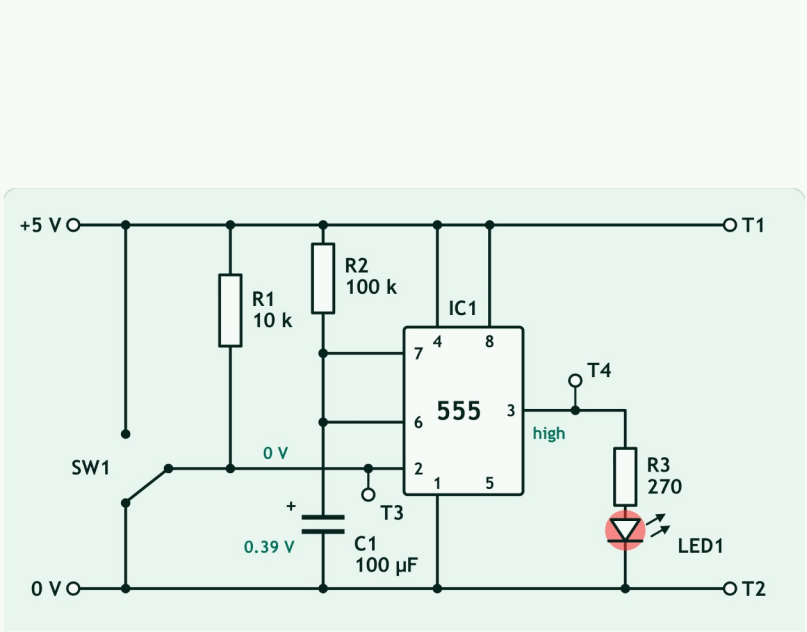
The 555 Monostable

How does one press keep a light on for exactly 11 seconds?



National 5 Practical Electronics

Daily Review



1	+ **3.0 V**, – **2.2 V**. **State** the **output**.	High
2	**Calculate** V_{ref}: 10 V, 6 kΩ over 4 kΩ.	4.0 V
3	Brown, green, red. **Determine** the **value**.	1.5 kΩ
4	**State one** soldering **safety** step.	Eye protection
5	20 Ω and 16 Ω in **series**. **Calculate** R_T.	36 Ω

PART 1

How It Works

We are learning how a 555 monostable makes one timed pulse.

By the end of this part…



1. I can **simulate** a **monostable** in Yenka and **time** its **pulse**

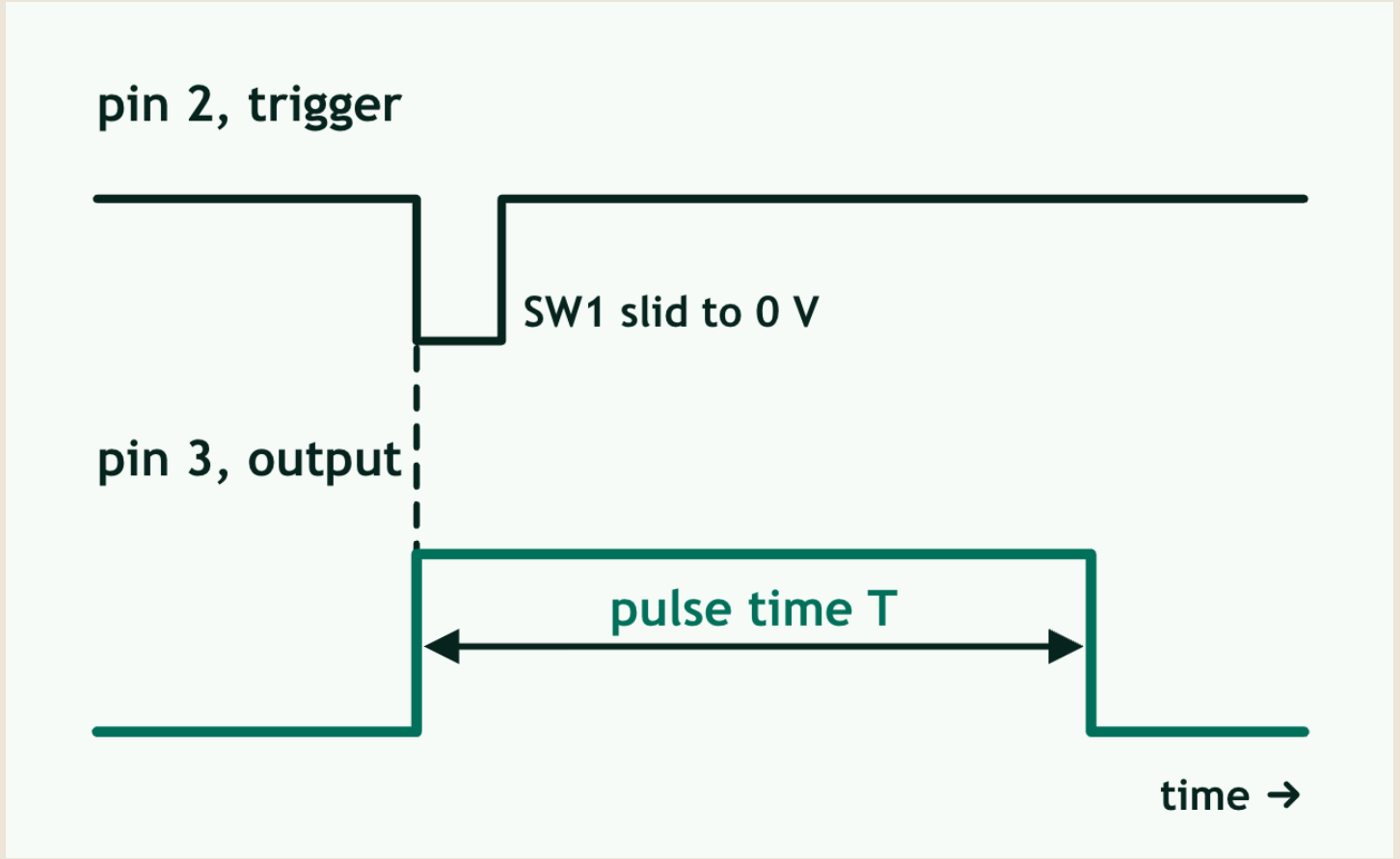
What a Monostable Does

One trigger: **one** pulse.

Waiting: output **low**.

Trigger: pin 2 **low** for a moment.

Output **high** for a **set** time, then **low**.

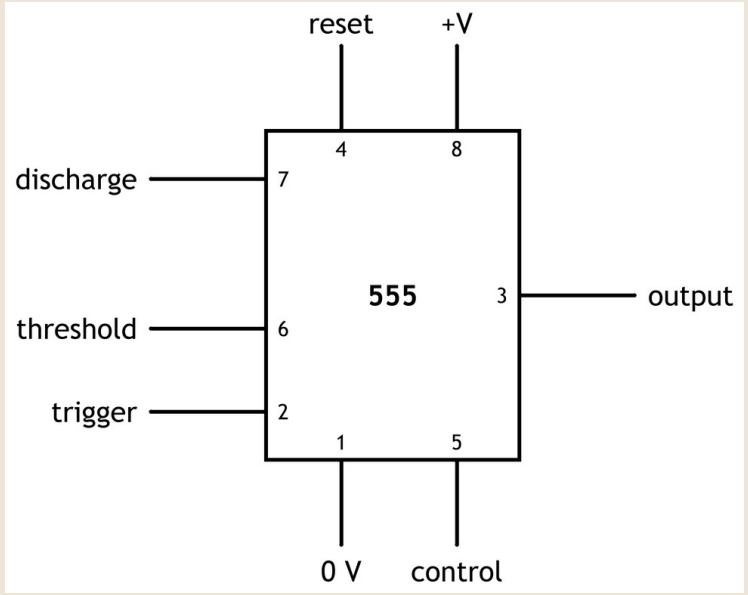


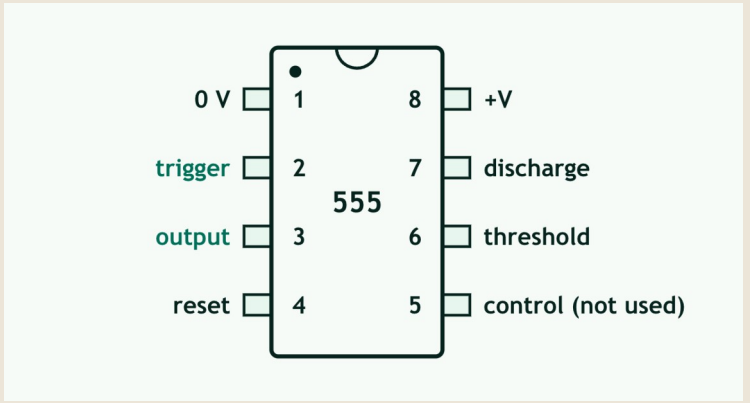
The 555 Timer

Notch at the **top**: pin **1** top left.

Pin **2** trigger, pin **3** output.

Pins **8** and **4** to **+V**, pin **1** to **0 V**.





Show Me: Name the Pin

1	**State** the **pin** that **ends** the pulse.	Pin 6
2	**State** the **pin** that **empties** C1.	Pin 7
3	**State** the **pin** joined to **0 V**.	Pin 1
4	**State** the **two** pins joined to **+V**.	Pins 8 and 4
5	**State** the **pin** that is **not used**.	Pin 5

The Booklet Circuit

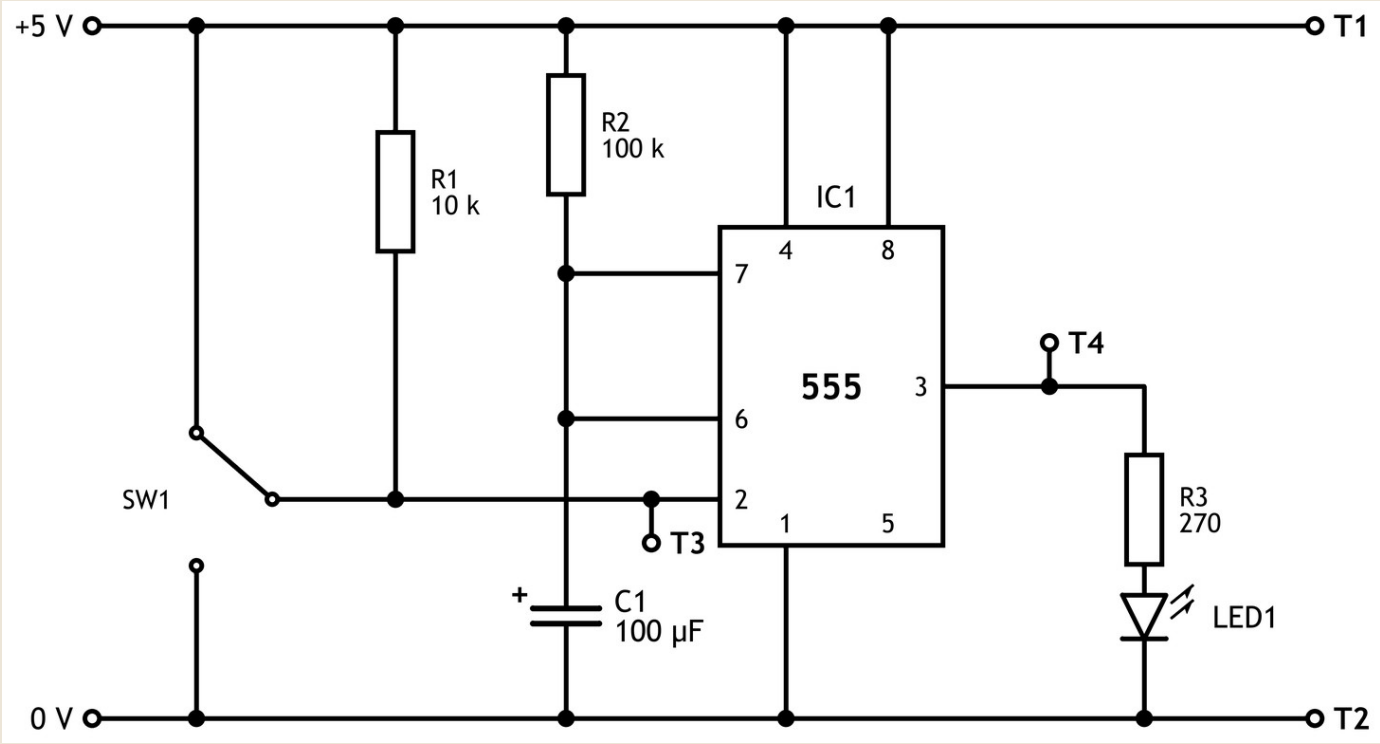
SW1: pin 2 to **+5 V** or **0 V**.

R1 holds pin 2 **high**.

R2, **C1**: the **pulse time**.

R3 protects **LED1**.

T3 pin 2, **T4** pin 3.



How It Works

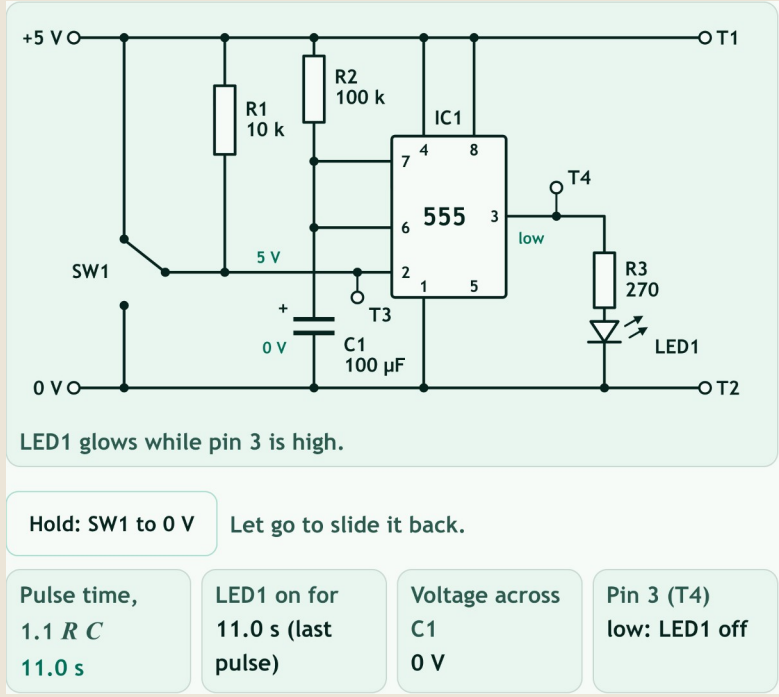
Waiting: LED1 **off.**

SW1 to **0 V:** pin 3 **high.**

C1 **charges** through **R2.**

C1 nears **two thirds** of 5 V.

