Brain International School
Vikas Puri, New Delhi

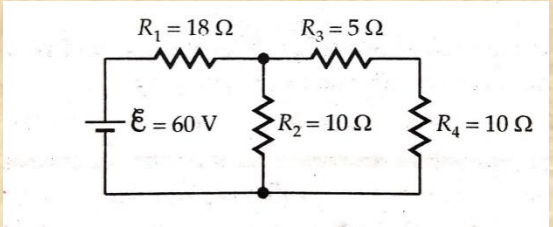
ASSIGNMENT NO. 2

SUBJECT: PHYSICS **CLASS-XII** **JULY'2026**

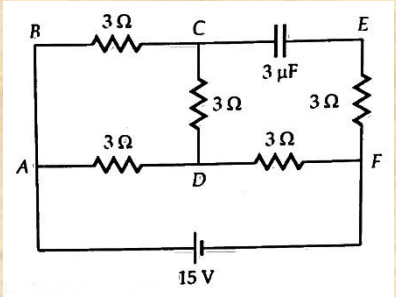
CH: 3 CURRENT ELECTRICITY

LIST OF DERIVATION

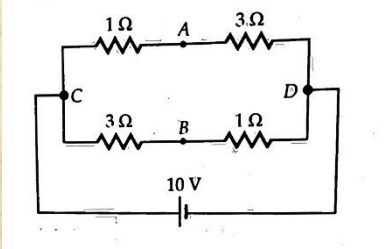
1. Derive an expression for the drift velocity of free electrons in a conductor in terms of relaxation time.
2. Derive an expression for the current density of the conductor in terms of the drift speed of the electrons.
3. Define the term 'drift velocity' of charge carriers in a conductor. Obtain the expression for the current density in terms of relaxation time.
4. Use this relation to deduce the expression for the electrical resistivity of the material.
5. Derive the relation between current density j and potential difference V across a current carrying conductor of length ***l,*** area of cross-section A and the number density ***n*** of free electrons.
6. Define relaxation time of electrons in a conductor. Explain how it varies with increase in temperature of a conductor. State the relation between resistivity and relaxation time.
7. Two cells of emf E_1 , E_2 and internal resistances r_1 and r_2 respectively are connected in parallel. Derive the expression for the emf and internal resistance of a cell which replace this combination.
8. State Kirchhoff's rule, obtain the balance condition in terms of the resistances of four arms of Wheatstone bridge.
9. Determine the voltage drop across the resistorR_1 in the circuit given below with$\boldsymbol{\varepsilon}$ = 60 V, R_1= 18Ω, R_2 = 10Ω.



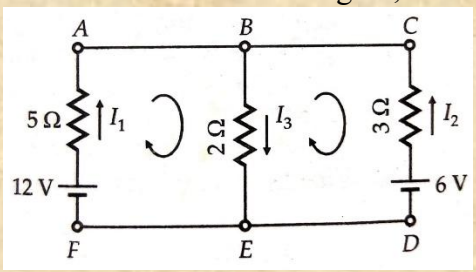
10. In the circuit shown in figure, find the potential difference across the capacitor.



11. A battery of emf 10 V is connected to resistances as shown in figure. Find the potential difference between the points A and B.

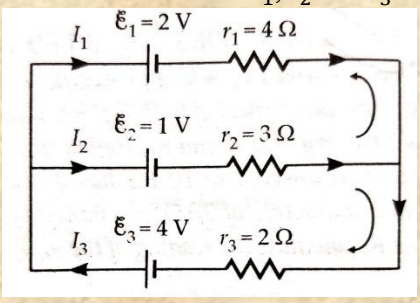


12. Using Kirchhoff's laws in the electrical network shown in figure, calculate the values of I_1, I_2 and I_3.



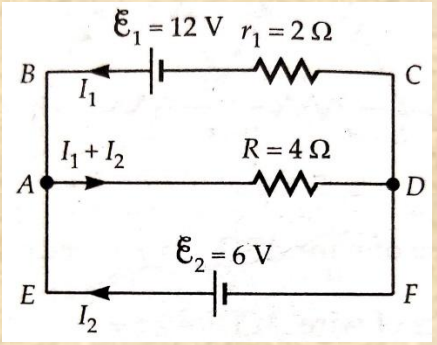
Ans: I_1=48/31 A, I_2= 18/31 A and I_3= 66/31 A

13. Use Kirchhoff's rules to write the expression for the currentsI_1, I_2 and I_3 in the circuit diagram shown in figure.



