Staff planning · paper chromatography

YEAR 10 · LESSON 7 · Staff edition — keep separate from student copies

Status and audience
Staff use only; keep separate from student copies. This document is not a local risk assessment or classroom authorisation. No local physical validation is claimed. Complete normal practical setup checks before use.

Curriculum and class default

Year 10; Pearson Edexcel 2017 linear IGCSE Chemistry and Science (Double Award). Points 1.11–1.13, plus **1.10 partially: paper chromatography only**. Other 1.10 separation techniques are not covered. One class chromatogram, optional repeat if needed. Water-soluble inks/food colourings and water only. No student organic-solvent extension.

Requisition · per group

Chromatography paper, cut to fit the selected 100 cm^3 or 250 cm^3 beaker; lid/watch glass; splint/rod and clips or equivalent support; HB pencil and millimetre ruler; separate clean capillary/spotter per sample; distilled/deionised water; actual water-soluble inks and/or food colourings including at least one mixture, plus suitable reference dyes for the same-paper run; drying tray/towel; eye protection; glass/sharps bin.

Illustrative class organisation: 10 groups of 3 require 10 beakers/covers/supports, 10 papers plus spares, and one clean spotter per sample per group. Select water volume by actual depth (about 1 cm), not by an untested fixed beaker volume. Pencil baseline about 2 cm above the lower edge; all spots must stay above water.

Advance preparation · teacher trial before class

- No local physical validation is claimed. Test the actual paper, beaker, depth, dye load, support and lid. Paper must stay clear of walls; solvent must remain below the baseline.
- Use chromatography paper as default. Do not casually relabel ordinary filter paper as chromatography paper; any substitution requires an explicit method check.
- Pilot the samples and references. Retail “single colour” labels do not establish a single dye; green may be a mixture. Aim for resolved, visible spots, not a predetermined invented result.
- Prefer reference lanes and mixture on the same paper. Actual water-soluble inks/food colourings, including a mixture, must remain in the kit and be run. Clearly labelled comparison data may supplement (not replace) that run; state matching paper, solvent and relevant conditions. Do not use an unmatched identification table.
- Pre-run a water-only circular chromatogram for observation (next page). Prepare clear sample labels and a waste plan for the actual ink products.

Safety

Eye protection; no tasting; handle capillaries carefully; use glass/sharps disposal; prevent dye staining; wash hands. Check supplier labels/allergens. No unshielded UV viewing. Air-dry papers. No ethanol or other flammable solvent in these methods. Dispose of actual ink waste according to supplier and local rules; only permitted dilute food-dye water goes to drain with running water.

Staff delivery · water only

YEAR 10 · LESSON 7 · Staff edition — keep separate from student copies

Teacher circular starter · observation, not student method

1. Before the lesson, use a circle of paper with a small central spot of the chosen water-soluble colouring. Use a paper wick through the centre into water, arranged so water reaches the centre through the wick. Pilot this arrangement locally.

2. Allow the water to spread radially and the colours to separate. Remove and air-dry the paper before the lesson. This preparatory demonstration uses water only; no student wick-cutting or solvent alternatives are included.

3. Show the pre-run circular chromatogram. Elicit chromatogram, soluble, solvent and mixture. More than one resolved colour supports more than one detected dye; do not promise a particular band pattern.

Class run · critical checkpoints

• Small, dry, concentrated starting spots; separate clean spotters; sample labels in pencil **beside** spots, not below the baseline.

• Water about 1 cm deep and pencil baseline about 2 cm from the lower edge, subject to actual glassware check. Paper vertical, clear of walls; cover replaced; do not move the beaker.

• Stop before the front reaches the top. **Immediately mark the front in pencil across the width**. Then air-dry, outline clear spots and mark their centres.

• Measure from the same baseline, along the same lane/direction, to the spot centre and local solvent front. Do not assign a spurious centre to a broad streak or unresolved group.

• One careful run is default; repeat only to address a fault or as an optional extension. No three-repeat scoring requirement.

Troubleshooting and timing · estimates only

Streaks: reduce loading and dry between applications. **Sample stays at origin:** check water solubility; do not introduce ethanol as an ad hoc fix. **Slanted/irregular front:** check walls, paper support and uneven handling; repeat if measurement is unreliable. **Baseline submerged:** stop and restart correctly. **Front lost:** do not invent it after drying.

Indicative timing from intake: spotting 5–10 min, run often 10–15 min, followed by air-drying, measuring and analysis. Actual timing depends on paper and setup and must be checked locally. Keep a spare paper for faults.

Cleanup

Preserve dried papers as instructed; clean unneeded dry paper may enter paper waste under local rules. Broken capillaries go to glass/sharps, never general waste. Rinse equipment, wipe stains and wash hands. Check actual ink waste requirements before drain disposal.

Staff reasoning · claims and evidence

YEAR 10 · LESSON 7 · Staff edition — keep separate from student copies

Analysis guidance · not an experimental answer key

• More than one resolved spot supports multiple detected components. **One visible spot does not establish purity**: components may co-migrate, be colourless, or be below detection.

• Colour and Rf matching a same-paper reference support possible identity only. A single solvent separation does not prove identity; co-chromatography under another suitable, separately approved condition or other independent evidence could strengthen identification.

• Rf = baseline-to-centre distance / baseline-to-front distance. Units cancel. Suitable spot centres normally lie at or between baseline and front (0 to 1); a clear migrated centre below the front gives 0 < Rf < 1. A result outside range is a reason to check measurement/run validity, not clamp the value.

• No universal numerical tolerance is prescribed for matching. Discuss spot width, locating the centre, ruler resolution and differences in conditions. Same Rf without matching colour is not enough for the stated comparison.

• Pencil graphite does not dissolve and travel like an ink label could. Starting spots below solvent may dissolve into the bulk water. The front must be marked immediately because it becomes hard to locate as solvent evaporates.

• Dye movement depends on solubility in the mobile solvent and attraction to the stationary paper. Greater travel cannot be attributed to a dye "liking" a phase.

• No continuous identity trend graph is required. Preserve the actual chromatogram, measurements and stated limitations. Do not substitute example values for observed results.

Sources and pre-use checks

Sources: Pearson 2017 linear Chemistry specification, points 1.10–1.13; Pearson IGCSE Chemistry lab-book sample, Core Practical 2; RSC paper chromatography resources for ages 14–16; CLEAPSS SSS070. The 2024 modular guide provides supporting method advice, not the school's course specification.

Pearson lab-book sample: https://www.pearson.com/content/dam/one-dot-com/one-dot-com/international-schools/pdfs/secondary-curriculum/international-gcse/science/IGChemistryLabBooksample.pdf
CLEAPSS SSS070: https://science.cleapss.org.uk/resource/sss070-dyes-and-indicators.pdf

Before classroom use: complete the local risk assessment; check actual samples, references, paper, beaker, solvent depth and support. Any supplementary comparison-data exercise must not replace the actual sample run. No local physical validation is claimed.

Audience boundary
Student booklets contain 5 pages. This separate staff file contains 3 pages. Keep staff pages out of student files. Hosted staff downloads require access controls; filename labels alone do not restrict access.