Pin 3 **low;** pin 7 **empties** C1.



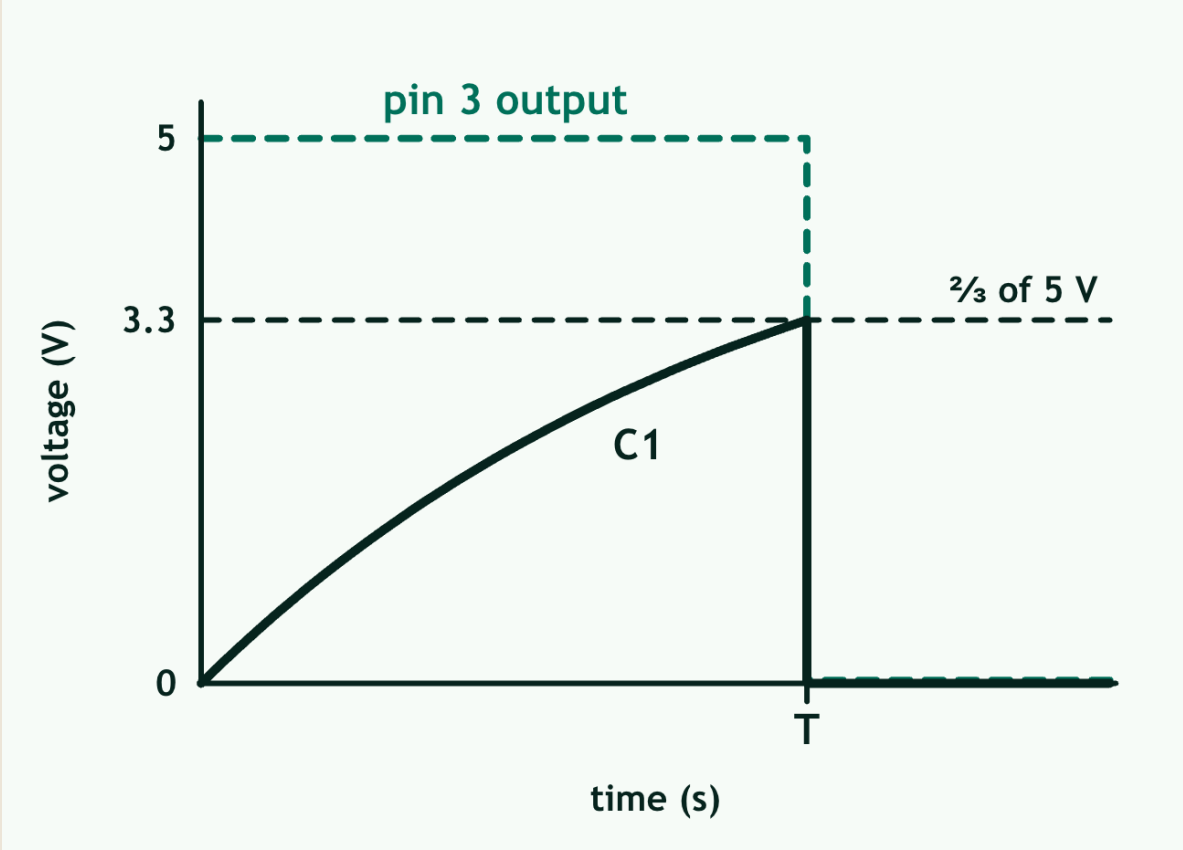
The Monostable

Pin 2 **low**: pin 3 goes **high**, LED1 **on**.

C1 **charges** through R2.

C1 reaches **two thirds** of the supply: pin 3 goes **low**.

Draw the **graph** beside your notes.



Pulse Time

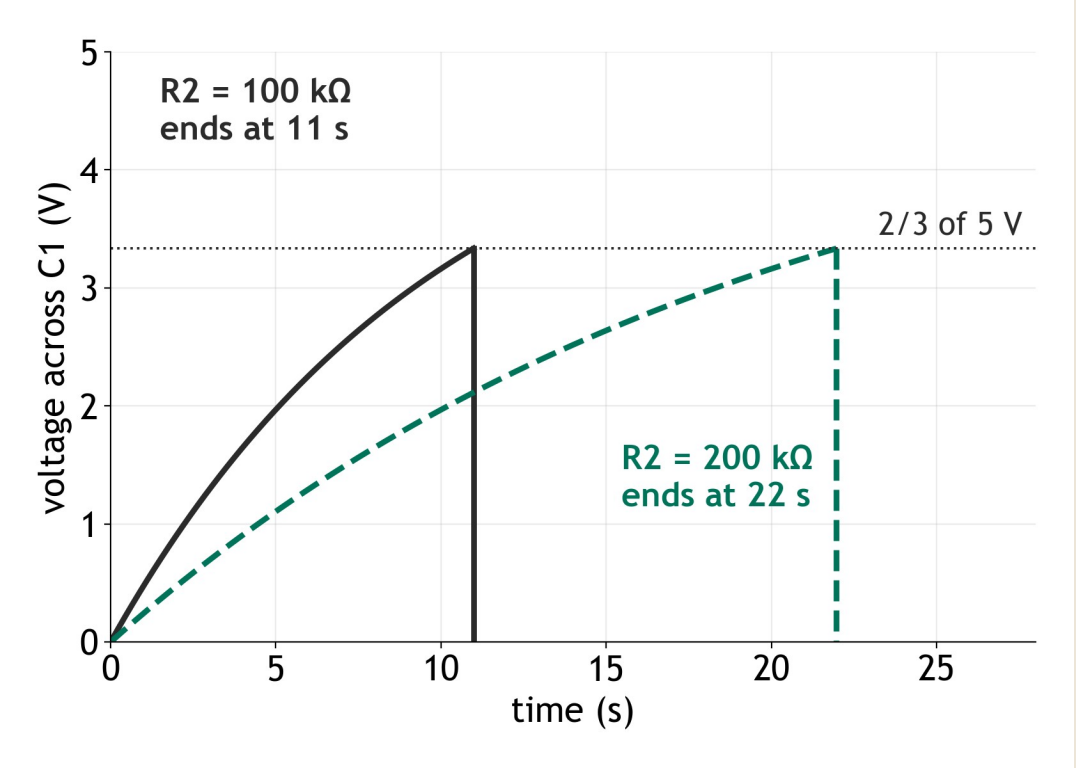
$$T = 1.1\,R\,C$$

R2 in **ohms**, C1 in **farads**.

Our board: **11 s**.

Bigger R2 or C1: **longer**.

Not in the exam.



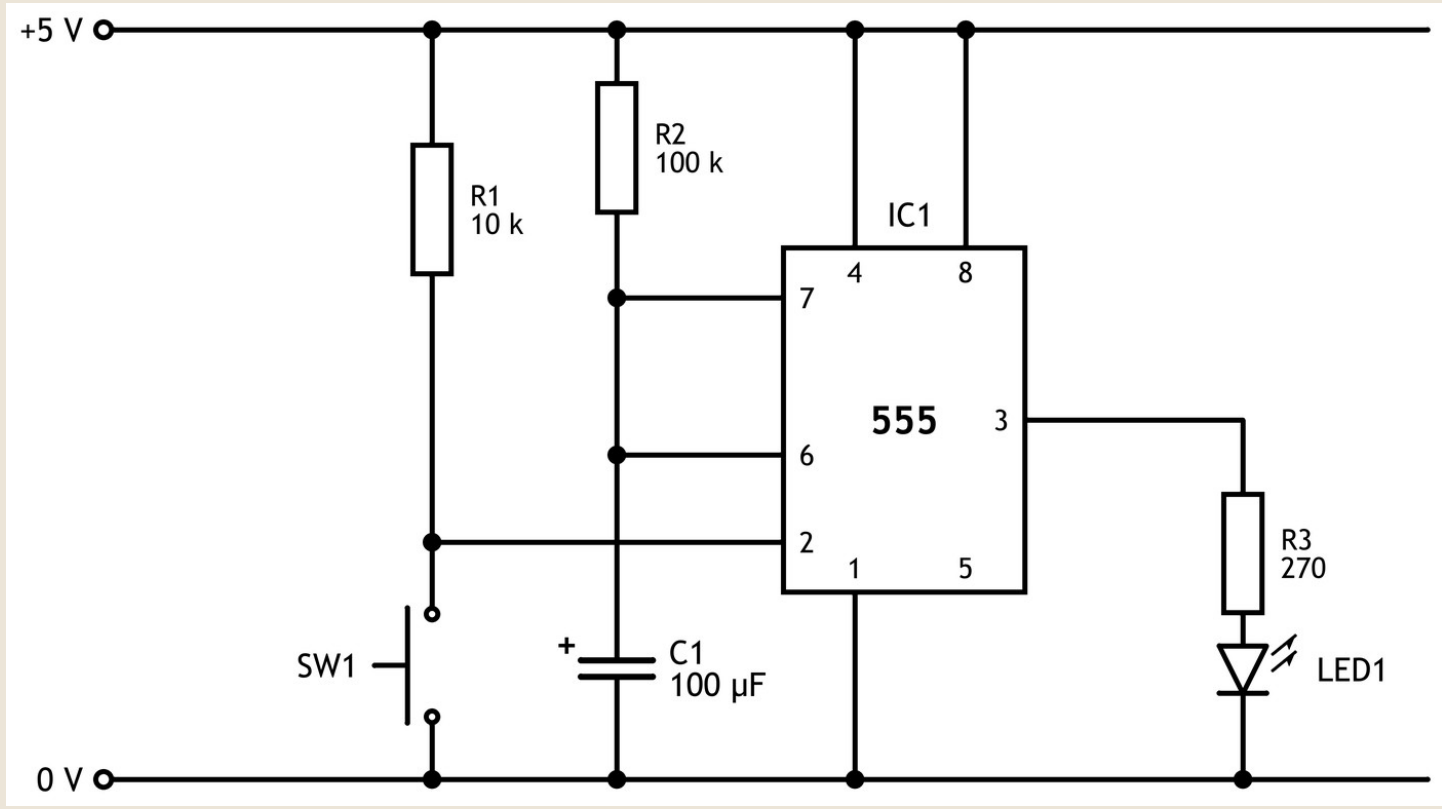
Another Way to Trigger It

Push-to-make switch: pin 2 to **0 V**.

R1 holds pin 2 **high**.

Press: pin 2 **low**, the pulse **starts**.

Exam papers draw it **this way**.



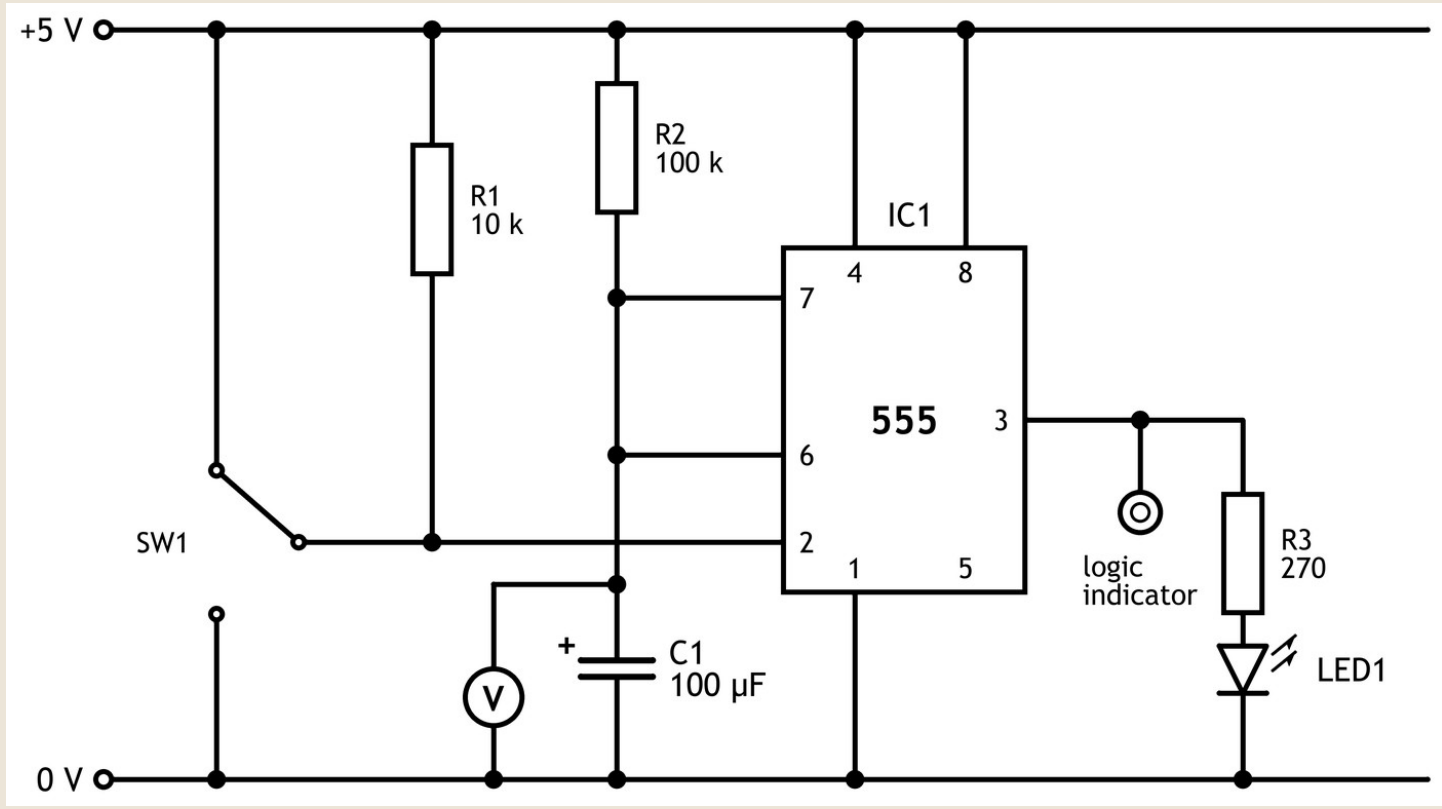
Simulate It in Yenka

Voltmeter across **C1**.

