Edexcel AS Physics: Electric Circuits – Calculation Practice

Praneel Physics

1. A circuit has a current of 2 A flowing through a resistor of 5 Ω. What is the voltage across the resistor? **(P)**

Working and Answer:
Using Ohm's Law, $V = I \times R$. Thus, $V = 2\,\text{A} \times 5\,\Omega = 10\,\text{V}$.

2. A battery provides a voltage of 12 V and is connected to a resistor of 4 Ω. Calculate the current flowing through the circuit. **(P)**

Working and Answer:
Using Ohm's Law, $I = \frac{V}{R}$. Thus, $I = \frac{12\,\text{V}}{4\,\Omega} = 3\,\text{A}$.

3. If a circuit has a total resistance of 10 Ω and a current of 0.5 A, what is the voltage supplied by the battery? **(P)**

Working and Answer:
Using Ohm's Law, $V = I \times R$. Thus, $V = 0.5\,\text{A} \times 10\,\Omega = 5\,\text{V}$.

4. A resistor of $20\,\Omega$ has a current of $0.25\,\text{A}$ flowing through it. What is the power dissipated by the resistor? **(P)**

Working and Answer:
Using the power formula, $P = I^2 \times R$. Thus, $P = (0.25\,\text{A})^2 \times 20\,\Omega = 1.25\,\text{W}$.

5. A circuit has a voltage of $9\,\text{V}$ and a current of $3\,\text{A}$. What is the resistance in the circuit? **(P)**

Working and Answer:
Using Ohm's Law, $R = \dfrac{V}{I}$. Thus, $R = \dfrac{9\,\text{V}}{3\,\text{A}} = 3\,\Omega$.

6. A circuit contains two resistors in series: $4\,\Omega$ and $6\,\Omega$. What is the total resistance? **(PP)**

Working and Answer:
For resistors in series, $R_{\text{total}} = R_1 + R_2$. Thus, $R_{\text{total}} = 4\,\Omega + 6\,\Omega = 10\,\Omega$.

7. In a parallel circuit, two resistors of $8\,\Omega$ and $12\,\Omega$ are connected. What is the total resistance? **(PP)**

Working and Answer:
Using the formula for parallel resistors, $\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2}$. Thus, $\frac{1}{R_{\text{total}}} = \frac{1}{8} + \frac{1}{12} = \frac{3}{24} + \frac{2}{24} = \frac{5}{24}$. Therefore, $R_{\text{total}} = \frac{24}{5} = 4.8\,\Omega$.

8. A $10\,\Omega$ resistor is connected in series with a $15\,\Omega$ resistor. If the total current is $2\,\text{A}$, what is the voltage across the $15\,\Omega$ resistor? **(PP)**

Working and Answer:
Total resistance $R_{\text{total}} = 10\,\Omega + 15\,\Omega = 25\,\Omega$. Voltage across $15\,\Omega$ is $V = I \times R = 2\,\text{A} \times 15\,\Omega = 30\,\text{V}$.

9. A circuit has a total voltage of $24\,\text{V}$ and contains three resistors in series: $5\,\Omega$, $10\,\Omega$, and $15\,\Omega$. What is the current flowing through the circuit? **(PP)**

Working and Answer:
Total resistance $R_{\text{total}} = 5\,\Omega + 10\,\Omega + 15\,\Omega = 30\,\Omega$. Current $I = \dfrac{V}{R} = \dfrac{24\,\text{V}}{30\,\Omega} = 0.8\,\text{A}$.

10. In a parallel circuit with a $6\,\Omega$ and a $3\,\Omega$ resistor, if the voltage across the circuit is $12\,\text{V}$, what is the total current flowing through the circuit? **(PP)**

Working and Answer:
Using $I = \dfrac{V}{R}$ for each resistor: $I_1 = \dfrac{12\,\text{V}}{6\,\Omega} = 2\,\text{A}$ and $I_2 = \dfrac{12\,\text{V}}{3\,\Omega} = 4\,\text{A}$. Total current $I_{\text{total}} = I_1 + I_2 = 2\,\text{A} + 4\,\text{A} = 6\,\text{A}$.

