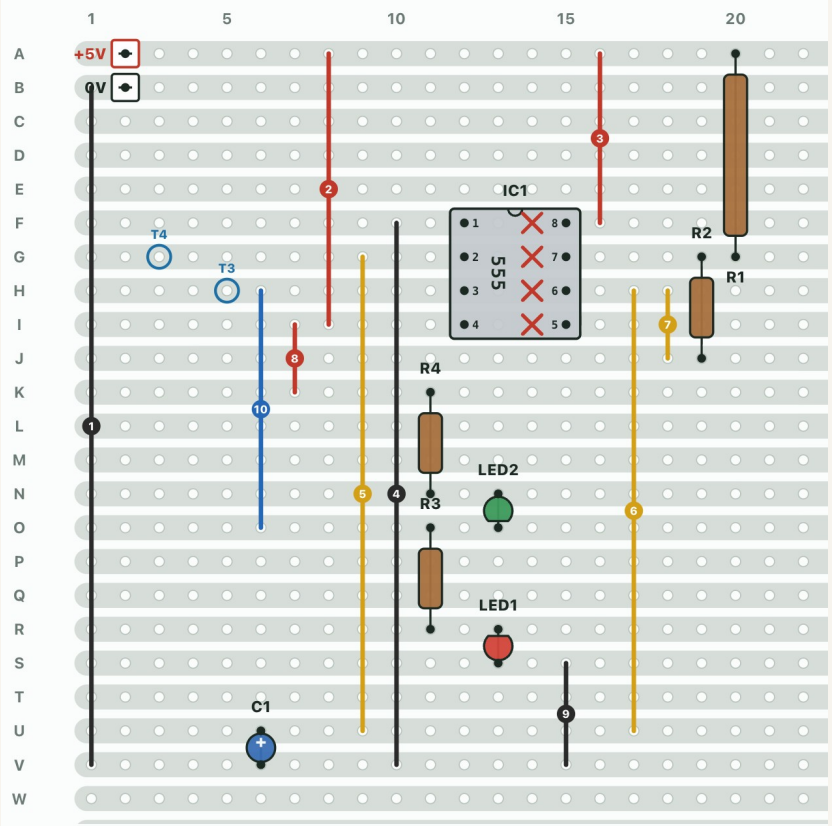
Multimeter and Logic Probe

This board should flash. It doesn't.
How do you find out why?



National 5 Practical Electronics

Daily Review

1	**Complete** the **AND** truth table.	0, 0, 0, 1
2	Outputs 0, 1, 1, 0. **Name** the **gate**.	XOR
3	**Identify** the **largest**: 220 R, 22, 2.2 mΩ, 2M2.	2M2
4	**State two** soldering **safety** rules.	Stand; eye protection
5	**Name** another way to join wires.	Connector blocks

PART 1

The Multimeter

We are learning to choose and use a multimeter to test a circuit.

By the end of this part…



1. I can **choose** the **setting** and **socket**
2. I can **predict** what a **meter** should **read**

The Multimeter

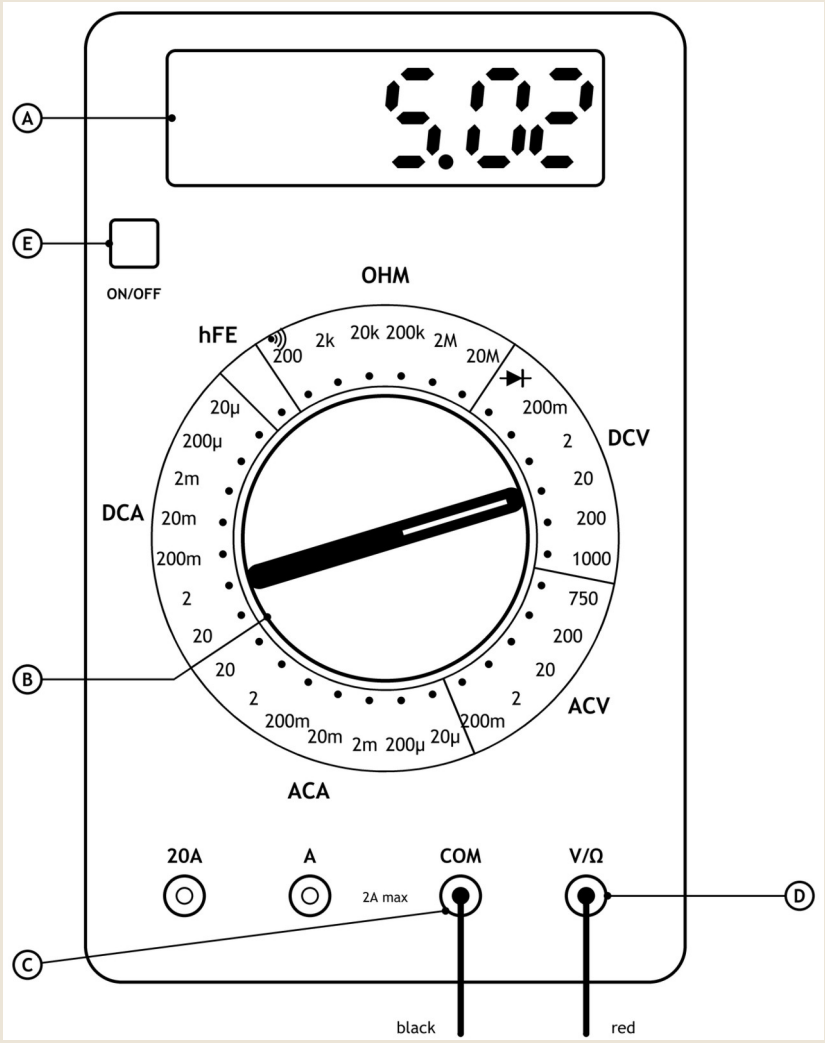
A display: the reading

B dial: the setting

C COM: the black lead

D V/Ω: the red lead

E ON/OFF button



Choosing the Setting

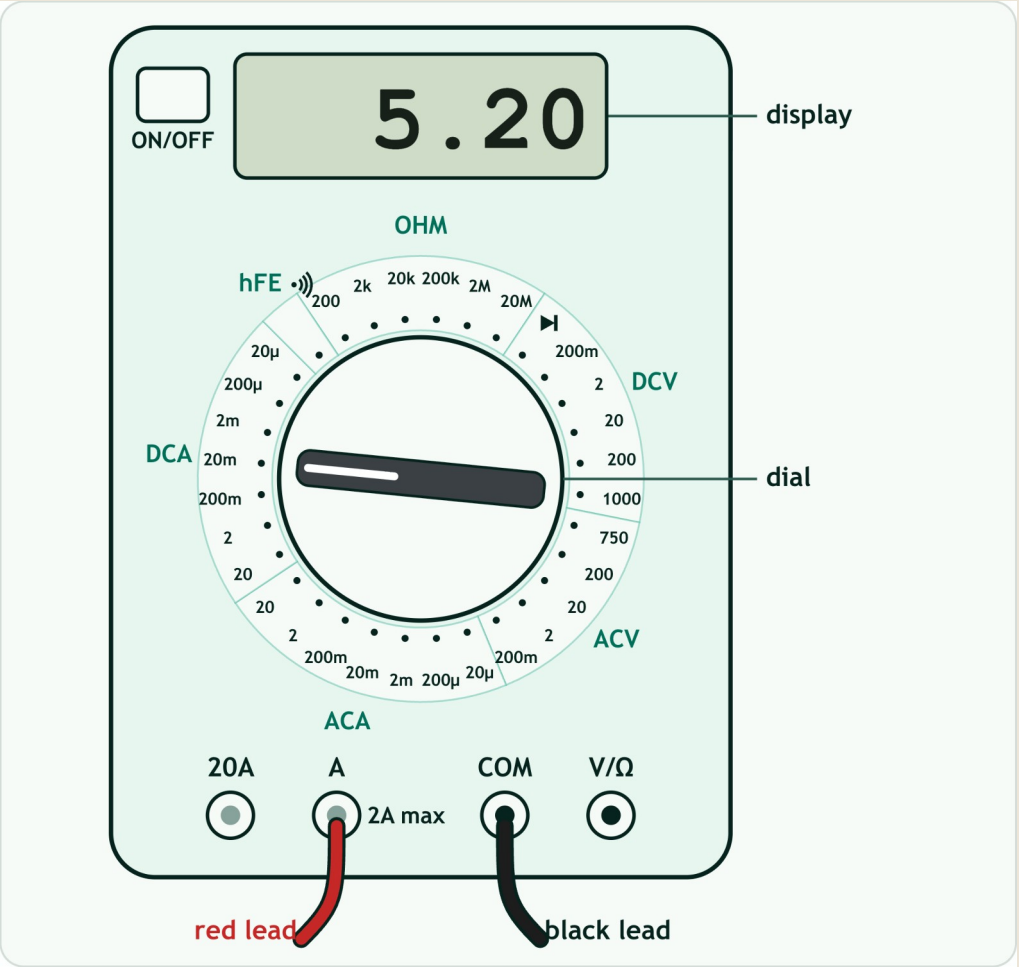
DCV: voltage. Red in V/Ω.

OHM: resistance. Power **off**.

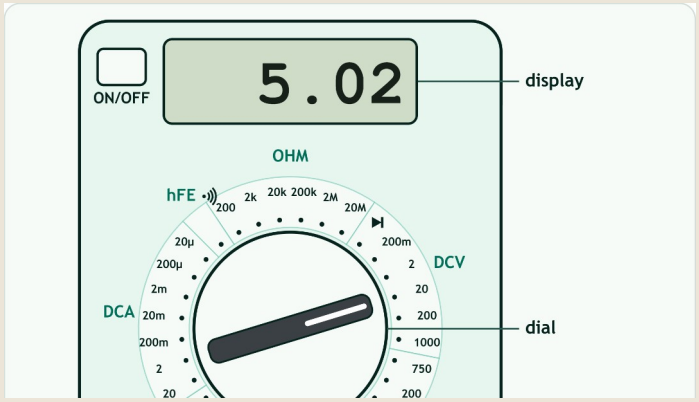
Continuity: a **beep** means joined.

Diode check: which way it conducts.

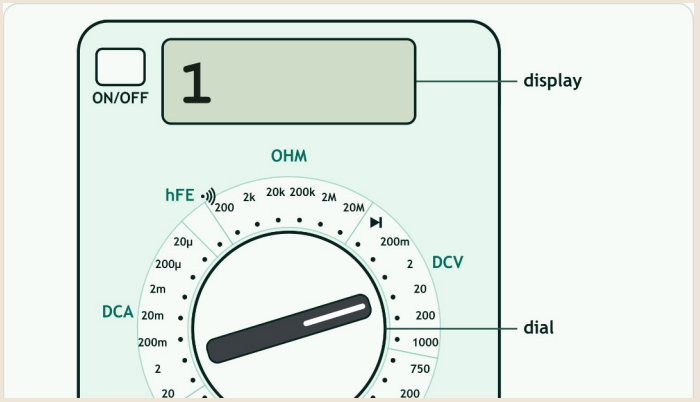
DCA: current. Red in **A**.