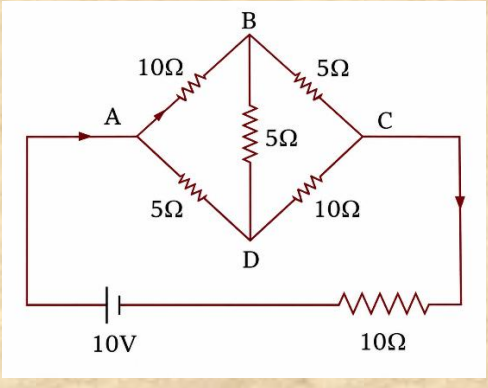
Ans:I_1= 2/13 A, I_2 =7/13 A, and I_3 = 9/13 A

14. In the electric network shown in figure, use Kirchhoff's rules to calculate the CURRENT in the resistance R=4Ω.



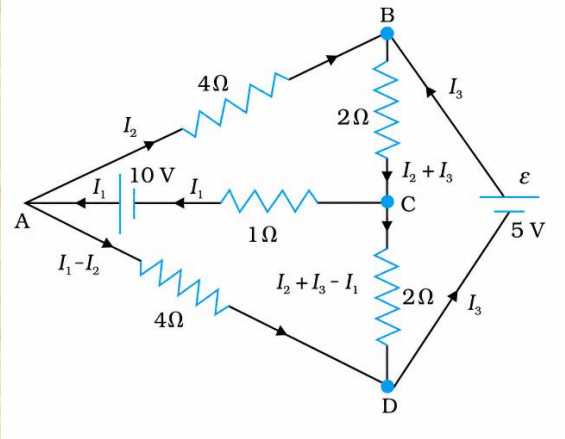
Ans: 1.5 A

15. Determine the current in each branch of the network shown in



ANS: The current in branch AB is 4/17. The current in branch BC is 6/17. The current in branch CD is 4/17. The current in branch AD is 6/17. The current in branch BD is 2/17.

16. Determine the current in each branch of the network shown in Fig.

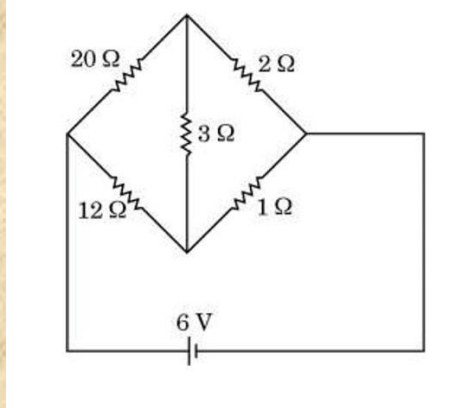


The currents in the various branches of the network are

AB : $\frac{5}{8}$ A, CA : $2\frac{1}{2}$ A, DEB : $1\frac{7}{8}$ A

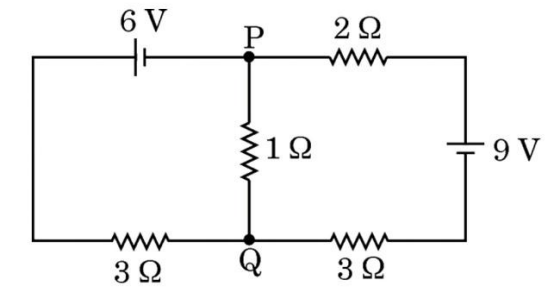
AD : $1\frac{7}{8}$ A, CD : 0 A, BC : $2\frac{1}{2}$ A

17. Determine the current in 3 Ω branch of a Wheatstone Bridge in the circuit shown in the figure.



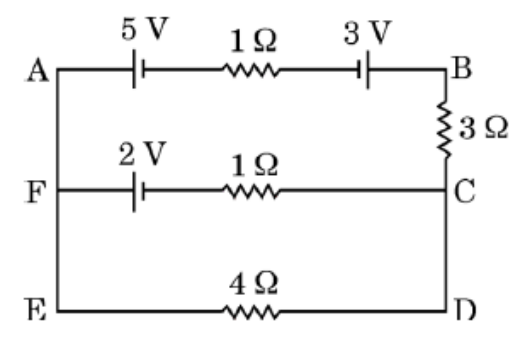
ANS: 12/821 A

18. (a) The two Kirchhoff 's rules are based on law of conservation of two physical quantities. Name the quantities.
(b) Find magnitude and direction of current in 1 Ω resistor in the given circuit.



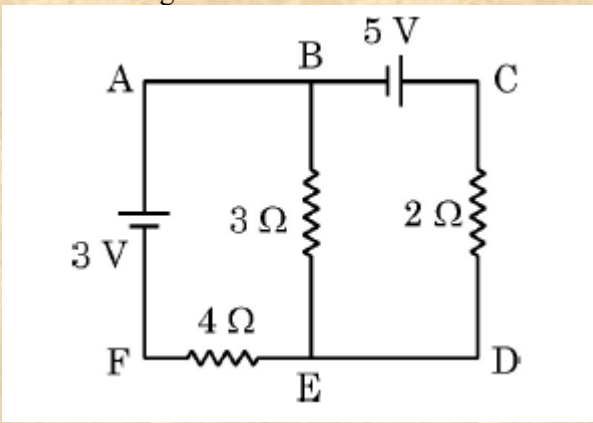
ANS: 3/23 A

19. State Kirchhoff 's rules. Using these rules, find the current flowing through branch FC in the given circuit.



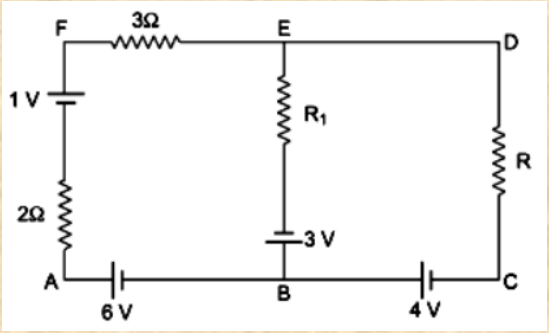
Ans: 1/3 A

20. (a) Explain the statement: "Current is a scalar although we represent current with an arrow".
(b) Use Kirchhoff's rules to find the current through 3 Ω resistor in the circuit shown in the figure:



