

TEACHER LAUNCH PACK

Magic Conch Teacher Lesson Plan

A three-period classroom sequence for a first through-hole electronics build. The plan is written for grades 6-12 and pairs with the illustrated assembly deck for board version 1.3.

SUGGESTED TIME	3 x 50-minute periods
GROUPING	Individual build with partner inspection
EXPERIENCE	Designed for first-time solderers
PRODUCT	Magic Conch board v1.3

CORE RULE	Sockets get solder. Chips do not. Seat integrated circuits only after inspection, with every iron parked and unplugged.
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Plan at a glance

Period	Instruction	Student work	Evidence
1	Safety, component literacy, joint demonstration	Inventory; sort resistors; practice joint; install resistors and sockets	Inventory check and one inspected practice joint
2	Polarity and build-order mini-lesson	Install C2/C3, LEDs, C1, switches, and battery holder	Partner quality-gate initials
3	Signal-path thinking and fault isolation	Teacher seats chips; students power, test, troubleshoot, and reflect	Working board, inspection notes, and quiz

Learning objectives

- Identify resistors, capacitors, LEDs, integrated circuits, sockets, switches, and a battery holder by both function and placement marking.
- Produce a solder joint that heats the pad and lead together and can be inspected against a visible quality standard.
- Use polarity and orientation markings to place directional parts correctly.
- Apply a repeatable troubleshooting sequence: power off, inspect, isolate, correct, and retest.
- Document evidence from inspection and testing rather than guessing at a fault.

Possible standards connections

This build supports engineering-design practices such as analyzing test evidence, evaluating solutions, and improving a system after failure. It can also support local standards for laboratory safety, electronic systems, measurement, and technical communication. Confirm exact course and district standards before placing codes in a syllabus.

TEACHER MOVE

Keep all chips and batteries at the teacher table until the quality gate is signed. This creates a real inspection checkpoint and prevents accidental chip soldering.

Before students arrive

Room setup

- Provide safety glasses for every person in the work area.
- Use soldering stations with stable stands and tip-cleaning material.
- Provide moving air or local fume extraction appropriate to district policy.
- Set one cooled practice board or scrap pad at each table when possible.
- Print one study guide per student or post the QR resource page.
- Open the assembly deck where every student can see part orientation close-ups.
- Hold the four chips and three AA batteries from each kit at the teacher table.

Consumables not included with the kit

Item	Suggested classroom provision	Reason
Solder	District-approved electronics solder	Creates the electrical and mechanical joint
Safety glasses	One pair per person	Protects eyes during clipping and soldering
Flush cutters	One per pair	Trims cooled component leads
Tip cleaner	One per station	Keeps heat transfer consistent
Three AA batteries	One set per finished board	Powers the first test

Safety briefing

- The iron is hot enough to burn skin and damage a board. Hold only the insulated handle.
- Return the iron to its stand whenever it is not touching a joint.
- Heat pad and lead together. Feed solder to the joint, not directly to the iron tip.
- Clip only after a joint cools; point clipped leads away from faces.
- Switch power off immediately if a board becomes hot or smells unusual.
- Wash hands after soldering and before eating.

Period 1: skill before speed

0-8 minutes: inventory and purpose

Students identify the board, 11 resistors, four empty sockets, C1-C3, eight LEDs, two switches, battery holder, and four chips. Ask: Which parts carry information, which control timing, and which show the result?

8-18 minutes: demonstrate one joint

Model the four moves: bend, push, heat plus feed, and clip. Show a shiny cone beside a dull ball. Narrate that solder follows heat, so both the pad and lead must be hot.

18-45 minutes: resistors and sockets

- R1-R8: 180 ohm. R9: 10 kilohm. R10: 1 or 1.2 kilohm. R11: 18 kilohm.
- Resistor direction does not matter, but value and location do.
- IC1, IC2, and IC3 socket notches point up. IC4 socket notch points left.
- Tack opposite socket corners, confirm flat seating, then finish the pins.

45-50 minutes: shutdown

Students park irons, place work on a labeled tray, and circle one joint they want a partner to inspect next period.

EXIT PROMPT

Why can a joint look connected but still fail electrically? Name one visual clue.

Period 2: orientation is evidence

0-7 minutes: retrieval

Project the build order. Students explain why shorter parts are installed first and identify every remaining part whose direction matters.

7-38 minutes: complete the board

Part	Placement evidence	Common error
C2 / C3	C2 is marked 474; C3 is marked 103	Choosing by body color instead of printed number
Eight LEDs	Long leg right into +; flat side left	One LED reversed, creating one dead answer
C1	Long positive leg left; striped negative side right	Stripe placed toward +
SW1 / SW2	SW1 latches; SW2 springs back; dot matches dot	Switches swapped
Battery holder	Mounted on back; + and - match the board	Mounted on front or polarity reversed

38-50 minutes: quality gate

- Every pad filled with no bare shiny ring.
- Joints are shiny cones, not dull balls.
- No bridges between neighboring pads or socket pins.
- All eight LEDs match; C1 stripe is on the right.
- C2 is 474, C3 is 103, and all socket notches match the board.
- Sockets are still empty.

Period 3: test, explain, improve

0-12 minutes: seat chips

With irons put away, students or the teacher seat the chips: 555 at IC4 with notch left; two 74LS74 chips at IC1 and IC2 with notches up; 74HC138 at IC3 with notch up. Inspect for folded-under legs.

12-25 minutes: first power

- Insert three AA batteries with correct polarity.
- Press SW1. Nothing should light yet and nothing should warm up.
- Hold SW2. Eight LEDs should chase.
- Release SW2. One answer remains lit.

25-40 minutes: troubleshoot from evidence

Symptom	Inspect first	Then inspect
Nothing at all	Battery direction and holder joints	SW1 placement and solder joints
Lights never move	IC4 notch and 555 seating	C2 marked 474
Chase never stops	SW1 and SW2 locations	Switch dot alignment
One LED never lights	That LED polarity	Its two solder joints
Pattern skips	IC1 and IC2 seating	Socket-pin bridges

40-50 minutes: assessment

Students complete the quiz and a short reflection: What evidence helped you trust the board, and what would you inspect first if the same symptom returned?

Assessment, access, and extension

Evidence to collect

- Completed board that performs the expected chase-and-stop behavior.
- Partner-signed inspection gate.
- Study-guide annotations or troubleshooting record.
- Quiz score and one evidence-based reflection.

Support first-time solderers

- Pair a builder with an inspector, then switch roles every five joints.
- Use a printed orientation card at each table for LEDs, C1, sockets, and chips.
- Mark completed rows on the assembly deck rather than relying on memory.
- Allow students with fine-motor needs to place and inspect parts while a partner solders.
- Offer a cooled practice joint and verbal rehearsal before live soldering.

Extension prompts

- Explain why the board needs both a timer stage and logic stages.
- Predict how changing the timing capacitor would change the chase behavior.
- Create a fault tree for one symptom using yes-or-no inspection questions.
- Compare a random-looking output with a truly random process and discuss the distinction.

RESOURCE SET

Use the QR-linked assembly deck during the build, the student study guide for review, and the Google Forms-ready quiz for assessment. Keep the separate answer key in the teacher copy only.