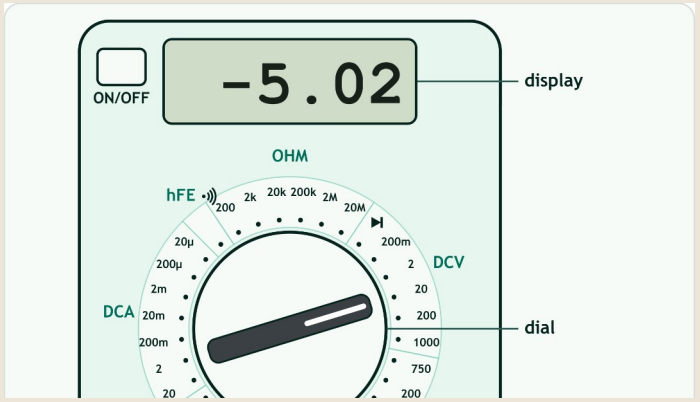
Reading the Display



In range: **5.02**



1 on the left: over range



Minus: leads swapped

Show Me: State the Setting and Socket

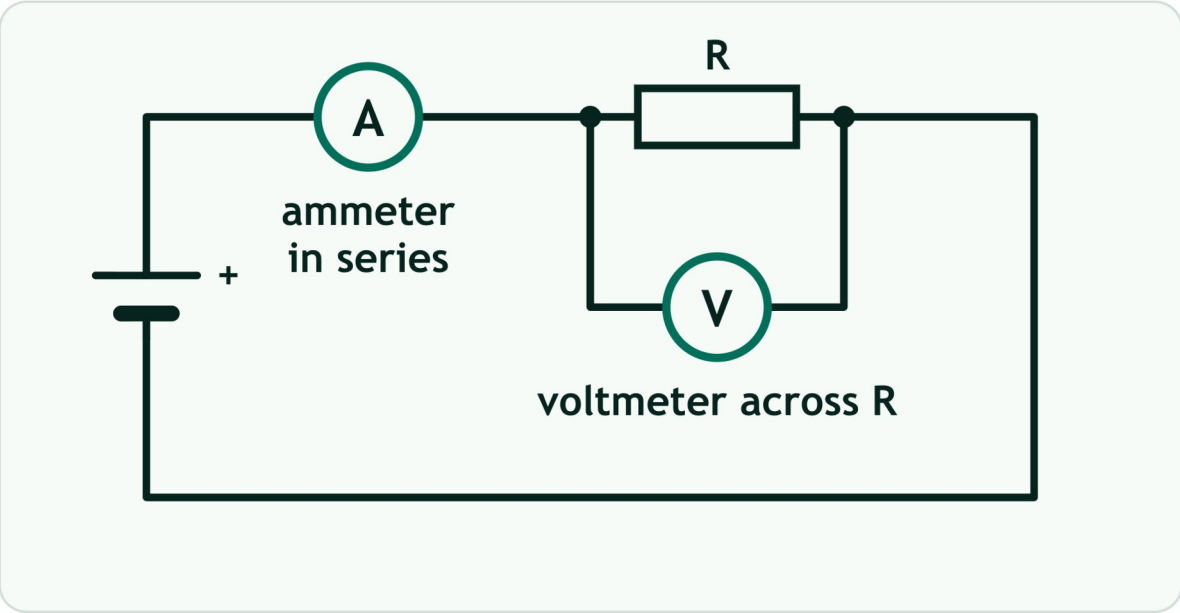
1	**State** both for a **12 V battery**.	DCV 20, V/Ω
2	**State** both for a **2.2 kΩ** resistor.	OHM 20k, V/Ω
3	**State** both to check a **1N4001 diode**.	Diode check, V/Ω
4	**State** both for a current of about **15 mA**.	DCA 20m, A
5	**State** both to check a **wire** is joined.	Continuity, V/Ω

Across or In Series

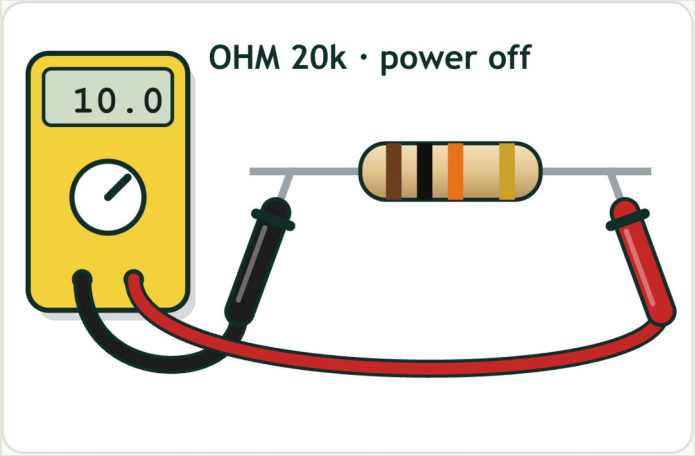
A **voltmeter** goes **across** the part.

An **ammeter** goes **in series**: break the circuit and put the meter in the gap.

For current, the red lead goes in the **A** socket.

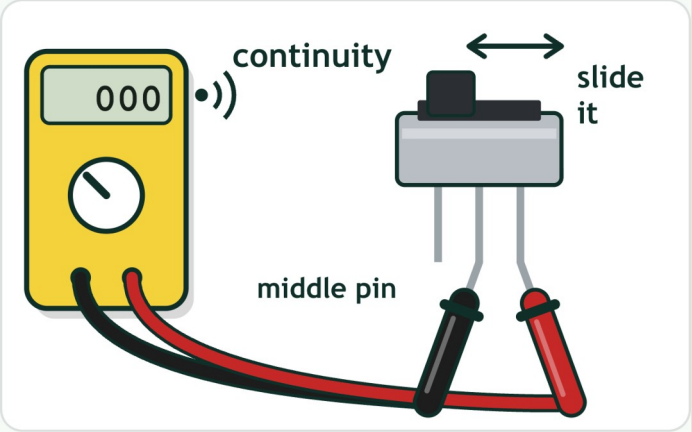


Testing Jobs 1 to 3



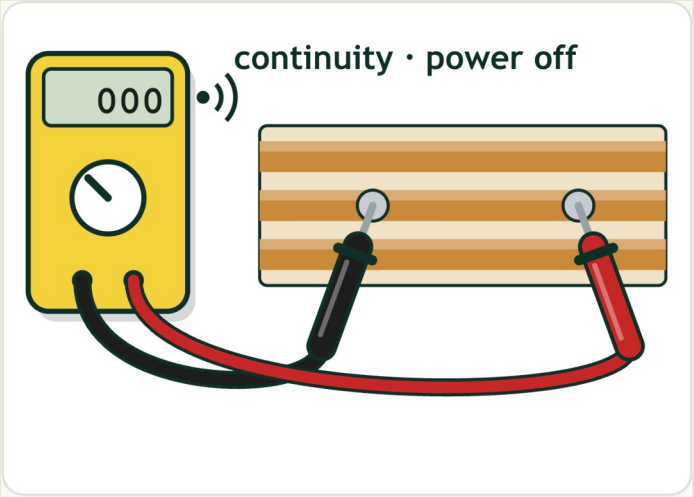
A resistor

OHM, range just above. Power off.



A slide switch

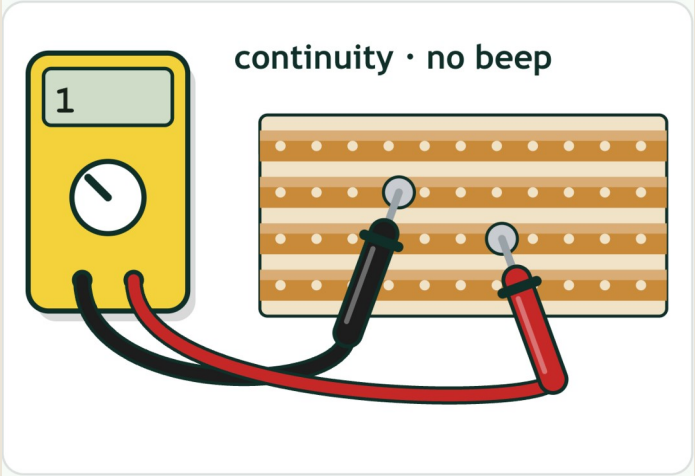
Continuity: middle pin to an outer pin.



A track or joint

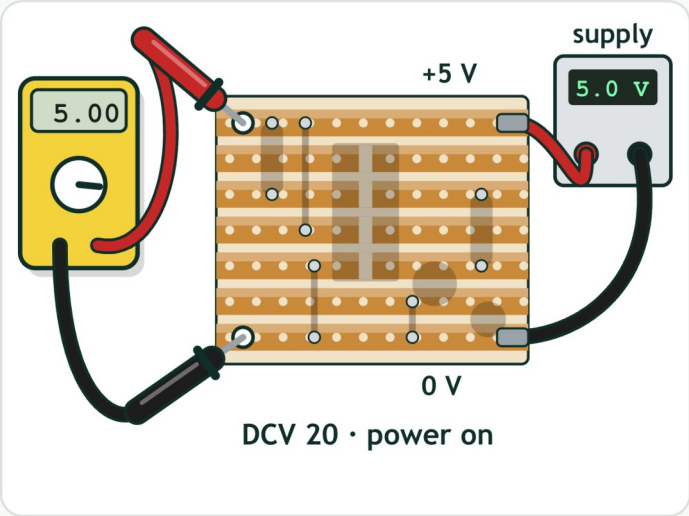
Continuity: one probe each end.

Testing Jobs 4 to 6



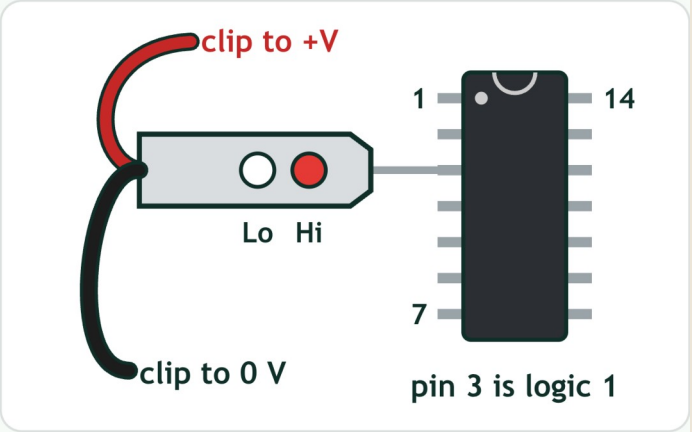
No shorts

Continuity: two tracks side by side. No beep.



The supply

DCV 20. Black on 0 V, red on +V.



A logic level

The logic probe only: not the meter.

Your Turn: Predict the Reading

Task 1 (B6-L1-p6)