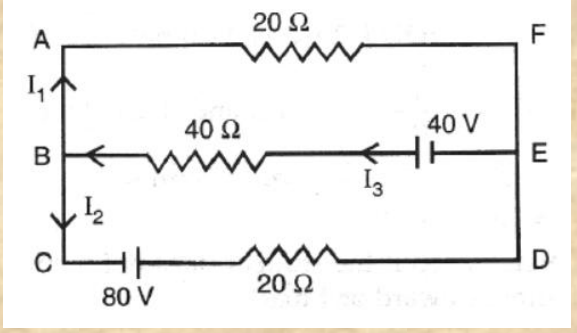
Ans:7/13 A

21. Use Kirchhoff's rules to determine the potential difference between the points A and D when no current flows in the arm BE of the electric network shown in the figure.

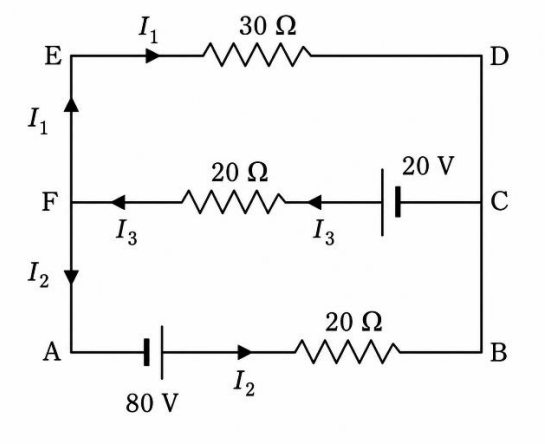


Ans:9V

22. State Kirchhoff 's laws of current distribution in an electrical network. Using these rules determine the value of the current I_1 in the electric circuit given.

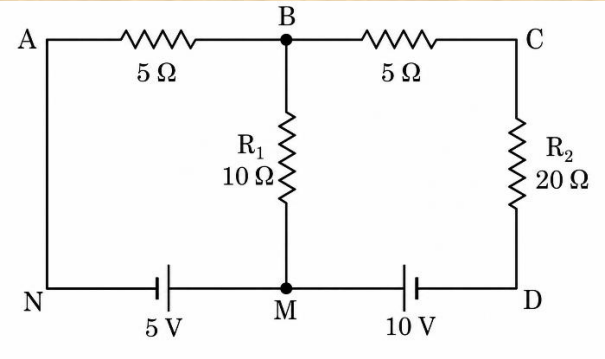


23. State Kirchhoff 's laws of current distribution in an electrical network. Using these rules determine the value of the current I_1 in the electric circuit given.



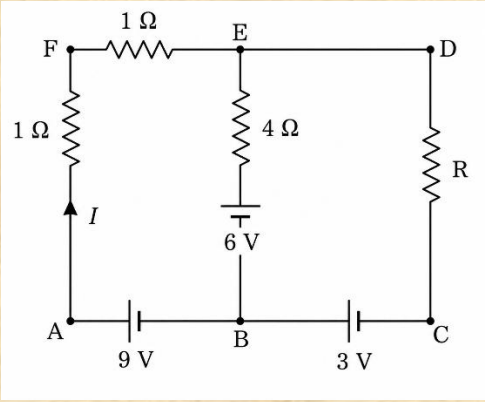
ANS: 0 .75A

24. Find the currents flowing through the branches AB and BC in the network shown.



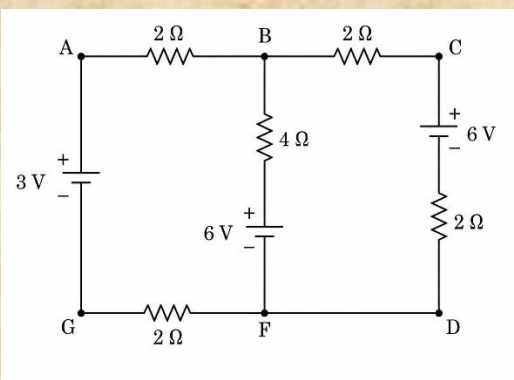
ANS: 3/17 A and 4/17 A

25. Using Kirchoff's rules determine the value of unknown resistance R in the circuit shown in figure, so that no current flows through 4 Ω resistance. Also find the potential difference between A and D.



ANS:3V

26. The figure shows a circuit with three ideal batteries. Find the magnitude and direction of currents in the branches AG, BF and CD.



ANS: 1/3 A, 1/4 A, 1/4 A