

Prayoga kit: component requirements

Every component needed for the 62 Prayoga worksheets (Physics 29, Chemistry 13, Biology 20), what it does, and which worksheets use it · updated 16 October 2026

How to read this list

- **Worksheet numbers** follow the subject worksheet files: P = Physics, C = Chemistry, B = Biology. Class is in brackets, e.g. P1 Ohm's law (10) = Physics worksheet 1, Class 10. Items used by more than 14 worksheets show worksheet numbers only.
- **Kit:** Basic = core kit; Full = Basic plus the add-ons in section 2; Lab add-on = one per school; School = usually in the school lab or bought locally. **New** marks parts added for the nine completed practicals (pressure sensor, buzzer, IR sensors, LED holder, USB microscope, prepared slides, tubes and slinky) and for the two power modes (power-in socket, power path, charge-out port).
- **Software:** everything runs on Prayoga's own app and firmware. No third-party app is needed.
- Prices are estimates of typical Indian online prices for single units, not quotes. Bulk buying for 400 kits will lower them.

Power and connection: two modes

Mode	Power	Readings travel by	Best for
Cable mode	Phone powers the kit through the OTG cable (about 0.5 W; roughly 5–10% of a phone's charge in a one-hour period)	The same cable	Quick use anywhere with nothing else needed; most reliable connection
Wireless mode	Power bank or 5 V charger into POWER IN; the kit's CHARGE OUT port charges the phone at the same time	Bluetooth (built into the ESP32)	Long sessions; experiments where the phone moves or must stay apart (pendulum, solar cooker); phones that cannot power the kit

There is no battery inside the kit, so there is nothing to wear out or certify. Test two or three common power banks: some switch off when the load is very small.

Cost summary

Package	What it includes	Approx. cost
Basic kit	Sections 1 and 4	₹1,750–3,290
Full kit	Basic kit + section 2	₹3,460–6,520
Lab add-on (one per school)	Section 3	₹1,800–3,800
School materials (one set per school, if bought new)	Section 5; most schools already have many of these	₹2,520–6,010
Tools (once, for building)	Section 7	₹1,350–2,750

Most of the Full kit's extra cost is the pH probe (₹1,000–1,700). The USB microscope is shared, so it adds little per student.

1. Basic kit: electronics

Everything in the Basic kit except the housing. Items marked New were added for the nine completed practicals.