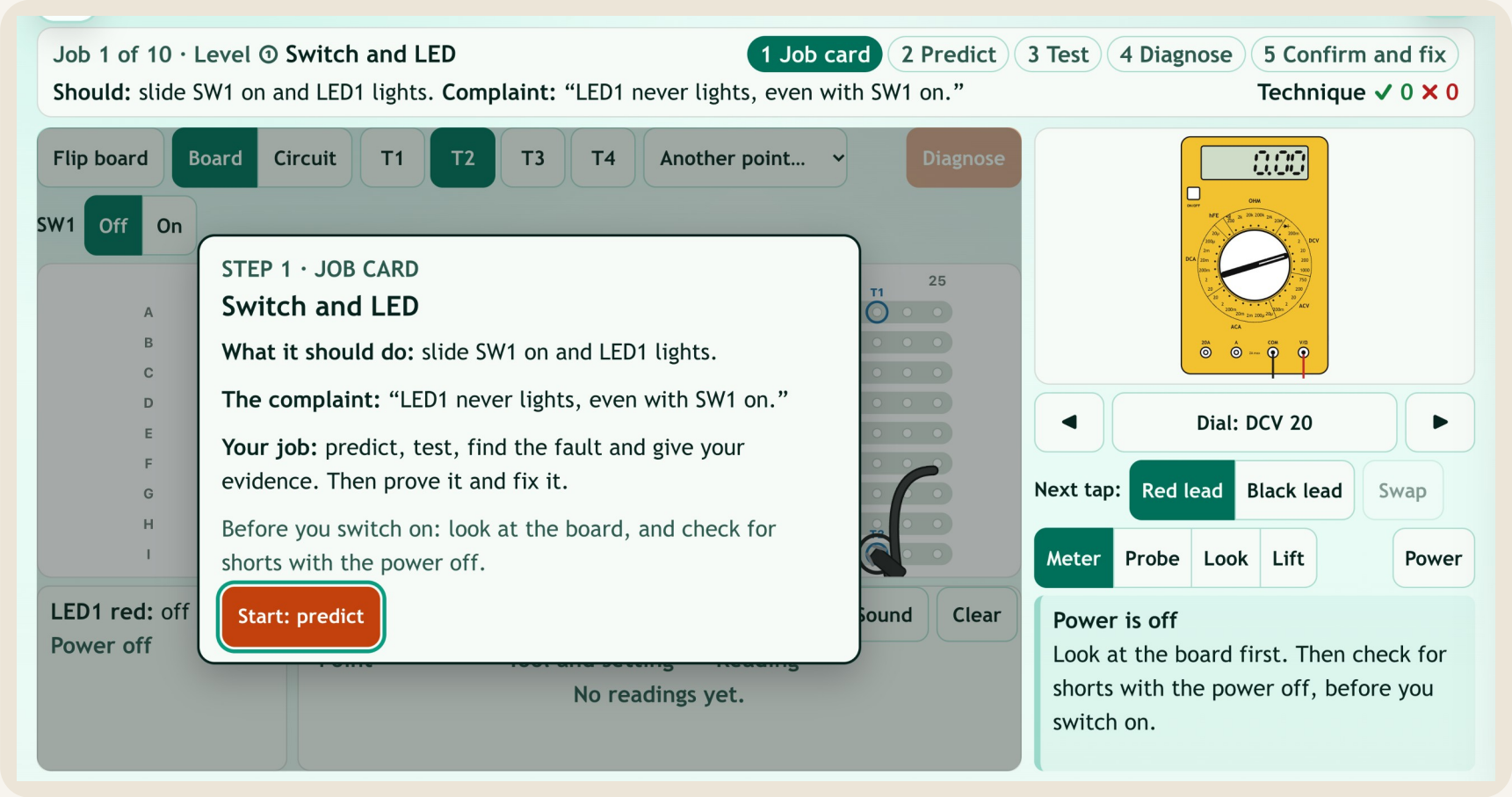
Write the **dial setting**, the **socket** and the **likely reading** for each job.
Use the setting guide on p.3.

TASK 1 — Predict the reading

Multimeter only, no kit yet. For each job, **write** the dial setting, the socket for the red lead and what the display is likely to show. Use the guide. The first row is done for you.

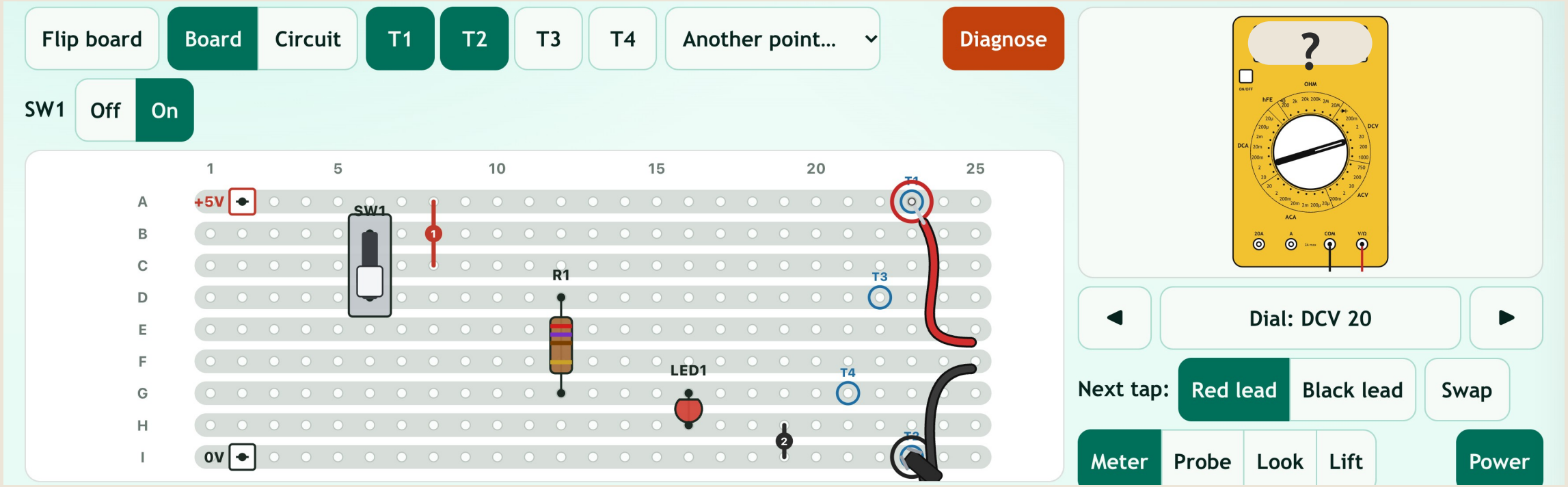
What you are measuring	Dial setting	Red lead in	Likely reading
Example: the supply of the 5 V astable board	**DCV 20**	**V/Ω**	**about 5.00**
A 9 V battery			
A 10 kΩ resistor (brown black orange), out of the circuit			
A 470 Ω resistor (yellow violet brown), out of the circuit			
A push-to-make switch, held pressed			
A red LED, red probe on the long leg			
The same LED, probes swapped			
The current through an LED (about 11 mA)			

Practise Testing: Job 1



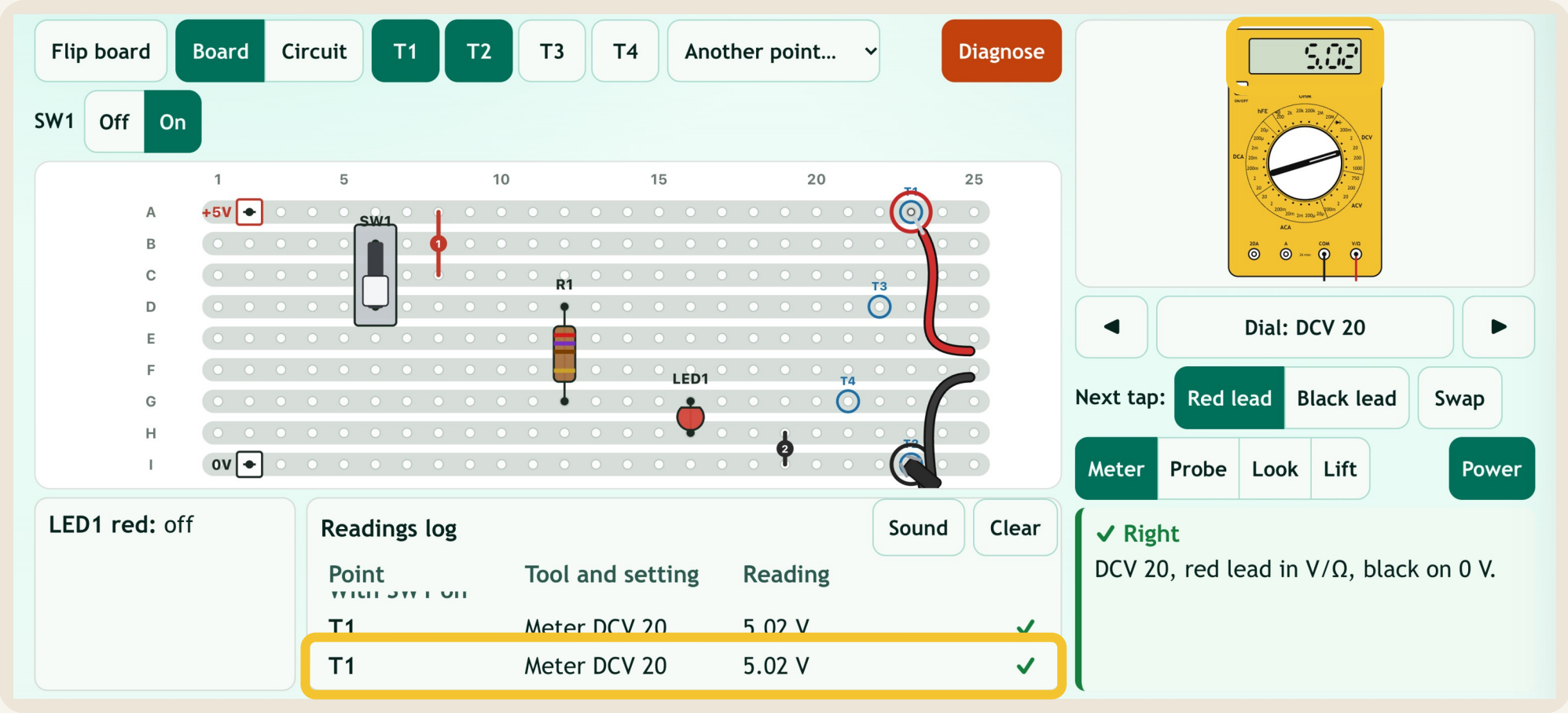
The complaint: LED1 never lights, even with SW1 on.

Power on, SW1 on. Red lead on **T1**, black on **T2** (0 V).
State the **reading** on **DCV 20**.



