

Reading ammeters and voltmeters in circuits

Grade 7 science (Year 8 · Class 7) · Worksheet answers

Full answers are given for every problem, with the rule used at each step. When a calculation uses a rule, check that you picked the right one for a series or a parallel circuit. The key result of each step is in bold.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS2-3

Problem 1 Quantities and units

1. The **ampere, A**.
2. The **volt, V**.
3. Current is measured with an **ammeter** and voltage with a **voltmeter**.

Problem 2 Meter connections

1. In **series**: in the loop, so that all the current passes through it.
2. In **parallel**: across the component.
3. The **ammeter**.

Problem 3 Changing units

1. $350 \div 1000 = \mathbf{0.350\ A}$.
2. $0.045 \times 1000 = \mathbf{45\ mA}$.
3. $2.4 \times 1000 = \mathbf{2400\ mA}$.

Problem 4 Current in a series loop

1. **0.40 A**.
2. **0.40 A**.
3. No. The current is the same everywhere because the charge has only one path and none is used up. The bulbs transfer energy, not charge.

Problem 5 Voltage shared in series

1. $6.0\ \text{V} - 2.0\ \text{V} = \mathbf{4.0\ V}$.
2. They add up to the supply voltage, **6.0 V**.

Problem 6 Reading an ammeter scale

1. The pointer is at the 13th mark of 0.05 A: $13 \times 0.05 = \mathbf{0.65\ A}$.
2. $0.65 \times 1000 = \mathbf{650\ mA}$.

Problem 7 Voltage in parallel

1. **4.5 V** across each bulb.
2. Each bulb is connected straight across the supply, so each has the supply voltage.
3. Nothing changes: the other two bulbs still have **4.5 V**.

Problem 8 Branch currents

1. $0.35 \text{ A} + 0.20 \text{ A} = \mathbf{0.55 \text{ A}}$.
2. In a parallel circuit the branch currents add up to the main current.

Problem 9 The missing branch

1. $1.20 \text{ A} - 0.45 \text{ A} = \mathbf{0.75 \text{ A}}$.
2. $0.75 \times 1000 = \mathbf{750 \text{ mA}}$.

Problem 10 Three components in series

1. $9.0 \text{ V} - 3.2 \text{ V} - 2.8 \text{ V} = \mathbf{3.0 \text{ V}}$.
2. **0.15 A**, since the current is the same everywhere in a series circuit.

Problem 11 Faulty meters

1. The ammeter is connected in parallel across the bulb, and the voltmeter is connected in series in the loop.
2. The ammeter gives a very easy path, so the bulb goes out and a large current may damage the meter or the cell. It acts as a short circuit.
3. **Put the ammeter in the loop and the voltmeter across the bulb.**

Problem 12 Charger currents

1. $1500 \div 1000 = \mathbf{1.5 \text{ A}}$.
2. $1.5 \text{ A} + 0.50 \text{ A} = \mathbf{2.0 \text{ A}}$.
3. $2.0 \times 1000 = \mathbf{2000 \text{ mA}}$.

Problem 13 Current and voltage for a lamp

1. **0.42 A**.
2. **4.0 V**.
3. $0.50 \text{ A} - 0.32 \text{ A} = \mathbf{0.18 \text{ A}}$.

Problem 14 Motorbike lamps

1. **12 V** across each lamp, because they are in parallel.
2. $2.5 \text{ A} + 0.4 \text{ A} = \mathbf{2.9 \text{ A}}$.

3. In the main wire from the battery, in series with the battery.

Problem 15 Solar panel readings

- $(0.32 + 0.54 + 0.71 + 0.83) \div 4 = 2.40 \div 4 = \mathbf{0.60\ A}$.
- $0.83 \times 1000 = \mathbf{830\ mA}$.
- Increases: 0.22 A, 0.17 A, 0.12 A. The largest is **0.22 A** (between 08:00 and 09:00).

Problem 16 A series and parallel circuit

- $9.0\ \text{V} - 4.0\ \text{V} = \mathbf{5.0\ V}$.
- 5.0 V**, the same as L2 because they are in parallel.
- $0.60\ \text{A} - 0.35\ \text{A} = \mathbf{0.25\ A}$.
- 0.60 A**, because all of the current passes through L1.

Problem 17 A voltmeter in the wrong place

- About **3.0 V**, very nearly the cell voltage.
- A voltmeter has a very high resistance, so it lets almost no current through the loop.
- About **0 V** across the bulb, because with almost no current the bulb takes almost none of the voltage.

Problem 18 Do the readings agree?

- $0.62 + 0.48 + 0.35 = \mathbf{1.45\ A}$.
- $1.50 - 1.45 = \mathbf{0.05\ A}$.
- Greatest total uncertainty = $3 \times 0.02 + 0.02 = \mathbf{0.08\ A}$. The difference, 0.05 A, is smaller than this, so the readings agree with the rule.

Problem 19 Sharing 12 volts

- $12.0\ \text{V} - 2.4\ \text{V} = \mathbf{9.6\ V}$.
- Let $V_2 = x$. Then $2x + x = 9.6\ \text{V}$, so $x = 3.2\ \text{V}$. $V_2 = \mathbf{3.2\ V}$ and $V_1 = \mathbf{6.4\ V}$.
- $6.4 + 3.2 + 2.4 = \mathbf{12.0\ V}$, which equals the supply.

Problem 20 An overloaded extension lead

- $1.2\ \text{A} + 0.8\ \text{A} + 1.5\ \text{A} = \mathbf{3.5\ A}$.
- 3.5 A is greater than the 3.0 A rating, so **the fuse will blow**.
- $1.2\ \text{A} + 1.5\ \text{A} = \mathbf{2.7\ A}$, which is less than 3.0 A, so the fuse is safe.