#	Item	Qty	Approx. price	Kit	Function	Used in (worksheet number, name, class)
1	ESP32 development board (38-pin, WROOM-32)	1	₹350–500	Basic	The kit's brain: reads every sensor and sends the readings to the Prayoga app over the OTG cable or by Bluetooth (built in). No battery inside the kit.	40 worksheets. Physics (20): P1–9, P11–13, P20–26, P29 Chemistry (11): C1–3, C5–12 Biology (9): B1–2, B4–6, B16–17, B19–20
2	USB OTG cable or adapter (match the phone and board ports)	1	₹100–200	Basic	Cable mode: powers the kit from the phone and carries the readings. The same adapter connects the USB microscope.	40 worksheets. Physics (20): P1–9, P11–13, P20–26, P29 Chemistry (11): C1–3, C5–12 Biology (9): B1–2, B4–6, B16–17, B19–20
3	DS18B20 waterproof temperature probe, 1 m, rated to at least 110 °C, with 4.7 kΩ resistor	1	₹90–150	Basic	Measures the temperature of water, air, soil and reacting mixtures.	Physics : P4 Heating effect of current (10); P13 Inside a solar cooker (10); P22 Hot and cold (7); P23 Which cup keeps tea warm? (7) Chemistry : C1 Hot and cold reactions (10); C9 Heating curve of ice (9); C10 Evaporation causes cooling (9); C12 Physical and chemical changes (9) Biology : B1 Germinating seeds give off heat (10); B16 Yeast fermentation (10, 8); B20 Compost heats up (10)
4	BH1750 light sensor module (GY-302) on a short lead	1	₹80–150	Basic	Measures brightness in lux; also sits in the LED holder to measure cloudiness and colour change.	Physics : P8 Light and distance (10); P9 Light through glass and water (10); P11 Why the sky is blue (10); P24 Transparent, translucent, opaque (6); P29 Solar cell: sun, cloud and shade (8) Chemistry : C12 Physical and chemical changes (9) Biology : B6 Plants and sunlight (7); B17 Photosynthesis and light (10); B19 Plants bend towards light (10)
5	INA219 voltage/current sensor module	1	₹150–250	Basic	Measures voltage and current in low-voltage circuits (up to 16 V, 0.4 A); the app works out resistance and power. Replaces ammeter and voltmeter.	Physics : P1 Ohm's law (10); P2 Resistance and length of a wire (10); P3 Resistors in series and parallel (10); P4 Heating effect of current (10); P5 Magnetic field around a wire (10); P6 Field of a solenoid (10); P12 Solar cell output (10); P25 Does the bulb glow? (6); P26 Conductors and insulators (6); P29 Solar cell: sun, cloud and shade (8) Chemistry : C5 Metals and non-metals: which conduct? (10); C6 Salt water and sugar water (10); C11 Solutions, colloids and suspensions (9)
6	BMP280 pressure sensor module + one-hole rubber stoppers (2 sizes) + 30 cm silicone tubing	1 set	₹150–350	Basic · New	Measures gas pressure in a sealed tube or flask: gas given off in reactions, or used up in respiration.	Chemistry : C7 Properties of hydrochloric acid and sodium hydroxide (10); C8 Properties of ethanoic acid (10); C12 Physical and chemical changes (9) Biology : B2 Carbon dioxide is given out in respiration (10)
7	Active buzzer module (3.3–5 V)	1	₹20–40	Basic · New	Sound source that the app switches on and off.	Physics : P20 Reflection of sound (9)
8	4×AA cell holder with switch (cells: see section 5)	1	₹60–100	Basic	Safe low-voltage source, 1.5–6 V. Never mains power.	Physics : P1 Ohm's law (10); P2 Resistance and length of a wire (10); P3 Resistors in series and parallel (10); P4 Heating effect of current (10); P5 Magnetic field around a wire (10); P6 Field of a solenoid (10); P25 Does the bulb glow? (6); P26 Conductors and insulators (6) Chemistry : C5 Metals and non-metals: which conduct? (10); C6 Salt water and sugar water (10); C11 Solutions, colloids and suspensions (9)
9	Resistor set: 22, 47, 100 (×2) and 220 Ω	1 set	₹20–40	Basic	Known resistances; the 22 Ω keeps current safe in wire, coil and solenoid circuits.	Physics : P1 Ohm's law (10); P2 Resistance and length of a wire (10); P3 Resistors in series and parallel (10); P5 Magnetic field around a wire (10); P6 Field of a solenoid (10); P12 Solar cell output (10); P25 Does the bulb glow? (6); P26 Conductors and insulators (6); P29 Solar cell: sun, cloud and shade (8) Chemistry : C5 Metals and non-metals: which conduct? (10); C6 Salt water and sugar water (10); C11 Solutions, colloids and suspensions (9)

#	Item	Qty	Approx. price	Kit	Function	Used in (worksheet number, name, class)
10	LEDs, assorted	4	₹10–20	Basic	Visible indicator in test circuits.	Physics: P25 Does the bulb glow? (6); P26 Conductors and insulators (6) Chemistry: C5 Metals and non-metals: which conduct? (10)
11	Slide or push switch	1	₹10–20	Basic	Opens and closes a circuit.	Physics: P25 Does the bulb glow? (6)
12	Thin nichrome wire, 1.5 m	1	₹50–100	Basic	High-resistance wire: resistance grows with length; heats with current.	Physics: P2 Resistance and length of a wire (10); P4 Heating effect of current (10)
13	Insulated hook-up wire, 2 m	1	₹20–40	Basic	Wound into a 10-turn bundle for the field around a wire.	Physics: P5 Magnetic field around a wire (10)
14	Enamelled copper wire, 5 m (26–28 SWG)	1	₹60–120	Basic	Students wind their own solenoid.	Physics: P6 Field of a solenoid (10)
15	Crocodile-clip leads, red and black (4 pairs)	1 set	₹80–150	Basic	Connect circuits, test objects and coils to the sensor.	Physics: P1 Ohm's law (10); P2 Resistance and length of a wire (10); P3 Resistors in series and parallel (10); P4 Heating effect of current (10); P5 Magnetic field around a wire (10); P6 Field of a solenoid (10); P7 Magnet through a coil (induction) (10); P12 Solar cell output (10); P25 Does the bulb glow? (6); P26 Conductors and insulators (6); P29 Solar cell: sun, cloud and shade (8) Chemistry: C5 Metals and non-metals: which conduct? (10); C6 Salt water and sugar water (10); C11 Solutions, colloids and suspensions (9)
16	USB-C POWER IN socket with protection (5 V)	1	₹40–80	Basic · New	Wireless mode: power bank or charger powers the kit.	All kit worksheets, in wireless mode.
17	Power-path diodes or a small power-switch chip	1	₹20–60	Basic · New	Runs the kit from whichever source is connected (phone or power bank), never both against each other.	All kit worksheets.
18	USB CHARGE OUT port (USB-A or USB-C)	1	₹30–60	Basic · New	Charges the phone from the power bank while the kit runs in wireless mode.	All kit worksheets, in wireless mode.
19	Resettable fuse + mode LED (cable / wireless)	1 set	₹20–40	Basic · New	Protects the phone and power bank; shows which mode is active.	All kit worksheets.