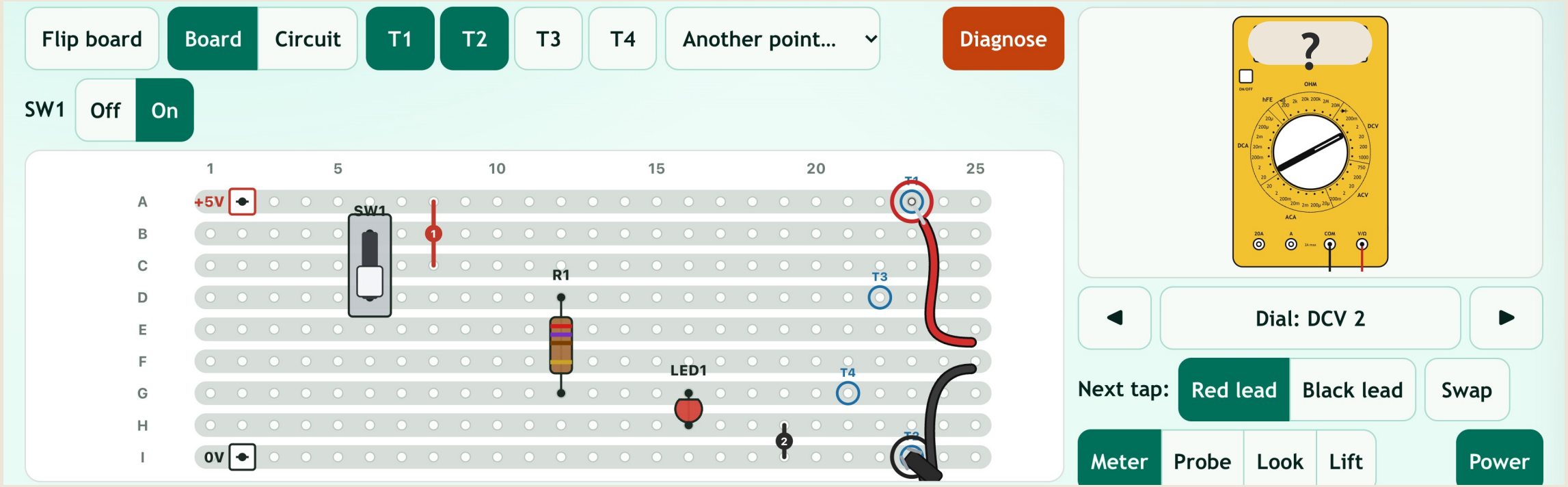
About 5 V: it is the supply

Reveal: T1 on DCV 20



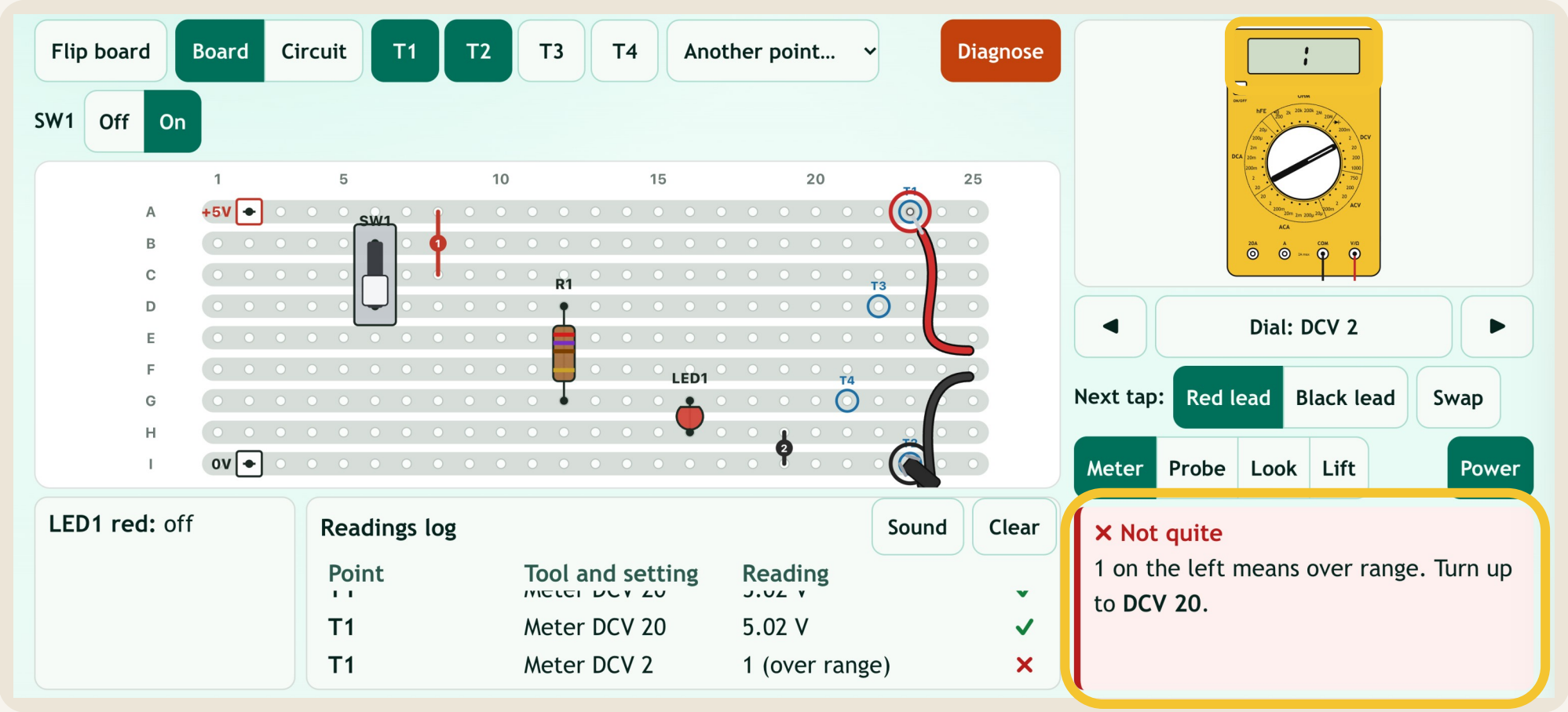
5.02 V: the supply reaches the board.

The dial is turned down to **DCV 2**. **State** what the **display** will **show**.



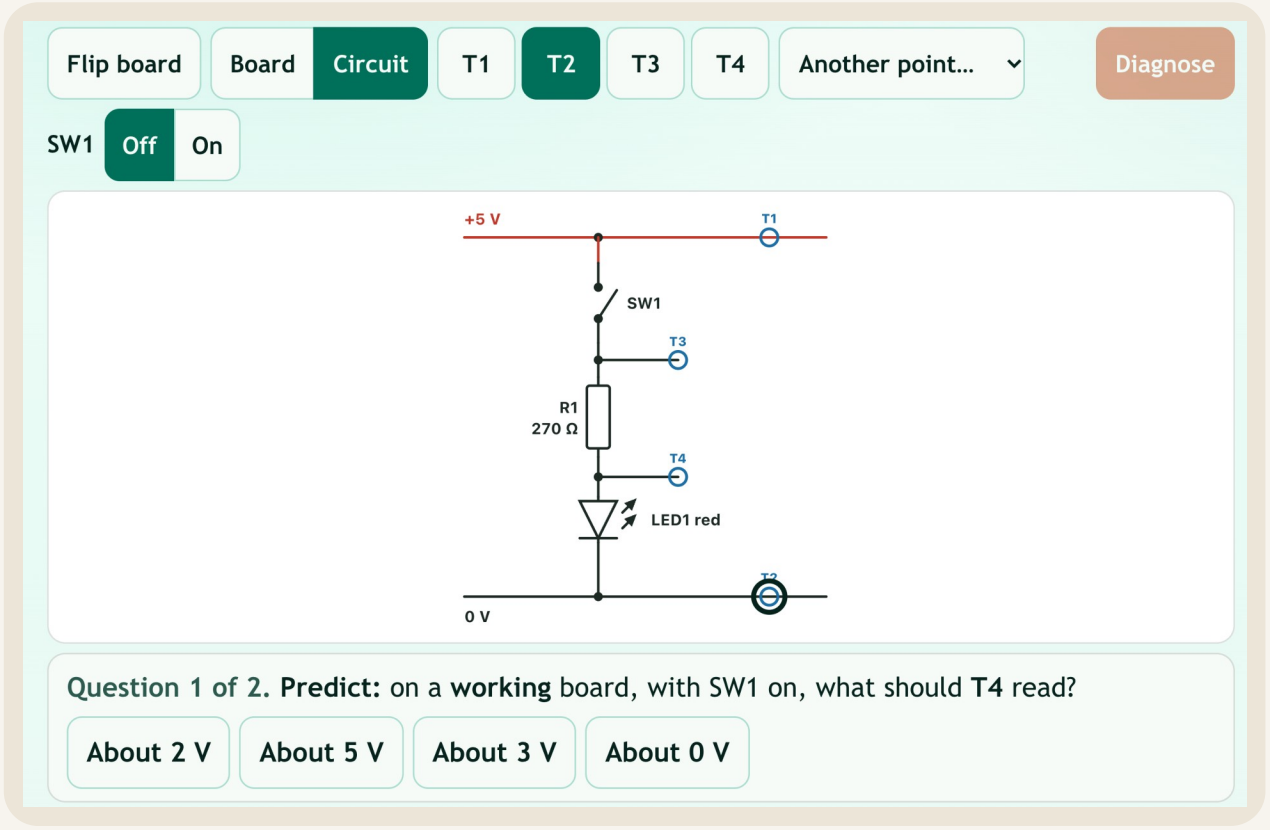
1 on the left: over range

Reveal: DCV 2



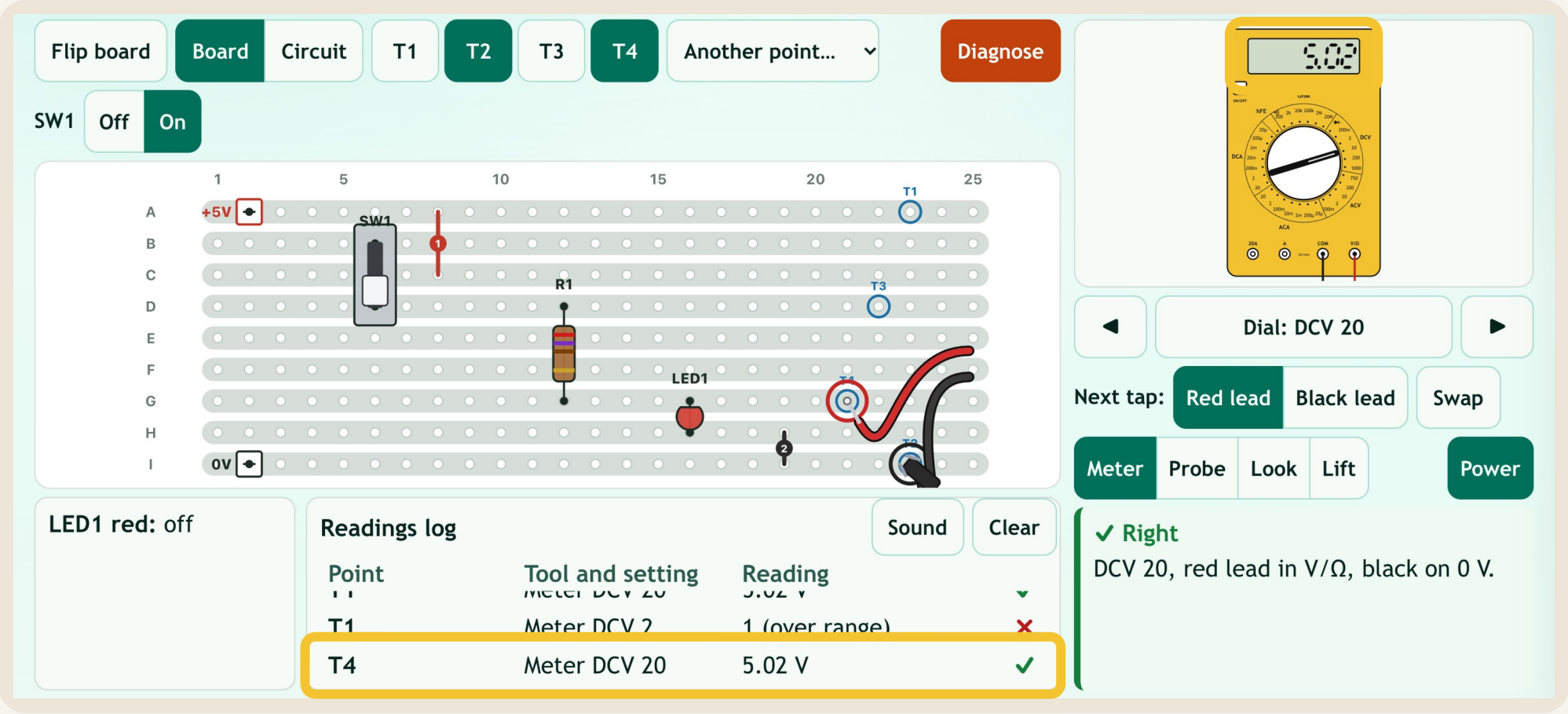
1 on the left: **over range**. Turn up to DCV 20.

On a **working** board, with SW1 on, **state** what **T4** should **read**.



About 2 V: LED1 takes about 1.9 V

Reveal: T4 on This Board



Expected about **1.9 V**. This board: **5.02 V**. What is wrong?

Try It: Job 1

Practise Testing

Try Job 1 yourself: Switch and LED.
Find the fault. **Prove** it. **Fix** it.

