Staff planning · serial dilution

YEAR 10 · LESSON 2 · Staff edition — keep separate from student copies

Status and audience
Staff use only; do not issue to students. This document is not a school risk assessment or classroom authorisation. No local physical validation is claimed. Complete normal teacher/technician checks and follow your employer's risk assessment before use.

Curriculum and boundaries

Year 10; Pearson Edexcel 2017 linear IGCSE Chemistry and Science (Double Award). Coverage: 1.3 dilution strand and the solute/solvent/solution terms from 1.4. Saturation is not demonstrated in this batch. **1.5C solubility is Chemistry only.** Gas diffusion is a residual discussion objective, not demonstrated here. Do not add ammonia/HCl or potassium manganate(VII) practicals; those forks remain deferred.

Requisition · planning estimates, not pilot results

Per group of 2–3: 8 test tubes and rack; 10 cm^3 cylinder; graduated 1 cm^3 pipettes with fillers, or syringes without fillers; 9 fresh, dry, graduated 1 cm^3 devices (initial dye, 7 onward transfers and final discard); white background; eye protection; about 80 cm^3 water; teacher-issued water-soluble food dye for the initial 1 cm^3 sample plus a supply allowance; labelled waste vessel; towels. Never mouth-pipette.

For 10 groups (illustrative only): 80 test tubes, 10 racks, 10 cylinders, 90 fresh, dry, graduated 1 cm^3 devices, about 800 cm^3 water plus washing water, and at least 10 cm^3 working dye plus a supply allowance. Scale after the local setup is checked.

Reagent and transfer pilot · not yet performed

- Use water-soluble liquid food colouring only. Check supplier label, allergens and safety information. Do not substitute laboratory stains or solid potassium manganate(VII).
- As normal preparation before class, trial the actual dye, tubes, measuring devices and viewing conditions locally. Record the observed visibility threshold; **do not target tube 6–8 or assume eight visible shades**. Food-dye colour may become invisible much earlier.
- Demonstrate accurate 1 cm^3 sampling after mixing. Use nine fresh, dry, graduated 1 cm^3 devices per group: one for stock to tube 1, seven inter-tube transfers, one final tube-8-to-waste discard. No extra donor draws. Use gentle swirling only, with no rod or added water. Never return liquid to stock. Fit fillers to pipettes only, not syringes.
- After mixing tube 8, discard 1 cm^3 of its solution to waste, leaving every tube at 9 cm^3. No dilution factor changes when a well-mixed aliquot is removed.

Safety and disposal · local review required

Eye protection; no tasting; avoid staining/skin contact; wipe spills; careful glassware handling and glass-bin disposal. No heating. Allow drain disposal of dilute food-dye solutions only under local rules, with running water. Review individual product information and accessibility needs before class use.

Staff guidance · not student answers to issue

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Expected reasoning · no invented observations

• Concentration sequence relative to issued dye: tube 1 = 10^{-1}, then 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, 10^{-8}. These are calculated ideal values, not measured results. Factor per step = 1/(1 + 9) = 0.1.

• Visual threshold: accept the student's actual observation, including "none" or very early disappearance. Equal final volumes help comparison but do not remove lighting, path length or observer limitations. Dilution does not destroy dye particles; portions are also physically removed during transfers.

• In the class practical, food dye is the solute and water is the solvent; the homogeneous liquid is the solution. A coloured solution can be clear (transparent), not colourless. Salt/sand belongs only to the deferred internal plan.

• For the separate 1.5C theory extension: a saturated solution contains the maximum dissolved solute at the specified temperature. No saturation demonstration or solubility measurement is included in the student activity.

• **1.5C Chemistry only:** solubility = mass of solute forming a saturated solution in 100 g of solvent at a stated temperature. Do not use 10° g or treat this as Double Award content.

• Gas diffusion explanation: random particle movement gives net spreading from higher to lower concentration. This is reasoning/discussion; no gas-diffusion experiment is included.

Troubleshooting · no guaranteed endpoint

Uneven colour: swirl thoroughly and view against white. Persistent colour: check volumes and actual dye concentration. Early disappearance may be genuine: record it honestly. Extra water or lost tube order: stop and repeat rather than guessing. No shared rod or extra donor draws.

Sources and pre-use checks

Source details and adaptations are recorded in the accompanying source notes. No fresh independent source verification or local physical validation is claimed.

Pearson 2017 Chemistry specification: points 1.3, 1.4 and 1.5C. CLEAPSS Student Safety Sheet 70, Dyes, stains and indicators (2022), as cited in intake: https://science.cleapss.org.uk/resource/sss070-dyes-and-indicators.pdf

Before classroom use: keep the saturation demonstration deferred; check the actual dye, products and transfer technique; complete the employer/local risk assessment and obtain teacher approval. Keep student and staff PDFs separate.

Audience boundary
Student booklets contain 3 pages. This separate staff file contains 2 pages. Deferred saturation planning is internal only and excluded from these booklets. Never append staff pages to a student file. Hosted staff downloads require access controls; filename labels alone do not restrict access.