Logic indicator on **pin 3**.

Red: high. **White**: low.

Time how long it stays **red**.



Your Turn: Yenka

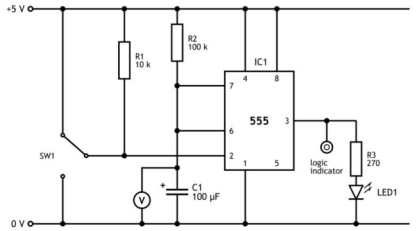
Task 1 (B6-L3-p17-18)

Build the circuit in **Yenka.**

Time the pulse. Then **predict** and **test** R2 = 47 kΩ.

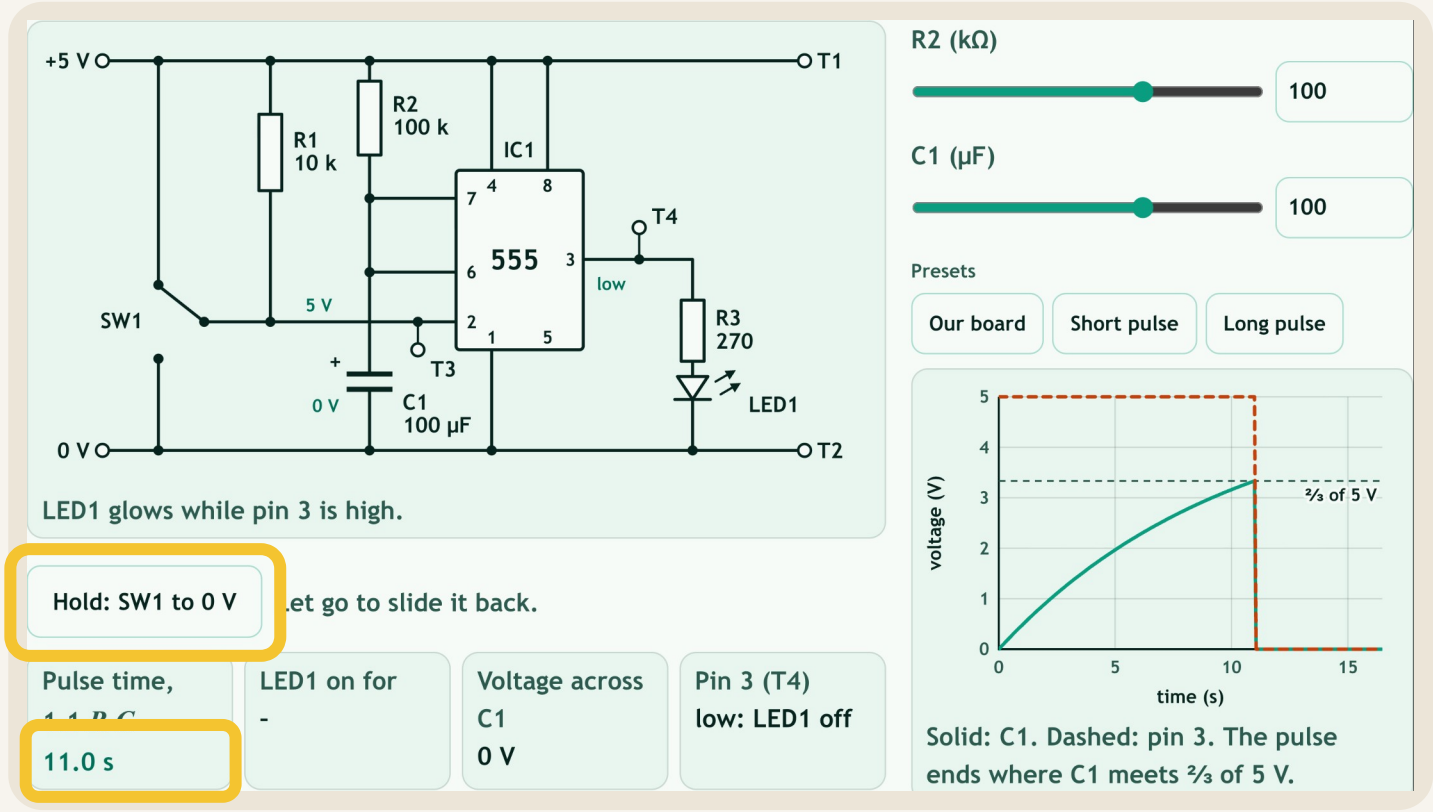
TASK 1 — Yenka: simulate it first

1. **Open** Yenka (Electronics). **Build** the circuit above.
2. **Add** a voltmeter across C1 and a logic indicator on pin 3, as in the diagram below.
3. **Slide** SW1 to 0 V and straight back. **Time** how long the logic indicator stays red.
4. Watch the voltmeter. **Record** C1's voltage when the logic indicator turns white.



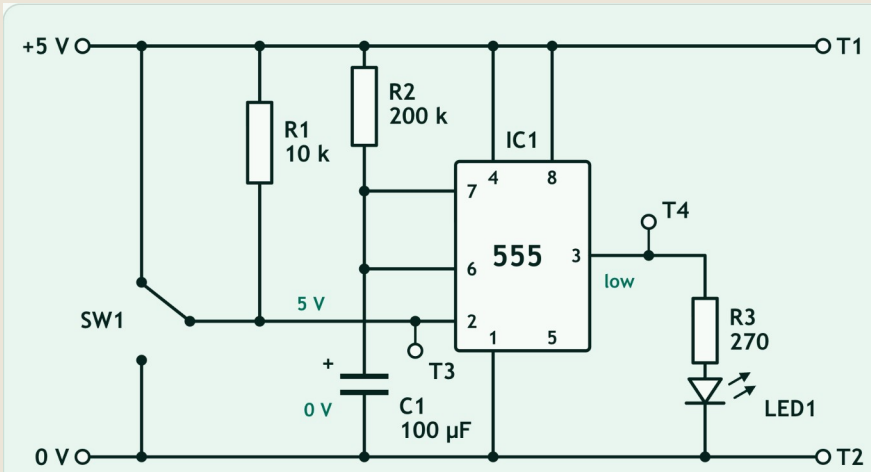
	Pulse time (s)	C1 voltage when it ends (V)
R2 = 100 kΩ		
R2 = 47 kΩ (predict first, then measure)		

Monostable Bench: Our Board



R2 **100 kΩ**, C1 **100 µF**: pulse time **11 s**. **Hold** the button to start it.

R2 is changed to **200 kΩ**. **Predict** the **pulse time.**



LED1 glows while pin 3 is high.

Hold: SW1 to 0 V

Let go to slide it back.

Pulse time,	LED1 on for	Voltage across C1	Pin 3 (T4)
1.1 *R C*	-	0 V	low: LED1 off
?			

R2 (kΩ) 200

C1 (µF) 100

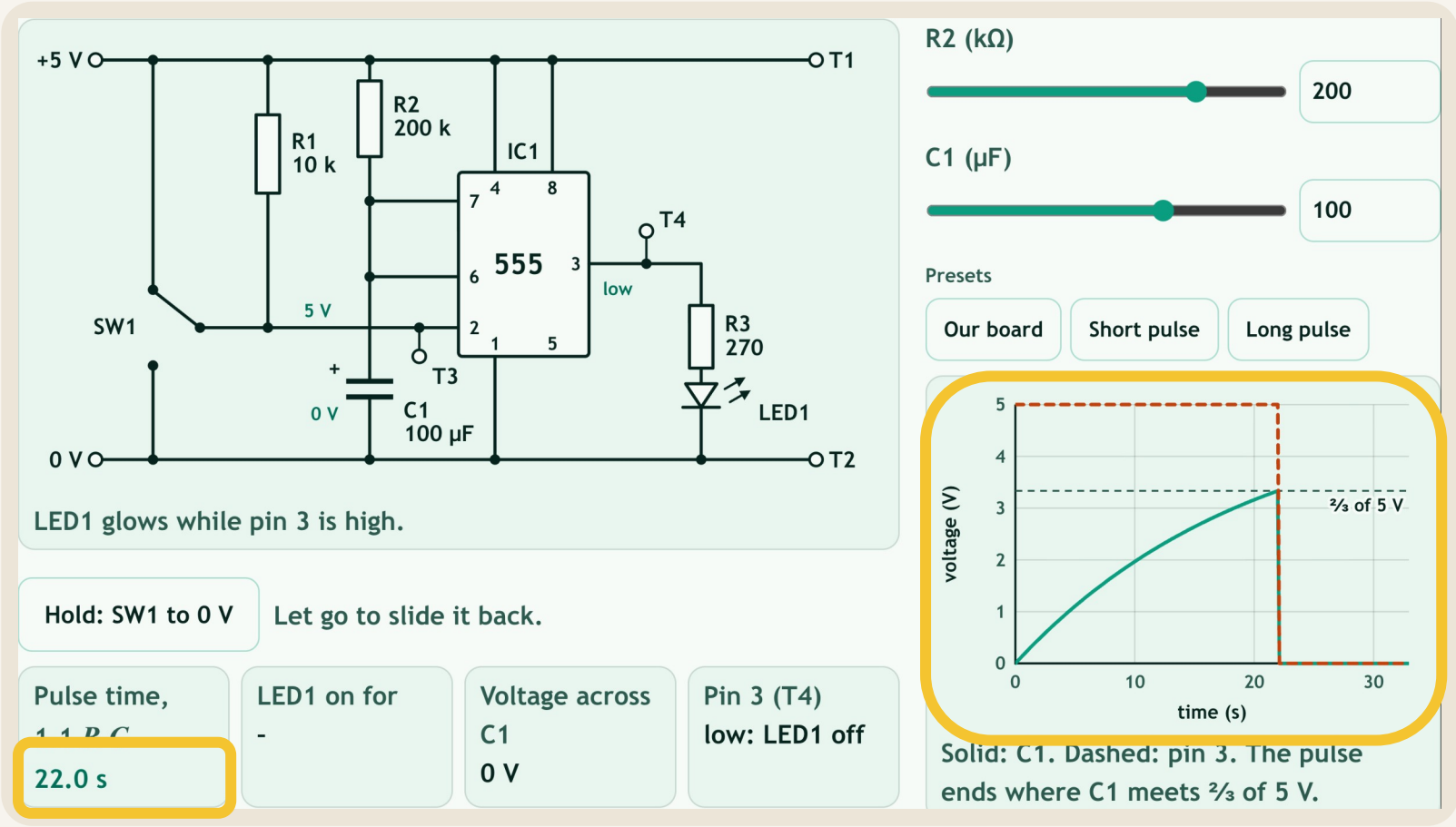
Presets: Our board | Short pulse | Long pulse

?

Solid: C1. Dashed: pin 3. The pulse ends where C1 meets ⅔ of 5 V.