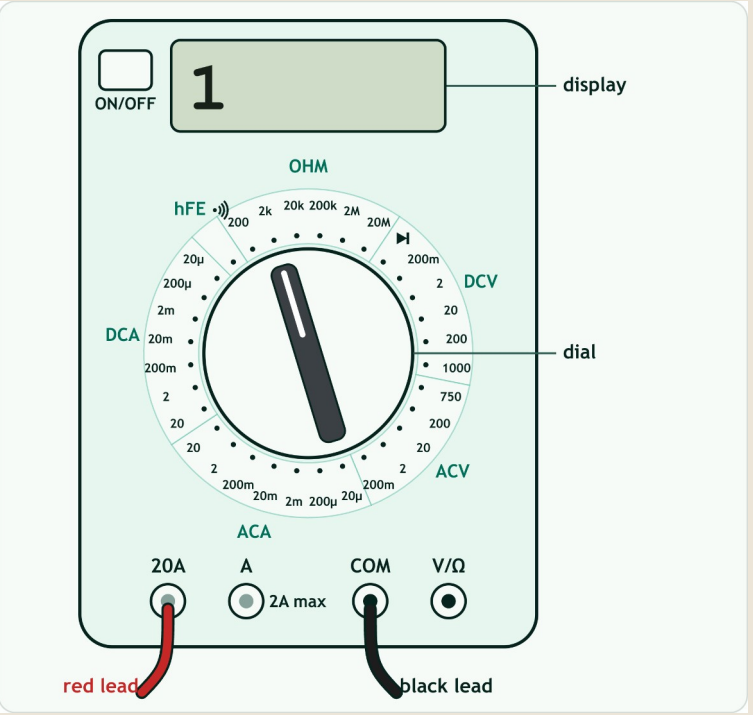
Scan me

Worked Example 1

A student wants to measure the voltage of a **9 V battery**. The multimeter is set up as shown.

(a) **Identify two** changes that must be made to the multimeter. **2**

(b) **State** the most appropriate **scale** to check the resistance of a **680 Ω** resistor. **1**



Marking: Worked Example 1

Question	Expected response	Max mark	Additional guidance
(a)	Turn the dial to DCV 20 (1 mark) Connect probe 1 to the V/Ω socket (1 mark)	2	Probe must be identified as probe 1 or red 'Move the lead' on its own: 0 marks
(b)	2k (1 mark)	1	Accept 2000, no unit required

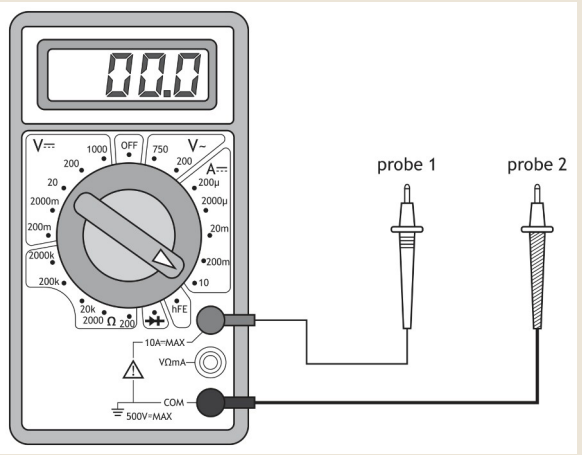
2024 Question 7

7. A student wants to check that the current flowing through a component is **1.2 mA DC**.

   (a) Identify **two** changes that must be made to the multimeter to get the most accurate measurement. **2**

   (b) Draw the symbol for direct current that is shown on the meter. **1**

   (c) State the most appropriate scale that should be used to check the resistance of a 15 000 Ω resistor. **1**



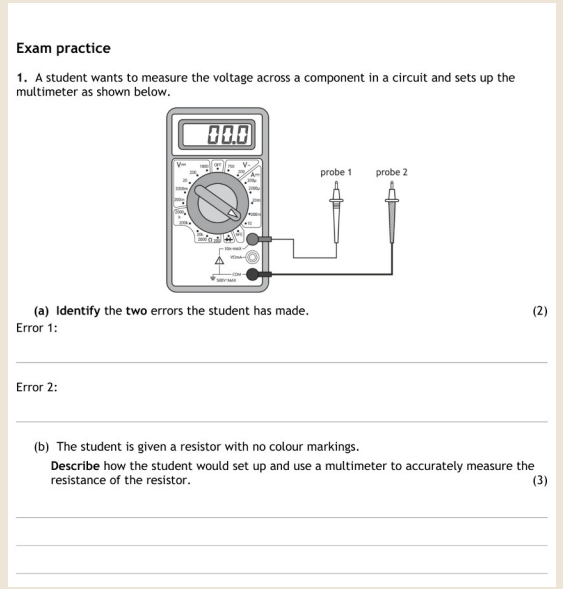
Marking: 2024 Question 7

Question	Expected response	Max mark	Additional guidance
7. (a)	Connect probe 1 to the VΩmA or middle socket of multimeter (1 mark) Select 2000 µ range (1 mark)	2	Probe must be identified as probe 1. Accept Red instead of Probe 1. Accept range/scale as interchangeable
(b)	⎓	1	Also accept A and symbol but do not accept V and symbol.
(c)	20K	1	Accept 20,000 no unit required

Your Turn: Exam Practice

Exam practice (B6-L1-p8-9)

Answer questions **1** and **2** in the booklet.
Show the **setting** and the **socket** in each answer.



Exam practice

1. A student wants to measure the voltage across a component in a circuit and sets up the multimeter as shown below.

(a) Identify the **two** errors the student has made. (2)

Error 1:

Error 2:

(b) The student is given a resistor with no colour markings.

Describe how the student would set up and use a multimeter to accurately measure the resistance of the resistor. (3)

Look back — by the end of this part…



1. I can **choose** the **setting** and **socket**
2. I can **predict** what a **meter** should **read**

Daily Review



1	**Name** the meter for **voltage**.	Voltmeter
2	**Describe** how a **continuity tester** checks a **cable**.	Both ends; lamp lights
3	**Complete** the **NOR** truth table.	1, 0, 0, 0
4	Brown, black, red, gold. **Determine** the **resistance**.	1000 Ω
5	**Name** a way to **identify** wiring.	Colour coding

PART 2

The Logic Probe

We are learning to use a logic probe and readings to find a fault.

By the end of this part…



1. I can **connect** a **logic probe** and read **logic 1**, **logic 0** and a **pulse**
2. I can **find** a **fault** from **readings**

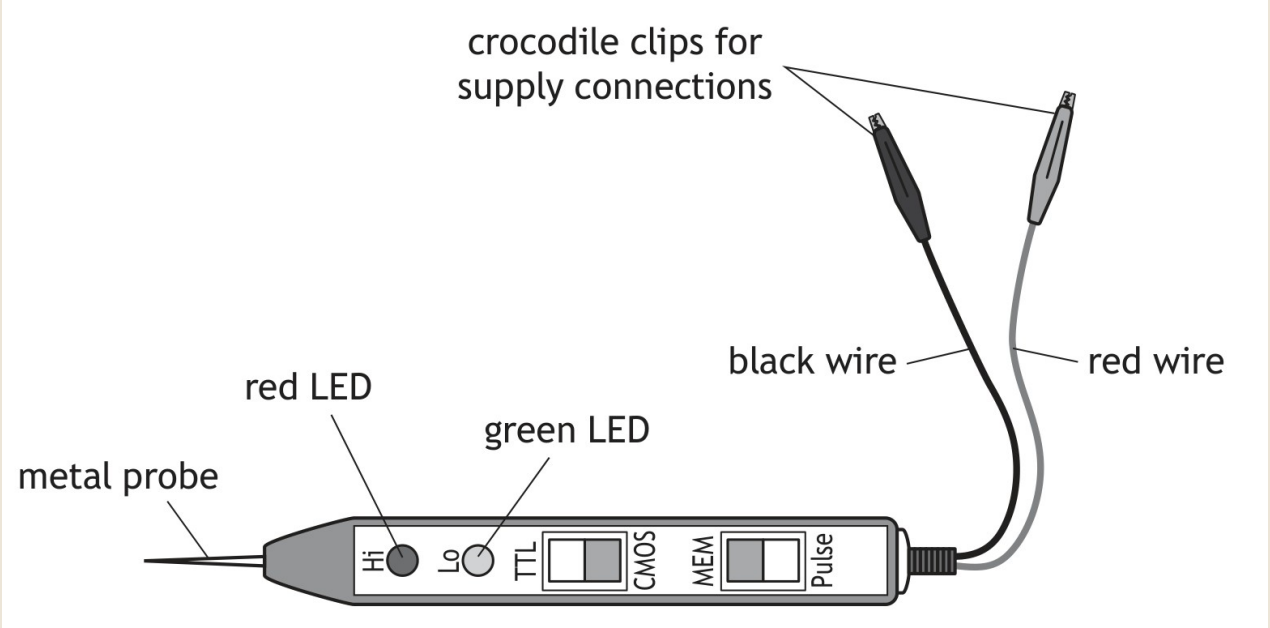
The Logic Probe

Metal probe: touch the point

Red LED (Hi): logic 1

Green LED (Lo): logic 0

Red wire to +V, **black** to 0 V



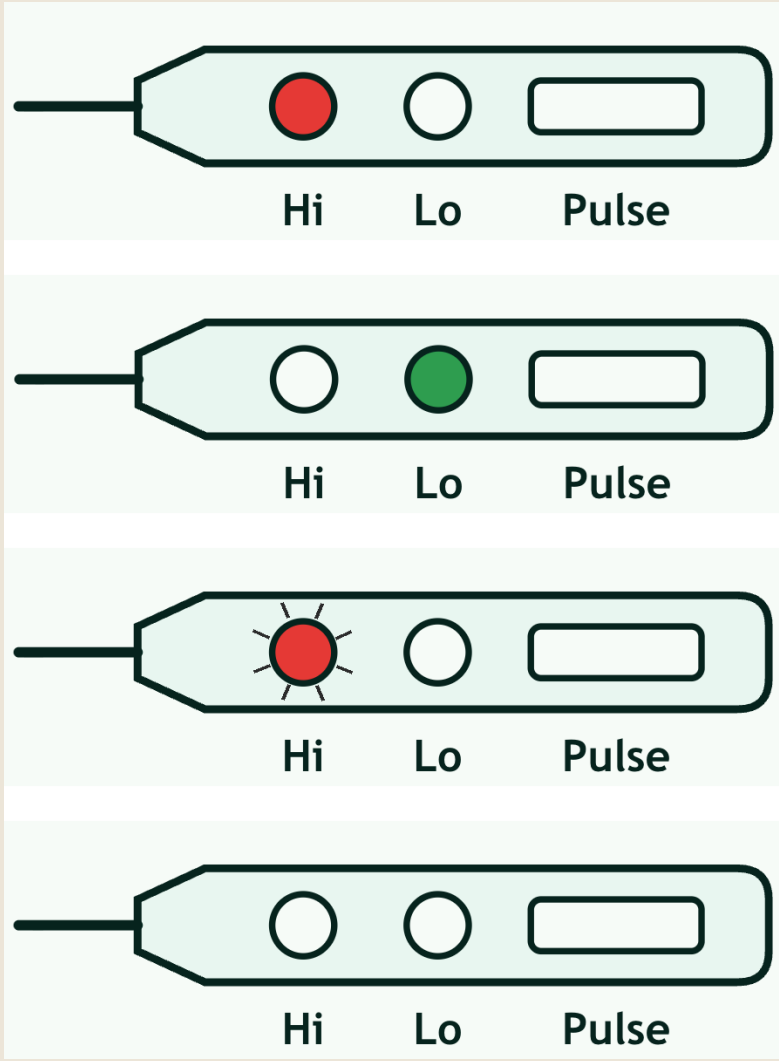
What the Probe Shows

Hi (red): logic **1**.

Lo (green): logic **0**.

Flashing: the point is **pulsing**.

Neither: not connected, or no supply.



Watch Out: Name the Wires

THE MISTAKE

- Connect the probe to the supply rails.

THE CORRECT ANSWER

- Red wire to +V, black wire to 0 V.