2. Full kit: add-ons

Added to the Basic kit for chemistry, energy, waves and microscopy.

#	Item	Qty	Approx. price	Kit	Function	Used in (worksheet number, name, class)
20	pH probe + amplifier board + pH 4.0 and 7.0 buffer powders	1	₹1,000–1,700	Full	Measures acidity (pH 0–14). Store wet in its cap; calibrate in buffer before use.	Chemistry: C2 pH of everyday things (10); C3 Neutralisation curve (10); C7 Properties of hydrochloric acid and sodium hydroxide (10); C8 Properties of ethanoic acid (10); C13 Acid or base in the kitchen (7) Biology: B4 Testing local soil and water (10); B5 Soil for crops (9)
21	Conductivity probe (two steel electrodes + small circuit)	1	₹50–100	Full	Shows how well a liquid conducts (dissolved salts and ions).	Chemistry: C8 Properties of ethanoic acid (10) Biology: B4 Testing local soil and water (10)
22	Coil, about 200 turns, on a tube	1	₹60–120	Full	A moving magnet induces a voltage in it.	Physics: P7 Magnet through a coil (induction) (10)
23	Bar magnet, N and S marked	1	₹40–100	Full	Induction; magnet strength and distance.	Physics: P7 Magnet through a coil (induction) (10); P27 Magnet strength and distance (6)
24	Small solar cell (about 5 V, 1 W)	1	₹80–150	Full	Turns light into electricity; output read by the voltage/current sensor.	Physics: P12 Solar cell output (10); P29 Solar cell: sun, cloud and shade (8)

#	Item	Qty	Approx. price	Kit	Function	Used in (worksheet number, name, class)
25	Diffraction grating film (about 1,000 lines/mm) with a phone clip	1	₹50–100	Full	Over the phone camera it splits light into a spectrum.	Physics: P10 Spectrum of different lamps (10)
26	Clip-on phone microscope lens (about 60×, with LED) + acrylic stand with wing-nut focus	1	₹300–700	Full	Turns the phone camera into a microscope for cells, stomata, pollen, seeds and mould.	Biology: B7 Onion peel cells (9); B8 Cheek cells (9); B10 Stomata on a leaf (10); B11 Pollen grains (10); B13 Parts of a dicot seed embryo (10); B14 Life in a drop of pond water (8); B15 Bread mould (8, 10)
27	IR obstacle sensor modules on 1.5 m leads	1 pair	₹80–160	Full • New	Detect the slinky coils passing; the board times the pulse between them.	Physics: P21 Speed of a pulse along a slinky (9)
28	LED test-tube holder: white LED + slot for the light sensor (3D-printed or card)	1	₹50–100	Full • New	Shines light through a test tube so the light sensor can measure cloudiness and colour fading.	Chemistry: C12 Physical and chemical changes (9)

3. Lab add-on (one per school)

Shared by all kits in a school.

#	Item	Qty	Approx. price	Kit	Function	Used in (worksheet number, name, class)
29	USB digital microscope with stand (realistic 200–400×), plugs into the phone through the OTG adapter	1	₹1,500–3,000	Lab add-on • New	Shows cells too small for the clip-on lens: yeast buds, Amoeba, tissues.	Biology: B9 Plant and animal tissues (9); B12 Binary fission and budding (10)
30	Prepared slide set: Amoeba, yeast, Hydra, parenchyma, collenchyma, sclerenchyma, three muscle types, neuron	1 set	₹300–800	Lab add-on • New	Ready-made slides for the prescribed microscope practicals.	Biology: B9 Plant and animal tissues (9); B12 Binary fission and budding (10)

4. Housing and assembly (per kit)

Not tied to particular worksheets: used by every kit.

