

Name _____

Class _____

Date _____

By the end of this worksheet I can...

- ☐ calculate the voltages in a voltage divider
- ☐ rearrange the voltage divider formula to find a resistor value
- ☐ describe how a sensing circuit works using LDR or thermistor resistance and V_{out}
- ☐ design a voltage divider to switch at a given light level or temperature

I DO**Worked example** Read how a full-mark answer is built

A frost alarm has a thermistor at the bottom of a voltage divider. Its resistance rises as the temperature falls.

1 Describe how the circuit switches the alarm on when it gets cold. (3 marks)**Full-mark answer** each ✓ is one mark

As the temperature falls, the thermistor's resistance increases ✓. This means the voltage across the thermistor, V_{out} , increases ✓. When V_{out} reaches about 0.7 V the transistor switches on and current flows through the alarm ✓.

Why marks are not awarded

"When it gets cold the thermistor detects it and turns on the alarm."

0 marks: no reference to resistance or V_{out} .

WE DO**Guided practice** Use the starters and word bank to help you

A voltage divider has $R1 = 10\text{ k}\Omega$ and $R2 = 15\text{ k}\Omega$ across a 6 V supply.

2 Calculate $V2$. (2 marks)**Sentence starters**

One ... is ..., which means ...
Another ... is ..., so ...

Word bank

Tip: 2 marks = 2 separate, developed points.

YOU DO**On your own** No notes. Check your answers afterwards.**3 Quick check: tick one box for each.**

- a) $V_s = 9\text{ V}$, $R_1 = 1\text{ k}\Omega$, $R_2 = 2\text{ k}\Omega$. V_2 is...
☐ 3 V ☐ 4.5 V ☐ 6 V ☐ 9 V
- b) An LDR ($2\text{ k}\Omega$) is at the bottom of a 9 V divider; the transistor must switch at 0.7 V . The top resistor is about...
☐ 24 k Ω ☐ 2 k Ω ☐ 12 k Ω ☐ 0.16 k Ω
- c) In a divider, the larger resistor has...
☐ The smaller share of voltage ☐ The larger share of voltage ☐ No voltage ☐ The same voltage
- d) A good description of a sensing circuit starts with...
☐ The sensor's resistance changing ☐ The relay switching on the output ☐ The LED lighting up as a warning ☐ The battery supplying the voltage

4 Key terms: write the letter of the matching description next to each term.

1. Voltage divider rule	___	A $V_1/V_2 = R_1/R_2$
2. V out of a divider	___	B Sensor resistance $\rightarrow V_{in} \rightarrow$ transistor $\rightarrow$ relay $\rightarrow$ output.
3. Sensor at the bottom of a divider	___	C $R_A/R_B = R_1/R_2$; no voltage difference across the middle.
4. LDR at the bottom	___	D V_{out} rises as it gets darker (resistance rises).
5. Describing a sensing circuit	___	E V_{out} rises when the sensor's resistance rises.
6. Balanced bridge	___	F $V_2 = V_s \times R_2 \div (R_1 + R_2)$

A thermistor is R_2 in a voltage divider with a fixed resistor $R_1 = 4.7\text{ k}\Omega$ and a 5 V supply. At 20°C the thermistor is $2.2\text{ k}\Omega$.

5 Calculate V_{out} across the thermistor at 20°C . (2 marks)

A light-sensing circuit needs $V_2 = 1.5\text{ V}$ from a 6 V supply. R_2 (an LDR) is $1.2\text{ k}\Omega$ at the switching light level.

6 Calculate the value of R_1 . (3 marks)

A Wheatstone bridge has two voltage dividers across 12 V : $R_1 = 10\text{ k}\Omega$, $R_2 = 10\text{ k}\Omega$; $R_3 = 8\text{ k}\Omega$, $R_4 = 12\text{ k}\Omega$.

7 Calculate the voltage between the two midpoints. (3 marks)

Check and reflect

Mark your answers with the answer sheet. Go back to the checklist on the site and re-rate each "I can" statement above. Which one still needs work?