Show Me: State What the Probe Shows

1	**State** it for **pin 14** of a powered **7408**.	Hi: logic 1
2	**State** it for **pin 7** of the same chip.	Lo: logic 0
3	**State** it for **pin 3** of a **555 astable**.	Flashing: pulsing
4	**State** it for a point **joined to nothing**.	Neither LED
5	**State** it for an **AND** output, inputs **1** and **0**.	Lo: logic 0

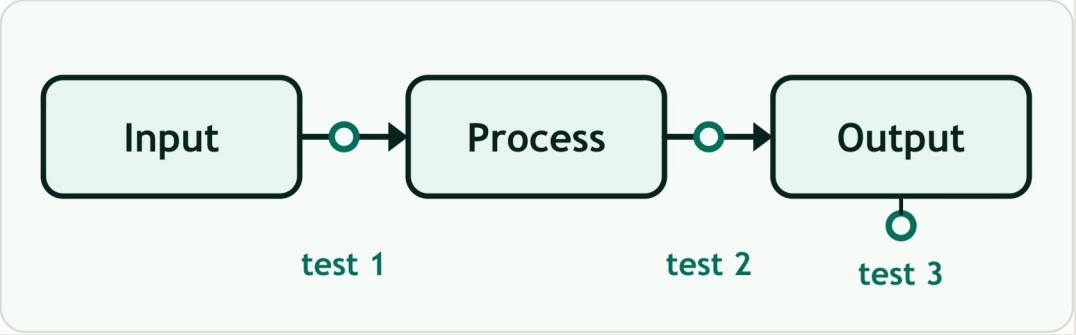
Finding a Fault

Expected: what it should read.

Measured: what it does read.

Work in order: **input**, **process**, **output**.

Right, then wrong: the fault is **between** them.

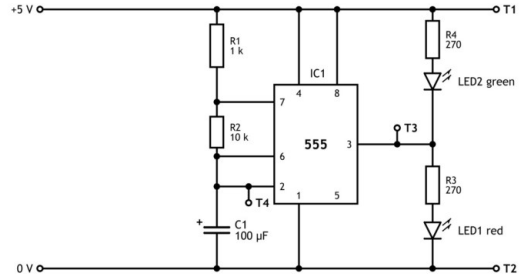


Your Turn: Probe Detective

Task 2 (B6-L1-p7)

Probe Detective: one fault on each board.
State the fault. **Describe** how you would check it.

TASK 2 — Probe Detective
This is the 555 astable practice board. Each reading below comes from a board with **one** fault.

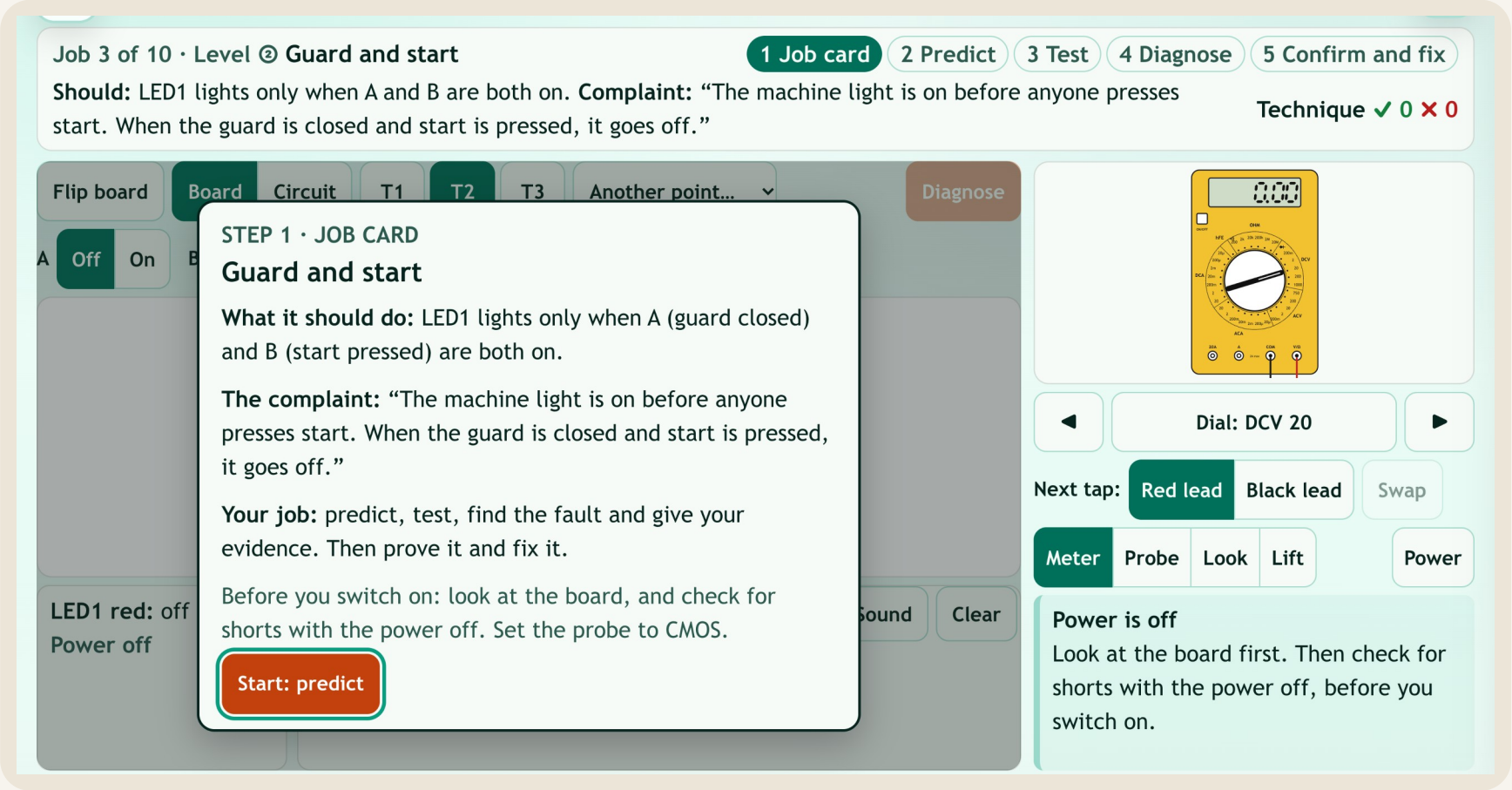


(a) T1 reads 0 V. **State** the most likely fault. (1)

(b) T1 reads 5.0 V. LED1 flashes, but LED2 never lights. **Suggest one** fault. **Describe** how you would check it with the meter. (2)

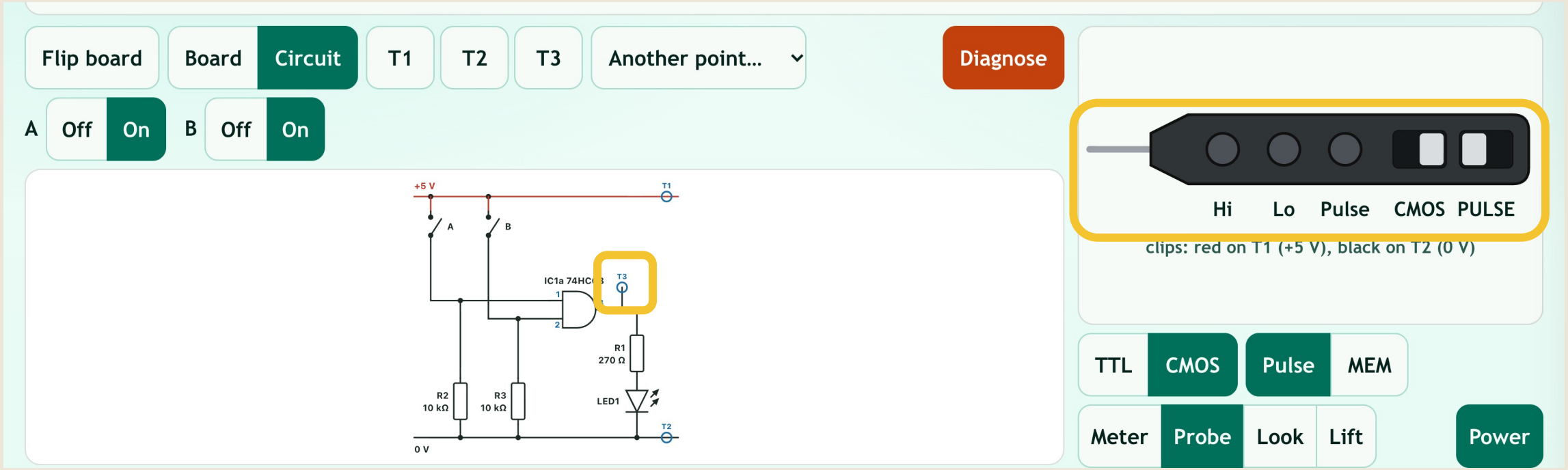
(c) T1 reads 5.0 V. The probe on pin 3 shows red all the time and T4 reads 0 V. **Suggest** the fault. **State** what T4 should read. (2)

Practise Testing: Job 3



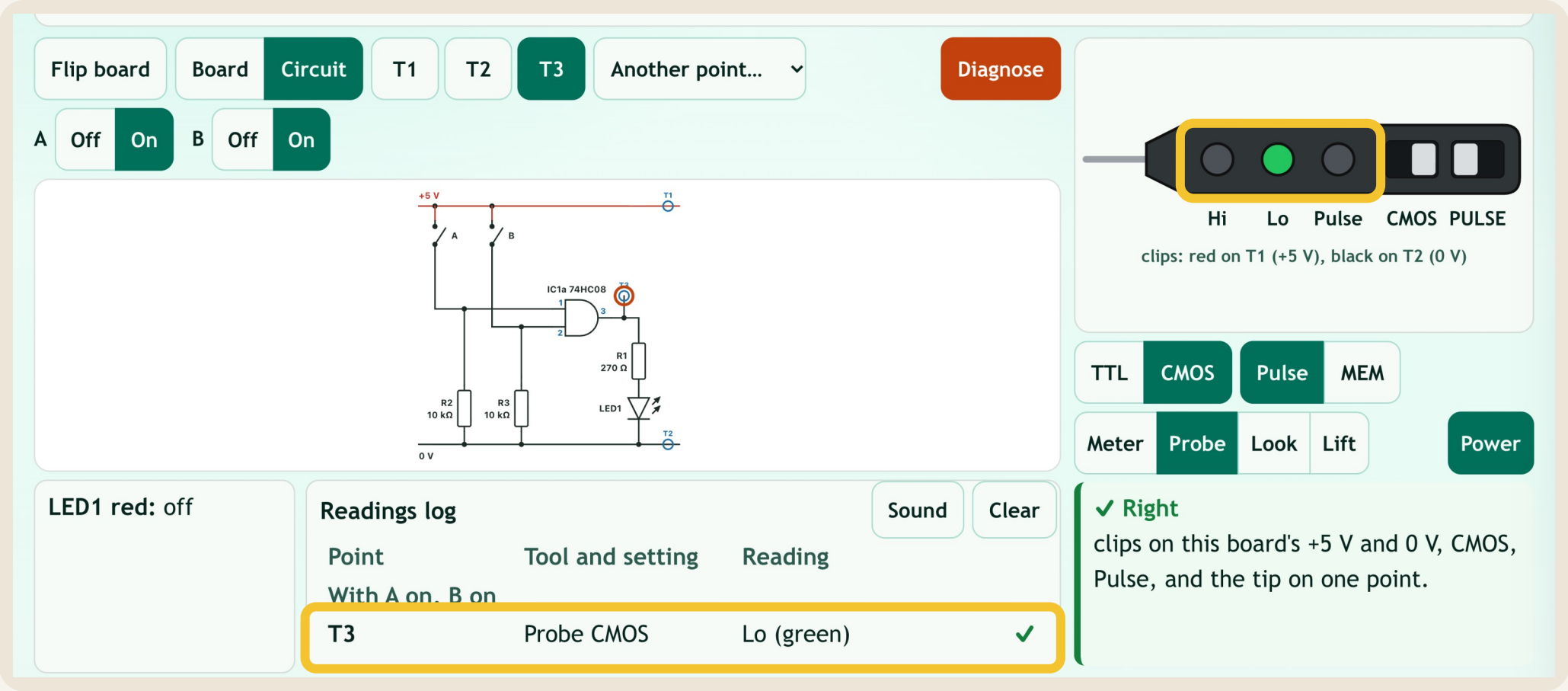
The complaint: the light is on before start, and off after.

