Glass and Plastic Labware Buying Guide

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Find the Right Glass and Plastic Labware for You

A variety of flasks, test tubes, beakers, graduated cylinders, and dishes are used in most classroom laboratories. As many of these items are available in glass or plastic material, this guide can help you better understand the differences and decide which materials are best suited to your users and applications.

Glass

Glass labware in the U.S. is typically made of borosilicate or soda lime glass. Its specifications are subject to specific international standards. Glassware can also be categorized by ASTM Class, which refers to the volumetric tolerance of the glassware. While there are no general tolerances — they are specific to individual pieces of glassware — Class A is more stringent than Class B.

International Glass Standards

Glass Type	ASTM* E-438	U.S. Pharmacopoeia (USP)	European Pharmacopoeia (EP)
3.3 Expansion Borosilicate Glass	Type 1 Class A	Type 1	Type 1
4.9 Expansion Borosilicate Glass (Clear)	Type 1 Class B	Type 1	Type 1
5.4 Expansion Borosilicate Glass (Amber)	Type 1 Class B	Type 1	Type 1
7.8 Expansion Soda-Lime Glass (Amber)	Type 2	Type 3	Type 3
9.1 Expansion Soda-Lime Glass (Clear)	Type 2	Type 3	Type 3

*Formerly the American Society for Testing and Materials

USP Glass Types

Type 1	Type 2	Type 3	Type NP
• Least reactive glass available for containers • Lab glass apparatus is generally Type 1 • For all applications: – Water for injection – Unbuffered products – Chemicals – Sensitive lab samples – Samples that require sterilization – Products that are alkaline or will become alkaline	• De-alkalized soda-lime glass • Less resistant to leaching than Type 1; more resistant than Type 3 • Use for products that remain below pH 7 • **Examples:** Vials for injectables	• Soda-lime glass • Suitable for alkali-insensitive liquid formulations • Can be dry-heat sterilized; not autoclavable • **Examples:** Wheaton 800 and 900	• Soda-lime glass • General purpose; for non-parenteral applications • Use for capsules, tablets, and topical products • **Examples:** Wheaton 810 and 910

Chemical Characteristics of Glass

3.3 Expansion Borosilicate Glass	Neutral Borosilicate Glass	Soda-Lime Glass
• Highly resistant to water, acids, salt solutions, halogens, and organic solvents • Can be corroded by hydrofluoric acid, hot concentrated phosphoric acid, and strong alkaline solutions	• Chemically resistant • Often used to store or package injectable solutions or acidic, neutral, or alkaline products	• Less chemical resistance than borosilicate glass • Used to store dry powders and other general purposes

Plastic

Plastic labware is made from a variety of plastic resins, all of which have specific strengths and weaknesses.

The most common are:

- Polypropylene (PP)
- Polystyrene (PS)
- Low-density polyethylene (LDPE)
- High-density polyethylene (HDPE)
- Polycarbonate (PC)
- Polymethylpentene (PMP)
- Polyvinyl chloride (PVC)
- Polytetraflouroethylene (PTFE)
- Polymethylmethacrylate acrylic (PMMA)
- Polyethylene terephthalate (PET)
- Polyethylene terephthalate glycol (PETG)
- Polybutylene terephthalate (PBT)

Plastic Properties

Plastic Type	Temperature Max.	Temperature Min.	Transparency	Flexibility	Microwavable	Autoclavable	Gas	Dry Heat	Radiation	Disinfection
PP	135°C	–20°C	Translucent	Rigid	Yes	Yes	Yes	No	No	Yes
PS	90°C	–40°C	Clear	Rigid	No	No	Yes	No	Yes	No
LDPE	80°C	–50°C	Translucent	Flexible	Yes	No	Yes	No	Yes	Yes
HDPE	120°C	–100°C	Translucent	Rigid	No	No	Yes	No	Yes	Yes
PC	135°C	–135°C	Clear	Rigid	No	Yes	Yes	No	Yes	Yes
PMP	145°C	–180°C	Clear	Rigid	Yes	Yes	Yes	Yes	No	Yes
PVC	70°C	–30°C	Translucent	Rigid	No	No	Yes	No	No	Yes
PTFE	260°C	–200°C	Opaque	Rigid	No	Yes	Yes	Yes	No	Yes
PMMA	50°C	–60°C	Clear	Rigid	No	No	No	No	Yes	No
PET	60°C	–10°C	Clear	Rigid	No	No	Yes	No	Yes	Yes
PETG	70°C	–40°C	Clear	Rigid	Yes	No	Yes	No	Yes	Yes
PBT	150°C	–40°C	Opaque	Rigid	No	Yes	Yes	Yes	Yes	Yes

Glass vs. Plastic

When choosing labware, consider specific conditions, users, and substances with which the labware will be used. This table includes some of the characteristics of the various materials used to make labware.

	Material	Transparency	Chemical Resistance	Maximum Temperature	Break Resistance	Microwaveable	Autoclavable
Glass	**Borosilicate**	Clear	Excellent	230° C (446° F)	Breakable	Yes	Yes
Glass	**Soda Lime**	Clear	Excellent	100° C (212° F)	Breakable	Yes	No
Plastic	**Polypropylene (PP)**	Translucent	Excellent	135° C (275° F)	Excellent	Yes	Yes
Plastic	**Polystyrene (PS)**	Clear	Poor	90° C (194° F)	Fair	No	No
Plastic	**Low-Density Polyethylene (LDPE)**	Translucent	Good	80° C (176° F)	Good	Yes	No
Plastic	**High-Density Polyethylene (HDPE)**	Translucent	Good	120° C (248° F)	Good	No	No
Plastic	**Polycarbonate (PC)**	Clear	Poor	135° C (275° F)	Good	No	Limited
Plastic	**Polymethylpentene (PMP)**	Clear	Good	175° C (347° F)	Fair	Yes	Yes
Plastic	**Polyvinyl chloride (PVC)**	Clear	Fair	70° C (158° F)	Fair	Yes	No

Glass		Plastic	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Can be heated without melting or breaking	Breakage can result in sample loss or exposure to contents	Lightweight, flexible, unbreakable	Not as transparent as glass
Easier to clean, reusable	Not disposable	Typically for single use	Graduation marks are more difficult to see
Better graduation mark visibility	Requires cleaning or autoclaving	Affordable	Affected by high temperatures
Chemically resistant to most acids and alkalis	Not suitable for storing hydrofluoric acid	May be reusable	May not be compatible with all chemicals

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