Nitrogen cycle and water change cheat sheet

The numbers to know while cycling a tank and keeping it stable.

AquaCompat

How long cycling takes

- UF/IFAS: a new biofilter needs six to eight weeks to build enough bacteria.
- Merck: about 6 weeks for complete establishment; up to 8 weeks in a tropical fish tank.
- Dr Tim's Aquatics: fishless cycling without bacterial additive takes about 30 to 45 days.
- Raising temperature slightly speeds nitrifier growth, but no more than 2 to 3 °C (3.6 to 5.4 °F) above the planned temperature.
- A cycle is complete when a full ammonia dose is converted to nitrate within 24 hours with no detectable nitrite.

Fishless cycling targets

- SRAC 4502: raise total ammonia to 3 to 5 mg/L when starting a biofilter.
- Dr Tim's Aquatics recommends 2 to 3 mg/L ammonia-N; PFK aims for 3 ppm.
- Keep ammonia and nitrite below about 5 mg/L during fishless cycling to avoid inhibiting nitrifiers.
- SRAC 4502: 60 mL of clear 10% household ammonia raises 1,000 gallons by about 1.6 mg/L.

Ammonia, nitrite and nitrate

- Un-ionized ammonia (NH3) is roughly 100 times more toxic than ionized ammonium (NH4+).
- The un-ionized share of total ammonia rises with pH and temperature and falls slightly with salinity; test kits read total ammonia, so pH and temperature are needed to calculate the toxic fraction.
- Nitrite can be toxic at levels as low as 0.10 mg/L.
- Keeping at least 10 parts chloride per part nitrite prevents nitrite uptake in catfish; sick fish may need a higher ratio.
- Merck's normal reference range for freshwater systems is nitrate below 20 mg/L (below 70 mg/L for saltwater). Merck notes most test kits read nitrate-nitrogen (NO3-N); multiply by 4.4 to convert to nitrate (NO3).

Water changes

- About 25% once a week suits most tanks, adjusted to stocking and feeding.
- Merck's maintenance schedule lists a water change every 2 weeks, with the amount set by stocking level, alongside testing pH, alkalinity, ammonia, nitrite and nitrate.
- Keep nitrate below about 40 ppm, or within about 40 ppm of tap water nitrate.
- When ammonia is detected, stop or reduce feeding for 1-3 days and change 25-50% of the water, if the source water has no ammonia.
- In new tank syndrome, change at least 50% of the water when total ammonia reaches 2 mg/L or more; test frequently.
- Small containers such as goldfish bowls need more frequent and larger changes, perhaps as much as 50% per week.

Sources: Aquarium Co-Op; Dr Tim's Aquatics (manufacturer); Merck Veterinary Manual; Practical Fishkeeping; Southern Regional Aquaculture Center; UF/IFAS EDIS; University of Florida IFAS Extension (EDIS). Checked 22 October 2026. Free to print and share under CC BY 4.0 with credit to AquaCompat (aquacompat.com/free-charts/).