

Module 3 — Formulations, Handling, Storage & Disposal

CORE exam · 8 practice questions · What the letters after a product name mean, how to mix without ruining a tank, and the storage and disposal rules ODA enforces.

Key numbers & facts to memorise

Mixing order	W-A-L-E: Wettable/dry → Agitate → Liquids/flowables → Emulsifiables; adjuvants last
Jar test	Small-scale compatibility check in the same order, stand 15 min
Storage	Original labelled containers, locked, ventilated; dry ABOVE liquids
Containers	Triple/pressure rinse → rinsate to tank → puncture → recycle
Highest dust hazard	Wettable powders (WP) while measuring

Formulations and what they mean for you

A pesticide **formulation** is the active ingredient plus carriers, solvents, surfactants and other inert ingredients that make it possible to handle and apply. The abbreviations on the label are not decoration: **EC** (emulsifiable concentrate) mixes into a milky emulsion and can be hard on rubber and plastic; **SC/F** (suspension concentrate/flowable) is a fine solid suspended in liquid and needs agitation; **WP** (wettable powder) is a dusty solid that must be kept suspended and is abrasive to pumps; **WDG/DF** (water-dispersible granule/dry flowable) is a low-dust improvement on WP; **SL** (soluble liquid) truly dissolves; and **RTU** products are ready to use.

Formulation drives four practical decisions: how much agitation you need, how much your equipment will wear, how likely you are to plug a screen or nozzle, and how much dust or splash exposure you face while measuring. It also affects drift and efficacy — the same active ingredient in two formulations can behave differently on a waxy leaf. Exams commonly ask which formulation poses the greatest inhalation hazard while mixing (wettable powders, because of dust) or which requires continuous agitation (suspensions and wettable powders).

For drone applicators there is an extra filter: small tanks, small lines, small screens. Fine **WDG** and true **SL/SC** products generally run well; coarse wettable powders can settle and plug a 10-gallon system far faster than they would trouble a 1,000-gallon rig. Always run a new product/tank combination on clean water first, watch your flow meter for drift, and flush thoroughly the same day.

Compatibility, mixing order and the jar test

When two or more products go in the same tank you are performing chemistry. Incompatible mixes curdle, gel, form flakes, or separate into layers — at best you plug the system, at worst you ruin an expensive tank of mix and lose a spray window. The label of every product in the mix must be checked; if any label prohibits the combination or specifies an order, that instruction controls.

A widely taught mixing sequence is **W-A-L-E**: fill the tank half to three-quarters with clean water and start agitation, add **W**ettable and dry products (WP, WDG, DF), **A**gitate until fully dispersed, add **L**iquids and flowables (SC, SL), then **E**mulsifiable concentrates, with adjuvants and surfactants generally last. Ammonium sulphate or water conditioners are often added first per label. Rinse each container three times and add the rinsate to the tank; top off with water and keep agitating until the tank is empty.

When you are unsure, run a **jar test** before you commit. Scale everything down: put water in a clear quart jar in proportion to your tank rate, add each product in the same order you would use in the tank, shaking gently between additions, then let it stand for about fifteen minutes. Watch for clumping, curdling, gel, oily layers or heavy sediment. A uniform mix is a good sign; a separated mix means do not tank-mix those products. Thirty minutes here regularly saves a full tank and a day of the season.

Storage that keeps you legal and safe

Store pesticides in their **original, labelled containers** — never in a food or beverage container, never in an unlabelled jug. The storage area should be cool, dry, well ventilated, and **secure (locked)**, sited away from food, feed, seed and water sources, and posted with warning signage. Temperature matters: freezing can break emulsions and crack containers, while extreme heat degrades some actives and can pressurise containers.

Organise deliberately. Keep **dry formulations above liquids** so a liquid leak cannot drip into and activate a powder. Separate herbicides from insecticides and fungicides where practical to prevent cross-contamination and mistakes under time pressure. Maintain a current inventory list — it speeds ordering, prevents buying what you already own, and is exactly what a fire department or emergency responder needs if there is an incident at your facility.

Keep the storage area equipped, not just tidy: absorbent material, a scoop and sealable container for spills, clean water, soap, an eyewash source, a fire extinguisher, and copies of labels and safety data sheets accessible outside the room. Practise a fifteen-second mental drill: if a container failed right now, could you contain it without leaving to fetch supplies? If the answer is no, the kit is in the wrong place.

