40 TRIZ principles

#	Principle	Description	Example
1	**Segmentation**	Divide an object or system into independent parts	• Modular furniture design allows for flexible arrangement and customization. • A multi-tool knife with separate tools for different functions.
2	**Taking out**	Remove or isolate the problematic part or property from the system	• Removable batteries in electronic devices to prevent overheating. • Detachable keyboards for tablets.
3	**Local quality**	Change the object's structure to provide different conditions in different areas	• Zoned mattresses with different firmness levels. • Shoes with reinforced heels for stability.
4	**Asymmetry**	Make the system asymmetric or change its shape for improved functionality	• Ergonomic handles that fit the natural grip of the hand. • Aerodynamic car mirrors to reduce wind resistance.
5	**Merging**	Combine identical or related objects/functions	• 2-in-1 shampoo and conditioner. • All-in-one printers (printer, scanner, copier).
6	**Universality**	Make a system or object perform multiple functions, reducing the number of parts	• Smartphone acting as a camera, calculator, and GPS. • Convertible sofa-bed.
7	**Nested Doll (embedding)**	Place one object inside another, like a nesting doll.	• Collapsible storage containers. • “Matryoshka” (nesting dolls)
8	**Anti-weight**	Use counterweight or leverage to balance the system	• Counterbalanced cranes. • Rocking chairs with stabilizing weights.
9	**Preliminary anti-action**	Take preventive action to mitigate a problem before it occurs	• Surge protectors to prevent electrical damage. • Waterproof coatings on electronics.
10	**Preliminary action**	Perform an action in advance to simplify subsequent operations	• Pre-cut vegetables for quicker meal preparation. • Pre-assembled kits for furniture.
11	**Beforehand cushioning**	Prepare emergency backup systems or safety measures	• Airbags in cars. • Lifeboats on ships.

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12	**Equipotentiality**	Eliminate differences in potential energy, reducing movement or stress	• Anti-vibration mats under washing machines. • Shock absorbers in cars.
13	**The other way round**	Invert the object, system, or process	• Reversible jackets for two styles in one. • Flip-top water bottles for easier drinking.
14	**Spheroidality (curvature)**	Replace flat surfaces with curved ones to reduce stress or improve aerodynamics	• Streamlined car designs. • Curved smartphone screens.
15	**Dynamics**	Make objects or systems adjustable or capable of change	• Adjustable office chairs. • Retractable awnings.
16	**Partial or excessive action**	Go slightly beyond or less than the required level of action	• Overfilling a coffee mug to test spill resistance. • Applying extra paint layers for durability.
17	**Another dimension**	Move to a different dimension or direction	• Foldable smartphones. • Multi-layered packaging.
18	**Mechanical vibration**	Introduce oscillations or vibrations to improve effectiveness	• Sonic toothbrushes for more effective cleaning. • Vibrating alarms for the hearing impaired.
19	**Periodic action**	Alternate between states or actions	• Pulsating water jets for massages. • Intermittent windshield wipers.
20	**Continuity of useful action**	Keep an action going without interruption	• Conveyor belts in manufacturing. • Continuous ink supply systems in printers.
21	**Skipping**	Perform a task in a non-continuous way, skipping unnecessary steps	• Skip-the-line services in ticketing. • Selective scanning in digital imaging.
22	**"Blessing in disguise" (convert harm into benefit**	Use harmful factors or effects to achieve a positive result	• Using waste heat from industrial processes to warm a building. • Repurposing food waste as compost.

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23	**Feedback**	Implement feedback mechanisms for control or adjustment	• Thermostats in heating systems. • Customer feedback loops in product design.
24	**Intermediary**	Use an intermediary to transfer or convert an action or property	• Lubricants to reduce friction. • Insulating materials to prevent heat transfer.
25	**Self-service**	Have the object serve itself or perform its own function.	• Self-cleaning ovens. • Automatic irrigation systems.
26	**Copying**	Use simple copies or replicas of objects.	• Virtual reality simulations. • Paper templates for sewing.
27	**Cheap short-living objects**	Replace expensive, durable objects with cheaper, disposable ones	• Single-use medical syringes. • Cardboard VR viewers.
28	**Replacement of mechanical systems**	Replace mechanical systems with other types (e.g., optical, acoustic)	• Wireless charging instead of wired connections. • Digital thermometers instead of mercury-based ones.
29	**Pneumatics and hydraulics**	Use fluid or gas pressure instead of mechanical action	• Hydraulic lifts. • Pneumatic drills.
30	**Flexible shells and thin films**	Replace solid structures with flexible or thin materials	• Inflatable life vests. • Stretchable smartphone screens.
31	**Porous materials**	Utilize materials with holes or gaps to reduce weight or improve functionality	• Foam padding for cushioning. • Porous ceramic filters.
32	**Color change**	Use color for visibility, warning, or identification	• Thermochromic paint for temperature indicators. • Color-coded cables for easy identification.
33	**Homogenity**	Make components from similar materials to simplify recycling or reduce costs	• Recyclable plastic bottles. • Aluminum cans.

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34	**Discarding and Recovering**	Remove and reuse parts or materials	• Modular building blocks. • Refillable ink cartridges.
35	**Parameter Change**	Modify temperature, pressure, speed, etc.	• Variable-speed fans. • Adjustable desk height.
36	**Phase Transition**	Use changes in state (e.g., liquid to gas) to improve operation	• Evaporative cooling systems. • Self-healing materials.
37	**Thermal Expansion**	Use thermal expansion/contraction to achieve desired effects	• Thermal valves in radiators. • Bimetallic strips in thermostats.
38	**Strong Oxidants**	Use oxidation processes to achieve results	• Bleaching agents in cleaning. • Ozone generators for disinfection.
39	**Inert Atmosphere**	Replace reactive environments with inert gases	• Nitrogen gas in food packaging. • Argon in welding.
40	**Composite Materials**	Combine materials with different properties	• Carbon fiber for lightweight strength. • Laminated glass for safety