A and B are **on**. The probe is on **T3**, the AND gate's **output**. **State** what it should show.



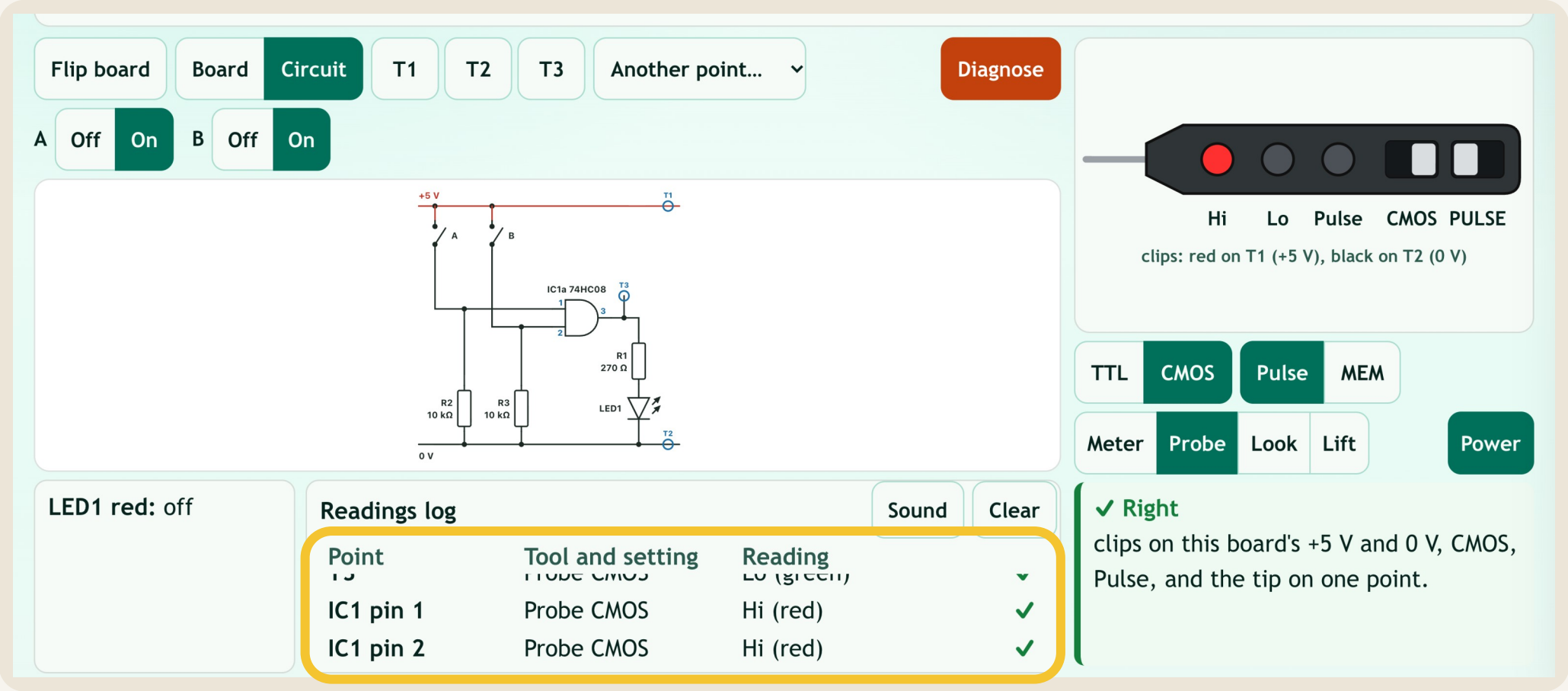
Hi (red): 1 AND 1 is 1

Reveal: T3 With A and B On



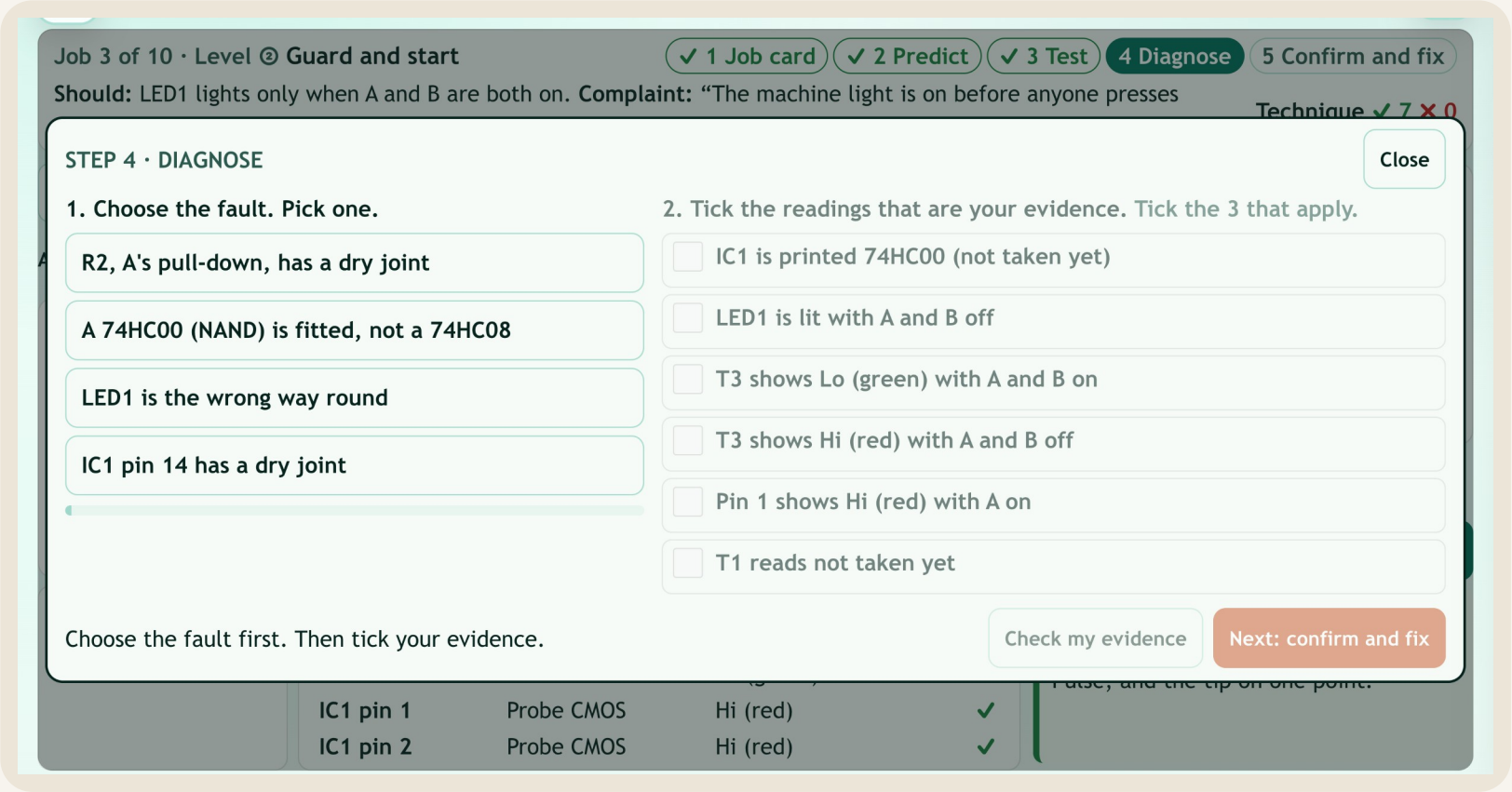
Expected **Hi**. The probe shows **Lo**.

Probe the Inputs



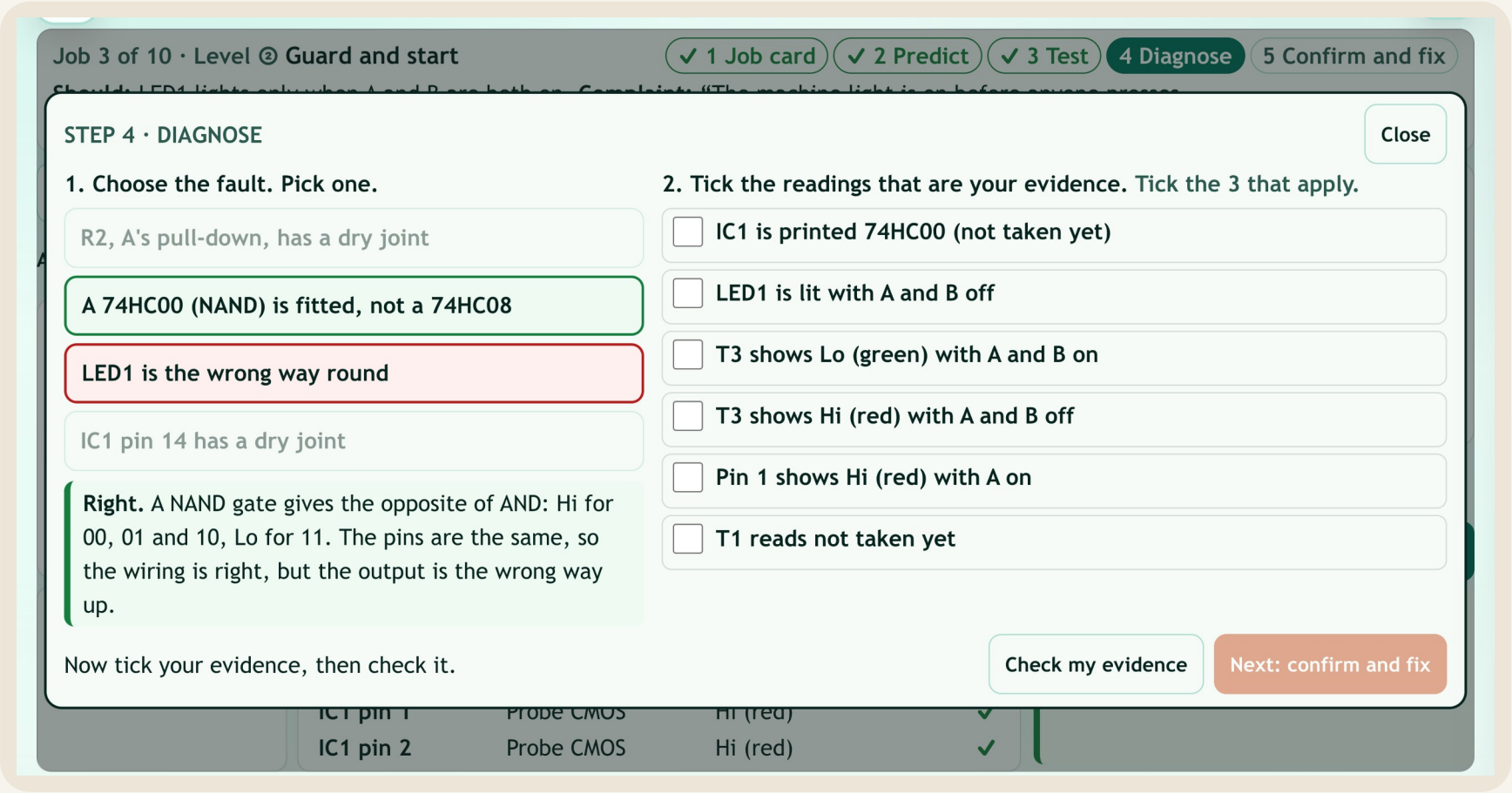
Inputs **Hi**, **Hi**. Output **Lo**. Both off: output **Hi**.