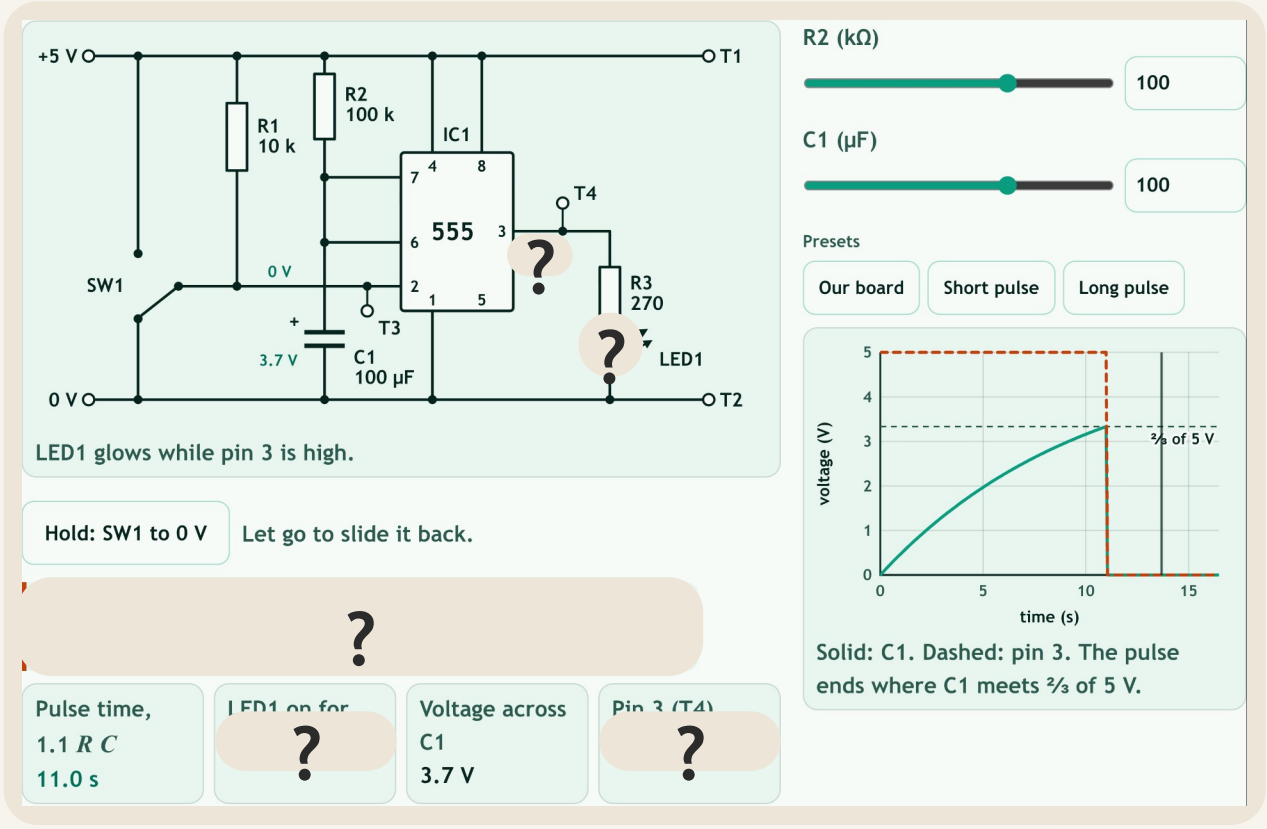
22 s: double R2, double the pulse

Reveal: R2 at 200 kΩ



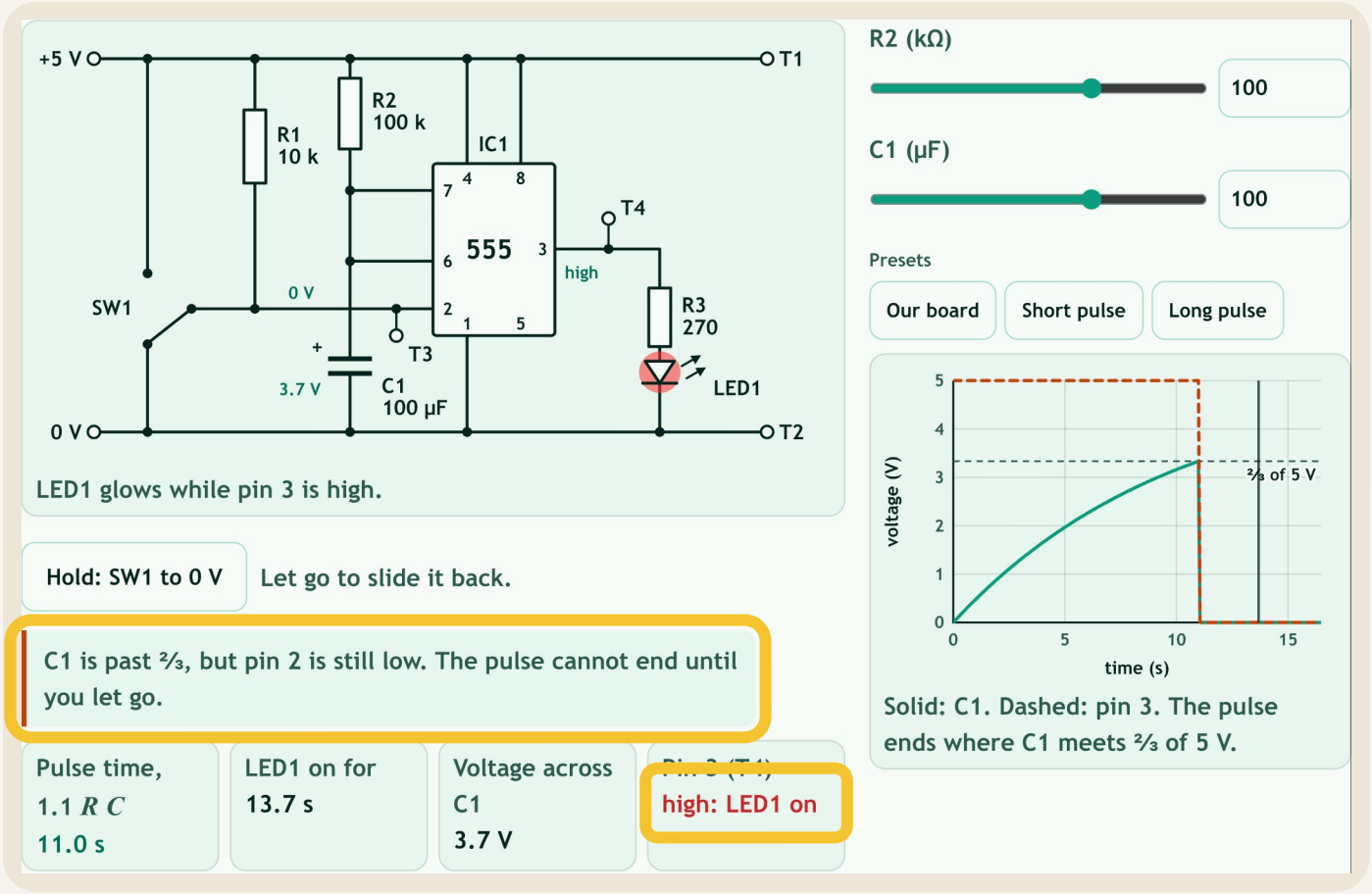
R2 **doubled**: the pulse time **doubled**, to **22 s**.

Back to 100 kΩ. SW1 is **held** at 0 V for **14 s**. **Predict** when LED1 goes **off**.



When SW1 is let go: pin 2 is still low

Reveal: Held Past 11 s



Pin 2 **still low**: the pulse **cannot end** until SW1 goes back.

Look back — by the end of this part…



1. I can **simulate** a **monostable** in Yenka and **time** its **pulse**

Daily Review

1	**State** the **pin** that **starts** the pulse.	Pin 2
2	Bigger C1. **State** the **effect**.	Longer pulse
3	**State** when the pulse **ends**.	C1 reaches two thirds
4	5 Ω and 20 Ω in **parallel**. **Calculate** R_T.	4 Ω
5	7.5 kΩ ±10 %. **Determine** the **maximum**.	8250 Ω

PART 2

Build and Test

We are learning to build a monostable on breadboard and test it.

By the end of this part…



1. I can **plan** a monostable on the **Breadboard Builder**
2. I can **check** parts, do a **pre-power-up** check and **test** it
3. I can **draw** a 555 **circuit diagram** from a **stripboard layout**

Why Breadboard First

Breadboard: no solder, easy to **change**: for **testing**.

Stripboard: soldered, **finished** circuit.

PCB: **many** copies.

A **column** of 5 holes is **joined**.

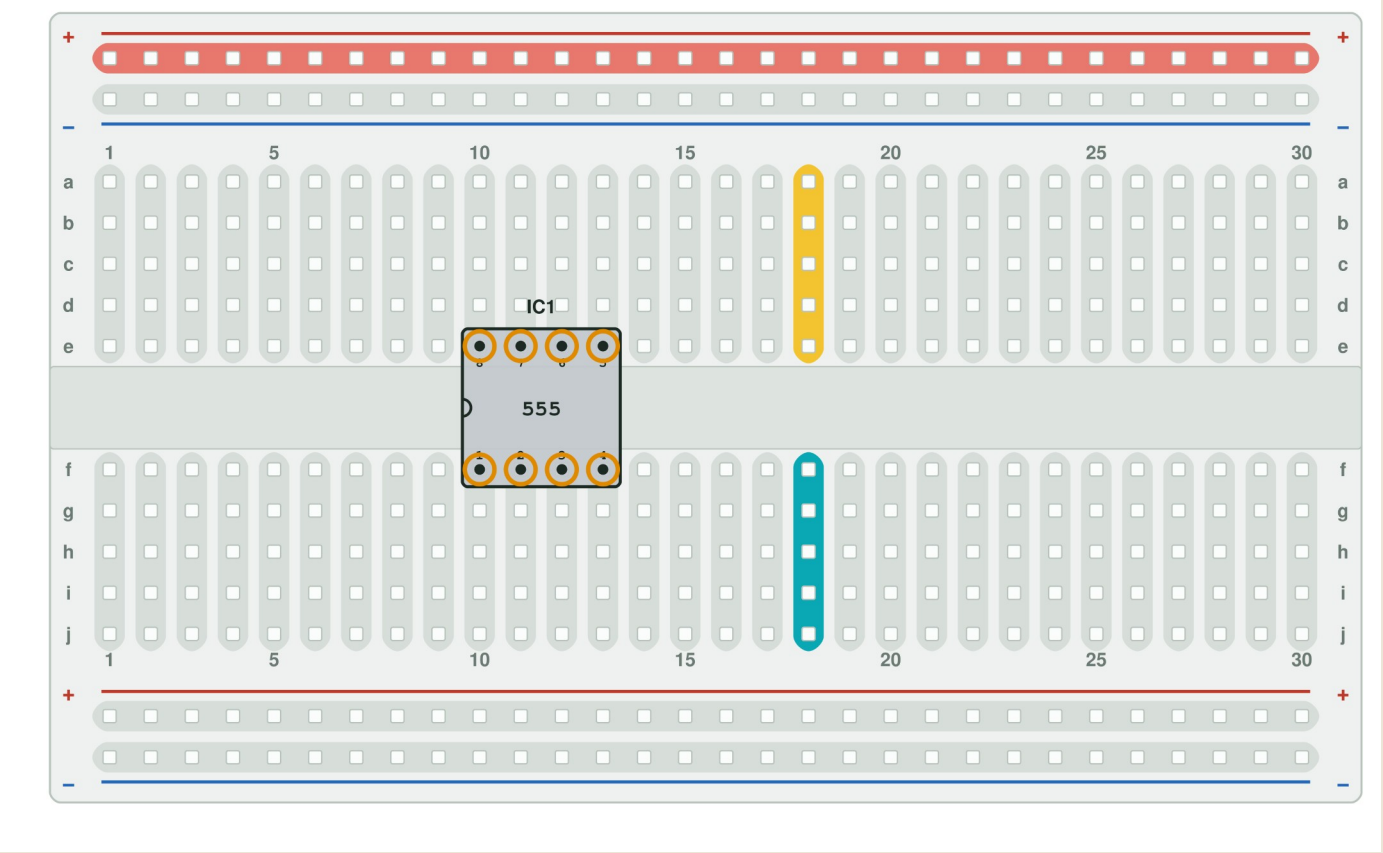
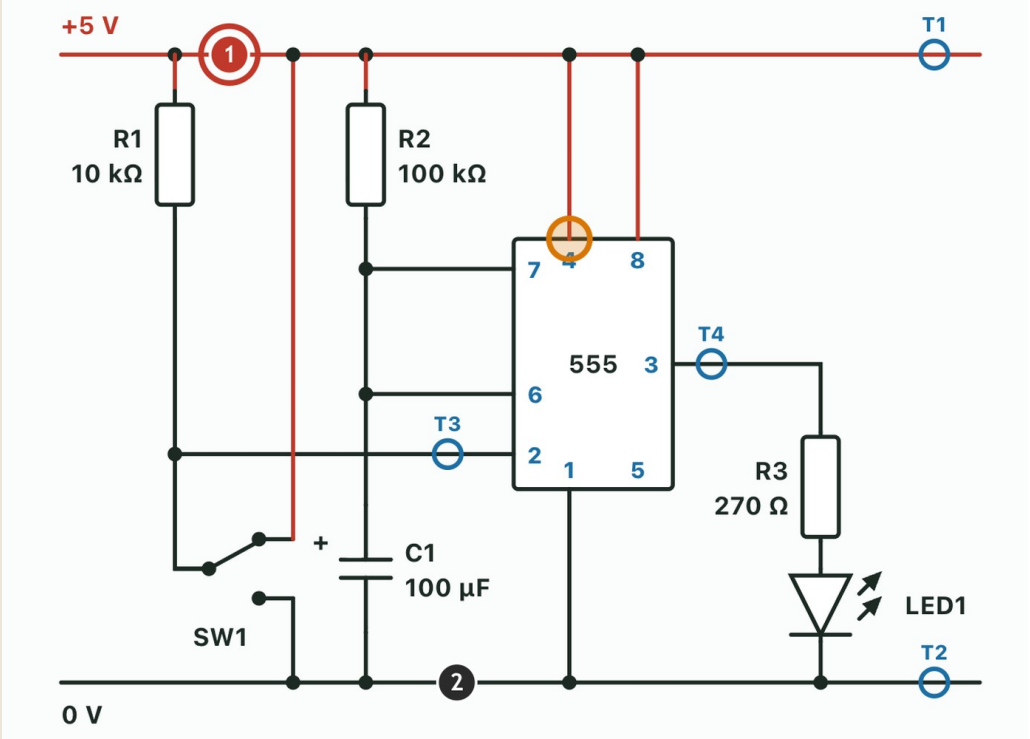
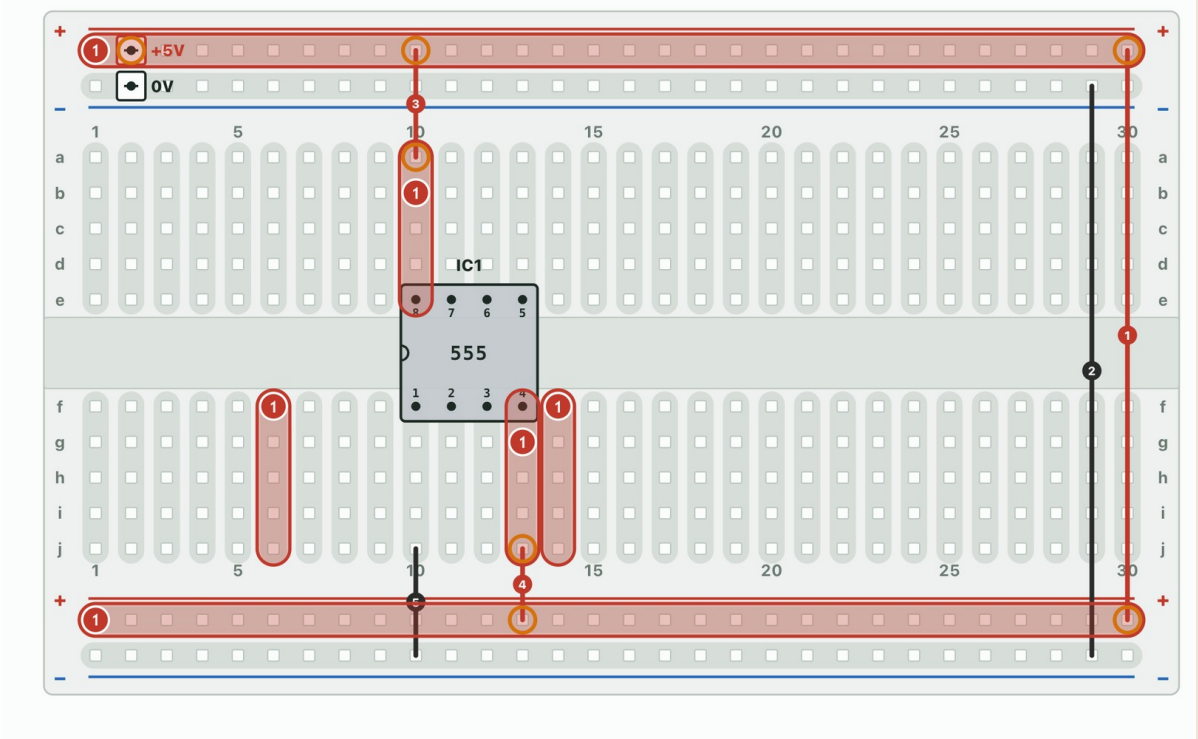