Disposal, container rinsing and unusable product

Empty containers are not empty. **Triple-rinse** or pressure-rinse immediately after emptying — waiting lets residue dry on and become far harder to remove. Pour each rinse into the spray tank so the product goes onto the labelled target rather than into a waste stream. Once properly rinsed, puncture the container so it cannot be reused, and recycle through an agricultural container programme or dispose of it as the label directs.

Rinsate is part of your mix, not waste: adding rinse water back into the tank is both the legal expectation and the practical way to avoid creating a disposal problem. Never pour excess mix on the ground, down a drain, into a ditch, or into a waterway. If you consistently end up with leftover mix, your calibration or your acreage math needs attention — mix what the field needs, which is exactly the arithmetic in Module 4.

For products that have become unusable — banned, expired, degraded, or unlabelled — do not stockpile them indefinitely and never burn or bury them. Ohio periodically offers **pesticide collection ("clean sweep") events** through ODA that accept unwanted agricultural pesticides at no charge; contact ODA's Pesticide & Fertilizer Section for current opportunities. Planning around a collection event is dramatically cheaper and safer than any improvised solution.

Practice questions

Answer these closed-book, then check against the answer key that follows. Ohio requires 70% to pass.

1. Which formulation generally poses the greatest inhalation hazard while measuring and mixing?

- A) Soluble liquid (SL)
- B) Wettable powder (WP)
- C) Ready-to-use (RTU)
- D) Emulsifiable concentrate (EC)

2. In the W-A-L-E mixing sequence, emulsifiable concentrates are added:

- A) First, before water
- B) After wettable/dry products and liquids/flowables
- C) Before agitation begins
- D) Only after adjuvants

3. The purpose of a jar test is to:

- A) Measure droplet size
- B) Check physical compatibility of a tank mix before mixing a full tank
- C) Determine soil pH
- D) Calibrate the pump

4. Pesticides must be stored:

- A) In any sealed container
- B) In original labelled containers in a cool, dry, ventilated, secure area
- C) Beside livestock feed for convenience
- D) In a sunny area to prevent freezing

5. In a storage area, dry formulations should be stored:

- A) Below liquid formulations
- B) Above liquid formulations
- C) Mixed with liquids
- D) Outside the building

6. After triple-rinsing an empty container, the rinsate should be:

- A) Poured on the driveway
- B) Added to the spray tank and applied to the labelled site
- C) Poured down a floor drain
- D) Stored indefinitely

7. A rinsed container should then be:

- A) Reused for water storage
- B) Punctured so it cannot be reused, then recycled or disposed per label
- C) Given to a neighbour
- D) Burned on site

8. Which formulations most require continuous agitation in the tank?

- A) Soluble liquids
- B) Suspensions and wettable powders
- C) Ready-to-use products
- D) Granules applied dry

Answer key & explanations

1. B) Wettable powder (WP) — Dry, dusty wettable powders create airborne dust during measuring and mixing — hence the dust/mist respirator requirements on many WP labels.

2. B) After wettable/dry products and liquids/flowables — W-A-L-E: Wettable/dry → Agitate → Liquids/flowables → Emulsifiabiles, with adjuvants generally last. Labels override the general order.

3. B) Check physical compatibility of a tank mix before mixing a full tank — A small-scale jar test in the same mixing order reveals curdling, gelling, layering or sediment before you ruin a full tank.

4. B) In original labelled containers in a cool, dry, ventilated, secure area — Original labelled containers only, in a locked, ventilated, temperature-appropriate area away from food, feed, seed and water.

5. B) Above liquid formulations — Storing dry products above liquids prevents a liquid leak from dripping into and activating or contaminating dry material.

6. B) Added to the spray tank and applied to the labelled site — Rinsate goes into the spray tank so it is applied to the labelled target, avoiding creation of a waste stream.

7. B) Punctured so it cannot be reused, then recycled or disposed per label — Puncture to prevent reuse, then recycle through an ag container programme or dispose as the label directs. Never burn or reuse pesticide containers.

8. B) Suspensions and wettable powders — Suspended solids (SC/F) and wettable powders settle out without agitation, causing uneven application and plugging.