

STUDENT RESOURCE

Magic Conch Student Study Guide

What to know before you solder, what to inspect before power, and how to troubleshoot from evidence instead of guessing.

BUILD	Through-hole electronics
BOARD	Magic Conch v1.3
SAFETY	Adult supervision required
ASSESSMENT	12-question review quiz

CORE RULE

Sockets get solder. Chips do not. Seat integrated circuits only after inspection, with every iron parked and unplugged.

1. Read the board like a map

A printed circuit board connects components with copper paths called traces. The printed labels tell you which part belongs at each location and, when direction matters, how it must face.

Component	What it does	Placement clue
Resistor	Limits current or helps set a circuit value	Color bands identify value; direction does not matter
LED	Turns electrical activity into visible light	Long leg is positive; flat side is negative
Capacitor	Stores charge; can help control timing	C1 has polarity; C2 and C3 use printed numbers
Socket	Holds a chip without heating the chip	Notch matches the board outline
Integrated circuit	Performs timing or logic functions	Chip notch matches socket and board notch
Switch	Opens, closes, or momentarily changes a circuit	SW1 latches; SW2 springs back
Battery holder	Supplies electrical energy	Mounted on the back; polarity must match

Board-specific facts

- R1-R8 are 180 ohm; R9 is 10 kilohm; R10 is 1 or 1.2 kilohm; R11 is 18 kilohm.
- C2 is marked 474. C3 is marked 103.
- IC1, IC2, and IC3 point up. IC4 points left.
- All eight LEDs have long leg right and flat side left.

2. Make one reliable joint

Every joint uses the same four moves

Move	Action	Evidence
1. Bend	Line up the leads so the part sits in the correct holes	Part value and direction match the board
2. Push	Seat the part close to the board	Part stays flat when the board turns over
3. Heat + feed	Touch pad and lead with the iron; feed solder to the heated joint	Solder flows around both surfaces
4. Clip	Let the joint cool, then trim the lead close	No sharp lead remains above the joint

QUALITY STANDARD

A good joint is shiny, smooth, and shaped like a tiny volcano. A dull ball may be a cold joint even when it looks connected.

Why build shortest parts first?

Short components can sit flat against the board while it is flipped for soldering. Taller parts added later do not push them out of place. The sequence also postpones sensitive or awkward parts until the basic board is stable.

Build order

1. Resistors | 2. Empty sockets | 3. C2 and C3 | 4. Eight LEDs | 5. C1 | 6. Switches | 7. Battery holder | 8. Chips with no solder

3. Direction matters

Part	Correct orientation	If reversed or swapped
LEDs	Long leg right in +; flat side left	That answer may never light
C1	Long positive leg left; striped negative side right	The capacitor can overheat and fail
C2 / C3	474 at C2; 103 at C3	Chase speed will be incorrect
Sockets	IC1-IC3 up; IC4 left	Chips can be inserted backward
Chips	Notch matches socket and board	Circuit will not operate correctly and may be damaged
Switches	SW1 latches; SW2 springs back	Board may not turn off or stop rolling
Battery holder	Back of board; + and - match	Board receives reversed or no power

Quality gate before chips

- Every pad is filled; no bare shiny rings remain.
- Joints are shiny cones rather than dull balls.
- No solder bridges connect neighboring pads or socket pins.
- All eight LEDs match and C1 stripe is on the right.
- C2 is 474 and C3 is 103.
- Sockets are empty and every notch matches the board.

STOP FIRST

Sockets get solder. Chips do not. Seat chips only after the inspection gate, with the iron put away.

4. Test from evidence

Expected behavior

- Three AA batteries are inserted with correct polarity.
- SW1 turns the board on. Nothing should light until a roll begins.
- Holding SW2 makes the eight lights chase.
- Releasing SW2 leaves one answer lit.

Troubleshooting map

Symptom	Start here
Nothing at all	Battery direction, battery-holder joints, then SW1
Lights never move	IC4 notch, 555 seating, then C2 = 474
Chase never stops	Check whether SW1 and SW2 were swapped
One dead LED	Check that LED polarity and its two joints
Skipped pattern	Check IC1/IC2 seating and socket-pin bridges

Vocabulary check

polarity - required positive and negative orientation; cold joint - a poorly heated connection; bridge - unwanted solder connecting neighbors; trace - copper path on a PCB; socket - removable chip holder; momentary - active only while pressed; latching - stays in its changed state.

Reflection

1. Which inspection clue gave you the most confidence before power?
2. If one LED is dark, what two observations should come before reheating anything?
3. Why is troubleshooting from a symptom more efficient than reheating every joint?