Choose the fault that fits **every** reading.



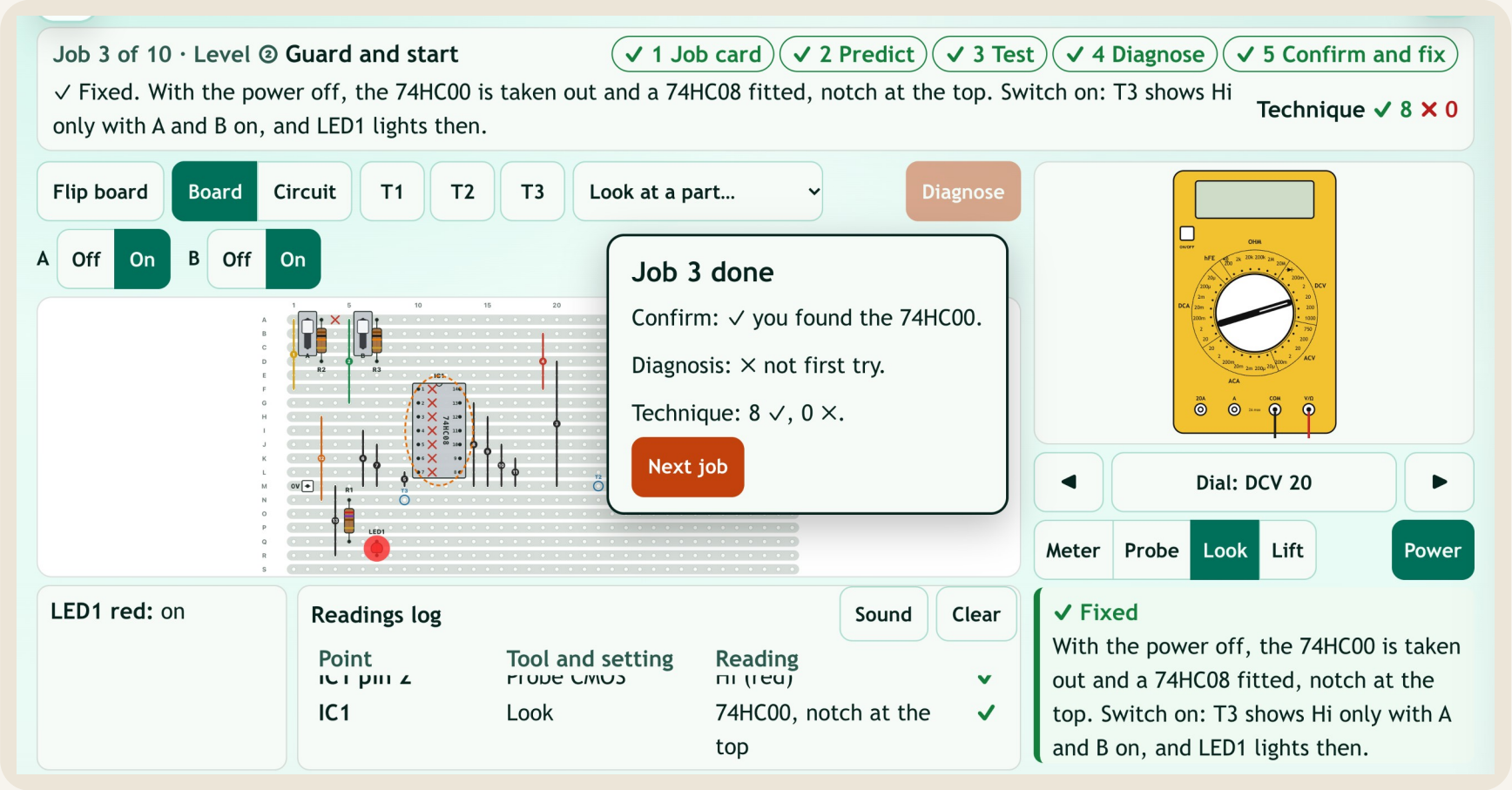
A 74HC00 (NAND) is fitted

Rule It Out, Then Pick



LED1 is ruled out: it lights. **NAND** fits every reading.

Prove It, Then Fix It



Look at IC1: printed **74HC00**. Power off, fit a **74HC08**.

Try It: Jobs 1 to 3

Practise Testing

Jobs 1 to 3 now.
The **rest** for homework.

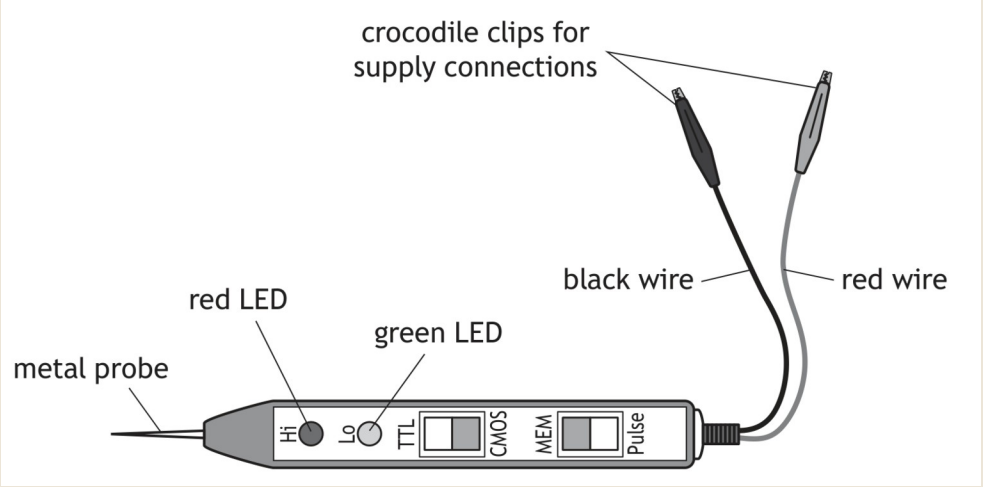
Scan me

Worked Example 2

A logic probe is used to test the output of a **555 astable** circuit.

The logic probe is set to TTL and pulse.

Describe how to **connect** and **use** the logic probe to test the output. In your answer include how a **pulse** is detected. **3**



Marking: Worked Example 2

Question	Expected response	Max mark	Additional guidance
	Connect red wire of probe to +V and black wire to 0 V (1 mark) Place the probe tip on the output, pin 3 (1 mark) The LEDs flash (1 mark)	3	Do not accept: connect the probe to the supply rails (on its own) 3 independent marks

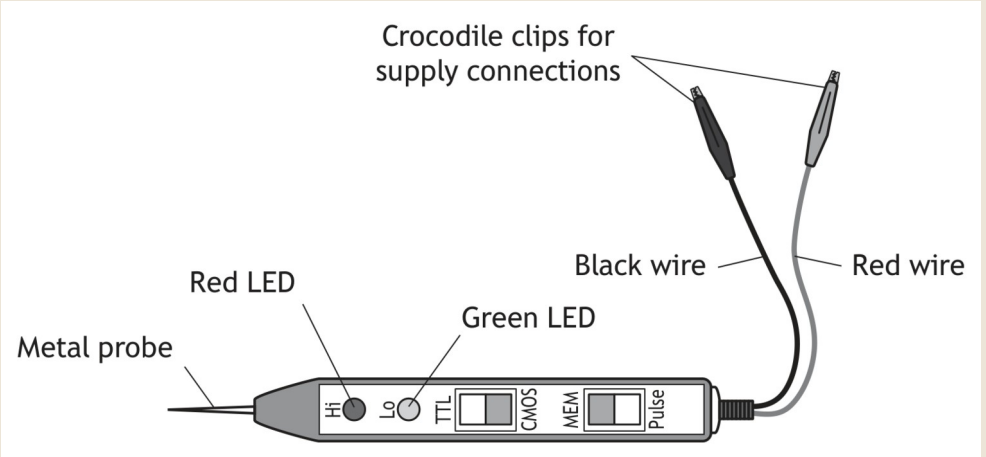
2018 Question 5

5. A logic probe is used to test the inputs and outputs of a 74 series logic chip.

The logic probe is set to TTL and pulse.

Describe how to connect and use the logic probe to test the inputs and outputs of the chip.

In your answer include how a logic 1 is detected. **3**



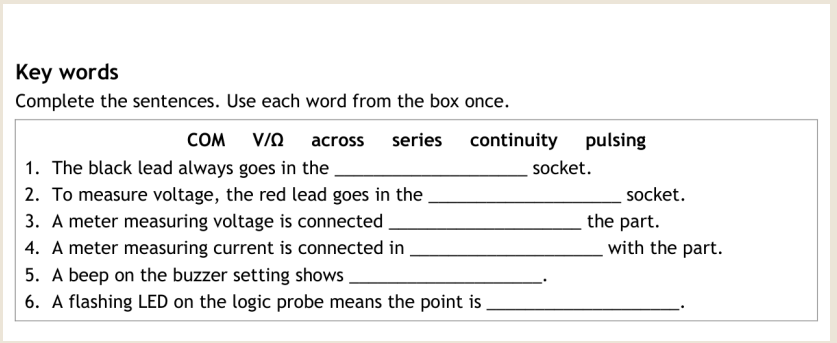
Marking: 2018 Question 5

Question	Expected response	Max mark	Additional guidance
5.	Connect red wire of probe to Vsupply and black wire to 0 V or equivalent. (1 mark) Place the probe tip onto circuit at selected point. (1 mark) Red LED lights. (1 mark)	3	Do not accept: connect the probe to the supply rails (on its own). 3 independent marks

Your Turn: Key Words

Key words (B6-L1-p10)

Complete the sentences.
Use each word from the box **once**.



Key words

Complete the sentences. Use each word from the box once.

COM	V/Ω	across	series	continuity	pulsing

1. The black lead always goes in the _____ socket.
2. To measure voltage, the red lead goes in the _____ socket.
3. A meter measuring voltage is connected _____ the part.
4. A meter measuring current is connected in _____ with the part.
5. A beep on the buzzer setting shows _____.
6. A flashing LED on the logic probe means the point is _____.

Look back — by the end of this part…



1. I can **connect** a **logic probe** and read **logic 1**, **logic 0** and a **pulse**
2. I can **find** a **fault** from **readings**

Course Specification — 1 of 2

Circuit construction (cont)

- Identify and draw the circuit symbols for, and describe the function of, the following components (using American National Standards Institute (ANSI) and International Electrotechnical Commission (IEC) symbols):
  - voltmeter and ammeter

Course Specification — 2 of 2

Circuit construction (cont)

- Select appropriate scale and range on a multimeter for measuring voltage, resistance and current.
- Describe the use of a logic probe and continuity tester in circuit testing.

Credits

Drawings: Multimeter drawing, 555 practice board and booklet pages: Block 6 booklet, R Stewart.

Daily Reviews: © Qualifications Scotland (SQA). N5 Practical Electronics 2024 Q4(a); 2025 Q1(a), Q4(a), Q6(a), Q6(b); 2026 Q1(c), Q2; specimen Q1(b), Q2(b), Q4(a).

Screenshots and page figures: mrstewartphysics.co.uk, Practise Testing and Lesson 1 pages, R Stewart.

2024 Question 7: © Qualifications Scotland (SQA). N5 Practical Electronics 2024 Q7: question, figure and marking instructions.

Logic probe figure: © Qualifications Scotland (SQA). N5 Practical Electronics 2025 Q7: figure and marking instructions.

2018 Question 5: © Qualifications Scotland (SQA). N5 Practical Electronics 2018 Q5: question, figure and marking instructions.

Course specification: © Qualifications Scotland (SQA). N5 Practical Electronics course spec v2.1, p.9

R Stewart - October 2026