#	Item	Qty	Approx. price	Kit	Function	Used in (worksheet number, name, class)
31	ABS project box, about 100 × 60 × 25 mm	1	₹60–150	Basic	Compact, durable housing for the board and sensor modules.	All kit worksheets.
32	Perfboard 7 × 5 cm + female header strips	1	₹40–80	Basic	Holds the ESP32 in a socket and the sensor modules.	All kit worksheets.
33	JST-XH connector pairs (3- and 4-pin) for 5 sockets: temperature, light, pressure, buzzer, IR	5	₹50–100	Basic	Keyed plug-in sockets, so sensors cannot be plugged in the wrong way.	All kit worksheets.
34	4 mm binding posts: red, yellow, black	3	₹40–90	Basic	Circuit terminals on the lid.	All circuit worksheets.
35	22 AWG hook-up wire (colours) + heat-shrink	shared	₹50–100	Basic	Internal wiring.	All kit worksheets.
36	Carry case with foam + leak-proof pouch for liquids and glass	1	₹150–300	Basic	Keeps electronics and wet items apart.	All worksheets.

5. School, lab and home materials

Usually already in the school lab or bought locally. Prices are for buying new.

#	Item	Qty	Approx. price	Kit	Function	Used in (worksheet number, name, class)
37	AA cells	4	₹60–120	School	Power for student circuits.	Physics: P1 Ohm's law (10); P2 Resistance and length of a wire (10); P3 Resistors in series and parallel (10); P4 Heating effect of current (10); P5 Magnetic field around a wire (10); P6 Field of a solenoid (10); P25 Does the bulb glow? (6); P26 Conductors and insulators (6) Chemistry: C5 Metals and non-metals: which conduct? (10); C6 Salt water and sugar water (10); C11 Solutions, colloids and suspensions (9)
38	Power bank (10,000 mAh) or 5 V 2 A charger	1	—	School / home	Wireless mode power source; most schools and families already have one (about ₹600–1,000 to buy).	All kit worksheets, in wireless mode.
39	Digital multimeter	1	₹300–600	School	Hand reading to check the sensor; least count practice.	Physics: P1 Ohm's law (10); P3 Resistors in series and parallel (10)
40	Lab thermometer, –10 to 110 °C	2	₹60–150	School	Hand reading to check the temperature probe.	Physics: P4 Heating effect of current (10); P13 Inside a solar cooker (10); P22 Hot and cold (7); P23 Which cup keeps tea warm? (7) Chemistry: C1 Hot and cold reactions (10); C9 Heating curve of ice (9); C10 Evaporation causes cooling (9) Biology: B1 Germinating seeds give off heat (10); B16 Yeast fermentation (10, 8); B20 Compost heats up (10)
41	Scale / metre rule	1	₹20–100	School	Distances, lengths, millimetre scale under the microscope.	24 worksheets. Physics (12): P2, P5–6, P8–9, P14, P16–17, P19, P21, P27–28 Biology (12): B3, B5–8, B10–11, B13–17
42	Stopwatch or watch	1	₹0–200	School	Hand timing alongside the sensors.	Physics: P4 Heating effect of current (10); P13 Inside a solar cooker (10); P14 Trolley on a ramp: speed and acceleration (9); P16 Measuring g with a pendulum (9); P21 Speed of a pulse along a slinky (9); P23 Which cup keeps tea warm? (7) Chemistry: C9 Heating curve of ice (9) Biology: B17 Photosynthesis and light (10); B18 Pulse rate before and after exercise (10)
43	Protractor	1	₹10–30	School	Angles: solar cell, sound reflection, plant bending.	Physics: P12 Solar cell output (10); P20 Reflection of sound (9) Biology: B19 Plants bend towards light (10)
44	Glassware: beakers, cups, test tubes, conical flask, measuring cylinder, tall jar	1 set	₹300–700	School	Hold water, solutions, seeds and soil.	24 worksheets. Physics (5): P4, P15, P18, P22–23 Chemistry (11): C1–4, C6–9, C11–13 Biology (8): B1–2, B4–5, B12, B14, B16–17
45	Droppers, glass slides and cover slips, new toothpicks	1 set	₹200–450	School	Microscope mounts and dropwise additions.	Physics: P11 Why the sky is blue (10) Chemistry: C3 Neutralisation curve (10) Biology: B7 Onion peel cells (9); B8 Cheek cells (9); B10 Stomata on a leaf (10); B11 Pollen grains (10); B13 Parts of a dicot seed embryo (10); B14 Life in a drop of pond water (8); B15 Bread mould (8, 10)
46	pH paper with chart; red and blue litmus	1 set	₹80–160	School	Hand readings alongside the pH probe, as the textbook asks.	Chemistry: C2 pH of everyday things (10); C7 Properties of hydrochloric acid and sodium hydroxide (10); C8 Properties of ethanoic acid (10); C13 Acid or base in the kitchen (7) Biology: B4 Testing local soil and water (10); B5 Soil for crops (9)