11. A $100\,\Omega$ resistor is connected in series with a $200\,\Omega$ resistor. If the total current is $0.1\,\text{A}$, what is the power dissipated by the $200\,\Omega$ resistor? **(PPP)**

Working and Answer:
Total resistance $R_{\text{total}} = 100\,\Omega + 200\,\Omega = 300\,\Omega$. Voltage across $200\,\Omega$ is $V = I \times R = 0.1\,\text{A} \times 200\,\Omega = 20\,\text{V}$. Power $P = \dfrac{V^2}{R} = \dfrac{20^2}{200} = 2\,\text{W}$.

12. A circuit has a total voltage of 48 V and contains two resistors in series: 20 Ω and 30 Ω. What is the voltage across the 30 Ω resistor? **(PPP)**

Working and Answer:
Total resistance $R_{\text{total}} = 20\,\Omega + 30\,\Omega = 50\,\Omega$. Current $I = \dfrac{48\,\text{V}}{50\,\Omega} = 0.96\,\text{A}$.
Voltage across 30 Ω is $V = I \times R = 0.96\,\text{A} \times 30\,\Omega = 28.8\,\text{V}$.

13. In a parallel circuit with a 4 Ω and a 6 Ω resistor, if the total current is 5 A, what is the voltage across the circuit? **(PPP)**

Working and Answer:
Using $I = \dfrac{V}{R}$ for each resistor: $I_1 = \dfrac{V}{4}$ and $I_2 = \dfrac{V}{6}$. Total current
$I_{\text{total}} = I_1 + I_2 = \dfrac{V}{4} + \dfrac{V}{6}$. Solving gives $V = 12\,\text{V}$.

14. A $50\,\Omega$ resistor is connected in series with a $100\,\Omega$ resistor. If the total voltage is $60\,\text{V}$, what is the power dissipated by the $50\,\Omega$ resistor? **(PPP)**

Working and Answer:
Total resistance $R_{\text{total}} = 50\,\Omega + 100\,\Omega = 150\,\Omega$. Current $I = \dfrac{60\,\text{V}}{150\,\Omega} = 0.4\,\text{A}$.
Power $P = I^2 \times R = (0.4\,\text{A})^2 \times 50\,\Omega = 8\,\text{W}$.

15. A circuit has three resistors in series: $10\,\Omega$, $20\,\Omega$, and $30\,\Omega$. If the total current is $2\,\text{A}$, what is the total power dissipated in the circuit? **(PPPP)**

Working and Answer:
Total resistance $R_{\text{total}} = 10\,\Omega + 20\,\Omega + 30\,\Omega = 60\,\Omega$. Voltage
$V = I \times R_{\text{total}} = 2\,\text{A} \times 60\,\Omega = 120\,\text{V}$. Power
$P = I^2 \times R_{\text{total}} = (2\,\text{A})^2 \times 60\,\Omega = 240\,\text{W}$.

16. In a parallel circuit with a $12\,\Omega$ and a $4\,\Omega$ resistor, if the voltage across the circuit is $24\,\text{V}$, what is the total current flowing through the circuit? **(PPPP)**

Working and Answer:
Using $I = \dfrac{V}{R}$ for each resistor: $I_1 = \dfrac{24\,\text{V}}{12\,\Omega} = 2\,\text{A}$ and $I_2 = \dfrac{24\,\text{V}}{4\,\Omega} = 6\,\text{A}$. Total current $I_{\text{total}} = I_1 + I_2 = 2\,\text{A} + 6\,\text{A} = 8\,\text{A}$.

17. A $100\,\Omega$ resistor is connected in series with a $200\,\Omega$ resistor. If the total voltage is $120\,\text{V}$, what is the voltage across the $200\,\Omega$ resistor? **(PPPP)**

Working and Answer:
Total resistance $R_{\text{total}} = 100\,\Omega + 200\,\Omega = 300\,\Omega$. Current $I = \dfrac{120\,\text{V}}{300\,\Omega} = 0.4\,\text{A}$.
Voltage across $200\,\Omega$ is $V = I \times R = 0.4\,\text{A} \times 200\,\Omega = 80\,\text{V}$.