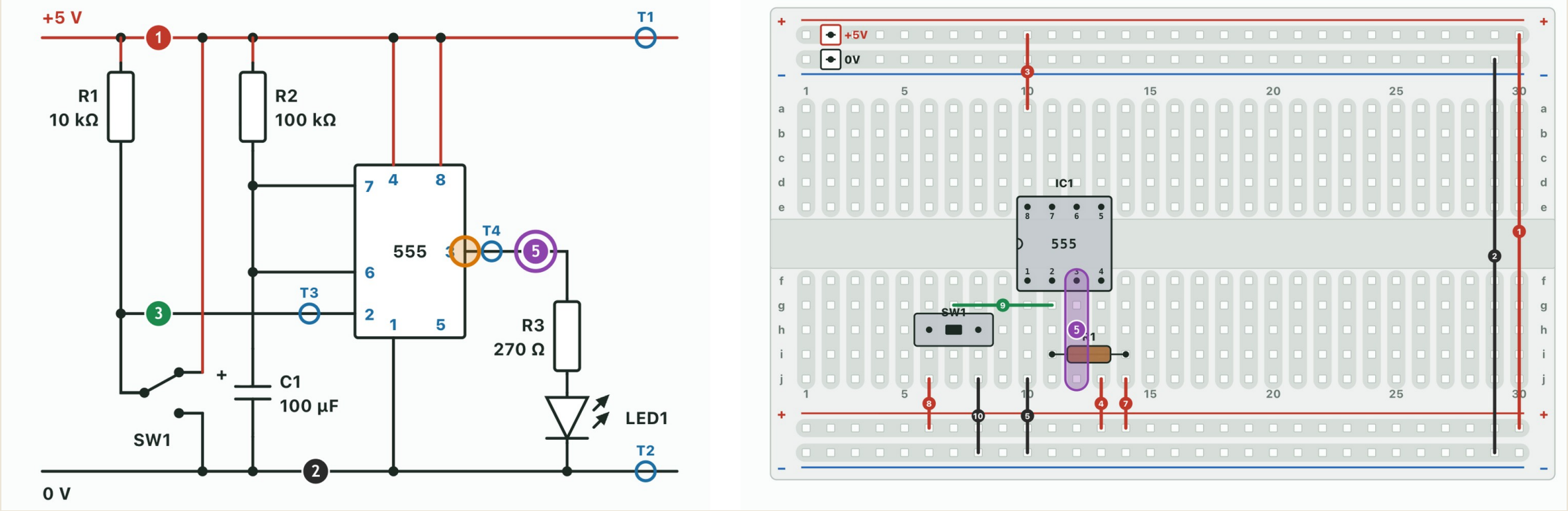
Diagram to Breadboard: 1 of 3





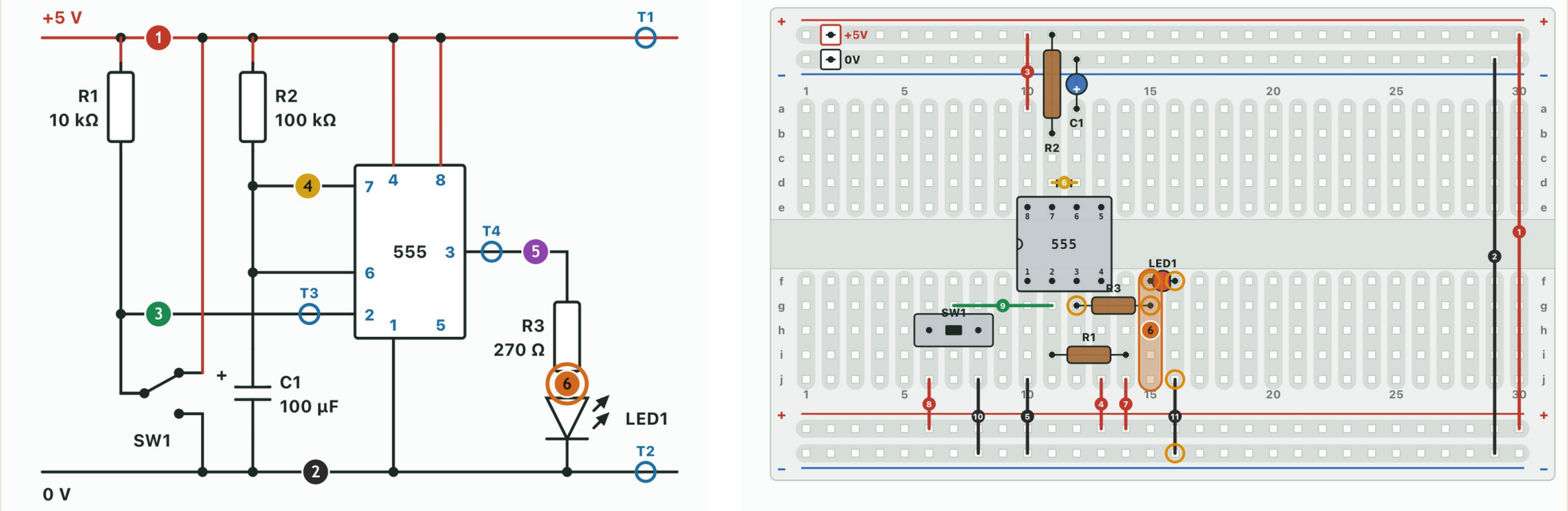
Net **1**, **+5 V**: pins 8 and 4 to the + rail.

Diagram to Breadboard: 2 of 3



Net **5**, **pin 3**: the **output** column.

Diagram to Breadboard: 3 of 3



Net **6**: **R3** to LED1, LED1 to **0 V**.

Your Turn: Plan It

Task 2 (B6-L3-p19)

Follow the guide on the Lesson 3 page.
Plan it on the **Breadboard Builder**.
Fill in the **wiring schedule**.

Scan me

PERIOD 2 STARTS HERE

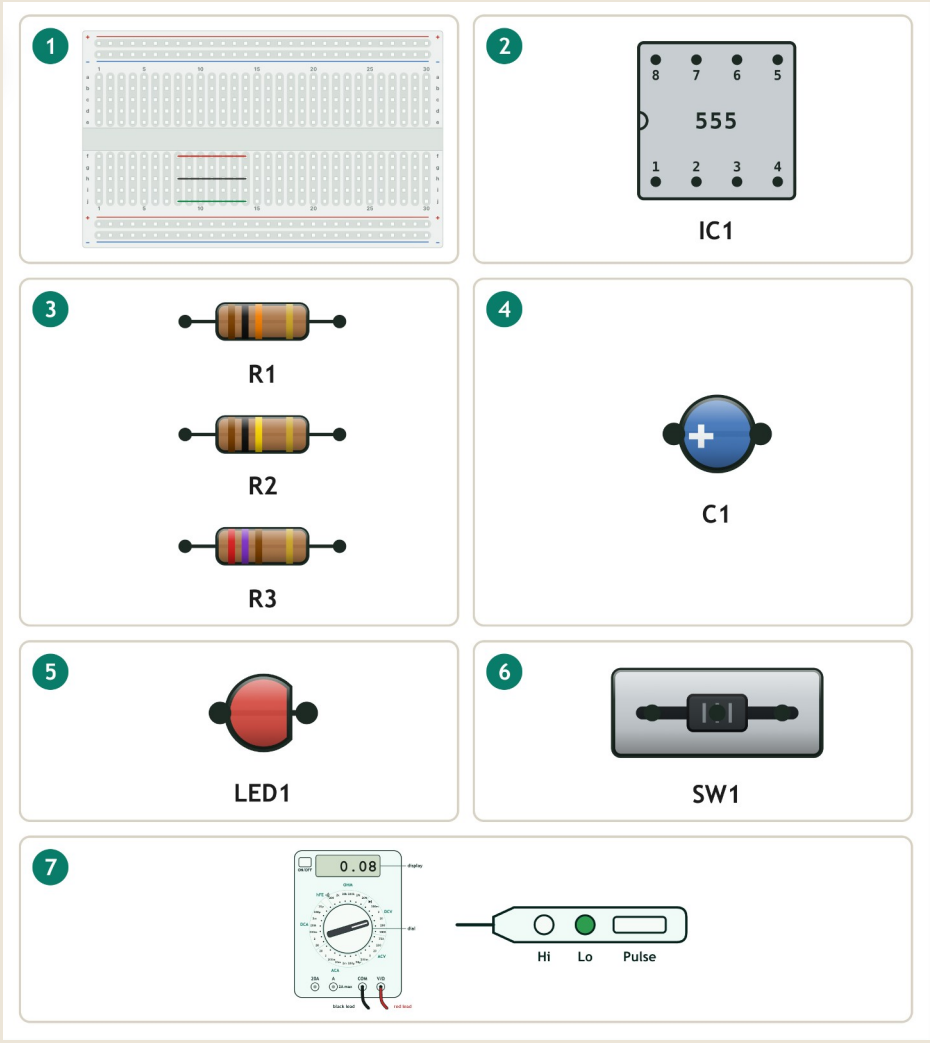
Build It

Collect the kit, check it, then build.

What to Collect

Collect one set each.

1. **Breadboard**, **jumper wires**
2. **555** timer (IC1)
3. **R1** 10 kΩ, **R2** 100 kΩ, **R3** 270 Ω
4. **C1** 100 µF
5. **Red LED** (LED1)
6. **Slide switch** (SW1)
7. **Multimeter**, **logic probe**



Your Turn: Check It

Tasks 3-4 (B6-L3-p20)

Check each part with the **meter**.
Then the **pre-power-up** check: **every** row.

SAFETY Supply **off** to build.

TASK 3 — Check the parts
Check every part **before** it goes in. Use the Testing jobs table in section 1.

Part	Setting	Expected	Measured	OK?
R1	OHM 20k	10 kΩ: reads 9.5 to 10.5		
R2	OHM 200k	100 kΩ: reads 95 to 105		
R3	OHM 2k	270 Ω: reads about 0.27		
LED1	diode check	a number one way round, 1 the other		
SW1	continuity	middle pin beeps to one outer pin, then the other		

TASK 4 — Pre-power-up check
Fill this in **before** the supply is connected. Power on only when every row is done.

Date	Test point	Description of test	Result	Changes made
	T1 to T2	No short between the supply rails: continuity setting, no beep.		
	—	IC1 straddles the centre gap, notch and pin 1 on the left.		
	—	C1 the right way round: + leg to pins 6 and 7, − leg to 0 V.		
	—	LED1 the right way round: long leg to R3, short leg to 0 V.		
	—	Every wire matches the wiring schedule.		
	—	Supply set to 5 V before it is connected.		

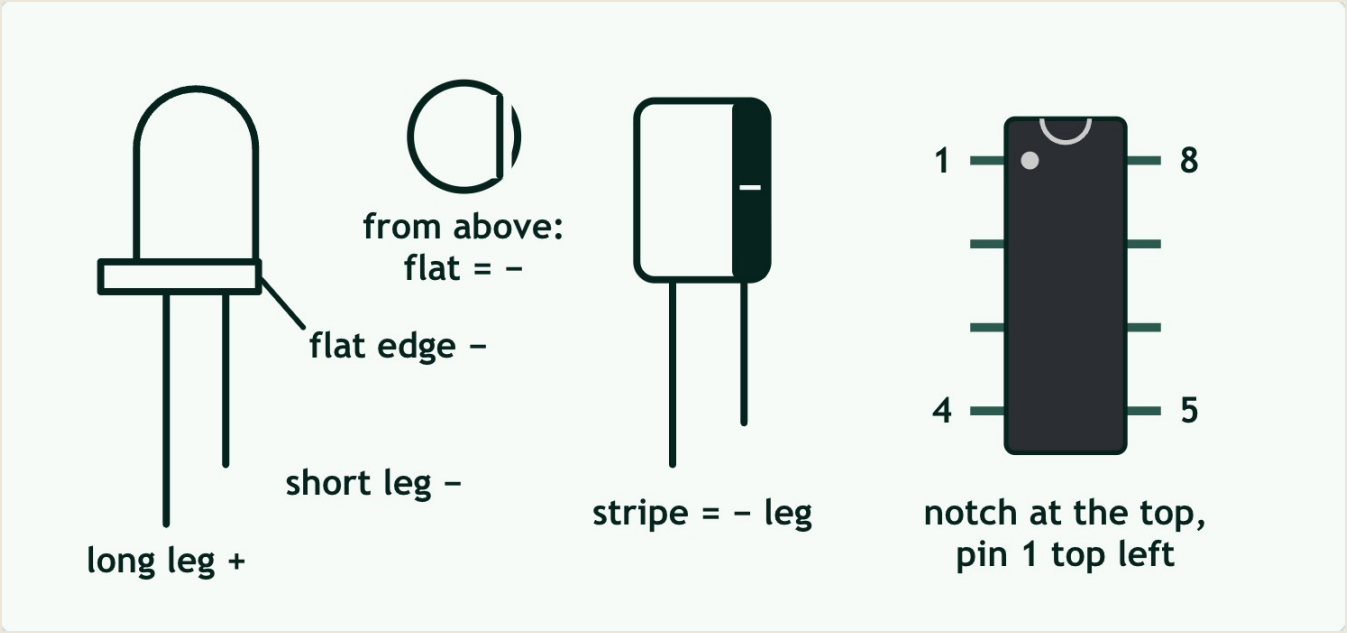
Pre-power-up Checks

No short: T1 to T2, **no beep**.

IC1, **C1**, **LED1** the right way **round**.

Right **values** in the right **places**.

Supply set to **5 V** first.

