Q1- In the construction of an electrical circuit a 5.00μF capacitor was accidentally used instead of the required 16.0 μF capacitor? What value capacitor must a technician add to correct this circuit without removing existing circuit elements? Must any connections be broken in the process?

The capacity of combination of two capacitors in parallel is the sum of the capacitance of the two individual capacitors hence adding a capacitor of 11 μF in parallel to the 5 μ F capacitor results in the total capacity of 16 μF.

Without breaking any connection the new capacitor can be soldered with the previous one in parallel.

Answer: 11 μF in parallel.

Q2- The specifications on a light bulb is 1W, 6V. What is the minimum resistance of a resistor that is required to be able to use it with a 12V battery and how it must be connected?

The power dissipated in a circuit is given by $P = V^2/R$

Hence the resistance of the bulb will be $R = V^2/P = 36/1 = 36\ \Omega$.

Hence a resistance of 36 Ω in series will divide the potential drop of the 12 V batteries in two equal parts of 6 V and the potential difference across the bulb will be safe 6V.

The resistance of 36 Ω should be connected in series with the bulb.

Q3- Three identical light bulbs are connected in series across a potential difference V. This combination dissipates 5.0 W energy. What is the total amount of energy dissipated if the bulbs are connected in parallel with the same potential difference?

Let the resistance of each bulb is R then the resistance of the combination will be 3R.

The power dissipated in the circuit will be

$P = V^2/(3R) = 5.0$ W

Gives $V^2 = 15.0\ R$ ---------- (1)

Now if the bulbs are connected in parallel then the equivalent resistance will be

$R' = R/3$ and hence the power will be given by

$P' = V^2/(R/3) = 3V^2/R$

Substituting value of $V^2/(3R)$ from equation 1 we get

$P' = V^2/(R/3) = 3*15.0\ R/R = 45.0$ W