#	Item	Qty	Approx. price	Kit	Function	Used in (worksheet number, name, class)
47	Chemicals. Household: vinegar, baking soda, salt, sugar, lemon, soap, toothpaste, milk, red cabbage, turmeric, sanitiser, yeast. Lab stock: dilute HCl, NaOH and H ₂ SO ₄ , ethanoic acid, zinc granules, sodium carbonate, sodium hydrogen carbonate, KOH, copper sulphate, barium chloride, sodium sulphate, magnesium ribbon, limewater, ammonium chloride, quicklime, iodine, methylene blue	1 set	₹300–700	School	Reactions, pH, indicators and stains. Acids, alkalis, KOH and quicklime are handled by the teacher.	15 worksheets. Physics (1): P11 Chemistry (11): C1–4, C6–8, C10–13 Biology (3): B2, B7, B16
48	Torch and desk lamp	1 each	₹200–400	School	Light sources.	Physics : P8 Light and distance (10); P9 Light through glass and water (10); P10 Spectrum of different lamps (10); P11 Why the sky is blue (10); P12 Solar cell output (10); P24 Transparent, translucent, opaque (6) Chemistry : C11 Solutions, colloids and suspensions (9) Biology : B17 Photosynthesis and light (10)
49	Spirit lamp (teacher only)	1	₹50–150	School	Gentle heating.	Chemistry : C9 Heating curve of ice (9); C12 Physical and chemical changes (9)
50	Two iron nails; test objects (key, coin, eraser, pencil lead, foil); paper and card	1 set	₹20–50	Home	Electrodes, conductors and insulators, light materials.	Physics : P9 Light through glass and water (10); P24 Transparent, translucent, opaque (6); P26 Conductors and insulators (6) Chemistry : C4 Natural indicator from red cabbage (10); C5 Metals and non-metals: which conduct? (10); C6 Salt water and sugar water (10); C11 Solutions, colloids and suspensions (9)
51	Glass slab, glass prism, clear plastic box	1 each	₹200–500	School	Light through materials, dispersion, scattering.	Physics : P9 Light through glass and water (10); P10 Spectrum of different lamps (10); P11 Why the sky is blue (10); P24 Transparent, translucent, opaque (6)
52	Galvanometer (school lab)	1	—	School	Hand check for induction until the coil-voltage view is used.	Physics : P7 Magnet through a coil (induction) (10)
53	Toy trolley, plank and books, kitchen scale, strong string + phone pouch	1 set	₹300–700	School	Motion, force and pendulum experiments.	Physics : P14 Trolley on a ramp: speed and acceleration (9); P15 Force, mass and acceleration (9); P16 Measuring g with a pendulum (9); P17 Energy in a swinging pendulum (9)
54	Tuning fork, rubber band and box, two wooden blocks	1 set	₹120–350	School	Sound sources.	Physics : P18 Frequency and pitch (9); P19 Speed of sound from an echo (9); P28 Loud and soft, high and low (8)
55	Two cardboard tubes, hard board, slinky	1 set	₹100–200	School · New	Reflection of sound; speed of a pulse.	Physics : P20 Reflection of sound (9); P21 Speed of a pulse along a slinky (9)
56	Box solar cooker parts, shoe box, PVC pipe, paper clips, cotton, funnel and filter paper, balloons	1 set	₹150–300	School	Small items for single worksheets.	Physics : P6 Field of a solenoid (10); P13 Inside a solar cooker (10); P27 Magnet strength and distance (6) Chemistry : C10 Evaporation causes cooling (9); C11 Solutions, colloids and suspensions (9) Biology : B1 Germinating seeds give off heat (10); B16 Yeast fermentation (10, 8); B19 Plants bend towards light (10)
57	Fresh materials: soaked seeds, leaves, flowers, bread, seedlings in pots, pond water, Hydrilla, compost, soil	per class	₹50–150	Local	Specimens collected fresh for each class.	Biology : B1 Germinating seeds give off heat (10); B2 Carbon dioxide is given out in respiration (10); B6 Plants and sunlight (7); B10 Stomata on a leaf (10); B11 Pollen grains (10); B13 Parts of a dicot seed embryo (10); B15 Bread mould (8, 10); B17 Photosynthesis and light (10); B19 Plants bend towards light (10); B20 Compost heats up (10)

6. Phone features (already in the phone)

Experiments that use the phone's own sensors need no kit. Check two or three budget phones for USB OTG and a magnetometer before the school pilot.