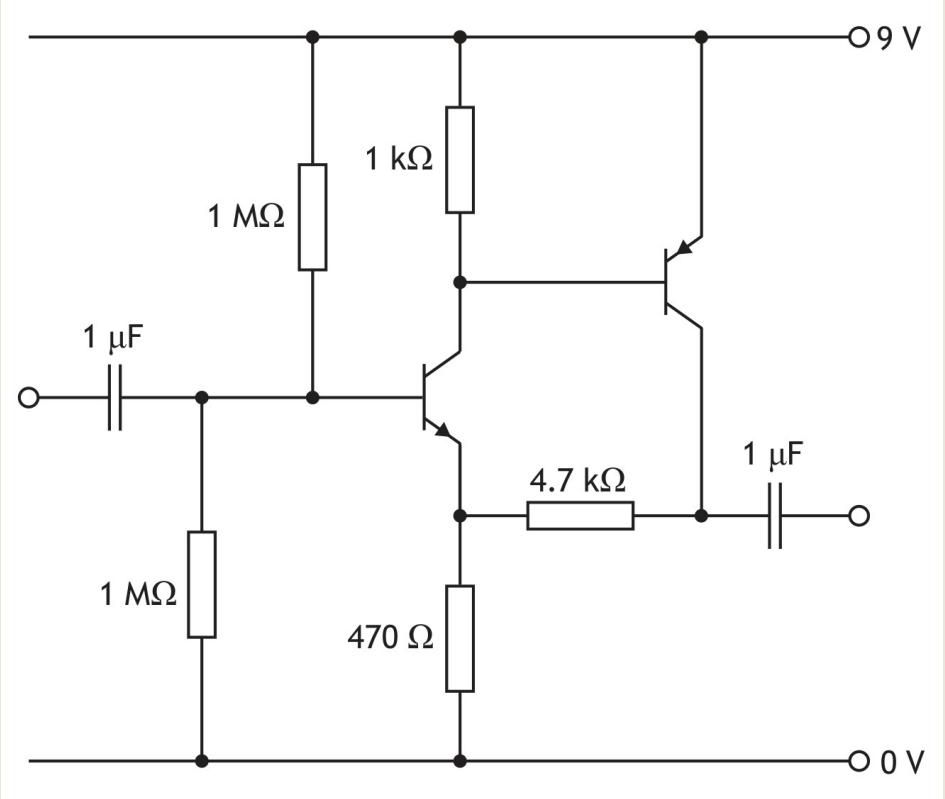


2024 Question 6

6. A technician constructed a circuit from the schematic diagram shown below.

Complete the following table by giving **three** pre-power up checks for this circuit. **3**

Pre-power up checklist
Correct power supply voltage



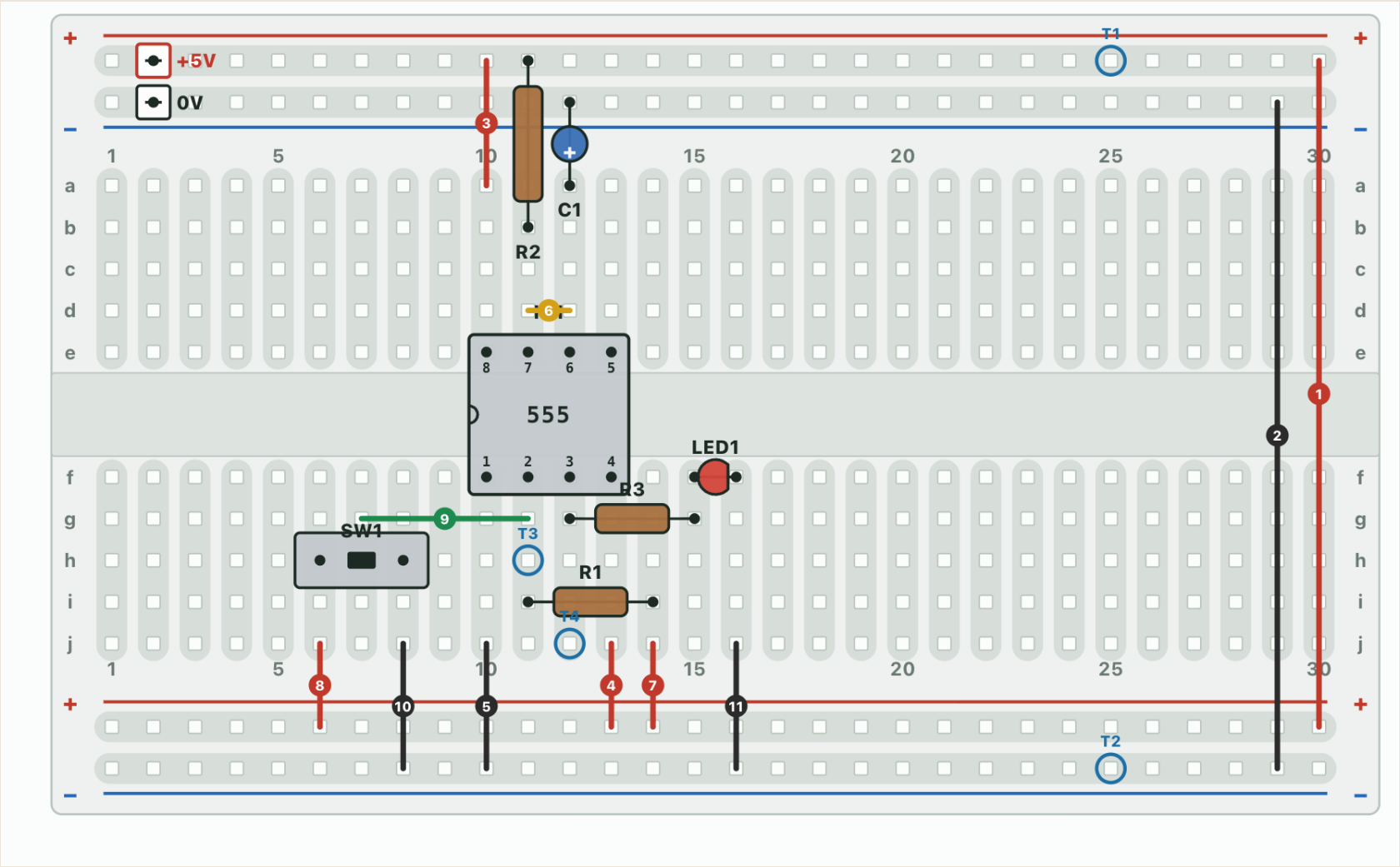
Marking: 2024 Question 6 (1 of 2)

Question	Expected response	Max mark	Additional guidance
6.	Any three from • Check that there is no short circuit across the circuit supply terminals • Power supply correct way round (0V lower rail) • Transistors in correct position or location • Transistor orientations correct	3	Any other suitable response

Marking: 2024 Question 6 (2 of 2)

Question	Expected response	Max mark	Additional guidance
6.	• Resistor values • Capacitor values correct • Resistors in correct location • Capacitors in correct location • Check wiring is secure • Check for solder bridges	3	Any other suitable response

Build It: Bench Card 1

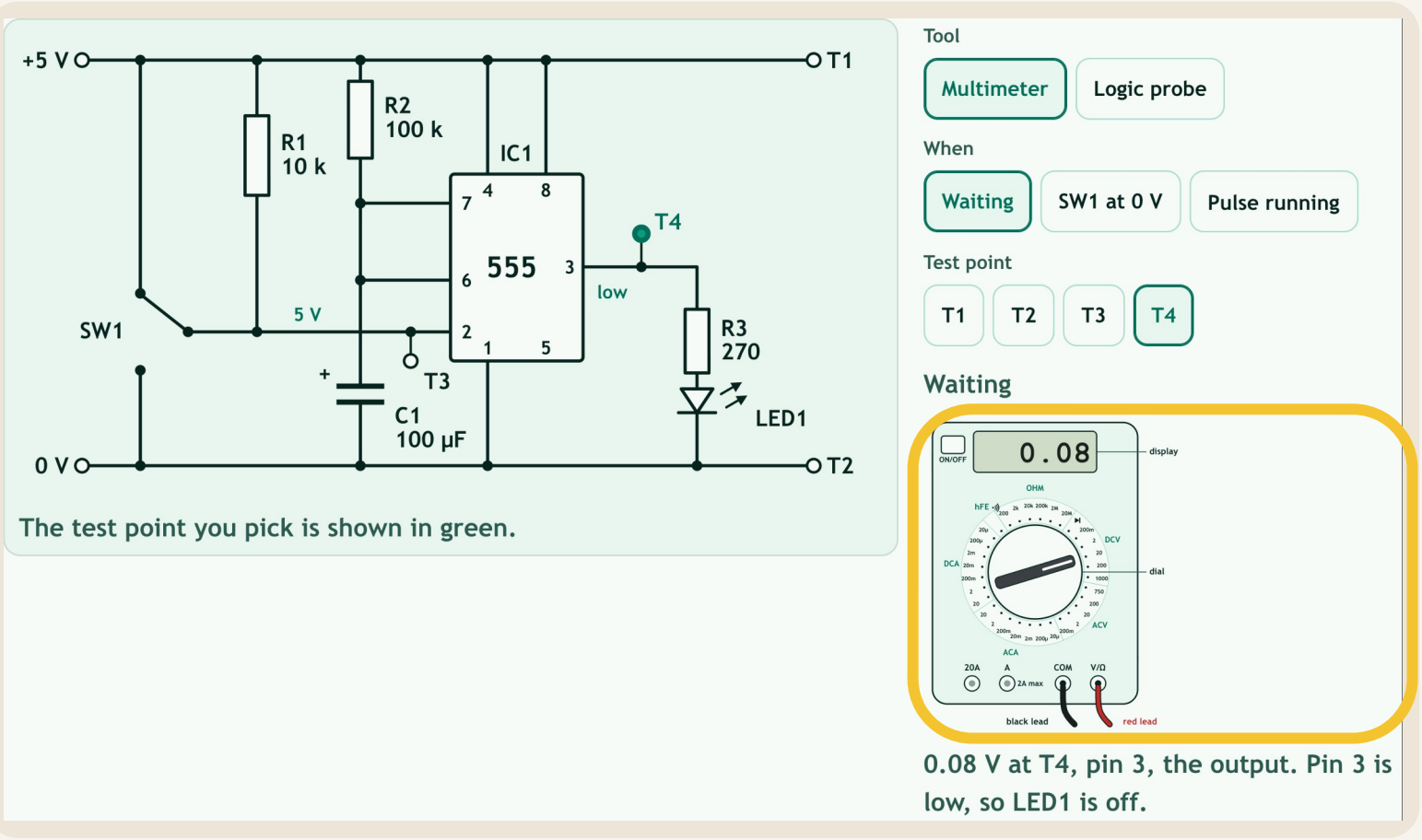


PERIOD 3 STARTS HERE

Test It

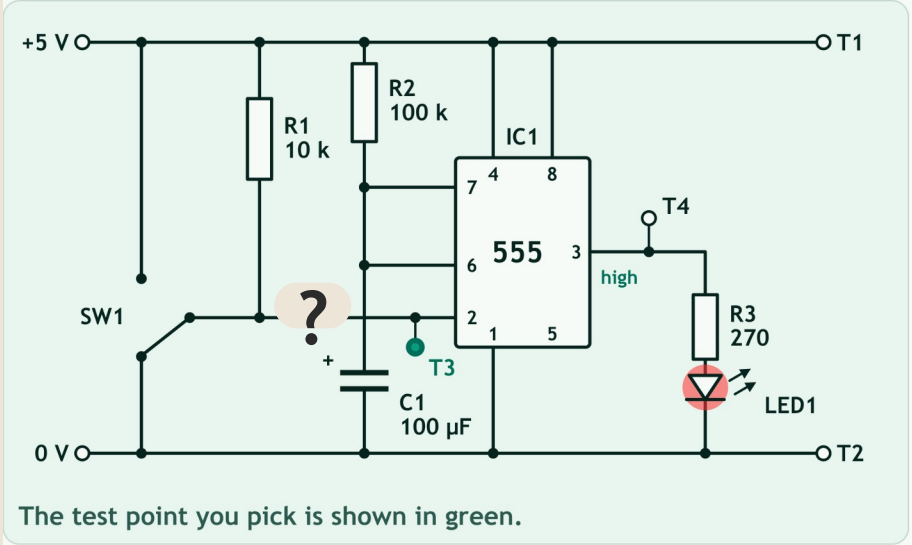
Meter and probe on your board, then find the faults.

Test Your Board



Meter on **DCV 20**, black on **T2**. **Waiting:** T4 reads about **0 V**.

SW1 is **held** at 0 V. **Predict** the reading at **T3**.