18. A circuit has a total voltage of 36 V and contains three resistors in series: 10 Ω, 20 Ω, and 30 Ω. What is the current flowing through the circuit? **(PPPP)**

Working and Answer:
Total resistance $R_{\text{total}} = 10\,\Omega + 20\,\Omega + 30\,\Omega = 60\,\Omega$. Current $I = \dfrac{36\,\text{V}}{60\,\Omega} = 0.6\,\text{A}$.

19. In a parallel circuit with a 5 Ω and a 15 Ω resistor, if the total current is 3 A, what is the voltage across the circuit? **(PPPP)**

Working and Answer:
Using $I = \dfrac{V}{R}$ for each resistor: $I_1 = \dfrac{V}{5}$ and $I_2 = \dfrac{V}{15}$. Total current $I_{\text{total}} = I_1 + I_2 = \dfrac{V}{5} + \dfrac{V}{15}$. Solving gives $V = 15\,\text{V}$.

20. A $50\,\Omega$ resistor is connected in series with a $100\,\Omega$ resistor. If the total voltage is $150\,\text{V}$, what is the power dissipated by the $100\,\Omega$ resistor? **(PPPPP)**

Working and Answer:
Total resistance $R_{\text{total}} = 50\,\Omega + 100\,\Omega = 150\,\Omega$. Current $I = \dfrac{150\,\text{V}}{150\,\Omega} = 1\,\text{A}$.
Power $P = I^2 \times R = (1\,\text{A})^2 \times 100\,\Omega = 100\,\text{W}$.

21. A circuit has three resistors in series: $10\,\Omega$, $20\,\Omega$, and $30\,\Omega$. If the total current is $1.5\,\text{A}$, what is the total power dissipated in the circuit? **(PPPPP)**

Working and Answer:
Total resistance $R_{\text{total}} = 10\,\Omega + 20\,\Omega + 30\,\Omega = 60\,\Omega$. Voltage
$V = I \times R_{\text{total}} = 1.5\,\text{A} \times 60\,\Omega = 90\,\text{V}$. Power
$P = I^2 \times R_{\text{total}} = (1.5\,\text{A})^2 \times 60\,\Omega = 135\,\text{W}$.

22. In a parallel circuit with a $12\,\Omega$ and a $6\,\Omega$ resistor, if the voltage across the circuit is $24\,\text{V}$, what is the total current flowing through the circuit? **(PPPPP)**

Working and Answer:
Using $I = \dfrac{V}{R}$ for each resistor: $I_1 = \dfrac{24\,\text{V}}{12\,\Omega} = 2\,\text{A}$ and $I_2 = \dfrac{24\,\text{V}}{6\,\Omega} = 4\,\text{A}$. Total current $I_{\text{total}} = I_1 + I_2 = 2\,\text{A} + 4\,\text{A} = 6\,\text{A}$.

23. A $100\,\Omega$ resistor is connected in series with a $200\,\Omega$ resistor. If the total voltage is $240\,\text{V}$, what is the voltage across the $100\,\Omega$ resistor? **(PPPPP)**

Working and Answer:
Total resistance $R_{\text{total}} = 100\,\Omega + 200\,\Omega = 300\,\Omega$. Current $I = \dfrac{240\,\text{V}}{300\,\Omega} = 0.8\,\text{A}$.
Voltage across $100\,\Omega$ is $V = I \times R = 0.8\,\text{A} \times 100\,\Omega = 80\,\text{V}$.

24. A circuit has a total voltage of 48 V and contains three resistors in series: 10 Ω, 20 Ω, and 30 Ω. What is the current flowing through the circuit? **(PPPPP)**

Working and Answer:

Total resistance $R_{\text{total}} = 10\,\Omega + 20\,\Omega + 30\,\Omega = 60\,\Omega$. Current $I = \dfrac{48\,\text{V}}{60\,\Omega} = 0.8\,\text{A}$.