#	Phone feature (no purchase)	Function	Used in
F1	Android 8 or newer with USB OTG (host) support	Runs the Prayoga app; powers the kit in cable mode; connects the USB microscope.	42 worksheets that use the kit or the USB microscope
F2	Bluetooth (BLE)	Wireless mode: receives the readings from the kit without the cable.	All kit worksheets, in wireless mode
F3	Camera with flash	Colour reading, spectrum, clip-on microscope photos, bubble counting, pulse.	P10 Spectrum of different lamps (10); C4 Natural indicator from red cabbage (10); B7 Onion peel cells (9); B8 Cheek cells (9); B10 Stomata on a leaf (10); B11 Pollen grains (10); B13 Parts of a dicot seed embryo (10); B14 Life in a drop of pond water (8); B15 Bread mould (8, 10); B17 Photosynthesis and light (10); B18 Pulse rate before and after exercise (10)
F4	Accelerometer	Motion of a trolley.	P14 Trolley on a ramp: speed and acceleration (9); P15 Force, mass and acceleration (9)
F5	Gyroscope / motion sensors	Pendulum period and speed.	P16 Measuring g with a pendulum (9); P17 Energy in a swinging pendulum (9)
F6	Magnetometer (some cheap phones lack it)	Magnetic field.	P5 Magnetic field around a wire (10); P6 Field of a solenoid (10); P27 Magnet strength and distance (6)
F7	Microphone	Frequency, sound wave, loudness.	P18 Frequency and pitch (9); P19 Speed of sound from an echo (9); P20 Reflection of sound (9); P28 Loud and soft, high and low (8)
F8	Touch screen timing	Reaction-time tap test.	B3 Reaction time (10)

7. Tools and software

#	Tool (once, for building)	Approx. price	Used for
T1	Soldering iron with stand, solder, flux	₹400–800	Joining wires and pins
T2	Multimeter (the school multimeter in section 5 will do)	₹300–600	Checking for shorts before power-up; calibration checks
T3	Wire stripper / cutter	₹150–300	Preparing wires
T4	Hot glue gun	₹200–350	Fixing modules, strain relief on sockets
T5	Hand drill or step bit	₹200–500	Holes for sockets, posts and the USB slot
T6	Small screwdriver set	₹100–200	Module terminals and box screws
T7	Laptop for firmware and app development	own	Writing and uploading firmware; building the Prayoga app

Software (Prayoga's own)

- **Prayoga app (Android):** Kannada and English; all 62 worksheets by subject and class; tells students which sensor to plug in; live graphs and tables; save and share readings as a spreadsheet; teacher mode.
- **App views needed:** voltage and current; temperature; light; pressure; pH; conductivity; coil voltage; solar cell; pulse timer (IR); reflection of sound (buzzer + microphone); combined views (current and magnetic field, current and temperature, pH with pressure, temperature–pressure–light); phone-sensor views (acceleration, rotation, pendulum, magnetic field, sound frequency, sound wave, loudness); camera views (colour, spectrum, clip-on microscope, USB microscope, pulse); reaction-time tap test.
- **Firmware (ESP32):** reads all kit sensors and sends them to the app over the OTG cable or Bluetooth (the app finds the kit by its name, e.g. Prayoga-07); drives the buzzer; times the IR sensors.

Safety

- Low voltage only: cells up to 6 V. Never connect to mains.
- The teacher handles acids, alkalis, KOH, quicklime, hot water, the spirit lamp and burning magnesium. Goggles for all chemistry worksheets.
- Wash hands after soil, compost, pond water and mould. One new toothpick per student for cheek cells.