Tool

Multimeter | Logic probe

When

Waiting | SW1 at 0 V | Pulse running

Test point

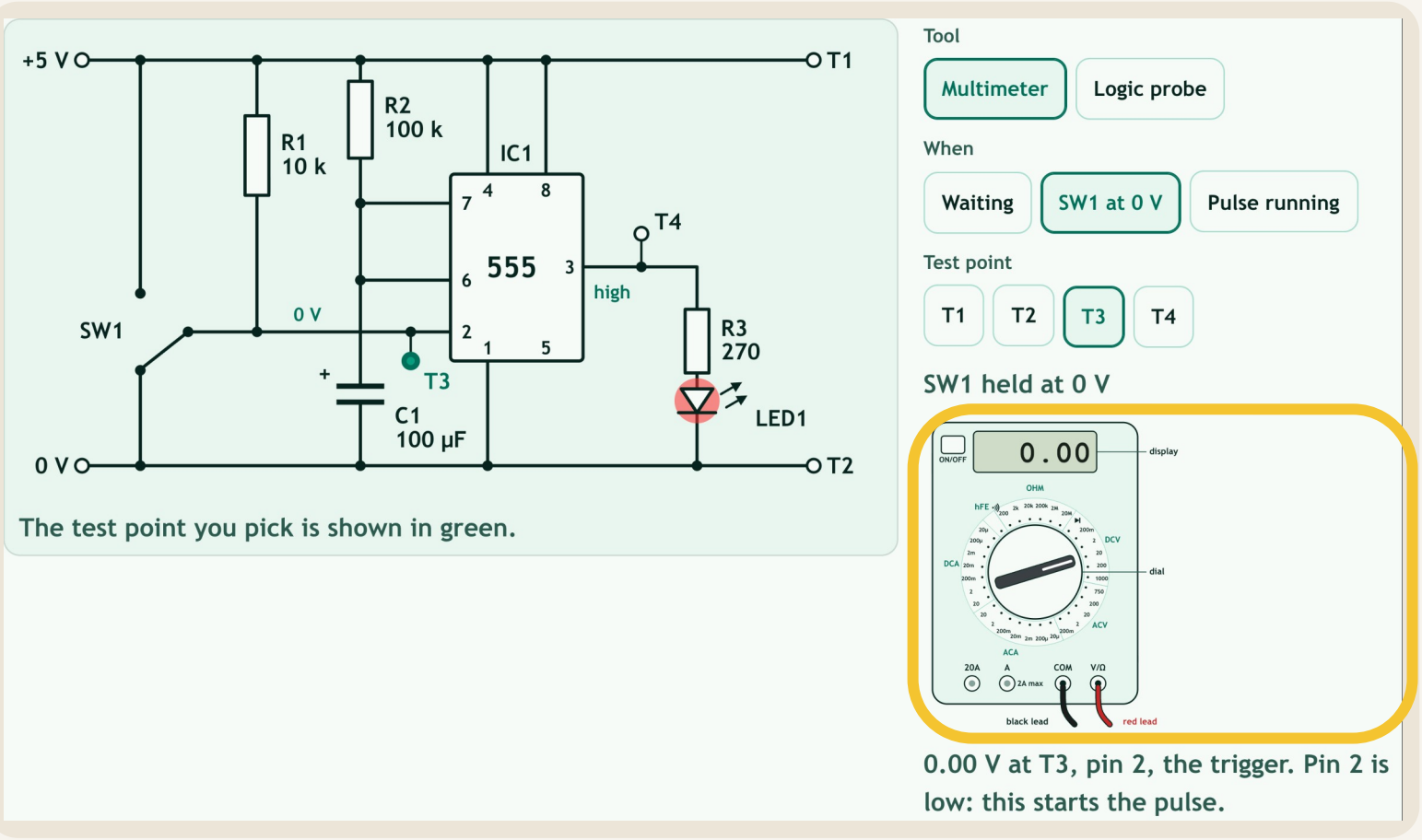
T1 | T2 | T3 | T4

SW1 held at 0 V

?

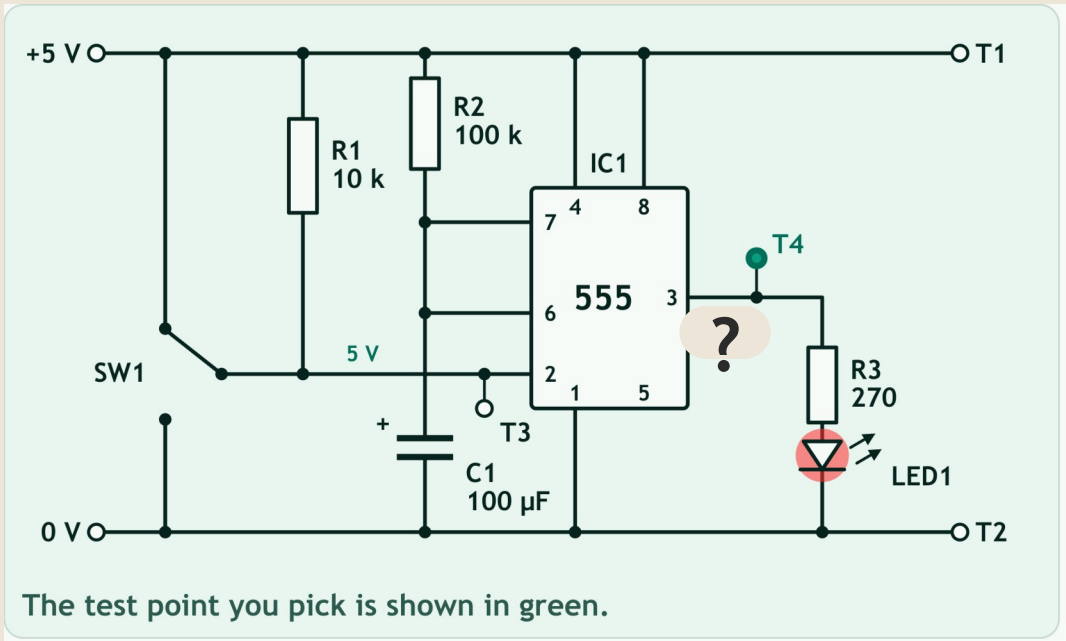
0.00 V: pin 2 is low

Reveal: T3 With SW1 at 0 V



SW1 at **0 V**: T3 reads **0.00 V**. Pin 2 is **low**: the pulse **starts**.

The pulse is **running**. **Predict** what the **probe** shows on **T4**.



Tool

Multimeter | Logic probe

When

Waiting | SW1 at 0 V | Pulse running

Test point

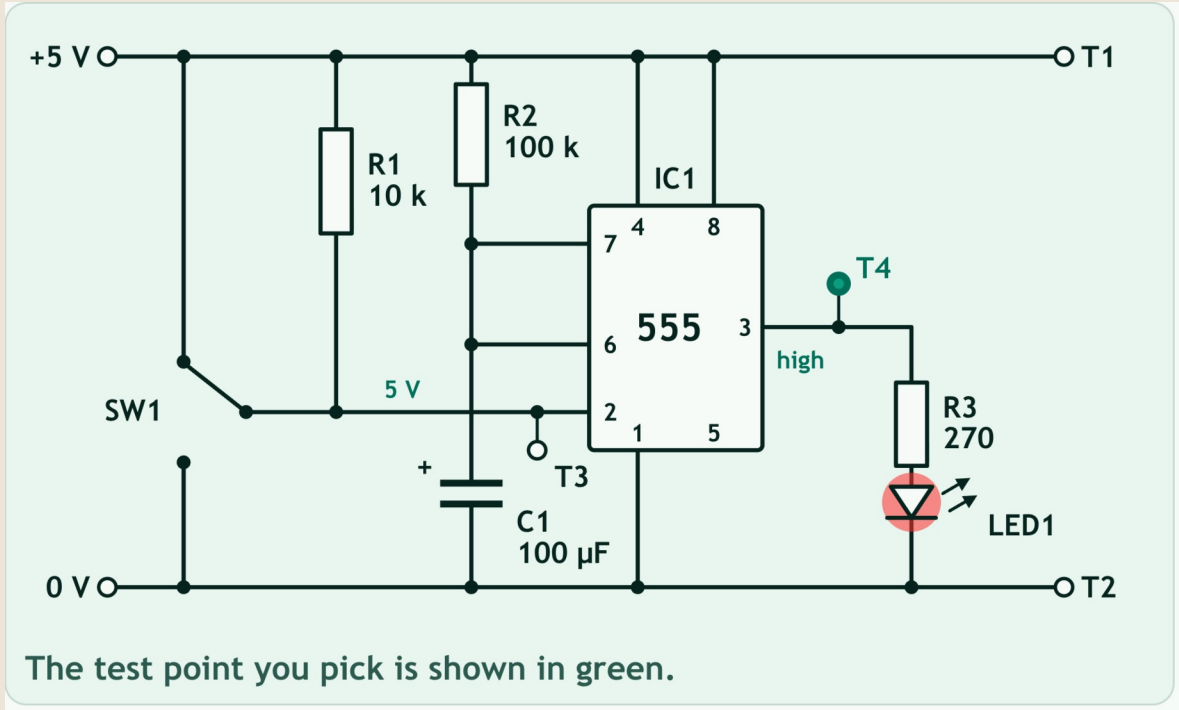
T1 | T2 | T3 | T4

Pulse running, SW1 back at +5 V

?

Red (Hi), steady: pin 3 is high

Reveal: Probe on T4



The test point you pick is shown in green.

Tool

Multimeter | Logic probe

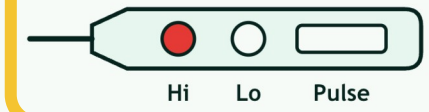
When

Waiting | SW1 at 0 V | Pulse running

Test point

T1 | T2 | T3 | T4

Pulse running, SW1 back at +5 V



Red Hi LED on at T4, pin 3, the output. It is at logic 1 (high). It stays red for the whole pulse. It does not flash: one pulse, not a stream.

Red, steady for the **whole** pulse: pin 3 is **high**.

Fault From Readings

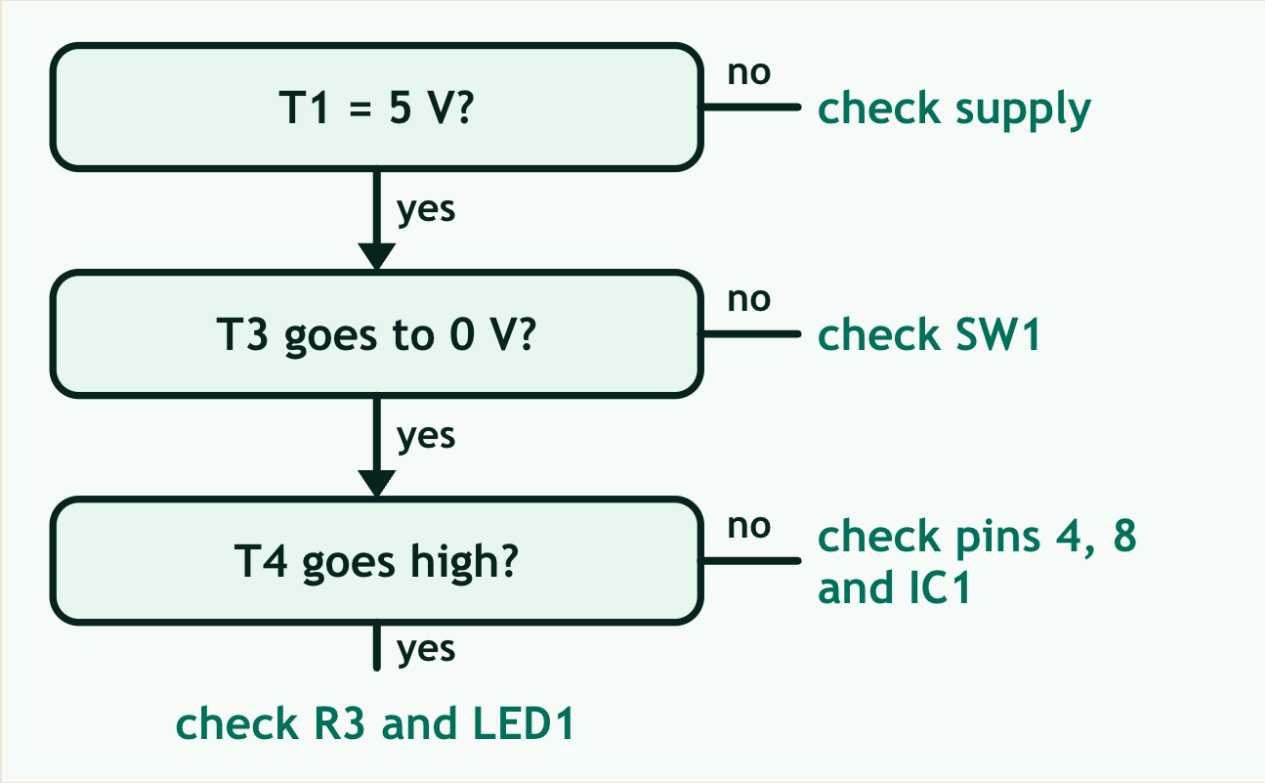
Test **supply** to **output**.

T1 not 5 V: the **supply**.

T3 never 0 V: **SW1**.

T4 never high: pins **4**, **8**, IC1.

T4 high, LED1 off: **R3**, **LED1**.



Your Turn: Test It

Tasks 5-6 (B6-L3-p21)

Test T1 to T4 with the **meter**, then the **probe**.

Time 3 pulses. Then **Task 6**.

SAFETY Power **off** to change it.

TASK 5 — Test it

Meter on DCV 20, black probe on T2. Slide SW1 to 0 V and straight back to start a pulse.

Test point	What it is	Waiting: expected	Measured	During the pulse: expected	Measured
T1	+5 V supply	5 V		5 V	
T2	0 V	0 V		0 V	
T3	pin 2, trigger	5 V		0 V while SW1 is at 0 V	
T4	pin 3, output	about 0 V		3.5 V to 5 V	

Now the logic probe, on TTL and Pulse. Clip it to this board's +5 V and 0 V.

Point	Waiting: expected	Seen	During the pulse: expected	Seen
pin 2	high (red)		low (green) while SW1 is at 0 V	
pin 3	low (green)		high (red)	

Time the pulse three times.

Try 1 (s)	Try 2 (s)	Try 3 (s)	Average (s)	Predicted (s)
				T ≈ 1.1 × R2 × C1 = 11

Give one reason your average might not be exactly 11 s. (1)

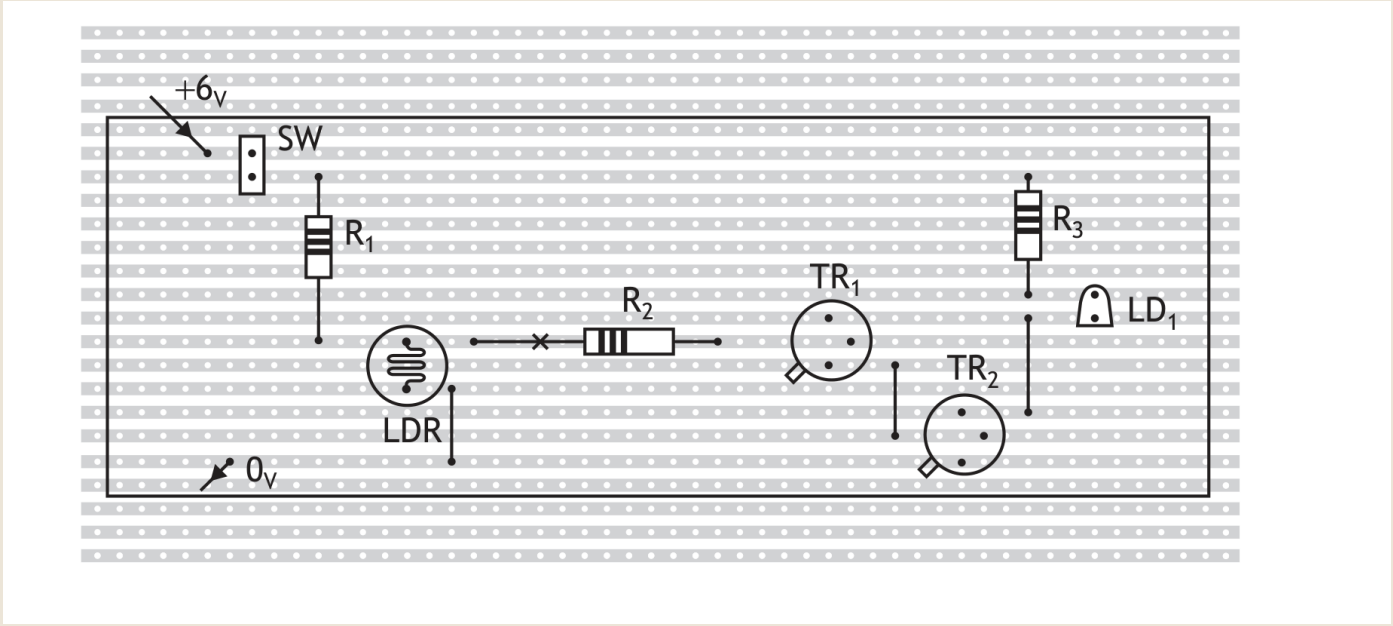
TASK 6 — Fault from readings

(a) The LED never lights. T1 reads 5.0 V and T3 stays at 5 V, even when SW1 is slid to 0 V. **Suggest** the fault. (1)

(b) The LED is on all the time. T3 reads 0 V all the time. **Suggest two** possible faults. (2)

2024 Question 11

11. The stripboard plan below shows a **component (top) view** of a circuit with the following layout.



Draw a circuit diagram for this circuit.
Each component must be labelled.

