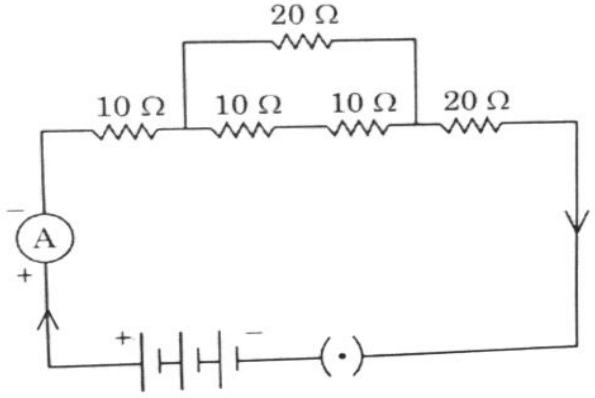


20. An electric heater rated 1100W operates at 220V. Calculate

(i) its resistance, and

(ii) the current drawn by it

21. Calculate the equivalent resistance of the following electric circuit

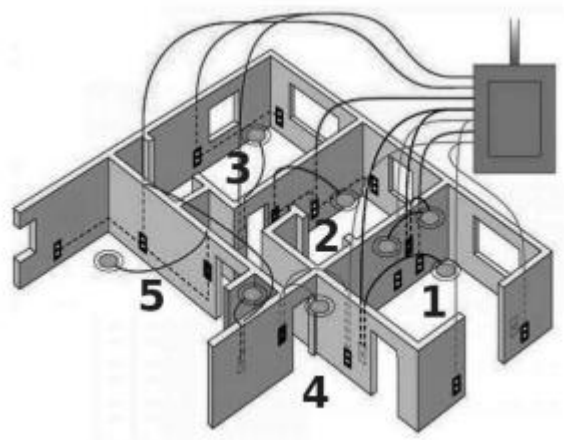


THREE MARKS TYPE QUESTIONS

22. 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
23. 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?
24. 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

25.



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.

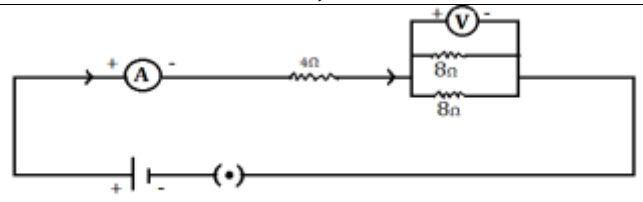
(c) What is the current in space 3?

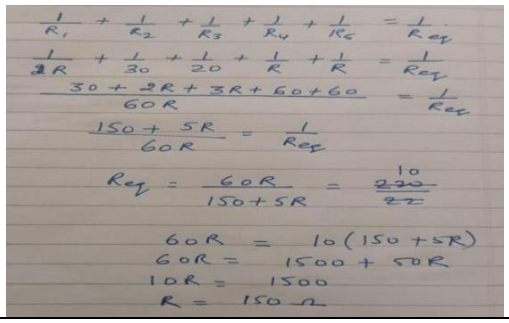
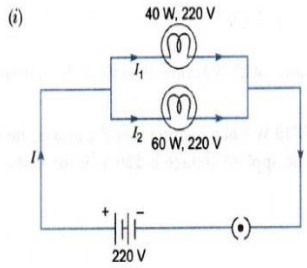
(d) What should be placed between the main connection and the rest of the house's electrical appliances to save them from accidental high electric current?

26. 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) 2 Ω
    (ii) 9Ω ?
27. 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.	(a)ammeter is connected in series and the voltmeter in parallel.	1
2.	(b)300% Heat dissipated is given by $H = I^2Rt$ If the current is increased to times the original value, then new current is given by $H' = I'^2Rt = 4I^2Rt = 4H$ The percentage increase in heat dissipation is given by $\Delta H\% = \frac{4H-H}{H} \times 100 = 300\%$	1
3.	(a) 32	1
4.	(a) higher power ratings such as geyser.	1
5.	(c) increases.	1
6.	(b) diameter d of the wire	1
7.	(d) the same in all the cases	1
8.	(d)maximum in case (iii)	1
9.	(b) (ii)	1
10.	(d) 1 Ω	1
11.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1
12.	(d) Assertion (A) is false but reason (R) is true.	1
13.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1
14.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1
15.	(c) Assertion (A) is true but reason (R) is false.	1
16.	(a) The equivalent resistance in the arm A = 5Ω + 15Ω + 20Ω =40 Ω (b) The equivalent resistance of the parallel combination of the arms B and C= $((1/10\Omega+20\Omega+30\Omega) + (1/5\Omega+10\Omega+15\Omega))^{-1}$ =20Ω (c)i) Current flow flowing through the ammeter = 6/60 = 0.1 A OR ii) Current that flows in the ammeter when the arm B is withdrawn from the circuit = 6/100=0.06A	1
17.	(i) d (ii) c (iii) a (iv) b (v) d	1
18.	From the graph, slope of wire **A** is greater. Hence wire **A** has greater resistance. The heat produced by resistor is given by **$H=I^2RT$**. 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
19.	The overall current needed = 9A. The voltage is 12V Hence by Ohm's Law V=IR,	2

	The resistance for the entire circuit = 12/9 = 4/3 Ω. = R R1 and R2 are in parallel. Hence, R=(R1 R2)/(R1 + R2) = 4R2/(4+R2) = 4/3 R2 = 2Ω.	
20.	P=1100W V=220V i)$P=V^2/R$ 1100= 220×220/R R=44 Ω ii)I=V/R=220/44=5A	2
21.	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
22.	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
23	Earth wire in electrical instruments saves us from all possible electric shocks. ii) Accidently, when live and neutral wires of an electric circuit comes into direct contact, it is called short circuiting. iii) (a) 5A (b) 15A	2
24.	 Maximum current through 4 Ω resister $= \sqrt{\frac{P}{R}}$ $= \sqrt{\frac{16}{4}} = 2A$ $\therefore$ Maximum current through each 8 Ω resister $= \frac{1}{2} x2 = 1A$	3

25.	(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  $\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}+\frac{1}{R_4}+\frac{1}{R_5}=\frac{1}{R_{eq}}$ $\frac{1}{2R}+\frac{1}{30}+\frac{1}{20}+\frac{1}{R}+\frac{1}{R}=\frac{1}{R_{eq}}$ $\frac{30+2R+3R+60+60}{60R}=\frac{1}{R_{eq}}$ $\frac{150+5R}{60R}=\frac{1}{R_{eq}}$ $R_{eq}=\frac{60R}{150+5R}=\frac{10}{\frac{220}{22}}$ $60R=10(150+5R)$ $60R=1500+50R$ $10R=1500$ $R=150\ \Omega$	3
26	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
27	(a) Statement of Joules law of heating Derivation -steps (b)  (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, $I_2=\frac{P}{V}=\frac{60}{220}=\frac{3}{11}\text{ A}=0.27\text{ A}$ Total current drawn from circuit, $I=I_1+I_2=0.18\text{ A}+0.27\text{ A}=\mathbf{0.45\ A}$	5

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