Appendix: parts for each worksheet

Physics worksheets

No.	Worksheet	Class	Kit tier	From the Prayoga kit (and phone)	From school or home
P1	Ohm's law	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Cell holder, Resistor (100 Ω)	AA cells, Multimeter
P2	Resistance and length of a wire	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Cell holder, Resistor (22 Ω), Nichrome wire	AA cells, Scale / metre rule
P3	Resistors in series and parallel	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Cell holder, 2 resistors (100 Ω)	AA cells, Multimeter
P4	Heating effect of current	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Temperature probe, Crocodile clips, Cell holder, Nichrome wire	AA cells, Cups / tumblers, Lab thermometer, Stopwatch / watch
P5	Magnetic field around a wire	10	Basic kit + phone sensor	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Cell holder, Resistor (22 Ω), Insulated wire	AA cells, Scale / metre rule
P6	Field of a solenoid	10	Basic kit + phone sensor	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Cell holder, Resistor (22 Ω), Enamelled copper wire	AA cells, PVC pipe or thick pen, Scale / metre rule
P7	Magnet through a coil (induction)	10	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Crocodile clips, Coil (Full kit), Bar magnet	Galvanometer (if available)
P8	Light and distance	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Light sensor	Torch, Scale / metre rule
P9	Light through glass and water	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Light sensor	Torch, Glass slab, Clear box of water, Paper, card, materials, Scale / metre rule
P10	Spectrum of different lamps	10	Full kit	Your phone, Grating film (Full kit)	Lamp / bulb, Glass prism (if available)
P11	Why the sky is blue	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Light sensor	Torch, Clear box of water, Dropper, Samples / chemicals
P12	Solar cell output	10	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Resistor (100 Ω), Solar cell (Full kit)	Lamp / bulb, Protractor
P13	Inside a solar cooker	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Temperature probe	Box solar cooker, Lab thermometer, Stopwatch / watch
P14	Trolley on a ramp: speed and acceleration	9	Phone only (Prayoga app)	Your phone	Toy trolley + ramp, Plank + books (ramp), Scale / metre rule, Stopwatch / watch
P15	Force, mass and acceleration	9	Phone only (Prayoga app)	Your phone	Toy trolley + ramp, Flasks / bottles, Kitchen scale
P16	Measuring g with a pendulum	9	Phone only (Prayoga app)	Your phone	String + pouch, Scale / metre rule, Stopwatch / watch
P17	Energy in a swinging pendulum	9	Phone only (Prayoga app)	Your phone	String + pouch, Scale / metre rule

No.	Worksheet	Class	Kit tier	From the Prayoga kit (and phone)	From school or home
P18	Frequency and pitch	9	Phone only (Prayoga app)	Your phone	Tuning fork, Rubber band on a box, Cups / tumblers
P19	Speed of sound from an echo	9	Phone only (Prayoga app)	Your phone	Two wooden blocks, Scale / metre rule
P20	Reflection of sound	9	Basic kit + phone sensor	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Buzzer	Two cardboard tubes, Hard board or wall, Protractor
P21	Speed of a pulse along a slinky	9	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Two IR sensors (Full kit)	Slinky, Scale / metre rule, Stopwatch / watch
P22	Hot and cold	7	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Temperature probe	Lab thermometer, Cups / tumblers
P23	Which cup keeps tea warm?	7	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Temperature probe	Lab thermometer, Cups / tumblers, Stopwatch / watch
P24	Transparent, translucent, opaque	6	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Light sensor	Torch, Glass slab, Paper, card, materials
P25	Does the bulb glow?	6	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Cell holder, LED, Resistor (100 Ω), Switch	AA cells
P26	Conductors and insulators	6	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Cell holder, LED, Resistor (100 Ω)	AA cells, Test objects
P27	Magnet strength and distance	6	Phone only (Prayoga app)	Your phone, Bar magnet	Scale / metre rule, Paper clips
P28	Loud and soft, high and low	8	Phone only (Prayoga app)	Your phone	Rubber band on a box, Scale / metre rule
P29	Solar cell: sun, cloud and shade	8	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Light sensor, Crocodile clips, Resistor (100 Ω), Solar cell (Full kit)	—

Chemistry worksheets

No.	Worksheet	Class	Kit tier	From the Prayoga kit (and phone)	From school or home
C1	Hot and cold reactions	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Temperature probe	Lab thermometer, Beakers, Samples / chemicals
C2	pH of everyday things	10	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), pH probe (Full kit)	pH / indicator paper, Beakers, Samples / chemicals
C3	Neutralisation curve	10	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), pH probe (Full kit)	Measuring cylinder, Dropper, Beakers, Samples / chemicals
C4	Natural indicator from red cabbage	10	Phone only (Prayoga app)	Your phone	Test tubes or glasses, Samples / chemicals, Paper, card, materials
C5	Metals and non-metals: which conduct?	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Cell holder, LED, Resistor (100 Ω)	AA cells, Test objects
C6	Salt water and sugar water	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Cell holder, Resistor (100 Ω)	AA cells, Two iron nails, Beakers, Measuring cylinder, Samples / chemicals