6

2024 Question 11 (continued)

11. Component data

TR_1 and TR_2 — BFY51 npn transistors

LD_1 — 5 mm standard led (red)

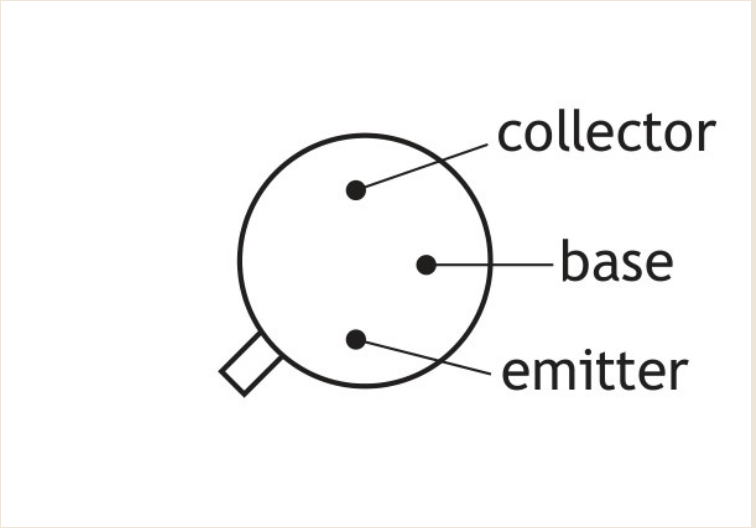
LDR — ORP12 light dependent resistor

R_1 — carbon film 10 K 0.25 w

R_2 — carbon film 6K8 0.25 w

R_3 — carbon film 270 R 0.25 w

SW — SPST switch (on/off switch)



2024 Question 11: Net by Net

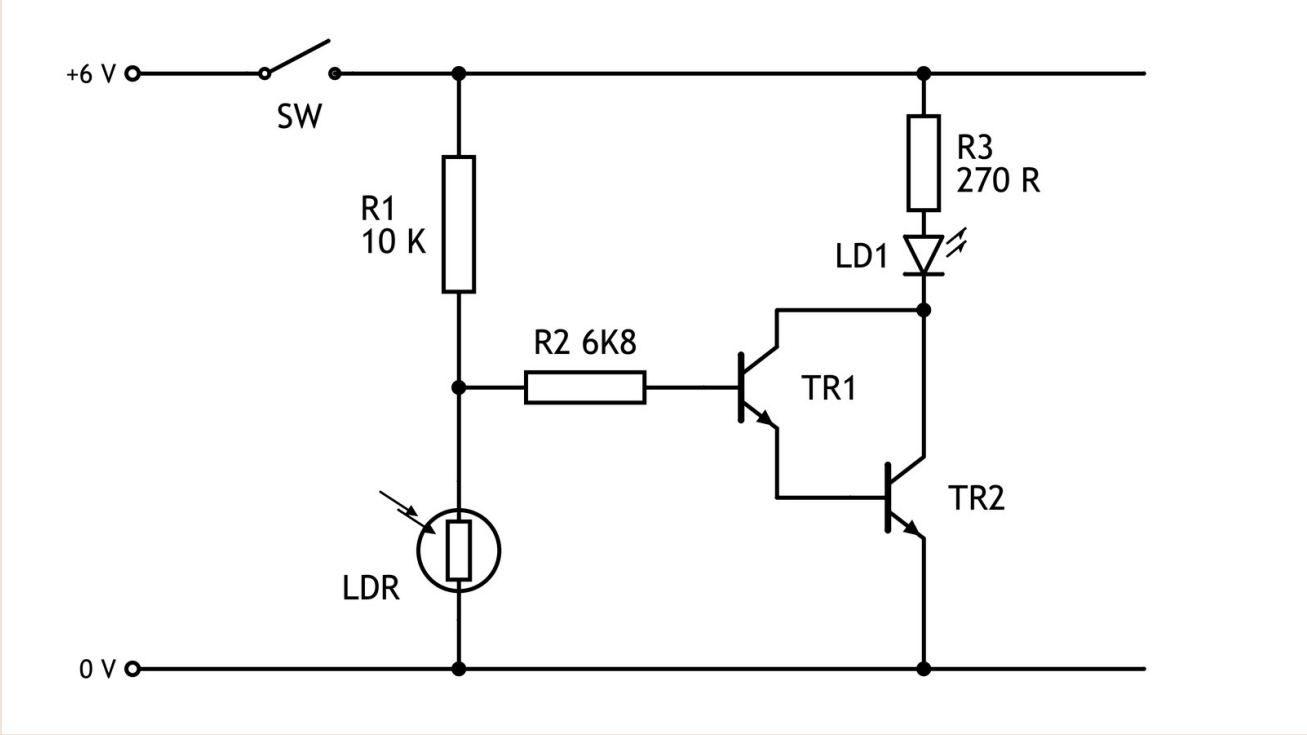
Rails; **SW** in +6 V.

R1 over the **LDR**.

Divider to **R2**, then **TR1**, **TR2**.

Collectors: **LD1**, **R3** to +6 V.

Label every part.



Marking: 2024 Question 11 (1 of 2)

Question	Expected response	Max mark	Additional guidance
11.	Both power rails labelled with nodes (1 mark) Switch in correct position (1 mark) R1, LDR voltage divider to R2 (1 mark)	6	Any errors in circuit symbols max 5 marks, only if candidate has achieved maximum marks for the question

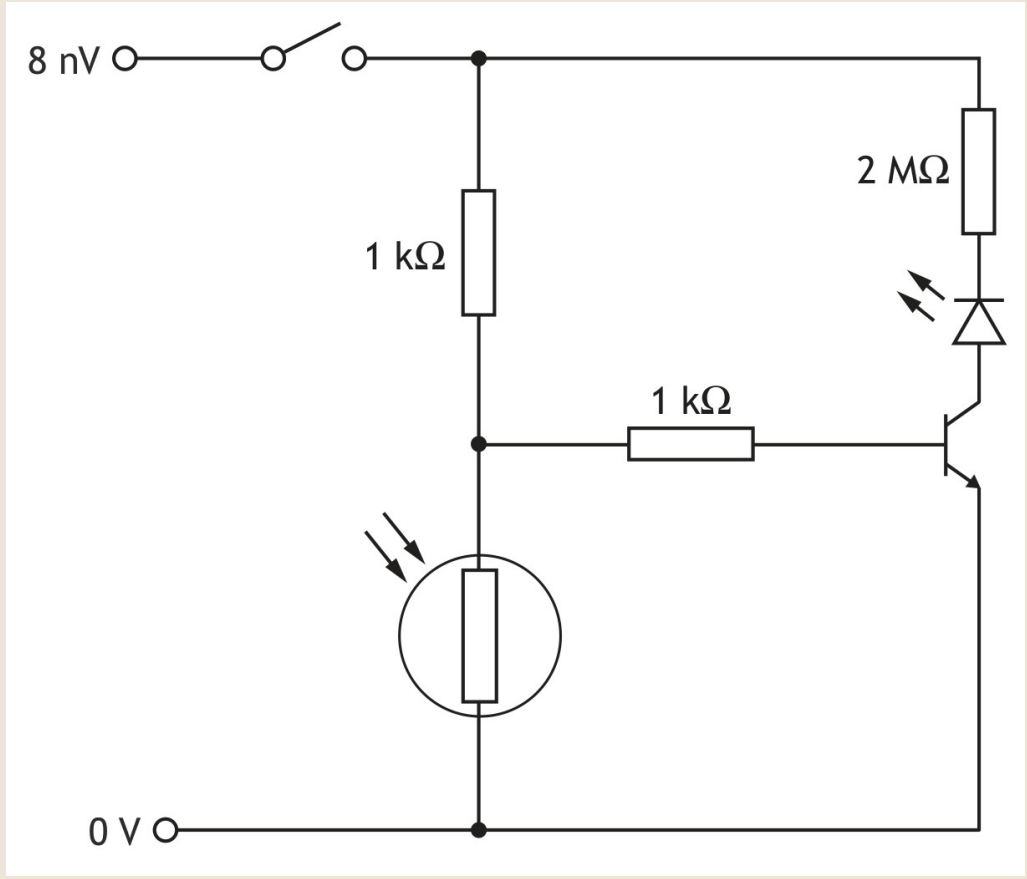
Marking: 2024 Question 11 (2 of 2)

Question	Expected response	Max mark	Additional guidance
11.	Transistor positions/connections in relation to each other and 0v rail. (1 mark) Collectors to + 6V via 270R resistor and LED in series with correct orientation. (1 mark) Component labelling (either values or identifiers) (1 mark)	6	Accept LED1 as the label Accept SPST as a descriptor for SW

2026 Question 6

6. A student simulated the circuit shown.

Identify three errors in this simulation. **3**



Marking: 2026 Question 6

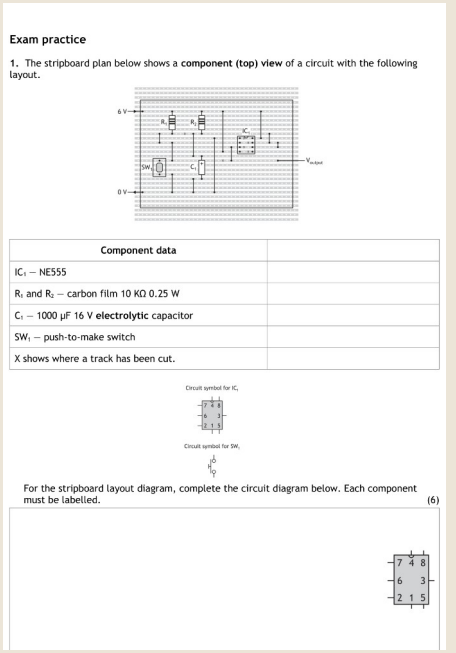
Question	Expected response	Max mark	Additional guidance
6.	• voltage supply value too small • protective resistor for LED too large a value • LED incorrect polarity/orientation	3	Do not accept too large a resistor.

Your Turn: Exam Practice

Exam practice (B6-L3-p22-24)

Answer questions **1** to **3**.

Then **complete** the **key words**.



Exam practice

1. The stripboard plan below shows a **component (top) view** of a circuit with the following layout.

Component data	
IC_1 – NE555	
R_1 and R_2 – carbon film 10 KΩ 0.25 W	
C_1 – 1000 µF 16 V **electrolytic** capacitor	
SW_1 – push-to-make switch	
X shows where a track has been cut.	

Circuit symbol for IC_1

Circuit symbol for SW_1

For the stripboard layout diagram, complete the circuit diagram below. Each component must be labelled. (6)

Look back — by the end of this part…



1. I can **plan** a monostable on the **Breadboard Builder**
2. I can **check** parts, do a **pre-power-up** check and **test** it
3. I can **draw** a 555 **circuit diagram** from a **stripboard layout**

Course Specification — 1 of 3

Circuit simulation and design

- Given a printout of a simulated circuit, identify potential faults, eg incorrect supply voltage, incorrect resistor values or wrong component orientation (test points to be included).
- Compile a pre-power up checklist for a given simulation printout, layout diagram or circuit diagram.
- Given circuit layout diagrams, produce circuit diagrams.

Course Specification — 2 of 3

Circuit construction

- 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):
  - ICs (logic gates, 7400 series or equivalent, 555 timer)

Course Specification — 3 of 3

Circuit construction

- Describe the use of a logic probe and continuity tester in circuit testing.
- Describe the uses of prototype board, stripboard and printed circuit board (PCB) in electronic design and construction.

Credits (1 of 2)

Screenshots and page figures: mrstewartphysics.co.uk, Lesson 3 The 555 Monostable page and its build guide, R Stewart.

Daily Reviews: © Qualifications Scotland (SQA). N5 Practical Electronics 2024 Q1(b)(iii), Q2; 2025 Q3(b)(i); 2026 Q1(b)(i), Q3(a)(i).

Drawings: Circuit drawings, 555 symbol, graph and booklet pages: Block 6 booklet and deck, R Stewart.

2024 Question 6: © Qualifications Scotland (SQA). N5 Practical Electronics 2024 Q6: question, figure and marking instructions.

2024 Question 11: © Qualifications Scotland (SQA). N5 Practical Electronics 2024 Q11: question, stripboard plan and marking instructions.

2026 Question 6: © Qualifications Scotland (SQA). N5 Practical Electronics 2026 Q6: question, figure and marking instructions.

Credits (2 of 2)

Course specification: © Qualifications Scotland (SQA). N5 Electronics course specification v3.1, pp.6-7

R Stewart - October 2026