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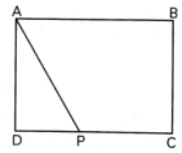
Questions:

3 Marks

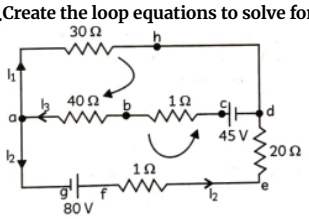
1. At room temperature (27.0°C) the resistance of a heating element is 100 Ω. What is the temperature of the element if the resistance is found to be 117Ω given that the temperature coefficient of the material of the resistor is 1.70 x 10^{-4} °C^{-1}.

2. An electric toaster uses nichrome for its heating element. When a negligibly small current passes through it, its resistance at room temperature (27.0 °C) is found to be 75.3 Ω. When the toaster is connected to a 230 V supply, the current settles, after a few seconds, to a steady value of 2.68 A. What is the steady temperature of the nichrome element? The temperature coefficient of resistance of nichrome averaged over the temperature range involved, is 1.70 x 10^{-4} °C^{-1}.

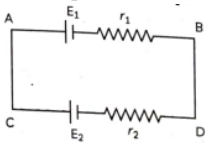
3. A wire of uniform cross-section and resistance 4 ohms is bent in the shape of square ABCD. Point A is connected to a point P on DC by a wire AP of resistance 1 ohms. When a potential difference is applied between A and C, the points B and P are seen to be at the same potential. What is the resistance of the part DP?



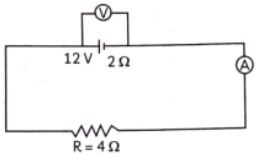
4. Create the loop equations to solve for the given circuit.



5. Two cells of emf E_1 and E_2 and internal resistances r_1 and r_2 are connected in parallel, with their terminals of the same polarity connected together. Obtain an expression for the equivalent emf of the combination.



6. (A) The potential difference applied across a given resistor is altered so that the heat produced per second increases by a factor of 9. By what factor does the applied potential difference change?
(B) In the figure shown, an ammeter A and a resistor of 4 Ω are connected to the terminals of the source. The emf of the source is 12 V having the internal resistance of 2 Ω.



Calculate the voltmeter and ammeter readings.

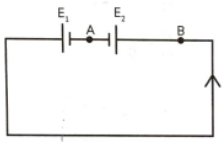
2 Marks

7. The storage battery of a car has an emf of 12 V. If the internal resistance of the battery is 0.4Ω, what is the maximum current that can be drawn from the battery?

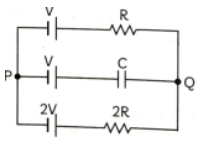
8. (a) In the electron drift speed is estimated to be only a few mm s^{-1} for currents in the range of a few amperes? How then is current established almost the instant a circuit is closed?
(b) The electron drift arises due to the force experienced by electrons in the electric field inside the conductor. But force should cause acceleration. Why then do the electrons acquire a steady average drift speed?
(c) If the electron drift speed is so small, and the electron's charge is small, how can we still obtain large amounts of current in a conductor?
(d) When electrons drift in a metal from lower to higher potential, does it mean that all the 'free' electrons of the metal are moving in the same direction?
(e) Are the paths of electrons straight lines between successive collisions (with the positive ions of the metal) in the
(i) absence of electric field,
(ii) presence of electric field?

9. What happens to the drift velocity (v) of electrons and to the resistance (R), if length of a conductor is doubled (keeping potential difference unchanged)?

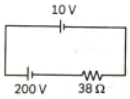
10. The circuit in figure shows two cells connected in opposition to each other. Cell E_1 is of emf 6 V and internal resistance 2 Ω; the cell E, is of emf 4 V and internal resistance 8 Ω. Find the potential difference between the points A and B.



11. In the circuit three ideal cells of e.m.f. V, V and 2V are connected to a resistor of resistance R, a capacitor of capacitance C and another resistor of resistance 2R as shown in figure. In the steady state find (A) the potential difference between P and Q and (B) potential difference across capacitor C.



12. A 10 V cell of negligible internal resistance is connected in parallel across a battery of emf 200 V and internal resistance 38 S2 as shown in the figure. Find the value of current in the circuit.



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