No.	Worksheet	Class	Kit tier	From the Prayoga kit (and phone)	From school or home
C7	Properties of hydrochloric acid and sodium hydroxide	10	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), pH probe (Full kit), Pressure sensor, Stopper + tubing	Test tubes or glasses, Red and blue litmus, Samples / chemicals, Beakers
C8	Properties of ethanoic acid	10	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), pH probe (Full kit), Conductivity probe (Full kit), Pressure sensor, Stopper + tubing	Test tubes or glasses, Red and blue litmus, Samples / chemicals
C9	Heating curve of ice	9	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Temperature probe	Lab thermometer, Cups / tumblers, Spirit lamp (teacher), Stopwatch / watch
C10	Evaporation causes cooling	9	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Temperature probe	Lab thermometer, Cotton, Samples / chemicals
C11	Solutions, colloids and suspensions	9	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Voltage / current sensor, Crocodile clips, Cell holder, Resistor (100 Ω)	AA cells, Two iron nails, Beakers, Torch, Funnel + filter paper, Samples / chemicals
C12	Physical and chemical changes	9	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Temperature probe, Light sensor, LED test-tube holder (Full kit), Pressure sensor, Stopper + tubing	Test tubes or glasses, Samples / chemicals, Spirit lamp (teacher)
C13	Acid or base in the kitchen	7	Full kit (or by eye)	pH probe (Full kit)	pH / indicator paper, Test tubes or glasses, Samples / chemicals

Biology worksheets

No.	Worksheet	Class	Kit tier	From the Prayoga kit (and phone)	From school or home
B1	Germinating seeds give off heat	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Temperature probe	Flasks / bottles, Soaked seeds, Lab thermometer, Cotton
B2	Carbon dioxide is given out in respiration	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Pressure sensor, Stopper + tubing	Flasks / bottles, Soaked seeds, Samples / chemicals
B3	Reaction time	10	By hand + Prayoga app	—	Scale / metre rule
B4	Testing local soil and water	10	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), pH probe (Full kit), Conductivity probe (Full kit)	pH / indicator paper, Tall jar with lid, Beakers
B5	Soil for crops	9	Full kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), pH probe (Full kit)	Tall jar with lid, pH / indicator paper, Scale / metre rule
B6	Plants and sunlight	7	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Light sensor	Seedlings in pots, Scale / metre rule
B7	Onion peel cells	9	Full kit	Your phone, Clip-on lens + stand (Full kit)	Glass slides, Dropper, Samples / chemicals, Scale / metre rule
B8	Cheek cells	9	Full kit	Your phone, Clip-on lens + stand (Full kit)	Glass slides, New toothpick, Dropper, Scale / metre rule
B9	Plant and animal tissues	9	Lab add-on: USB microscope	Your phone, USB microscope + OTG adapter (lab add-on)	Prepared slides
B10	Stomata on a leaf	10	Full kit	Your phone, Clip-on lens + stand (Full kit)	Fresh leaf, Glass slides, Dropper, Scale / metre rule
B11	Pollen grains	10	Full kit	Your phone, Clip-on lens + stand (Full kit)	Flowers, Glass slides, Scale / metre rule

No.	Worksheet	Class	Kit tier	From the Prayoga kit (and phone)	From school or home
B12	Binary fission and budding	10	Lab add-on: USB microscope	Your phone, USB microscope + OTG adapter (lab add-on)	Prepared slides, Flasks / bottles
B13	Parts of a dicot seed embryo	10	Full kit	Your phone, Clip-on lens + stand (Full kit)	Soaked seeds, Glass slides, Scale / metre rule
B14	Life in a drop of pond water	8	Full kit	Your phone, Clip-on lens + stand (Full kit)	Flasks / bottles, Dropper, Glass slides, Scale / metre rule
B15	Bread mould	8, 10	Full kit	Your phone, Clip-on lens + stand (Full kit)	Bread in a closed box, Glass slides, Scale / metre rule
B16	Yeast fermentation	10, 8	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Temperature probe	Flasks / bottles, Balloons, Lab thermometer, Scale / metre rule, Samples / chemicals
B17	Photosynthesis and light	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Light sensor	Lamp / bulb, Beakers, Seedlings in pots, Stopwatch / watch, Scale / metre rule
B18	Pulse rate before and after exercise	10	By hand + Prayoga app	—	Stopwatch / watch
B19	Plants bend towards light	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Light sensor	Shoe box with a hole, Seedlings in pots, Protractor
B20	Compost heats up	10	Basic kit	Your phone, Prayoga kit (board), OTG cable (or Bluetooth), Temperature probe	Lab thermometer, Seedlings in pots